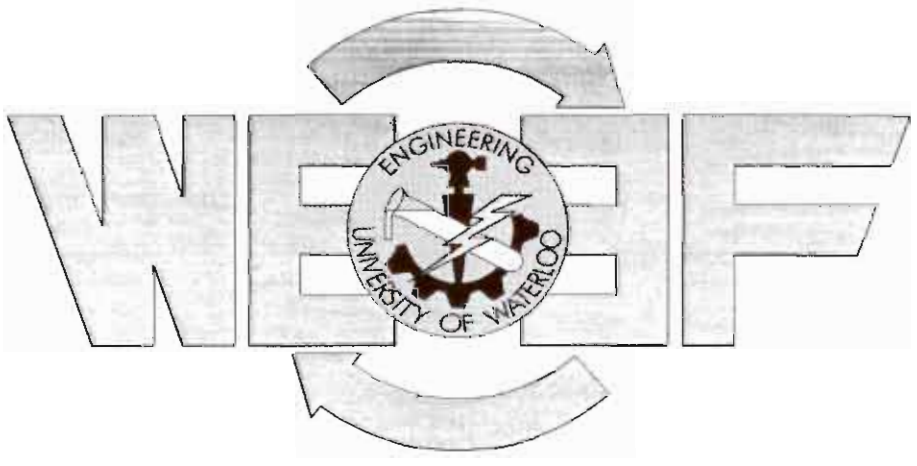
WEEF Proposals & Allocations	Winter 2000	
Chemical and Environmental Chemical	Requested	Allocated
Upgrading of Analytical Facilities for ChE 032 Laboratory	$ 6,846.00	$ 4,950.00
		$ 4,950.00
Civil and Environmental Civil		
Total Station	$ 8,500.00	$ 5,700.00
Survey Equipment	$ 2,854.10	$ -
CSRS-1 Cation Suppressor	$ 1,250.00	$ -
HP5 GC Column	$ 750.00	$ 500.00
ICP Quartz Glassware	$ 1,100.00	$ -
		$ 6,200.00
Electrical and Computer		
Audio Amplifier System	$ 1,588.00	$ -
Semiconductor Parameter Analyzer	$ 20,000.00	$ -
Telnet Server Upgrades	$ 2,130.00	$ 1,420.00
Telnet Server Computers	$ 3,360.00	$ 2,240.00
Monitor Upgrade	$ 5,760.00	$ 1,280.00
Dynamometre Work Station Upgrade	$ 8,600.00	$ 5,100.00
		$ 10,040.00
Environmental		
Spectrophotometer for Water Quality Analysis and Wastewater Treatment	$ 10,000.00	$ 5,000.00
		$ 5,000.00
Mechanical		
Energy Dispersive X-Ray Analysis System for Scanning Electron Microscope	$ 19,000.00	$ -
Fuel Cell Demonstration Project	$ 14,653.00	$ -
Robot Equipment Upgrade	$ 36,000.00	$ 7,800.00
		$ 7,800.00
Systems Design		
Monitors for Systems Design Computer Lab	$ 1,446.00	$ -
Multimedia Classroom Equipment	$ 9,400.00	$ 7,200.00
		$ 7,200.00
Geological		
Rocks and Minerals	$ 2,399.65	$ 1,500.00
		$ 1,500.00
Misc		
Engineering Student Shop	$ 11,684.00	$ 5,500.00
Helix Lab Upgrade	$ 5,000.00	$ -
		$ 5,500.00
Sub-Total Department	**$ 172,320.75**	**$ 48,190.00**
Student Groups		
GNCTR 2002	$ 1,000.00	$ 400.00
GNCTR 2001	$ 1,600.00	$ 800.00
Waterloo Aerial Robotics Group	$ 3,200.00	$ 3,000.00
Midnight Sun VI Solar Car Project	$ 5,215.89	$ 3,000.00
Formula SAE project	$ 6,990.00	$ 3,100.00
UWAFT - Cold Start System	$ 2,358.00	$ 1,500.00
CART (Commuter Assisting Recumbent Tricycle)	$ 2,000.00	$ 200.00
Sub-total Student Groups	**$ 20,363.89**	**$ 12,000.00**
Total	**$ 192,684.64**	**$ 60,190.00**

Waterloo Engineering Endowment Fund



Winter 2000 Proposals

WEEF Proposals - Winter 2000

	CHEMICAL AND ENVIRONMENTAL CHEMICAL	
1	Upgrading of Analytical Facilities for ChE C32 Laboratory	$6,846.00
	CIVIL and ENVIRONMENTAL CIVIL*	
2	Total Station	$8,500.00
3	Survey Equipment	$2,854.10
4	CSRS-1 Cation Suppresser	$1,250.00
5	HP5 GC Column	$750.00
6	ICP Quartz Glassware	$1,100.00
	ELECTRICAL AND COMPUTER	
7	Audio Amplifier System	$1,588.00
8	Semiconductor Parameter Analyzer	$20000 (US)
9	Telnet Server Upgrades	$2,130.00
10	Telnet Server Computers	$3,360.00
11	Monitor Upgrade	$5,760.00
12	Dynamometre Work Station Upgrade	$8,600.00
	ENVIRONMENTAL	
13	Spectrophotometer for Water Quality Analysis and Wastewater Treatment	$10,000.00
	MECHANICAL	
14	Energy Dispersive X-ray Analysis System for Scanning Electron Microscope	$19,000.00
15	Fuel Cell Demonstration Project	$14,653.00
16	Robot Equipment Upgrade	$36,000.00
	SYSTEMS DESIGN	
17	Monitors for Systems Design Computer Lab	$1,446.00
18	CART (Commuter Assisting Recumbent Tricycle)	$2,000.00
19	Multimedia Classroom Equipment	$9,400.00
	GEOLOGICAL	
20	Rocks and Minerals	$2,399.65
	MISC	
21	Engineering Student Shop	$11,684.00
22	Helix Lab Upgrade	$5,000.00
	Sub-Total Departmental	**$145,720.75**
	STUDENT	
23	GNCTR 2002	$1,000.00
24	GNCTR 2001	$1,600.00
25	Waterloo Aerial Robotics Group	$3,200.00
26	Midnight Sun VI Solar Car Project	$5,215.89
27	Formula SAE Project	$6,990.00
28	UWAFT – Cold Start System	$2,358.00
	Sub-Total Student Groups	**$20,363.89**
	TOTAL	**$166,084.64**

Table of Contents

1. Upgrading of Analytical Facilities for ChE 032 Laboratory

Lillian Liao
lliao@engmail X6161
Analytical Chemist

Description of Proposal:
To replace and upgrade laboratory equipment that is outdated. To purchase new equipment for increased number of students in the laboratory.

Benefits of the Proposal:
Access to this equipment would permit more accurate chemical determinations and improve success rate of experiments. It would also improve exposure to basic laboratory equipment. Approximately 150 students of ChE 032 would greatly benefit from this upgrade.

Cost Breakdown of Proposal:

	Item	Price	Use	Description
a)	2 -Spectrophotometers	$2,475.00	to measure absorbance of solutions	Spectronics 20 Genesys
b)	8 - MicroPipettors	$237.00	to aliquot set volumes of liquid	Nichiryo Adjustable Volume 10 – 100uL and 1 - 5mL
	TOTAL	**$ 6,846.00**		

Implementation Schedule for Project:
Equipment will be used once available.

Additional Information:
Priority given to the Spectrophotometers, item a) followed by the MicroPipettors, item b). All prices are current and include taxes.

Summary

There has been an increase in the number of students that are enrolled in the course since the previous 2 years, from approximately 120 to 150. This has increased both space and equipment demands.

Currently, the spectrophotometer being used gives an analog output. There is a large error associated with these readings. In labs 2 and 6, determining the growth curve of a bacterium. In lab 4, monitoring the colour change of an enzyme reaction.

A pipettor allows repetitive measurements of volumes of liquid that is consistent and reproducible. This is vital in obtaining reliable results. In lab 6, a simulated industrial effluent experiment, serial dilutions are required to determine the IC50 of culture broth samples. In labs 4 and 5, again volumes of liquid are aliquoted into cuvettes and absorbance measurements are taken to determine the rate of reaction.

2. Total Station

Submitted By:
Terry Ridgway tridgway@uwaterloo.ca

Ext. 3042
Lab. Technologist

Description of Proposal:
1) Set6006" Total Station c\w manual, batteries, charger, case and tool kit
2) HD Wooden Tripod
3) Single tilting prism assembly
4) Metric telescoping prism pole

Proposal Benefits:
Env. Eng. 100 with approx. 80 students
Civ. Eng. 125 with approx. 100 students
Env. Eng. 330 with approx. 80 students
Civ. Eng. 342 with approx. 80 students
300 and 400 projects

Cost Breakdown:
$8,500***
The Department of Civil Engineering will contribute one third towards this proposal
*** An estimation of taxes included

Implementation Schedule:
September 2000

ADDITIONAL INFORMATION:

Currently the surveying courses in Civil, Geological and Environmental Engineering are using mechanical- optical instruments in their surveying programs. However, the majority of work term employers are using electronic Total Stations on the job site. This instrument would be incorporated into the current survey courses to give the students hands on experience with the instrument and augment the student's knowledge of what is currently being used in the industry.

3. Survey Equipment

Submitted By:
Name: Ken Bowman
E-mail: kbowman@engmail.uwaterloo.ca
Phone Number: 3656
Position:Lab Technician

Description of Proposal:

4 Sokkia Transits Model KT5; 4 Tripods; 6 Level rods
Proposal Benefits: The addition of the four transits will increase our inventory to provide all of our student survey crews with comparable transits for field work assignments. The equipment being used currently is a combination of old and new instrumentation.

Cost Breakdown:

4 KT5 Sokkia Transits @ $1228.50 = $4914.00
4 PFA1 Flat Tripods @ $120 = $ 480.00
6 $347206.805me Dual Rods @ $139.50 = $837
Total: $6231 plus 10% tax = $6854.10 (see attached quotation N.C. Pestill Limited, Feb. 3/2000)

Partial Funding Available:
One-third of the cost is available from the Department of Civil Engineering.
(Include partial funding options)
Implementation Schedule: September 2000
Additional Information: All first year (1A) Civil, Geological and Environmental Engineering students (approx. 160 students each Fall) and project courses (in Civil/Environmental/Geological) use this equipment.

Approved:_____ Dated:_____
J.Sykes, Chair, Civil Eng.

Contact Information for Funding if different than above:
Name: same as above
E-mail:
Phone Number:

4. CSRS-1 Cation Suppresser

Submitted By: Environmental Engineering (Civil)
Your Name:Mark Sobon
E-mail: msobon@sunburn.uwaterloo.ca
Phone Number: Ext. 5263
Position: Chemical Engineering Technologist

Description of Proposal: One Dionex CSRS-1 cation suppresser. For use in a Dionex DX-200 Ion Chromatograph.

Proposal Benefits: The existing CSRS-1 suppresser was found to be defective and non-functional. In this state the Ion Chromatograph is not operational. The suppresser is an essential component for cation analysis measurements. The Ion Chromatograph is used for Env E 275/330 labs and projects. (Approx. 100 Students/year)

Cost Breakdown: The cost is $1250 plus shipping and taxes.

Implementation Schedule: Immediate.

Additional Information: Additional information will be provided upon request.

5. HP5 GC Column

Submitted By: Environmental Engineering (Civil)
Your Name:Mark Sobon
E-mail: msobon@sunburn.uwaterloo.ca
Phone Number: Ext. 5263
Position: Chemical Engineering Technologist
Description of Proposal: One Hp5 GC Column. For use in a Hewlett-Packard 6890 Gas Chromatograph.

Proposal Benefits: The instrument is presently without a GC column connected to the ECD detector. In this state the ECD detector is not utilised. The HP5 GC Column will provide for an instrument set-up configured to an ECD detector. The ECD detector set-up will provide for the ability to quantify halogenated chemical compounds. This addition expands the measuring capabilities of the instrument. The GC is used for Env E 275/330 labs and projects. (Approx. 100 Students/year)

Cost Breakdown: The cost is $ 750 plus shipping and taxes.

Implementation Schedule: Immediate.

Additional Information: Additional information will be provided upon request.

6. ICP Quartz Glassware

Submitted By: Environmental Engineering (Civil)
Your Name:Mark Sobon
E-mail: msobon@sunburn.uwaterloo.ca
Phone Number: Ext. 5263
Position: Chemical Engineering Technologist
Description of Proposal: One Spectroflame torch assembly and one mienhard gas nebulizer. These are custom pieces of glassware used in a Spectroflame ICP Analyser.

Proposal Benefits: The existing quartz torch has evidence of wear at the torch tip. The torch will eventually need to be replaced. The additional mienhard nebulizer will serve as a backup nebulizer. This will reduce down time during the operation of the instrument in the event the nebulizer becomes plugged. (this happens periodically) The ICP is used for Env E 330/331 labs and projects. (Approx. 100 Students/year)

Cost Breakdown: Torch standard one piece, Quartz

Cat#020-050-090	$650	
Meinhard Nebulizer		
Cat#020-060-001		*$450*
Total Cost		*$1100*

Implementation Schedule: Immediate.

Additional Information: Additional information will be provided upon request.

7. Audio Amplifier System for E2-3344

Submitted By:
Name: Ed Spike
E-mail: spike@engmail.uwaterloo.ca
Phone Number: x3716
Position: Laboratory Instructor
Description of Proposal:
Audio amplification added to the laboratory to enhance the listening by the students.
The plan for the laboratory in E2-3344 is to enhance the instructors audio presence with a speaker in the Hard Drive bay of the forty computers to be installed. The laboratory will be split into two groups of 20 workstations. New test equipment and computers are being requisitioned.

Proposal Benefits:
The students will be able to have the same or variable audio set at the work bench while listening to the instructors presentation. The instructor will not have to shout to be heard in the audio dead parts of the long and narrow room. The background noise will not be a problem since each work station will have a volume control. The students and the instructors time will be reduced by not having to repeat what was said.
Cost Breakdown:

	Lab Budget	Weef requested
Audio Amplifier with 25 volt/70volt output		$699.00
45 transformers 25 volt/70volt		$270.00
Shielded cable (fire rated) 400 metres		$374.00
2 Micophones		$245.00
45 Speakers in HD bays	$1,125.00	
Miscilanious hardware	$ 350.00	
Installation by staff	?	
TOTAL	$1475.00	$1588.00

Implementation Schedule:
May 01, 2000.
The new laboratory test equipment and computers should be installed by then.
Additional Information:
This is part of the audio-visual package to be installed.
Four data projectors and four projection screens are also being requisitioned.
Contact Information for Funding if different than above:
Name: Roger Sanderson if Edward Spike is not available.

8. E&CE '30 Series Semiconductor Parameter Analyzer

Submitted By:

Your Name: Paul Hayes
E-mail: phayes@ece.uwaterloo.ca
Phone Number: ext. 3969
Position: Lab. Staff

Description of Proposal:

The curve tracers in E2-3347 and E2-3348 are due for upgrading. They are 30 year old, Tek 577/D2/177. I would like to upgrade to the HP 4145A Semiconductor Analyzer. The proposal is to purchase two used units for $10,000 U.S.

Proposal Benefits:

All the students in the '30' series classes will be using these units. The ECE 231 class can be over 200 and the ECE 332 class can be over 200 during some terms. The older units may not last much longer. It would be better to be using equipment from 1985 rather than equipment form 1970. If we were to cover the increase in class size with the purchase of two 30 year old used Tek 577 they would still cost us $5,500Can. per Tek 577.
The HP 4145A units have a computer HP-IB interface for hard copy to computer printer. The HP 4145A can measure smaller currents and voltages.

Cost Breakdown:

$10,000 U.S. per HP 4845A.

Implementation Schedule:

Winter 1999.

Additional Information:

I have one Tek 576 on long term loan in case there is a crisis.

9. E&CE Telnet Server Upgrade

Submitted By:

Your Name: Eric Praetzel
E-mail: praetzel@ece.uwaterloo.ca
Phone Number: ext. 5249
Position: Lab. Staff

Description of Proposal:

The E&CE department has a Telnet.Server (RedHat Linux) to give students remote access to six of our Coldfire Computers (a simple, single board computer from Motorola).
The server currently connects to 6 Coldfire computers using 9 serial ports. There are 45 other Coldfire computers available in labs (as necessary – typically only 24 to 35 are available).

We would like to expand the Telnet Server because many students have expressed an interest in being able to run their software from home or other remote locations.

The Coldfire computers are used by 2 core E&CE courses taken by all students: E&CE 354, E&CE 222.

E&CE 354 (160 students / yr) - Students write and compile their project (an operating system) using the free GCC compiler (anywhere). This will be the main group of students using the Terminal Server.

E&CE 222 (350 students / yr) students must use the P&E assembler on Waterloo Polaris or purchase a student copy of the software. So they are less able to make use of the remote computers than E&CE 354 students.

Proposal Benefits:

E&CE 354 – remote access to 160 students [40 groups] / yr in the winter term
E&CE 222 – remote access to 350 students [175 groups] / yr in the summer term

Cost Breakdown:

$710.00 per Blue Heat 8 port PCI serial card.

one ($710), two ($1420) or three ($2130) units are preferred.

Implementation Schedule:

ASAP

Additional Information:

One card can be easily added to the server. If WEEF purchases 2 or 3 cards then the department will upgrade the server to handle the extra PCI serial cards.

10. E&CE 354 Telnet Server Computers

Submitted By:

Your Name: Eric Praetzel
E-mail: praetzel@ece.uwaterloo.ca
Phone Number: ext. 5249
Position: Lab. Staff

Description of Proposal:

The E&CE department has a Telnet Server (RedHat Linux) to give students remote access to six of our Coldfire computers (a simple, single board computer from Motorola).

These computers are nearly out of production and expensive to purchase ($495 US from the mfg or $650 Cdn thru suppliers). They also need network cards and this makes them very hard mount in a small volume.
Ie each computer is 3 cm high and is easily stacked. When a network card is added the computers are 10cm high, impossible to stack and very awkward to mount on anything.

The server currently connects to 6 Coldfire computers and we plan to expand this to 10+ computers.
The Coldfire computers would be more useful in the E&CE 222 laboratory with the increased class sizes.

We are proposing that the computers on the Telnet Server be upgraded from the 5206 to a newer version of the Coldfire, 5206e (faster, 8x the cache RAM, more instructions). There are several commercial computers using this microprocessor and they are signif. Cheaper than the Motorola development board.

E&CE 354 (160 students / yr) - Students typically write and compile their project on our Unix machines. To test their software they need to use our Telnet Server or go into a Polaris lab, log in. wait, download and run their software to see if it works. Ie it is very time consuming to have to go to the Polaris lab.

Proposal Benefits:

E&CE 354 – 160 students [40 groups] / yr in the winter term. We currently only have 6 computers available for 40 groups and would like to expand that.

Cost Breakdown:

$220US (qty 50) to $340 US per 5206e Coldfire computer (Moreton Bay NETtel or.Netburner) We are in the process of evaluating the two different products right now. Both are small and stack easily into a small volume.

At $560 Cdn. each we are looking for:

2 ($1120), 4 ($2240) or 6 ($3360) computers.

Implementation Schedule:

ASAP

Additional Information:

The E&CE Dept. will kick in to purchase more and get a volume price break.

11. E&CE Monitor Upgrade

Submitted By:

Your Name: Eric Praetzel
E-mail: praetzel@ece.uwaterloo.ca
Phone Number: ext. 5249
Position: Lab. Staff

Description of Proposal:

The E&CE Dept. would like to upgrade the remaining 14" monitors on the Polaris stations in two of our labs E2-3339 (7), CPH-3371 (7). These monitors are the six years old and need upgrading. The rest of the computers (18) in these rooms have newer, 3 year old, 15" monitors.

We propose to purchase TTX 17" model 1771 monitors at $320 each

Proposal Benefits:

Note: The E2-3339 lab is to become a new public computer room.

E&CE 318 – a core E&CE course with 350 students per year uses the E2-3339 lab exclusively
E&CE 241 – a core E&CE course with 350 students per year uses the E2-3339 lab occasionally
E&CE 48x – optional 4th year courses with aprox. 150 students per year use the CPH-3371 lab

Cost Breakdown:

$320 per monitor.

7, 11 or 18 units are preferred. I.e. 7 units ($2240), 11 units ($3520), 18 units ($5760)

Implementation Schedule:

Winter 2000.

Additional Information:

20 monitors have already been upgraded from 14" to 15" by the department.
6 monitors in CPH-3371 are not being upgraded (they are stand-alone test stations).
4 computers with 14" monitors are being added to E2-3339 in Winter 2000.

12. Dynamometre Work Station Upgrade

Submitted by: Wesley Reid
Email: wreid@ece.uwaterloo.ca
Phone: ext.3815
Position: lab staff

Description of Proposal:

The department has a five horsepower dynamometer complete with a dc motor.

To start the motor we are using a manual resistor starter. These starters have not been used in industry circa 1940's. We do not have an instument that will provide a torque and speed readout.

We would like to:

1) Provide students the experience of using a modern dc motor controller
2) Be able to obtain torque and speed readouts from the dynamometer

Proposal Benefits:

Students of course numbers: E&CE 362, ME 269, System Design

Cost Breakdown:

(1) DC motor controller $5100.00 (taxes included)
(2) Torque-speed display $3500.00 (taxes included)

Implementation Schedule:

Autumn 2000

13. Spectrophotometer for Water Quality Analysis and Wastewater Treatment

Submitted By:

Name: Alan G. Werker
E-mail: agwerker@sunburn.uwaterloo.ca
Phone Number: x 6324
Position: Assistant Professor

Description of Proposal:

This proposal is a request for funding to aid in the purchase of a microplate spectrophotometer that would be instrumental towards a necessary advancement in the level of undergraduate education in concepts and practices in applied microbiology and water quality analysis that are critical to Environmental, Civil and Chemical Engineering students specialising in Water Resources.

Proposal Benefits:

Microplate readers and the associated suite of possible biochemical assays have become key instruments in water and wastewater engineering practice and, therefore, should become part of the training of undergraduate. In addition to the principles and concepts surrounding individual assays, the instrument is ideal for laboratory teaching due to automation in kinetic analysis and the potential for students to test a multitude of parameters in a short period of time. Laboratory experience at the undergraduate level is often restricted by the extent of data that students can acquire in a short period of time. This instrument would provide for more profound laboratory experiences.

Cost Breakdown:

Costs:	
VERSAmax Spectrophotometer	18,286
Service Contract	1,357
GST @ 2.31%	454
Total	$20,097

Budget:	
Department of Civil Engineering	10,097
WEEF	10,000
Total	$20,097

Implementation Schedule (immediate):

- EnvE 330 Field Sampling & Analysis impacts Civil & Chemical Engineering Dept.
- CivE & EnvE 375 Water Quality Engineering impacts Civil & Chemical Engineering Dept.
- CivE & EnvE 472 Wastewater Engineering impacts Civil & Chemical Engineering Dept.
- EnvE 430/431 Project Courses impacts Civil & Chemical Engineering Dept.
- CivE 400 Project Courses impacts Civil Engineering Department

Additional Information:

a) Reasons for Preferred supplier: Molecular Devices VERSAmax

1. most flexibility with price comparable to other suppliers
2. temperature regulation (Ambient +4 to 45 degrees C)
3. monochromator for tuneable wave length adjustment (340 to 850 nm)
4. no specialised filters required
5. agitation with data acquisition for kinetic and/or endpoint modes
6. company markets direct to customer

b) Reasons other suppliers rejected: BIO RAD and DYNEX

3. do not permit wave length tuning for optimisation in analysis.
4. each type of assay performed requires the purchasing of another filter set.
6. must deal through wholesale agent

14. Energy Dispersive X-ray Analysis System for Scanning Electron Microscope

Submitted by: **S. Corbin, Mechanical Engineering**

e-mail: rkap@surya.uwaterloo.ca

Position: **Professor, Mechanical Engineering**

Description of Proposal:

Recently the energy dispersive x-ray analysis system (EDX) attached to the Department of Mechanical Engineering's JOEL 840 Scanning Electron Microscope (SEM) malfunctioned and needs to be replaced.

Benefits of the Proposal:

This device is used in demonstration labs in ME 215 and ME 230 and is a critical experimental tool for students completing course projects in ME 435, ME 531, ME 533, ME 535, ME 481 and ME 482. In particular ME 435 (Industrial Metallurgy) contains a major project where a car engine is taken apart and metallurgical analysis is performed on a variety of parts. The EDX – SEM equipment is extensively used in these projects. Our enrolment records over the past several years indicate that over 60% of Mechanical Engineering students take part in fourth year courses that utilize the EDX system. In order to maintain the quality of undergraduate training in this important area we need to purchase a new EDX system as soon as possible.

Cost Breakdown of Proposal:

Total cost of new EDX system	$59,000.00
WEEF request	**$19,000.00**
Departmental contribution	**$20,000.00**
Materials Research Group contribution	$20,000.00

Implementation Schedule:

Upon receipt of funding.

15. Fuel Cell Demonstration Project

Submitted by: Professor Xianguo Li, Mechanical Engineering

E-mail: rkap@mecheng1.uwaterloo.ca

Position: Professor, Mechanical Engineering

Description of Proposal:

Purchase equipment to construct a fuel cell for classroom demonstrations and for final year projects, for which **WEEF** made available about $3,500.00 in the previous term.

Benefits of the Proposal:

Provides the ability to provide experience with the latest technology in fuel cells. The fuel cell arrangement will allow design modifications and measurements to be made for final year projects.

Cost Breakdown of Proposal:

Membrane-electrode assembly	*$ 7,492.00*
Flow Distribution Plates	*2,040.00*
Instrumentation and controls	*3,963.00*
GST and Shipping	*1,158.00*
Total	*$ 14,653.00*

Implementation Schedule:

Spring Term 2000

Additional Information

Fuel cells are currently under development for use in buses and automobiles. Commercial vehicles are expected within 5 years. Considering the growing interest in fuel cell technology, we would like to introduce a demonstration in ME 459 (Energy Conversion) and have final year projects in fuel cell development. There is no one company that can supply a complete unit. Therefore it will be necessary to purchase components and construct the unit. This will be a rich source of final year projects.

16. ME 447 Robot Equipment Upgrade

Submitted by: J. Huissoon, Mechanical Engineering

E-mail: rkap@mecheng1.uwaterloo.ca

Position: Professor, Mechanical Engineering

Description of Proposal:

The project component of ME 447 uses two small robot arms, two PCs with frame grabbers and a CCD camera. The objective is to write a program (for the PC) that:

- acquires an image of the robot workspace
- analyses the image to determine the location of a block
- determines the robot joint angles that will position the gripper over the block
- transmits these joint angles to the robot.

A program written for the robot controller uses the joint angles received from the PC to get the robot to pick up the block, and place it in the bin.

The robot equipment was purchased in 1986, and the controllers are showing their age. The controllers are shipped to the manufacturer (CRS Robotics in Burlington, Ontario) once per term for servicing, yet still have serious reliability problems. This leads to frustration for the 40-50 students trying to complete their projects.

Option A)

CRS Robotics has agreed to replace both robots and controllers with up-to-date equivalent systems (the A255) for **$36,000.00**. This is a 20% reduction over and above their educational price of $22,600.00 per robot.

Option B)

A somewhat less expensive alternative would be to trade in the controllers for the latest model, but this requires that the motor amplifiers and cable connecting the controller to the robot be transferred from the old controllers to the new controllers. The quote from CRS Robotics for this option is **$23,000.00**

Benefits of the Proposal:

The current system is not reliable and this results in wasted time and effort for student trying to complete the project component of ME 447. Replacing this system now will benefit the students enrolled in this course (40-50) as well as future students.

Cost Breakdown of Proposal:

Option A)	$36,000.00
Option B)	$23,000.00

Mechanical Engineering will participate in 50% cost sharing over two terms.

Implementation Schedule:

Upon receipt of funding

17. Monitors for Systems Design Computer Lab

Submitted By:

Name: David Tunnah
E-mail: dltunnah@uwaterloo.ca
Phone Number: (519) 747-7798
Position: 4B SYDE
Name: Kevin Krauel
E-mail: kbkrauel@kingcong
Phone Number: X5760
Position: Lab Director

Description of Proposal:

The aim of this proposal is to purchase up to a maximum of six 17" monitors to replace the ailing 15" monitors currently in the Systems Design RASL computing facility located at E2 1303C.

Proposal Benefits:

The monitors in the majority of Engineering Computing Facilities currently are 17" monitors. RASL is one of the few labs left with 15" monitors and some of these are ailing. As a result, students are less likely to use these computers. If the monitors in this lab were upgraded, students would be more likely to use the computers provided and thus free up resources for the rest of the engineering undergrads.

This proposal would immediately benefit all on-campus Systems Design Engineering undergrads. However, in addition, because Systems Design undergrads will be more likely to use the computer resources provided to them, it will free up shared resources, thus benefiting the rest of the on-campus engineering undergrads. This proposal will directly benefit approximately 140 Systems undergrads in any one term.

Cost Breakdown:

A quote for monitor prices was obtained from Group 4 Technologies. The department has often dealt with this vendor and they are reliable and fair.

Item	Unit Price	Qty	Total Price
ADI 5P+ 17" .26p 1280*1024 w/ Built in Microphone (w/ 3 yr warranty)	438	6	2628
subtotal plus taxes (10%)			2892
50% Contribution from Systems Design Department			1446

50% Contribution from WEEF			**1446**

Cheaper models were looked into but the alternate name brand was one that the university has not used before and the quality was not as good as the selected brand.

If full funding cannot be granted for this project, even given the contribution from the Systems Design Department, there are other options:

SYDE Dept Gets	SYDE Dept Gives	**WEEF Gives**
2 monitors	482	**482**
4 monitors	964	**964**

Implementation Schedule:

As soon as the funds are procured, the monitors can be purchased and installed almost immediately.

18. CART (Commuter Assisting Recumbent Tricycle)

Submitted By:

Names: David Demner, Bettina Hans, Andrew Keats, Stephen Koo, and KJ Shipp
E-mail: dndemner@engmail
Phone Number: 746-1379
Position: Students

Description of Proposal:

The group members listed above are currently doing their 3B Systems Design Engineering workshop project and hope to construct a prototype for a motor-powered bicycle by the end of next term. We are looking for money for the many parts that we will need to complete this task. Most of the major parts will come used (so will be less expensive), as listed in the Cost Breakdown. All five group members are very enthusiastic about our project, and really hope to get enough money to realize our goals.

Proposal Benefits:

Currently, this proposal will benefit the people listed above, as well as any future group members, and the group supervisor Steve Lambert. Since the money will be used to purchase components from local companies, all the donated money will go into the local economy. The main source of used bicycles and parts will likely be the SLC Bike Shop, so this proposal will benefit on-campus enterprises as well. Due to the public nature of testing the prototype, WEEF will gain exposure through logos posted on the side of the CART.

Cost Breakdown:

(Include partial funding options)

Component(s)	Cost	Qty	Total	New/Used	Likely Supplier	Required?
Motor	$ 200.00	1.00	$ 200.00	Used	Junkyard or repair shop	
Old Bikes for frame parts	$ 20.00	4.00	$ 80.00	Used	UW Bicycle Center	Yes
Bearings	$ 15.00	4.00	$ 60.00	Either	Bike Shop or old bikes	Yes
Cassettes	$ 60.00	4.00	$ 240.00	Either	Bike Shop or old bikes	Yes
Batteries for motor	$ 50.00	4.00	$ 200.00	New	Auto shop	
Welding Tools and Time	$ 200.00	1.00	$ 200.00	New	Mech. Eng or Exte source	Yes
Spare Construction Parts	$ 120.00	1.00	$ 120.00	Both	Bike Shop or old bikes	Yes
Shell Construction	$ 500.00	1.00	$ 500.00	Both	Local businesses	
Miscellaneous Expenses	$ 400.00	1.00	$ 400.00			

Total Required	**$ 700.00**
Total Desired	**$ 2,000.00**

Implementation Schedule:

Most of this money will be spent as soon as we get it on the parts listed above. Any remaining money will be used to construct our second (and subsequent) prototypes, which will involve additional (and higher-grade) materials.

Additional Information:

All five group members plan on continuing this project until we graduate one year from now.

19. Multimedia Classroom Equipment

Submitted By:

Name: Fred Lai
E-mail: fcklai@engmail
Position: 3B Student, SYDE

Name: Kevin Krauel
E-mail: kbkrauel@kingcong
Extension: 5760
Position: Lab Director, SYDE

Name: Jason Foster
E-mail: jafoster@engmail
Position: Master's Student, SYDE

Name: Colin Campbell
E-mail: campbell@ist
Extension: 5327
Position: Academic Computing Consultant, IST

Description of Proposal:

The Systems Design Engineering department would like to upgrade its three primary undergraduate classrooms by purchasing and installing equipment for multimedia presentations. Due to the relatively high cost of such equipment, we propose to spread the purchases over a number of terms.

This proposal is to request partial funding to purchase a data projector, projection screen, computer, and object/document camera for one of these classrooms, E2 1303B.

Proposal Benefits:

The installation of multimedia equipment in E2 1303B will result in a more interactive learning environment in the classroom, benefiting both students and lecturers. Furthermore, our students will benefit as users because they are expected to do a large number of technical presentations through a sequence of core workshop courses.

With a permanent installation, set-up and take-down time will be significantly reduced. In addition, the permanent installation allows Systems Design students 24-hour access to the equipment.

The following highlights the justification and benefits of the individual components:

A *data projector* is fundamental for the display of computer generated text and graphics. The display of computer generated images would likely be the most common application of a multimedia capable classroom. A data projector is also fundamental to the display of video that can be concurrently viewed by all students.

The selected data projector will be ceiling mounted and capable of projecting an image with sufficient luminosity and contrast so that it can be viewed from the back of the classroom under normal lighting conditions.

The selected *projection screen* would facilitate a much larger display than that of the smaller screen already installed in the classroom. In addition it features a motor drive for convenient on-demand deployment and retraction of the screen. This feature greatly simplifies use of the projection screen.

A *computer* is fundamental for presentation of computer generated text and graphics. The computer will be connected to the campus network to facilitate presentations involving live content, such as WWW sites.

The *object/document camera* would allow the presenter to conveniently display colour images from books and other reference materials. It would also allow the display and annotation of paper course notes.

Cost Breakdown:

Data Projector	$11,000
Projection Screen	$ 1,600
Computer and peripherals	$ 4,000
Object/Document Camera	$ 2,200
Total Cost	$18,800

Financial support requested from WEEF: $ 9,400.

The Systems department will provide the other half of the financing.

Implementation Schedule:

The Systems department is planning to have the equipment installed and fully functional by May 2000. Professor Keith Hipel is anticipating that this equipment will be installed and operational to teach SYDE 114 (Linear Algebra) this Spring term. Others will be eager to use this equipment as well.

Additional Information:

Next term we plan to request funding for the purchase of additional equipment to enhance the multimedia presentation capabilities of E2 1303B. In subsequent terms, we intend to request funding to purchase multimedia presentation equipment for the other two classrooms, E2 1303A and E2 1303E.

20. Rocks and Minerals

Submitted By:

Name: Niki Czerniak
E-mail: neczerni@engmail.uwaterloo.ca
Phone Number: 885-7960
Position: 2A Geological Engineering Student

Description of Proposal:

The proposal is for the purchase of rock and mineral identification sets and rock and mineral specimens. The rocks and minerals currently used for this are 20 years old (or older) and are in need of replacement. The identification sets are essential as a teaching tool to show students the various characteristics of the rocks and minerals, as well as for exam purposes.

Proposal Benefits:

The proposal will benefit Geological, Civil and Environmental-Civil Engineering and Earth Science students. The rocks and minerals will be used for Geo E 126, Earth 231, Earth 232, Earth 333, Earth 332, Civ E 253, as well as for reference material.

Cost Breakdown:

Igneous, Metamorphic and Sedimentary Rocks: 10 different rocks @ $40/packge

+ tax

= $460.00

Minerals: 10 different minerals @ $120/package + tax = $1380.00
Rock and Mineral Identification Sets + tax: $559.65
Total Cost: $2399.65

Implementation Schedule:

The rocks and minerals will be purchased as soon as possible after funding is received.

Additional Information:

21. FIRST MILLING MACHINE

Submitted by: Clarence Wallace, Supervisor, Engineering Student Shop
Extension: 2301

E-Mail: rkap@surva uwat...

Description of Proposal:

The Student Machine Shop provides essential hands-on experience for all undergraduate students either for core class courses or special projects. In order to facilitate the ever-increasing number of students it is essential that we upgrade some of our machines. It would be a great asset to the shop to have a new milling machine.

Benefits of Proposal:

Students from all engineering disciplines will benefit from a better-equipped student shop. More courses are requiring hands-on projects - making it essential to have better and safer equipment available. The number of students using the shop has increased quite dramatically over the past two years and this underlines the need to continually upgrade wherever possible. A new milling machine would also promote safety, efficiency and provide better quality work.

Cost Breakdown:

First Milling Machine – Model: #LC-1 US – Variable Speed Head
Heindenhain 2-Axis Digital Readout System: Model: #ND 710 and Accessories

	$10,160.00
GST	711.20
PST	812.80
Total	**$11,684.00**

Implementation Schedule:

Upon receipt of funding.

22. Helix Lab Upgrade

Submitted by:

Name: Martin MacLeod
e-mail: martin@engmail.uwaterloo.ca
Phone: ext. 2965
Position: Manager of Hardware Operations and System Reliability
Department of Engineering Computing

Description of Proposal:

Engineering Computing is an academic-support department within the Faculty of Engineering which provides leadership in the development and support of the Waterloo Polaris environment and the faculty computing communications network. It also manages and supports the general purpose computing labs Helix, Wheel, Wedge, Lever and Gaff as well as the engmail and engulf (novice replacement) servers.

The focus of this proposal is to upgrade the 29 Helix lab system units. Currently, the machines in Helix are 100MHz Pentium machines which were installed in Dec 95/Jan 96 so the lab will be roughly 4 1/2 years old at the time of its replacement. The current equipment is becoming increasingly expensive to maintain in terms of ongoing repairs.

Proposal Benefits:

The benefits of this proposal accrue to all users of Helix: increased speed, improved performance and reliability as well as staging the renewal of our labs over a period of time.

Cost Breakdown:

The request to WEEF is for a portion of the cost of the upgrade. Engineering Computing will contribute the rest.

Description	Quantity	Price/unit	Total	Total with 10.3% Taxes
550MHz P3, 64MB Ram, 9.1GB HD Mouse, 8M Dram video card	29	$1,164	$33,756	$37,233
Contribution from Engineering Computing:				$32,233
Request for funding from WEEF				***$5,000***

(Prices as of Feb 17, 2000 from JKL)

Implementation Schedule:

The upgrade is planned for the end of April, 2000, prior to the Spring term.

Update on progress from S99, F99 :

WEEF provided Engineering Computing with $2500 in its S99 decision and $5000 in its F99 decision in partial support of a new email server (engmail). The server was purchased in late December and installed in February, 2000. It is as Sun Ultra Enterprise 250, with dual 400MHz CPUs 1 Gb memory and 3 x 18 Gb disks. The total cost was $27,000 including taxes.

The original proposals were for a Mirapoint e-mail appliance, but it was not purchased due to a large price increase and some unresolved technical questions, which we knew were not an issue with the Sun.

There have been a few minor implementation issues, but these have been resolved and performance of the server has been excellent .

I would like to thank WEEF for its continued support.

Beth Jewkes
Associate Dean for Computing, Engineering

23. GNCTR 2002 (tentative name: FRIDGID)

Submitted By:

Name: Randall DeLong
E-mail: rwdelong@engmail.uwaterloo.ca
Phone Number: 725-1549
Position: Team Founder

Description of Proposal:

We our asking for $1000 from WEEF. This money will allow our team to handle team start-up costs. It is meant to allow us to purchase Boggan Burgers, team stationary (which shall be sent to potential sponsors) and all sorts of other things that will need to be funded.

Proposal Benefits:

It will allow the tradition of the Concrete Toboggan to continue. We will also place WEEF stickers on everything we do, and if possible stamp each burger sold with the WEEF logo.

Cost Breakdown: $1000

(Include partial funding options)

Implementation Schedule:

First Thursday of Fall Term. Mmm...burgers

Additional Information:

WEEF is good.

Contact Information for Funding if different than above:
Name: Luke Anderson
E-mail: sausealso@hotmail.com
Phone Number:
Position: Team Founder

24. GNCTR 2001

Submitted By:

Name: Heather Anne Armitage, Gord Turner
E-mail: hamarmit@engmail.uwaterloo.ca, hamarmit@yahoo.com, turner@ftn.net
Phone Number: 658-1065
Position: members of design team for GNCTR 2001 team

Description of Proposal:

We are requesting funds for the entrance fees of the GNCTR 2001. For, at least, the last two years the registration fee has been $100 per person. The minimum number of team members is six. We are entering two separate teams in the race. Ideally each team would have 8 members (5 design members + 3 support members). It is a requirement of the race that five people ride the toboggan down the hill.

Proposal Benefits:

GNCTR is a renowned event in Canada. The University of Waterloo hosted the event in 1999 and is always a strong competitor in the race. The race is an engineering competition combining creativity and innovation. Each team is required to design, construct, and race a toboggan. The toboggan's running surface is made out of Portland based concrete. In addition, each toboggan must be equipped with a braking system to stop the sled at the bottom of the hill. Judges ensure the toboggan meets all dimension, weight and safety requirements and award points at a technical exhibition as well as on race day.

GNCTR allows our class to work together on a large-scale project. It also allows us to apply our knowledge in a fun, but competitive, environment.

Cost Breakdown:

As mentioned above, we are requesting the entrance fee of $100 for 16 team members, for a total of $1600. However, the entrance fee for 12 members would also be appreciated, for a total of $1200.

Implementation Schedule:

The host school of the GNCTR 2001 has not yet been decided. However, in the past the host has requested the entrance fee by the fall prior to the race. Therefore, we would like to pay our entrance fee by the end of our summer term. At this point we will have a finalised list of team members.

Additional Information:

25. Waterloo Aerial Robotics Group

Submitted By:

Name: David Carney
E-mail: dfcarney@engmail.uwaterloo.ca
Phone Number: (519) 884-0420 (home) (519) 746-3700 x.318 (work)
Position: Sponsorship Co-ordinator

Description of Proposal:

The Waterloo Aerial Robotics Group (WARG) is a primarily undergraduate group that conducts research under the Department of Electrical and Computer Engineering. Currently, WARG is designing a system of autonomous aerial robots for the International Aerial Robotics Competition (see http://avdil.gtri.gatech.edu/AUVS/IARCLaunchPoint.html).

With the new addition of a 4th year project requirement to the E&CE curriculum, WARG has had an influx of students hoping to use it as a basis for undergraduate projects. In addition, there already exists a significant number of students enrolled within Mechanical Engineering and Systems Design Engineering who are fulfilling their project-related course requirements through contributions to and from WARG. It is the desire of the WARG team that it be able to support these student projects as they are mutually beneficial to both the individual students and the Faculty of Engineering. Some of these projects will require sponsorship in the way of monetary donations. WARG would like to request from WEEF sponsorship for use in promoting WARG-related undergraduate student projects.

In addition to funds used to advance student projects, WARG is also in need of capital so that new battery packs and chargers may be purchased. These components are vital to the performance of the WARG entry later this year. WARG is also in need of new rotor blades and money to aid in the construction of a complex testing platform for use in the system identification of the helicopter. Further funds, though not absolutely necessary, can surely be put to use towards the eventual purchase of a new single board computer, digital cameras, and a laptop computer (for use with field testing).

Proposal Benefits:

Funding WARG will result in an increased capacity for WARG to derive and fund student projects. This will encourage greater student involvement within a Faculty of Engineering venture and lead to the greater overall success of the WARG entry in future competitions.

Cost Breakdown:

Student project	$500
NiMH battery pack	$150
Battery charger	$40
Helicopter Rotors (pair)	$200
Testing Platform	$400
Single board computer	$800
Digital camera	$600
Laptop computer	$1800

Funding Package A*   10 NiMH battery packs   4 Battery chargers   2 Pairs of helicopter rotors   1 Testing platform   Total: $2660
Funding Package B   6 Student Projects   Total: $3000
Funding Package C   1 Single board computer   2 Digital cameras   1 Laptop computer   Total: $3200

* At this time it is highly preferable that we obtain funds to secure items as listed within the 'Funding Package A' option.

Implementation Schedule:

Funding Package A – All funds allotted will be used immediately.

Funding Package B – Sponsorship donations will be distributed over the course of the year.

Funding Package C – Sponsorship donations will be made over the course of the next couple months.

Additional Information:

None.

26. Midnight Sun VI Solar Car Project

Submitted By:

Name: Connie Kwan
E-mail: cmkwan@uwaterloo.ca
Phone Number: (519) 888 - 4567 x 2978
Position: Business Manager

Description of Proposal:

The Midnight Sun Solar Car Project strives to design, build, and race a winning solar car. Every term, over 100 University of Waterloo students, primarily engineers, lends their efforts. At the present time, Midnight Sun VI design is underway. The completely reengineered car will be racing in American Solar Challenge (ASC 2001) and World Solar Challenge (WSC 2001) in Australia. Midnight Sun VI aims for a lighter car, higher efficiency solar cells and improvements in aerobody, mechanical and electrical systems. Building on solid engineering practices, the latest in computer aided engineering, a wealth of past experience, and an influx of new ideas, the team is poised for the new challenge ahead. We are confident that these improvements will bring home another top 10 finish in the 2001 races. However, success does come with a price. In our current situation we need more funds for research, which is a vital step to a successful car. Thus we approach WEEF for funding in the purchase of 2-way radio, lightbar and solar cells.

2-way Radio

Midnight Sun VI is currently in the testing and research stage of development. During this stage, test driving of Midnight Sun V is important and a 2-way radio would allow communication between driver and outside support. This is crucial to the safety of the driver, as he/she can be informed if anything goes wrong. It is otherwise impossible to communicate with the driver within the vehicle.

The 2-way radio is useful for future uses as well including race communication. The lead car, solar car and chase car must be able to communicate throughout the race. This is to ensure safety and coordination. Much information is sent to the driver while travelling. These include weather conditions, ideal cruising speed, wind speed and dangers ahead. Thus the 2-way radios would be put to good use both now and for the future.

Lightbar

A lightbar is a race regulation item. Both ASC and WSC require that a lightbar be installed on the lead vehicle. This is to ensure safety. The lightbar include adapters and mounting feet used to install onto the vehicle. There are two options for this lightbar. One

is the large lightbar, which provides greater visibility to other drivers on the road. The other is the light beacon, which is a smaller version and is a smaller flashing light. Four of the latter would be required to fill the regulation. A larger lightbar is preferred for safety but either will suffice.

Solar Cells

A solar car must contain solar cells. Since we are aiming for 19% efficiency solar cells at $250 each, the expense for the entire array is costly and we hope to alleviate the cost a bit at a time. Thus we ask for 8 solar cells which amounts to $2000 (tax included).

Proposal Benefits:

Students from many faculties are involved in designing and building subsystems for Midnight Sun. Currently, the team consists of about 85 engineering students from all disciplines and approximately 15 non-engineering students from the faculties of Arts, Science, and Mathematics. Many students make research for the car's subsystems a student project and learn much from the experience. Many students will also be dealing with industry for obtaining sponsorship and consulting. The investment by WEEF in the **** will make Waterloo a stronger competitor the 2001 races. And since Midnight Sun represents University of Waterloo Engineering, a successful team gives Waterloo greater exposure. Exposure at shows such as Canadian International Auto Show (CIAS), at local festivals such as Earth Day in KW, to high school students via our new program Solar Quest and the media.

Goals of Midnight Sun VI:

- To design, build, and race a winning solar car for ASC 2001 and possibly WSC
- To develop an interdisciplinary engineering project that promotes education through applied engineering experiences
- To represent Waterloo Engineering through exposure of the project at races, trade shows, and media events
- To further alternative fuel technologies through research and development efforts

Students who work on this project develop manufacturing techniques and rigorous validation systems in order to produce a winning design. Students also benefit through working with industry contacts, professors, graduate students, and each other.

27. Formula SAE Project

Submitted By:

Your Name: Jonathan Hook, Jeremy Schmidt
E-mail: fsae@engmail
Phone Number: x5904
Position: Formula SAE Team 2000 co-leaders

Description of Proposal:

Batteries – purchase of one 12 volt motorcycle battery for 2000 car. Purchase of one car battery for 2000 car.
Helmets – purchase of 2 racing helmets for competition.
Printer – purchase of an HP-1220C inkjet printer.
Steering Wheel – purchase of 10" steering wheel for 2000 car.
Tent – purchase of an E-Z Up tent.
Transportation – rental of truck for transportation of car and supplies to competition.

Proposal Benefits:

Batteries – The team's current batteries have reached the end of their life and are in need of replacement. The motorcycle battery is required as an on-board power supply. The car battery is used for starting the car and serves as back up.
Helmets – Properly certified helmets are required for the FSAE competition. In order to ensure the effectiveness of a helmet it should be replaced every 3-5 years. Currently the team's helmets are due for replacement. Two helmets are needed, as the competition requires quick driver changes between event heats.
Printer – The HP-1220C printer is capable of printing 11x17" sheet of paper allowing it significantly offset the need for outside printing services. This will help reduce team operating costs. The printer will be used to produce all of the team's promotional literature, displays and competition documentation.
Steering Wheel – The purchase of a new steering wheel will allow the FSAE team to keep the previous car in complete running condition. This will allow for greater flexibility in testing and training than has been possible in the past.
Tent – The E-Z tent will be used in the paddock area at the competition. As the competition is outdoors shelter is required. The tent will also be used at the various promotional/display events attended by the team throughout the year. It is also hoped that other on-campus teams can make use of the tent.
Transportation – A large cube van is required to transport the car and required supplies to the competition in Detroit. The truck is required to be rented for 1 week.

Cost Breakdown:

Item	Cost
Batteries:	
Motorcycle Battery	$90.00
Car Battery	$100.00
Helmets (2)	$900.00
Printer	$800.00
Steering Wheel	$200.00
Tent	
10'x20' Basic Tent	$1700.00
Side Walls (3)	$550.00
Peak & Valance Logos	$1350.00
Funding Option: Any combination of the above.	
Transportation (Truck Rental)	$1300.00
Total:	$6990.00

Implementation Schedule:

The items listed above would be purchased as soon as possible. Each item would have an immediate positive impact on the 2000 FSAE team as well as future teams.

Additional Information:

28. UWAFT – Cold Start System

Submitted By:

Name: Keith Parker
E-mail: bkparker@engmail.uwaterloo.ca
Phone Number: 746-8163
Position: UWAFT Team Member

Description of Proposal:

UWAFT is preparing for the 2000 Ethanol Vehicle Challenge. In this edition of the challenge a Silverado pickup truck is to be optimized to run on Ethanol-85, a renewable, cleaner-burning fuel than gasoline. The truck is evaluated against four criteria: exhaust emissions, fuel economy, power and cold starting/driveability.

This is a proposal for funding of the parts necessary to construct the cold start system. The parts include the following items for the different cold start systems:

- The Air Intake Heater – Resistive Heating Coils and a Performance Air Filter
- Cold Start Controller – PLC
- Hydrogen/POX System: Reactor, Catalyst, Gaskets and Storage
- General: Batteries to operate the subsystems

Proposal Benefits:

The team comprises members from mechanical, chemical, and systems design engineering. There are also opportunities for electrical and computer engineers.

The competition is an invitation only even, where 13 of the top American schools are invited, as are 3 of the top Canadian schools. This is the first year that there are Canadian schools other than Waterloo, and thus it is even more important that Waterloo is successful in a high placing in the competition. A successful result would give Waterloo some very positive exposure to many schools and companies across North America.

For Waterloo engineering students there is a lasting benefit. The team has been very good at passing along information year to year. As such, any thing learned by this year's team, either at the competition or in research and development for the competition, will be passed along to future students.

An important part of the competition is in cold start. One of the challenges of Ethanol fuel is that it is very sensitive to cold starting and there is difficulty igniting the fuel even at room temperature. By funding the parts necessary to build these cold start systems, the team will be able to excel in the cold start category of the competition. This will complement the strengths that the truck has in emissions. The team has always done well in past competitions, and a better cold start system will go a long way in ensuring the truck places in the top three.

Cost Breakdown:

System	Item	Cost
Air Intake Heating	Resistive Heating Coils	$75
	Performance Air Filter	$100
Cold Start Controller	PLC	$350
Hydrogen/POX	Reactor	$150
	Catalyst	$150
	Gaskets	$33
	Storage	$800*
General	Batteries (3)	$600

*To be determined, this is the most likely worse case scenario. More information in the presentation.

TOTAL Amount: $2358

PARTIAL
(Hydrogen System+Controller+Battery): $1683

Implementation Schedule:

As soon as possible. All items will be purchased as soon as the funding is awarded such that the team can install and fully test the items prior to the competition.

Additional Information:

UWAFT has not made a request for funding from WEEF since the S99 term. The team endeavours to have a high sponsorship rate for key parts and also financial sponsorship for other expenses. Although the team has had success in securing many of these types of sponsorships, WEEF funding is being requested to ensure that the team is able to do its best preparation for the competition. In addition to the expensive nature of the parts required for the modifications to the truck, regular operating costs (as with any vehicle) have an impact on the budget.