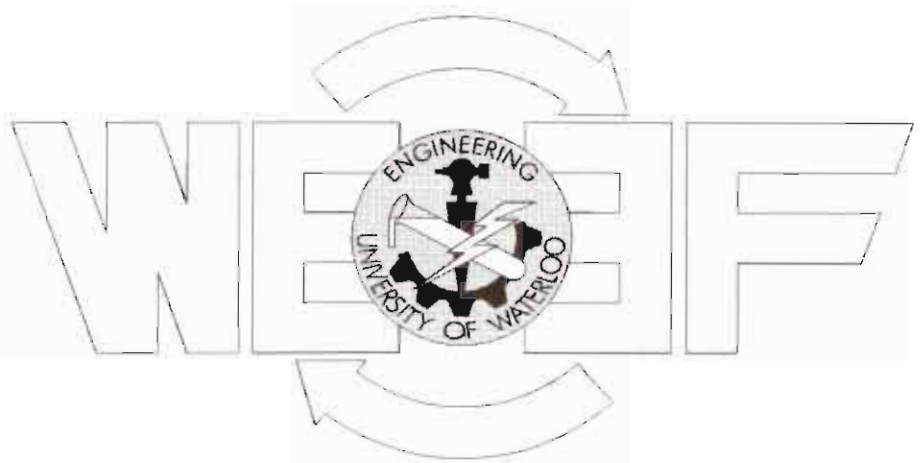
WEEF Proposals & Allocations	Spring 2000	
Chemical and Environmental Chemical	Requested	Allocated
64 Meg Memory Upgrade to Chem Eng Public Workstations	$ 4,873.00	$ 4,873.00
Recycle Experiment	$ 14,500.00	$ 4,850.00
		$ 9,723.00
Civil and Environmental Civil		
Civil Undergraduate Computer Lab Upgrade	$ 9,360.00	$ 9,077.56
Survey Equipment	$ 6,854.10	$ -
		$ 9,077.56
Electrical and Computer		
Audio Amplifier System for E2-3344	$ 2,857.00	$ -
E&CE Dept. PIC Microcomputer Development Stations	$ 1,625.00	$ 975.00
E&CE 223 Xilinx FPGA Upgrade	$ 3,400.00	$ 1,340.00
E&CE 223 Logic Probes	$ 700.00	$ 350.00
380 Lab Expansion	$ 3,975.00	$ 3,975.00
		$ 6,640.00
Mechanical		
Computer and Data Acquisition Card for Fluid Power Control Lab	$ 2,050.00	$ 2,050.00
ME 447 Robot Equipment Upgrade	$ 10,200.00	$ 5,100.00
Computer Data Projector	$ 2,225.00	$ -
Programmable Logic Controllers (PLC's)	$ 13,500.00	$ 2,700.00
		$ 9,850.00
Systems Design		
Multimedia Classroom Equipment	$ 3,450.00	$ -
Digital Video Camcorder	$ 4,425.00	$ 3,318.75
		$ 3,318.75
Geological		
Geological Computer Systems	$ 4,180.00	$ 4,180.00
		$ 4,180.00
Misc		
First Milling Machine	$ 11,684.00	$ 5,000.00
LEGO MindStorms (including Wireless RCX Interfaces)	$ 5,604.76	$ -
		$ 5,000.00
Sub-Total Department	**$ 105,462.86**	**$ 47,789.31**
Student Groups		
Waterloo Aerial Robotics Group	$ 4,500.00	$ 4,500.00
Free Flight Glider Team	$ 1,000.00	$ 430.00
Clean Snowmobile Challenge (CSC2001)	$ 6,344.37	$ 1,380.69
WOMBaT	$ 1,221.86	$ 900.00
Team Advancement for the Formula SAE Project	$ 10,000.00	$ 2,000.00
Midnight Sun VI Solar Car Project	$ 5,883.16	$ 3,000.00
Sub-total Student Groups	**$ 28,949.39**	**$ 12,210.69**
Total	**$ 134,412.25**	**$ 60,000.00**

Waterloo Engineering Endowment Fund



Spring 2000 Proposals

WEEF Proposals - Spring 2000

	CHEMICAL AND ENVIRONMENTAL CHEMICAL	Funding Requested
1	64 Meg Memory Upgrade to Chem Eng Public Workstations	$4,873.00
2	Recycle Experiment	$14,500.00
	CIVIL and ENVIRONMENTAL CIVIL*	
3	Civil Undergraduate Computer Lab Upgrade	$9,360.00
4	Survey Equipment	$6,854.10
	ELECTRICAL AND COMPUTER	
5	Audio Amplifier System for E2-3344	$2,857.00
6	E&CE Dept. PIC Microcomputer Development Stations	$1,625.00
7	E&CE 223 Xilinx FPGA Upgrade	$3,400.00
8	E&CE 223 Logic Probes	$700.00
9	380 Lab Expansion	$3,975.00
	MECHANICAL	
11	Computer and Data Acquisition Card for Fluid Power Control Lab	$2,050.00
12	ME 447 Robot Equipment Upgrade	$10,200.00
13	Computer Data Projector	$2,225.00
14	Programmable Logic Controllers (PLC's)	$13,500.00
	SYSTEMS DESIGN	
15	Multimedia Classroom Equipment	$3,450.00
16	Digital Video Camcorder	$4,425.00
	GEOLOGICAL	
10	Geological Computer Systems	$4,180.00
	MISC	
17	First Milling Machine	$11,684.00
18	LEGO MindStorms (including Wireless RCX Interfaces)	$5,604.76
	Sub-Total Departmental	**$105,462.86**
	STUDENT	
19	Waterloo Aerial Robotics Group	$4,500.00
20	Free Flight Glider Team	$1,000.00
21	Clean Snowmobile Challenge (CSC2001)	$6,344.37
22	WOMBaT	$1,221.86
23	Team Advancement For The Formula SAE Project	$10,000.00
24	Midnight Sun VI Solar Car Project	$5,883.16
	Sub-Total Student Groups	**$28,949.39**
	TOTAL	**$134,412.25**

Table of Contents

1. 64 Meg Memory Upgrade to Chem Eng Public Workstations

Submitted By:

Your Name: Dennis Herman
E-mail: dherman@chemeng.uwaterloo.ca
Phone Number: 2196
Position: Computer Systems Manager

Description of Proposal:

Add 64 Meg DIMMs to all 79 public Waterloo Polaris workstations in Chemical Engineering. The ChemEng department is able to contribute $2000 to this proposal.

Proposal Benefits:

Improve the stability of ever expanding applications on Polaris Workstations such as Matlab, MS Office etc and particularly the use of Chemical Engineering applications Aspen, Hysys, Systat etc. Stability problems are of particular concern when several of these programs are used simultaneously.

Improve the speed and startup time of Waterlo Polaris.

133 MHz SDRAM DIMMs could be reused in future upgrades to Pentium II and III systems

Cost Breakdown:

79 machines X $87 per DIMM = $6873 - $2000 (dept contribution) = $4873

Implementation Schedule:

Immediate installment upon receipt of goods.

2. Recycle Experiment

Submitted By:

Your Name: Siva Ganeshalingam
E-mail: sganesh@engmail.uwaterloo.ca
Phone Number: 6161
Position: Laboratory Technician

Description of Proposal:

To set up an experiment that will help students understand the recycle process. This experiment has been successful in the undergraduate laboratory at the University of Technology in England. A prototype which worked reasonably well was built last year with materials available in lab.

We request funding from WEEF to:

(1) To do substantial modification to make the data acquisition for this experiment quicker and easier. We will use the following:
(a) Flow cells and digital meters to measure flow rate instead of flow meters.
(b) Thermocouples and digital meters to measure temperatures instead of thermometers.
(c) A 3 kW heater instead of the lower power heater used in the prototype.
(d) A pump to circulate the recycle fluid to a maximum flow rate of 8L/m.
(e) A computer to make the data collection easier and more accurate.

Note: Since the first year has always been a large class, we need funding to build three of these units. All first year experiments are set in triplicates.

Proposal Benefits:

We intend to give this experiment initially to the first year students of chemical and environmental chemical engineering to be performed in their 101 Laboratory course. This apparatus permits both a visual and an experimental appreciation of the operation of a simple recycle loop. With little modification, the apparatus could be used, for a reaction experiment by the fourth year students in their 040 Laboratory and second year students in their Fluid Mechanics Laboratory.

Cost Breakdown:

(1) Flow measurements
- Flow cell and digital indicator: $800
- For three of these units: 3*800 = $2400

(2) Temperature measurements
- Thermocouple and digital indicator: $170
- For three of these units: 3*170 = $510

(3) Heater and control unit
- Unit cost = $700

(4) Circulation pump – maximum flow of 8L/m
- Unit cost = $ 250

(5) Computer interface
- Unit cost = $ 990

Total cost for one setup = $ 4850
Total cost for two units = $ 9700
Total cost for three units = $ 14500

Implementation Schedule:

As soon as possible

Additional Information:

- Department agreed to provide the computers
- The installation will be done by the departmental Technicians.

3. Civil Undergraduate Computer Lab Upgrade

Submitted By:

Name: Mark Mollison
E-mail: mamollis@engmail.uwaterloo.ca
Phone Number: 725-9175
Position: Civil Engineering Undergraduate Student, 2B Term

Description of Proposal:

This proposal requests upgrades to the Civil computing facility located on the 2nd floor in E2, room 2340. Specifically, this recommends upgrades to the current monitors, from 15" to 17" high resolution. This proposal has the support of three classes; 4A Civil, 2B Civil, and the 3A Environmental Civil.

Proposal Benefits:

This facility is available to and benefits all Civil undergraduate students. Many monitors in the civil lab are not dependable and routinely display indecipherable information. These 17 inch, high resolution monitors would drastically improve applications such as AutoCADD and Excel, not to mention the extensive 3rd year report writing courses. Upgrades would also eliminate the current inventory of malfunctioning monitors.

The civil engineering department endorses this proposal and will match any WEEF contribution dollar for dollar to a maximum of $10 000.

Cost Breakdown:

Proposal	Item	Price per unit	Units	WEEF Contribution
1	ADI MicroScan G700 PureFlat 17" .24ag 1600x1200 Monitor	468.00	40	9360.00
2	ADI MicroScan G700 PureFlat 17" .24ag 1600x1200 Monitor	468.00	20	4680.00
3	ADI MicroScan G700 PureFlat 17" .24ag 1600x1200 Monitor	468.00	10	2340.00

Implementation Schedule:

The above changes can be implemented immediately.

Additional Information:

The current civil lab exceeds three years since any upgrades have been implemented.

4. 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
4 PFA1 Flat Tripods @ $120 = $480
6 S347206.805ME Dual Rods @ $139.50 = $837
Total: $6231 plus 10% tax = $6854.10

Partial Funding Available: one-third of the cost is available from the Department of Civil Engineering

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.

5. 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 instructor's 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 workbench while listening to the instructor's 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 workstation will have a volume control. The students and the instructor's time will be reduced by not having to repeat what was said.

Cost Breakdown:

	Lab Budget	Weef budget 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 Microphones + 2 FM Transmitters + 2 FM receivers		$1245.00
45 Speakers in HD bays	$1,125.00	
Miscellaneous hardware	$ 350.00	
Installation by staff	?	
TOTAL	$1475.00	$2588.00
TAX		$2857.00

Implementation Schedule:

September 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.

6. E&CE Dept. PIC Microcomputer Development Stations

Submitted By:

Name: Roger Sanderson
E-mail: rsanders@ece.uwaterloo.ca
Phone Number: 6184
Position: Lab Instructor

Description of Proposal:

The E&CE Department now has a mandatory 4th year design project course. In this course, groups of students work independently to design and build a project. May of these projects could benefit from the use of some sort of microcontroller. A popular family of microcontrollers in industry are the Microchip Technology Inc PIC microcontrollers. (http://www.microchip.com/)
The are small, fast, inexpensive and come in many versions. The course has a small budget per group, but it is not enough to cover the cost of development tools. These tools would be available for future classes as well. I am asking WEEF to fund the purchase of up to 5 "PIC Start Plus" development systems. http://www.microchip.com/10/Tools/PICmicro/Program/picstart/index.htm Currently we have to borrow the one unit that ESQ has.

Proposal Benefits:

Will give the 4th year E&CE design course a useful development tool. Also could possibly be used by other departments, like the Systems Design Workshop courses.

Cost Breakdown:

$325 each (including tax)
We will take funding for 1 to 5 units:

1	$325
2	$650
3	$975
4	$1300
5	$1625

Implementation Schedule:

As soon as possible.

7. E&CE 223 Xilinx FPGA 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 obsolete Xilinx 3020 FPGAs (programmable gate arrays) to XC4005E parts. These new parts are approx. 4 to 6 times larger in size and will be used on a new student board that has to be designed and built. After prototyping the design, a circuit board will be built for both the labs [quantity 50?] and the students, on loan, for home use.

Proposal Benefits:

E&CE 223 – a core E&CE course with 360 students per year
E&CE 4th year projects - ?? students per year

Cost Breakdown:

$34 per integrated circuit, estimated $100 per circuit board
10 units are preferred. I.e. 10 units ($3400)

Implementation Schedule:

mid/late Fall 2000.

Additional Information:

Xilinx has already donated sixteen 4005E parts but is not donating more.
The E&CE Dept. will pick up other costs of designing & building the board.
Student boards are available from Xilinx for aprox $160 each and they don't suit our needs.

The raw costs of slightly larger FPGAs in the same package:
4005E-4PC84 $29 4006E-4 $44 4008E-4 $59 4010E-4 $68

8. E&CE 223 Logic Probes

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 replace broken and damaged logic probes in the E&CE 223 lab. These voltage meters are necessary for testing digital designs and suffer high breakage since they are the first tools that our students use in the digital labs.

Proposal Benefits:

E&CE 223 – a core E&CE course with 360 students per year

Cost Breakdown:

$35 per logic probe.

10, 20 or more units are preferred. I.e. 10 units ($350), 20 units ($700)

Implementation Schedule:

Fall 2000.

Additional Information:

The department is purchasing the connectors for connecting these to our existing power supplies.

9. 380 Lab Expansion

Submitted By:

Your Name: William Ott
E-mail: wmott@ece.uwaterloo.ca
Phone Number: X6134
Position: Lab Instructor

Description of Proposal:

Because of increased number of students taking E&CE-380, the number of lab stations were increased from 12 to 16. The number of PID and Position Controllers also have to be increased by an additional four (4) units. These units are to be copies of the existing ones.

Proposal Benefits:

By increasing the number of physical lab experiment controllers from 12 to 16, the number of days each lab experiment runs will be reduce to only 6 from the present 8. This lab will be running a double stream twice a year; that is, about 400 students per year. Reducing the amount of time spent in the lab by the students, TA's, and the Lab Instructor will provide more time for consulting, preparing, and writing the lab reports.

Cost Breakdown:

The PID and Position Controllers are made by Lab Staff.

PID Controller	300 x 4 units = 1200 + 10.4% tax =	$1325
Position Controller	600 x 4 units = 2400 + 10.4 % tax =	$2650.

Total		$3975.

Implementation Schedule:

September 30, 2000
These items are required for the second and third lab experiment.

10. Geological Computer Systems

Submitted By:

Name: Dave Rudolph
E-mail: drudolph@sciborg
Phone Number: Ext. 6778
Position: Chair - Geological Engineering Board

Description of Proposal:

To replace existing computers in GeoE computer room (E3-3112).
They are becoming obsolete and time consuming to use.

Proposal Benefits:

- To provide students with updated equipment.
- Improve time efficiency for students.
- GeoE enrolment has increased, which would warrant the 3 new systems.

Cost Breakdown:

Vault PIII550iP Pentium III Workstation

Intel Pentium III-550 w/ 512k PLB Cache
Asus P3B-F Motherboard with BX Chipset
Completely Energy-Star System for Lower Operating Cost
128 Meg SDRAM Ram Memory
IBM Deskstar 20GB IDE Hard Disk Drive
ATI Xpert 98 8MB/AGP Graphics Card
2 Serial, 1 Parallel (16550 UART Bidirectional Parallel Port)
Panasonic 1.44M Floppy Drive
Keystronics 104 Key Keyboard
SMC Ether power 9432TX 10/100 Ethernet Card
Logitech 3-Button Mouse

System comes with a 3-yr. Parts & Labor Warranty	$1425.00
Sony CPD-E200 17" Monitor	$ 569.00
Zip disk	$ 96.00
Cost per system (not including taxes)	**$2090.00**

Cost for 3 systems:	$6270.00
-	$2090.00
	$4180.00

GeoE department would subsidise 1/3 of the cost.

Implementation Schedule:

Immediate upon approval of funding.

Additional Information:

The 2 systems currently in use can be reused in the Soils Lab for testing.

11. Computer and Data Acquisition Card for Fluid Power Control Lab

Submitted by: A. Khajepour, Mechanical Engineering
E-mail: rkap@mecheng1.uwaterloo.ca
Position: Professor, Mechanical Engineering

Description of Proposal:

ME 561 (Fluid Power Control Systems) has recently been equipped with a hydraulic/pneumatic training stand. To enhance the quality of labs and be able to teach students the problems that they encounter working with hydraulic servo systems, a computer and a data acquisition card are requested. The equipment will be used to study, identify and design controllers for hydraulic servo systems, which are very common in industry.

Benefits of the Proposal:

- Students will learn advanced topics in hydraulic and pneumatic control, which are in great demand in industry.
- The proposed equipment can significantly help students to understand fluid power systems and increase the quality of the labs.

Cost Breakdown of Proposal:

Computer, PIII 500 with 17" monitor and 128 Mb Ram.	**$1,600.00**
Data Acquisition card compatible with Matlab and Simulink	**$2,500.00**
from Quanser Inc. with Wincom (similar card to the one used in ME 380 projects)	
Total	$4,100.00
WEEF	**$2,050.00**
Mechanical Engineering Department	$2,050.00

Implementation Schedule:

Fall 2000 term

12. 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.

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:

To replace the 2 robots	$36,000.00
WEEF's last term contribution	$7,800.00-
Mechanical Engineering	$7,800.00-
Still required	$20,400.00
Request from WEEF for this term	$10,200.00
Mechanical Engineering will contribute	$10,200.00

Implementation Schedule:

Fall 2000

13. Computer Data Projector

Submitted by: Prof. R. J. Pick, Mechanical Engineering
E-mail: rkap@surya.uwaterloo.ca
Position: Prof. R. J. Pick, Chair, Mechanical Engineering

Description of Proposal:

Students enrolled in ME 481 and ME 380 are required to make a design presentation proposal and a final presentation of their course project. We have had considerable success with the ME 481 projects presented in PowerPoint. We would like to do the same in ME 380. Up to now the students have to borrow the projector from Audio Visual. Lately there have been some timing problems in obtaining it when required.

Mechanical Engineering will build a lectern and provide a PC to complete this presentation station for project student use.

Benefits of the Proposal:

All students taking ME 481 and ME 380 will benefit from this new equipment. Civil Engineering will also share the benefits of this proposal.

Cost Breakdown of Proposal:

Computer Data Projector	*$4,500.00*
WEEF	**$2,225.00**
Mechanical Engineering	$2,225.00

Implementation Schedule:

Fall 2000

14. Programmable Logic Controllers (PLC's)

Submitted by: Sanjeeve Bedi, Mechanical Engineering
e-mail: rkap@surya.uwaterloo.ca
Position: Professor, Mechanical Engineering

Description of Proposal:

PLC's are finding a wide usage in industry today. First year Mechanical Engineering students need to be able to program these PLC's. We need to set up a PLC Lab so that the programming course can be offered on a regular basis to all departments. Currently the course is being offered on borrowed equipment.

Benefits of the Proposal:

If first year students could program PLC's the quality of jobs they could get during their first few work terms would improve. Furthermore, during a downturn in the economy PLC programming would be an asset in getting employment.

Cost Breakdown of Proposal

5 Siemens PLC's	$ 4,500.00
10 Micrologics 100 PLC's	$ 9,000.00
10 Software licenses for RSS Logic	$ 1,000.00
10 Experimental Set-up built in the M/C Shop	$10,000.00
Total	**$24,500.00**
Mechanical Engineering will pay M/C Shop charges	$10,000.00-
A-B Company will donate the software	$ 1,000.00-
WEEF request to purchase the PLC's	**$13,500.00**

Implementation Schedule:

Fall 2000

15. Multimedia Classroom Equipment

Submitted By:

Name: Hao Xin
E-mail: h2xin@engmail
Position: 1B Student, SYDE

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

Name: Carolyn MacGregor
E-mail: cgmacgre@engmail
Extension: 5760
Position: Assistant Professor, SYDE

Description of Proposal:

This proposal is an extension of one presented during the Winter term. 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 proposed to spread the purchases over a number of terms.

Following the presentation of our proposal in the Winter term, WEEF provided $7,200 to cover approximately half the cost of a data projector and a computer for our E2-1303B classroom.

This proposal is to request partial funding to purchase a projection screen, object/document camera, and podium to enhance what was purchased with the Winter term funding for our E2-1303B classroom.

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 purchasing the equipment described in this proposal:

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.

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.

The *podium* will be custom designed by the Systems department and a Plant Operations designer. We will benefit from the experience our university has gained in the design of podiums deployed elsewhere on campus. The most current design, resulting from on-campus efforts, is located in the LT3 (Learning and Teaching Through Technology) facility. Although the design of the LT3 podium is well thought out, it is not optimum for our faculty members, and students.

Our podium will be designed to accommodate a computer, the object/document camera, a VCR, an audio amplifier for sound reinforcement and controls for selecting the video to be viewed through the data projector. The design will also facilitate the needs of a lecturer to organize notes and other documents required for a presentation. The work surface and layout of the LT3 podium does not have adequate space to accommodate the object-camera as well as the lecture and design materials typically used in SDE courses and presentations.

We intend to stay with a footprint similar to that of the LT3 podium so as to minimize encroachment into current student seating areas. In addition, we intend to modify the profile of the LT3 podium so as to minimize disruption of student sight-lines within the classroom.

In short, the multi-medium podium will allow the students to benefit from more seamless and regular integration of multi-media resources and materials into lectures, and presentations.

Cost Breakdown:

Projection Screen	$ 1,600
Object/Document Camera	$ 1,800
Podium	$ 3,500 *
Total Cost	$ 6,900

Financial support requested from WEEF: $ 3,450.

The Systems department will provide the other half of the financing.
(* This is the cost of building the podium used in the LT3 facility.)

Implementation Schedule:

We are in the process of designing the podium. The other equipment, described in this proposal, is readily available. We aim to have the equipment in place for the start of the Fall term.

Additional Information:

Benefits to Other Engineering Students:

Our classrooms are open 24 hours a day. It is our intention to design the podium so that the equipment will also be available for use 24 hours a day. Hence, this facility will be available for use by the engineering faculty community when not required by our department. Carrying through on this intention will be a challenge, due to the potential risk of theft.

16. Digital Video Camcorder

Submitted By:

Name: David Clausi
E-mail: dclausi@engmail
Phone Number: x2604
Position: Assistant Professor. SYDE

Name: Danny Ho
E-mail: ycdho@engmail
Position: 3A Student, SYDE

Name: Kevin Kraul
E-mail: kbkraul@kingkong
Phone Number: x5760
Position: Lab Director, SYDE

Description of Proposal:

The Systems Design Engineering Department would like to upgrade its video acquisition equipment by purchasing a current model digital video camera. The camera that meets our needs is the Canon Optura Pi.

Proposal Benefits:

Video camcorders are often required in the Systems Design Workshop Courses. Such a device is required for the following reasons:

- To perform a video capture of a working workshop demonstration for the purpose of an oral presentation. The same capture can be transferred to the Systems Design workshop website, which acts not only for internal information but external recognition as well.
- To record workshop oral presentations (for personal or course requirement reasons).
- To perform a video capture as a necessary part of a Systems Design Workshop project. For example, workshops in the image processing / pattern recognition field often require the use of a particular video data set that could be captured and downloaded to a computer with such a camera.
- To be used for any high quality video recording purposes for courses other than workshops.

The proposed camera is a Canon Optura Pi. Helpful features on this product include:

- the ability to transfer or copy videos in pure digital form to a DV compatible computer
- 60 Hz frame capture
- progressive scan camera (better for capturing high speed objects)
- ability to operate in a digital photo mode (ie. capture of still photos)
- 8.9cm view screen
- auto exposure for selected scenes
- option for a removable flash
- various digital effects: faders, video effects, multi-image screen (these can be implemented while copying to a tape in a VCR)
- analog line in (ie. input from a TV)
- A/V insert and audio dubbing
- miscellaneous: built-in speaker, photo search, time code, remote control

Cost Breakdown:

The cost breakdown is based on a quote from Gibson Sound & Vision

Optura PI	1973.40
BP511 (spare battery)	88.00
CR560 (battery charger)	187.00
VL-3 (removable light)	90.00
DM-50 (directional microphone)	220.00
Soft case	24.95
* Digital Origin DV 2.0 Studio	1265.00
TOTAL	3848.35
Taxes	577.25
GRANDTOTAL	4425.60

* Firewire interface board & associated software for the PC.

In support of this proposal, the Department of Systems Design will contribute 25% of the total cost.

Implementation Schedule:

As soon as WEEF authorizes the funding, the Lab Director will order the equipment. Most of the components are in stock at Gibson.

Additional Information:

The Lab Director has researched video camcorders and recommends that this camera will meet the needs of the department.

17. First Milling Machine

Submitted by:

Name: Clarence Wallace
Extension: 2301
E-Mail: rkap@surya.uwaterloo.ca
Position: Supervisor, Engineering Student Shop

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**

WEEF Funding allotted for Winter 2000 Term was	$5,000.00
WEEF Funding requested for Summer 2000 Term	**$5,000.00**
Engineering Machine Shop	$1,184.00

Implementation Schedule:

Upon Receipt of Funding.

18. LEGO MindStorms (including Wireless RCX Interfaces)

Submitted By:

Name: William R. Baer
E-mail: wrbaer@esq.uwaterloo.ca
Phone Number: ESQ office x.5239 or home 572-5141
Position: Director (Engineering & Technology)

Description of Proposal:

ESQ (formally Engineering Science Quest) is an ongoing student run program (entering its tenth year of operation) whose goal is to create an awareness and appreciation of science and engineering in a fun setting for children. ESQ provides twelve programs for children ranging from grade 1 to 12. The aim of each program is to explore new horizons in engineering and science by giving the campers an opportunity to see, touch, invent, design, create and experiment. ESQ runs weekly programs **each summer in the months of July and August**. ESQ also provides similar experiences through workshops, offered during the months of May and June, at local elementary schools.

The LEGO MindStorms (including the RCX Wireless Interface) kits will be used as a key component of four programs, Camp Bondar, ExXtreme! 0, I, & II (grades 5 to 12). The students will discover how to design, build, and create programs to control robots that can interact in their environment. In addition, the high school students will be introduced to control theory through the use of input sensors and RoboLab software (based on National Instruments LabView).

Normally, ESQ uses the **LEGO MindStorms** during the summer term (May to August). The LEGO MindStorms can then be used by a variety of courses during the fall and winter terms. In particular, Professor Carolyn MacGregor has expressed an interest to utilize the LEGO Mindstorm hardware for the SD 161 course, commencing this coming fall term (see attached letter of support).

Finally, ESQ will be developing a "LEGO Design Challenge" for the upcoming winter term. This project will be similar to the MIT Robotic Design challenge, and will be team orientated. The design teams will have a variety of programming languages to develop programs, such as C++, Visual Basic, RoboLab, NQC (Not Quite C) and pbFORTH (developed by UW EE 86 Alumni). ESQ is currently in discussions with a potential supporter, to provide prizes.

Proposal Benefits:

With the use of the Wireless RCX Interface and the LEGO pieces of the MindStorm kits, many engineering courses could benefit. Programming courses could be enhanced, providing opportunities to program "mechanical robots" verses file manipulation. Early design courses can combine simple to use building materials (i.e. LEGO) with advanced programming tools (i.e. LabView) to introduce the design process.

A new faculty wide "LEGO Design Challenge" could be offered during the fall and/or winter term. The challenge will incorporate the LEGO MindStorm kits. The challenge could vary each year, incorporating design and programming skills to solve an engineering problem.

The Wireless RCX interfaces can also be used to test newly developed, designed and built sensors, such as touch, angle and position sensors. For example, the Wireless RCX interfaces could be incorporated in a "rooming campus robot" to help direct parents to their child's.

The LEGO MindStorm kits would be available for fourth year student projects in the fall and winter terms.

The participants of the four ESQ programs would benefit immeasurably. Each participant would have access to the LEGO MindStorm kits considerably longer, providing a better opportunity to explore robotics and their control. Also, since RoboLab is based on National Instruments' LabView, ESQ is indirectly introducing the participants to software they will see in their future University careers (assuming they enter either engineering or science programs).

Cost Breakdown:

ESQ hopes that WEEF can fund Option #1. This would provide a total of 32 MindStorm kits, which should accommodate a "normal" class size, including TA's for development purposes. In addition, three additional options have been provided for partial funding considerations.

Proposal Levels	Item Description	Cost per package [1]	Quantity	Extended Cost [2]
Option #1	MindStorm Kit	$254	20	$5,604.76
Option #2	MindStorm Kit	$254	16	$4,483.81
Option #3	MindStorm Kit	$254	12	$3,362.86
Option #4	MindStorm Kit	$254	08	$2,241.91

(1) Includes a 15% discount through Spectrum Educational Inc.
(2) Includes PST (8%) and GST (2.33%)

Implementation Schedule:

Currently, ESQ has 12 complete LEGO MindStorm kits (including the Wireless RCX Interface). However, with four programs utilizing these kits, ESQ could use up to an

additional 20 LEGO MindStorm kits to provide 8 LEGO MindStorm kits for each program. These kits will be used during the months of July & August.

During the fall and winter terms, up to 32 LEGO MindStorm kits will be available for courses and project work. In the past, ESQ has provided LEGO MindStorm and LEGO Control Lab kits to fourth year projects with great success. As previously mentioned the LEGO MindStorm kits will be used in Systems Design 161 this coming fall term. Also, Professor Sanjeev Bedi has expressed an interest in utilizing the kits for a Mechanical Engineering course.

ESQ will also utilize these kits during the fall term (usually during UW Reading Week) when travelling to Moose Factory, Ontario. This is part of ESQ's Aboriginal outreach program, now in its second year of operation.

Finally, a design project (similar to the MIT project that actually created the first prototype of the RCX interface) will be developed for all engineering students. ESQ will be offering the design project in the winter term, and will include PRIZES (e.g. Panasonic has expressed an interest in providing commercial products).

Additional Information:

The following links are included to provide further details of the LEGO MindStorm product and potential uses of the hardware:

- http://www.esq.uwaterloo.ca [ESQ home page]
- http://www.lego.com/dacta/robolab/default.htm [RoboLab product line]
- http://www.oreilly.com/catalog/lmstorms [The Unofficial Guide to LEGO Mindstorms Robots!]
- http://www.hempeldesigngroup.com/lego/pbFORTH [pbFORTH for LEGO MindStorms]
- http://www.oreilly.com/catalog/lmstorms/resources/index.html [How to make your own sensors]
- http://ldaps.arc.nasa.gov/LEGOEngineer/ [LEGO Engineer interface]

19. Waterloo Aerial Robotics Group

Submitted By:

Name: John Sollazzo
E-mail: jnsollaz@engmail.uwaterloo.ca
Phone Number: (519) 725-0959 (home)

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. WARG would like to request from WEEF sponsorship for use in promoting WARG-related undergraduate student projects.

In order to advance student projects, WARG is in need of capital so that new power supplies may be purchased. This is vital to the continued performance of the WARG entry into future competitions. WARG is also in need of new cameras and money to go towards the designing of prototype boards. Further funds, though not absolutely necessary, can be put to use with the purchase of an additional helicopter.

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:

Power supplies	$500
Cameras	$350
Helicopter	$4500
Prototype board designing (custom board manufacturing)	$2500
Gyro	$1000

Funding Package A*	
1 Gyro 3 Power supplies 1 Camera	Total: $ 2850
Funding Package B	
Prototype board designing 1 Power supply	Total. $ 3000
Funding Package C	
Helicopter	Total: $4500

* 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 Packages 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.

20. Free Flight Glider Team

Submitted By:

Name:	Scott Redmond	Sanjay Singh
E-mail:	smredmon@engmail.uwaterloo.ca	ssingh@swen.uwaterloo.ca
Phone Number:	519 588-3696	519 888-4567 x2234
Position:	Project Leader	Team Adviser

Description of Proposal:

The Free Flight Glider Team is planning to purchase Pro/E 2000i Student Edition for design and analysis of the 2001 and future glider designs. The team is also requesting funding for construction materials to facilitate the production of many prototypes. Rapid prototyping has helped our team to bring a trophy home from each of the last three competitions entered. With the addition of Pro/E 2000i, we expect to repeat our success in the 2001 competition.

Proposal Benefits:

Pro/E 2000i Student Edition:

- Parametric modeling will significantly reduce time from concept to prototype.
- Sheet metal patterns will reduce waste of composite covering materials.
- Pro/E 2000i allows direct output of a design to TascFlow, for CFD analysis, and ANSYS for finite element stress analysis.
- Pro/E will generate 3D graphics and rendered images for proposals, reports, presentations, display boards, and the internet.
- We will share Pro/E software, computing resources and expertise with other student teams.

Construction Materials:

- Early and frequent prototyping is a proven method for success.
- Solid foam core, covered with kevlar, fibreglass and carbon fibre, is incredibly durable. In each of the past two competitions, the number of flights from UW was literally greater than the sum of all other flights.

Cost Breakdown:

Item	Price (US)	Price (Cdn)
Pro/E 2000i Student Edition	$275.00	$412.50
Pro/E 2000i Tutorial CD	$105.00	$157.50
Composite Covering Materials		$270.00
West Systems Epoxy Resin/Hardener		$160.00
TOTAL		**$1000.00**

Partial Funding Option #1:

Item	Price (US)	Price (Cdn)
Pro/E 2000i Student Edition	$275.00	$412.50
Pro/E 2000i Tutorial CD	$105.00	$157.50
TOTAL		**$570.00**

Partial Funding Option #2:

Item	Price (US)	Price (Cdn)
Pro/E 2000i Student Edition	$275.00	$412.50
TOTAL		**$412.50**

Implementation Schedule:

Pro/E 2000i Student Edition:

Spring 2000	✈ Team Tutorials ✈ Entry of Initial Designs ✈ Generation of Graphics for Display Boards
Fall 2000	✈ Revision of Designs ✈ Quick Export of Data for CFD and FEM Analysis
Winter 2001	✈ Generation of Engineering Drawings for Technical Report and Presentations

Construction Materials:

Spring 2000	✈ Prototype testing of multiple design possibilities
Fall 2000	✈ Refinement of selected design via multiple prototypes ✈ Towline launch technique training and practice
Winter 2001	✈ Purchase additional materials for final prototypes and competition glider

Additional Information:

WEEF will be acknowledged online, in print and on the glider as gold level sponsors of the Free Flight Glider Team.

21. Clean Snowmobile Challenge (CSC2001)

Submitted By:

Name: Andy Punkari
E-mail: acpunkar@cngmail.uwaterloo.ca
Phone Number: 885-3521
Position: CSC team member-MASc student

Description of Proposal:

The Clean Snowmobile Challenge 2001 is a competition initiated by Yellow Stone National Park and the Society of Automotive Engineers (SAE). The focus of this competition is to improve the emissions, fuel economy and reduce noise levels of a two-stroke snowmobile while maintaining or improving performance. The modified snowmobile will compete during the annual World Championship Hill Climb in Jackson Hole, Wyoming. The competition is scheduled to take place at the end of March, 2001

I would first like to thank WEEF for the support that was given to us two terms ago. With the support from WEEF we were able to capture 2nd place at the inaugural Clean Snowmobile Challenge which was held in March of this year. For this term, I would like to propose that WEEF assist the team in the purchase of several necessary items that will enable the team to improve upon last years performance. In particular I would like WEEF to assist the team in purchase of a few items which will help the efficiency and performance of the snowmobile. These items include an engine diagnostic display, roller secondary clutch, lightweight track, performance rear suspension, and lightweight plastic skis.

Proposal Benefits:

A diagnostic display is vital in the testing and tuning of our snowmobile. When the engine is in the dyno room at Cycle Improvements, all necessary engine parameters are constantly monitored to provide important tuning data and more importantly to keep the engine in a safe operating range. Once the engine is installed in the sled we have very limited methods to keep track of engine operating conditions. This data display will provide these necessary engine parameters and provide vital data to ME481 students.

A Roller Secondary Clutch will increase the efficiency of the snowmobile drivetrain and provide better performance. This will be advantageous during all events of the competition by providing better shifting, better throttle response, reduced fuel usage and reduced noise. This clutch is also better for fine tuning the sled due to it's adjustable nature. The secondary clutch that is currently on the machine is worn out and will need to be replaced in order for us to compete.

A more aggressive, light weight track will provided increased traction, acceleration and braking while decreasing the rolling resistance of the sled. This track will allow us to

finish better in the all-important Hill Climb event as well as the Acceleration and Fuel Economy Competitions. At last year's competition, our stock track was the single reason we did not win the Hill Climb event, and took us out of contention for first place.

A performance rear suspension will give the snowmobile better handling and a more comfortable ride by allowing more travel and replacing the current worn out rear suspension system. This addition will give the team an edge during the Handling, Hill Climb and Acceleration Events.

Lightweight plastic skis will assist in the weight reduction strategy in order to increase fuel economy and power-to-weight ratio. Plastic skis also provide better handling which will be vital during the handling event where sleds are judged by professional drivers.

Cost Breakdown:

We are asking WEEF for funding to cover all or any combination of the items described above and listed below in order of importance.

Avenger III Diagnostic Display: $1200.60 / $1380.69 with tax

Erlandson Engineering "Track Master" Roller Secondary Clutch: $761.25 / $875.44 with tax

Camoplast Predator Track: $833.99 / $959.09 with tax

EXPERT Suspension: $2169.13 / $2494.50 with tax

SLP Ultralite SLT Skis: $551.87 / $634.65 with tax

Total Cost: $5516.84 / $6344.37 with tax

Implementation Schedule:

Diagnostic Display to be purchased as soon as funding is available to assist with ME481 projects and testing.

Secondary clutch to be purchased as soon as funding is available to allow for dyno testing of system.

Remainder of items can be purchased at a later date, as snow will be needed for their utilization.

Additional Information:

Until recently there has been little attention given to the adverse effects that two-stroke recreational vehicles have on the environment. This has sparked research and development into the improvement of these vehicles. Industry players and off-road enthusiasts are finally starting to address the concerns of the public because of recent threats by the Clinton government to ban such activities in public parks and forests.

22. WOMBaT

Submitted by:

Name: Kurtis McBride
Email: knmcbrid@engmail.uwaterloo.ca
Phone: (519) 496-3160
Position: President, WOMBaT Team

Description:

This proposal will help to further develop the newly established WOMBaT (Waterloo Off-Road Mini-Baja Team). The money will be used the following main areas, prototype frame construction, gas costs for attending the 2000 competition and repair of the 1997 vehicle.

Cost Break Down:

1997 Vehicle Repair ~$300 – By the date of the presentation we should have a more accurate cost figure as the repairs are going ahead the weekend of the June 24th.

Frame Construction ~$800 – This cost is the cost of the materials which we will be using to build a prototype frame. We will use this prototype frame and the vehicle to follow to test before constructing our final product. We are currently looking for outside funding for this materials cost and if found we will not require WEEF support. Frame construction will commence earliest the middle of the fall term. By the meeting date we should have a more accurate number for this as well.

Gas Costs - $121.86 – We sent a team to Montreal to film the 2000 competition and to interview members of other teams. This trip cost us in gas. This is money we have already spent, have receipts for, and are looking to be reimbursed for.

Total ~$1221.86

23. Team Advancement For The Formula SAE Project

Submitted By:

Name: Asita Perera
E-mail: fsae@engmail.uwaterloo.ca
Phone Number: x5904
Position: Formula SAE Team 2001 Team Leader

Description of Proposal:

To purchase the following equipment for the further advancement of the Formula SAE 2001 team and all future FSAE teams:

Option 1:

Items
Data Acquisition Unit

Option 2:

Items
Engine
TEC Engine Management System
Impact Wrench
Casters for Jig Table
Tie Downs & Tarp
Vacuum

Proposal Benefits:

Data Acquisition Unit: Data acquisition is a critical part of testing and tuning many parts of the car such as suspension, brakes engine, etc. It allows the students working on the project to gain a greater understanding of the way in which the car operates. It also allows us to make quantitative adjustments to the car such that the University of Waterloo can field competitive entries at the FSAE competition. Currently the data acquisition system that has been available to the team is borrowed when it is convenient for the owner of the system. These time constraints on use means that testing is limited. With our own system the performance and design of the car could be more thoroughly understood by the designers. This system can be used by many teams in the future and would be an excellent long-term investment for the team.

The impact wrench, Casters, TEC, vacuum and tie downs are all items that are needed in order for the 2001 team to carry on with the design and construction of next year's car. The proposed engine is needed as a race engine and could be used by future teams for testing and race purposes.

The Formulas SAE team gives students the chance to apply knowledge gained during their education at the University of Waterloo in a practical and challenging environment. Students design, test and manufacture different components working together to build a competitive car. Strong entries in the past also contribute to the reputation of the University of Waterloo a first class engineering school.

Cost Breakdown:

Option 1:

Items	*Cost*
Data Acquisition Unit	$10,000
TOTAL	$10,000

Option 2:

Items	**Cost**
Engine	$4500
TEC Engine Management System	$2000
Impact Wrench	$350
Casters for Jig Table	$200
Tie Downs & Tarp	$100
Vacuum	$100
TOTAL	$7250

Implementation Schedule:

The items listed above would be purchased as soon as possible. Each item would have an immediate positive impact on the 2001 FSAE team as well as future teams.

Additional Information:

Priority funding is to the Data Acquisition

24. Midnight Sun VI Solar Car Project

Submitted By:

Name: Victoria Cheng
E-mail: vcheng@midnightsun.uwaterloo.ca
Phone Number: (519) 888 - 4567 x 2978
Position: Organization. Student Project

Description of Proposal:

The Midnight Sun Solar Car Project strives to design and construct an efficient solar car. Every term, about 100 University of Waterloo students, primarily engineers, spend numerous hours working on our project. At the present time, the Midnight Sun VI design is underway. The completely re-engineered car will be racing in American Solar Challenge and World Solar Challenge 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 a laptop, wood for aerobody construction, array stand components, and front suspension components.

Laptop

During the races, telemetry data from the solar car is vital in determining the optimal driving strategy. The laptop will be instrumental in collecting this data, along with wind data and GPS location data. All the data will be amalgamated and used in the team developed strategy models. This laptop will travel in the team support vehicles throughout the races. This item is also required throughout the pre-race testing phase of the project in order for the team to collect telemetry data and learn about the car's performance prior to the races.

Solar Cells

A solar car must contain solar cells. Solar cells are expensive yet required component of the solar car. We are aiming at 15-16% efficient solar cells at which, for the complete array, will amount to $30,000. The array is composed of approximately 850 solar cells with each cell costing approximately $20 U.S. Thus we ask for $1000 to put towards the purchase of solar cells for the array for Midnight Sun VI. The 15-16% efficient array is a higher quality array than the previous cars which will help maintain the competitiveness of the car.

Wood for Aerobody Construction

The aerobody construction begins with the creation of large high-density Styrofoam plugs, which exactly resemble the shape of the finished vehicle. From these plugs, a fibreglass mold is created. Subsequently, the final aerobody is created from this mold. It is crucial that these plugs maintain their rigidity throughout the aerobody construction process. The wood is required to build a decking so that the layered Styrofoam plugs do not fracture or flex.

Array Stand Components

Whenever the array is not actually on the car, it is kept on an array stand. This array stand also holds the array while charging. In order to capture the maximum amount of solar energy the array should be kept orientated in a direction perpendicular to the sun at all times. The new array stand being developed will automatically track the sun, maintaining the array's perpendicularity. The requested money will cover the material required to build the stand, as well as the motors and the electronic components for the control system.

Front Suspension Components

The front shocks for Midnight Sun IV, V, and the upcoming Midnight Sun VI are created from modified Honda motorcycle struts. The Honda parts for each of these struts costs $245. The solar car requires two front shocks for every race, and these shocks should be replaced after every race due to high side loading imposed on the shocks during the course of the race. As Midnight Sun VI will be competing in both the American Solar Challenge and the World Solar Challenge we will need a total of four modified shocks to maintain a high level of reliability and safety.

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 Midnight Sun VI project will make Waterloo a stronger competitor the 2001 races. Since Midnight Sun represents the University of Waterloo Engineering, a successful team gives Waterloo greater exposure. The team routinely displays the car at shows such as the Canadian International Auto Show (CIAS), and participates in local festivals such as Earth Day and the upcoming Canada Day. The car will also be attending the upcoming Molson Indy.

Faculty/Department		*Number of Students*
Engineering:	Mechanical	22
	Computer	14
	Electrical	10
	Systems	3
	Chemical	1
	Env. Civil	1
Engineering Total:		51
Mathematics		3
Earth Sciences		1
Science		1
Unknown		33
Total		89

Goals of Midnight Sun VI:

- To design and construct an efficient solar car for ASC 2001 and WSC 2001
- 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.

Cost Breakdown:

Approximate costs outlined. Exact costs will be discussed at presentation. Partial funding is appreciated as well.

	Item	Quantity	Amount	
Plan A				**Total: $**
	Laptop	1	$3000	$5883.16
	Solar Cells	50	$1000	
	Front Shocks	4	$983.16	
	Array Stand Components	N/A	$500	
	Wood for Aerobody Construction	N/A	$400	
Plan B				**Total: $**
	Laptop	1	$3000	$4983.16
	Solar Cells	50	$1000	
	Front Shocks	4	$983.16	
Plan C				**Total: $**
	Laptop	1	$3000	$3491.58
	Front Shocks	2	$491.58	

Implementation Schedule:

Items being requested will be purchased immediately upon the availability of funds. Please note that the laptop is critical to the testing stage, as telemetry data from the testing of Midnight Sun V will be used in the improvement of the design of Midnight Sun VI. Further, there is a substantial lead time involved with the purchase of solar cells, as they are a commodity item which many other solar car teams are required to purchase.

Additional Information:

Midnight Sun would like to thank WEEF for its on going support of Midnight Sun. As a result of contributions made by WEEF to Midnight Sun, WEEF is currently a **Bronze Sponsor**.