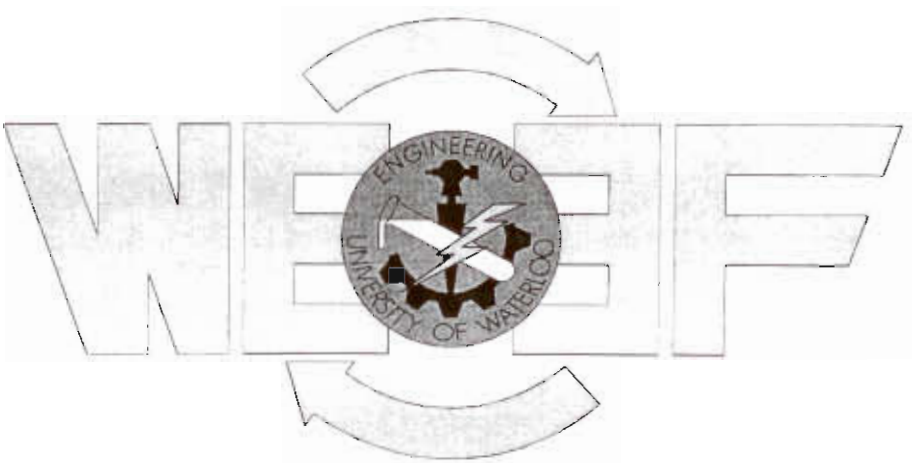
WEEF Proposals & Allocations	Winter 2001	
Chemical and Environmental Chemical	Requested	Allocated
Upgrading Two Undergraduate Labs	$ 8,730.00	$ 3,530.00
		$ 3,530.00
Civil and Environmental Civil		
Microscopic Simulation Model for Transportation Analysis	$ 7,620.00	$ 2,020.00
Civil Computer Lab Upgrade	$ 6,165.00	$ 6,165.00
Mobile Lift and Positioning Table	$ 2,100.00	$ 1,050.00
Measuring and Layout Tools	$ 1,300.00	$ 553.00
		$ 9,788.00
Electrical and Computer		
E&CE '30 Series' 'Projects in Semiconductors and Electronics Circuits'	$ 3,000.00	$ 3,000.00
E&CE Public Computer Room Upgrade	$ 6,900.00	$ 6,900.00
E&CE 4th Year Room - Computer Upgrade	$ 2,300.00	$ -
E&CE Design Course Computers	$ 9,000.00	$ -
Audio Wireless Microphone System for room E2-3344	$ 1,122.00	$ -
		$ 9,900.00
Mechanical		
Fluid Dynamics Media Presentation	$ 1,446.00	$ -
Hydraulic Transparent Components for ME 561 Lab	$ 3,612.00	$ 1,586.00
High Resolution Image Analysis System	$ 20,000.00	$ 5,000.00
		$ 6,586.00
Systems Design		
Systems Design Workshop Digital Multi-Meters	$ 3,500.00	$ 3,500.00
Systems Design Workshop FPGA Development Platform	$ 2,410.00	$ 2,410.00
Systems Design Workshop Digital Multi-Meters	$ 2,200.00	$ 2,200.00
		$ 8,110.00
Misc		
First Milling Machine	$ 4,000.00	$ 4,000.00
Faster, Simpler, General-Access Colour Printing	$ 10,900.00	$ 4,320.00
		$ 8,320.00
Sub-Total Department	**$ 96,305.00**	**$ 46,234.00**
Student Groups		
Iron Warrior Colour Laser Printer	$ 1,100.00	$ 1,100.00
RoboCup Soccer Robot Prototype	$ 2,500.00	$ 1,000.00
Clean Snowmobile Challenge (CSC2001)	$ 5,225.00	$ 2,390.00
Free Flight Glider Team	$ 250.00	$ 250.00
Waterloo Aerial Robotics Group (WARG) Equipment	$ 5,000.00	$ 2,000.00
University of Waterloo Alternative Fuels Team	$ 2,200.00	$ 1,600.00
Midnight Sun VI Solar Car Project	$ 5,183.00	$ 2,600.00
UW Formula SAE Team Proposal	$ 2,773.00	$ 2,865.00
Sub-total Student Groups	**$ 24,231.00**	**$ 13,805.00**
Total	**$ 120,536.00**	**$ 60,039.00**

Waterloo Engineering Endowment Fund



Winter 2001 Proposals

WEEF Proposals – Winter 2001

	CHEMICAL AND ENVIRONMENTAL CHEMICAL	Funding Requested
1	Upgrading Two Undergraduate Labs	$8730
	CIVIL and ENVIRONMENTAL CIVIL*	
2	Microscopic Simulation Model for Transportation Analysis	$7620
3	Civil Computer Lab Upgrade	$6165
4	Mobile lift and positioning table	$2100
5	Measuring and layout tools	$1300
	ELECTRICAL AND COMPUTER	
6	E&CE '30' Series 'Projects in Semiconductors and Electronic Circuits'	$3,000
7	E&CE Public Computer Room Upgrade	$6,900
8	E&CE 4th Year Room - Computer Upgrade	$2,300
9	E&CE Design Course Computers	$9,000
10	Audio Wireless Microphone System for room E2-3344	$1,122
	MECHANICAL	
11	Fluid Dynamics Media Presentation	$1,446
12	Hydraulic Transparent Components for ME561 Lab **Error! Bookmark not defined.**	$3,612
13	High Resolution Image Analysis System	$20,000
	SYSTEMS DESIGN	
14	Systems Design Workshop Digital Multi-Meters	$3,500
15	Systems Design WorkShop FPGA Development Platform	$2,410
16	Systems Design Workshop Digital Multi-Meters	$2,200
	MISC	
17	First Milling Machine	$4,000
18	Faster, Simpler, General-Access Colour Printing	$10,900
	Sub-Total Departmental	**$96,305**
	STUDENT	
19	Iron Warrior Colour Laser Printer	$1,100
20	RoboCup Soccer Robot Prototype	$2,500
21	Clean Snowmobile Challenge (CSC2001)	$5,225
22	Free Flight Glider Team	$250
23	Waterloo Aerial Robotics Group (WARG) Equipment	$5,000
24	University of Waterloo Alternative Fuels Team	$2,200
25	Midnight Sun VI Solar Car Project	$5,183
26	UW Formula SAE Team Proposal	$2,773
	Sub-Total Student Groups	**$24,231**
	TOTAL	**$120,536**

Table of Contents

1. Upgrading Two Undergraduate Labs

Submitted By:

Your Name: Siva Ganeshalingam
E-mail: sganesh@engmail.uwaterloo.ca
Phone Number: x6161
Position: Senior Technician

Description of Proposal:

(1) Software and Data Logging Accessory for Shell and Tube Heat Exchanger.

- Most process operations that are carried out by Chemical Engineers involve the production or absorption of energy in the form of heat. These heat transfer operations are achieved by the use of Heat Exchangers. Shell and Tube Heat Exchangers are the ones most commonly used in Food and Chemical Industries.
- Our department recently acquired a Shell and Tube Heat exchanger. To make the optimum use of this equipment and to get reliable and accurate data, we need to purchase the Software and Data Logging accessory specifically developed to be used with this equipment

(2) Upgrading the Packed Column Experiment.

- Packed Towers are used frequently in mass transfer operations in Chemical Industries, especially in gas absorption. For example, sulphurdioxide is a gas that causes acid rain. This occurs particularly in areas with high industrial density. Sulphurdioxide released by some of these industries combine with the moisture in the air to form acid rain.
- It is important to show our potential Chemical and Environmental Engineers how sulphurdioxide can be removed from the industrial gases by the Unit Operation called Gas Absorption.
- For the optimal operation of a Packed Column, the pressure drop across the column and the flow rates has to be monitored. At high flow, the phenomenon known as "flooding" can be observed. Data gathered can be analyzed and compared to standard design correlations for this type of common industrial equipment.
- We want to replace some parts in our aging Packed Column unit and also modify the unit to include both absorption and flooding characteristics experiment.

Proposal Benefits:

Proposal-1

The main features of the Data Acquisition System include

(1) Real time graphical displays of
- Hot and cold fluid temperatures
- Hot and cold fluid flow rates

(2) A wide range of sampling frequencies and durations
(3) Sensors can be calibrated and the calibration constants stored in the computer.
(4) Potential use in ChE 101, EnvE 101, ChE 025, ChE 040 and campus day demonstrations.

(5) Can also be used as a teaching aid by the Professor teaching the Heat Transfer course. The software provide details on the theory behind the experimental investigations, how to set the equipment etc.

Proposal-2

This unit can be used for courses ChE 101, EnvE 101, ChE 025, ChE 040 and EnvE 484. For example

- First year students could do material balances on the column and determine the percentage gas removal (SO_2, NH_3) and subsequently do experiments to observe the effect of flow rate and inlet gas composition on the removal efficiency.
- Second year students, in their Fluid Mechanics laboratory could investigate the flooding characteristics of a packed column
- Fourth year students can do comprehensive experiments to evaluate the mass transfer coefficients for any absorption system.

Cost Breakdown:

Proposal-1

HT30X-303 IFD Educational software with data logger (The package comprises the hardware and appropriate software for the heat exchanger.)

Cost: $5200

Proposal-2

Column (6cm ID with packing): $ 500
Rotameter for airflow measurement: $740
Rotameter for water: $860
Pump for water circulation: $930
Differential Pressure Transducer and Indicator: $500

Total cost for proposal-2: $3530

Total funding requested: $8730

Implementation Schedule:

As soon as possible

Additional Information:

- Computer, monitor etc for proposal-1 will be provided by the department.
- Miscellaneous piping and fittings for proposal-2 and labour will be provided by the department.

2. Microscopic Simulation Model for Transportation Analysis

Submitted By:

Your Name: Prof. Bruce Hellinga
E-mail: bhellinga@uwaterloo.ca
Phone Number: Ext. 2630
Position: Assistant Professor

Description of Proposal:

Purchase the PARAMICS traffic simulation model, developed by Quadstone Ltd., a software development firm located in Edinburgh, Scotland. This model is arguably the most advanced commercially available traffic simulation model.

The model consists of 4 components, available in two separate bundles. The *Project Suite* consists of the Paramics Processor; a productivity and configuration tool that allows the user to set up network simulations to be run in batch mode; the Paramics Analyser: a comprehensive analysis tool used to visualise the output of model runs and aid subjective evaluation of simulation statistics; and the Simulation Model. The *Project Suite* bundle represents the minimum configuration required to effectively use the model.

The fourth component, Paramics Programmer, is an Application Programming Interface (API) that permits extensive control and interacting with the Paramics simulation engine. The use of this API is similar to the use of Visual Basic for Applications within Microsoft Excel - it permits more flexibility and automation than is possible using the standard built in functions. This component is available for separate purchase.

Proposal Benefits:

Microscopic simulation is a powerful means of assessing system performance and is particularly suited for application to transportation systems as these systems typically cannot be modelled mathematically, and the system cannot be physically tested prior to implementation. Within the learning environment, simulation is particularly useful for permitting students to test the impact of various control algorithms (e.g. traffic signal control), management strategies (e.g. ramp metering, route guidance, increased or decreased use of public transit), etc.

The model will be used by students in two 4th year undergraduate technical elective courses in Civil Engineering, namely CivE440 and CivE443. The model will also be available for use by students in the Civil project courses (CivE300, CivE400, and CivE401). The use of this model will enable students to evaluate and design solutions for more realistic traffic engineering problems than is currently possible using only manual techniques. Furthermore, students will be exposed to software that is state-of-the-art and becoming more widely used in government agencies and private firms in Canada, the US, and overseas.

Cost Breakdown:

Paramics Project Suite	US$1,500	$2,400.00
Paramics Programmer (API)	US$3,500	$5,600.00
Hummingbird Exceed and Exceed3D		500.00
Delivery/processing charge:	US$ 75	120.00
TOTAL		$8,620.00
Departmental Contribution		-1,000.00
WEEF Application TOTAL		**$7,620.00**

Notes:

1. Exchange rate assumed to be 1.6 Canadian $ per US$
2. Hummingbird software required to run Paramics on Windows as Paramics is developed in an X-Windows environment
3. All costs quoted are Academic prices. The commercial cost of the software is > $35,000.

Implementation Schedule:

Software would be obtained and installed this term and would be used in CivE443 and available for use in CivE400 (Project Course) in the Spring term of 2001.

Additional Information:

More information on the model and downloadable demo can be obtained from Quadstone's web site at: (http://www.paramics-online.com/index.htm)

3. Civil Computer Lab Upgrade

Submitted By:

Name: Daniel Martis
E-mail: dmartis@engmail.uwaterloo.ca
Phone Number: 886-3588
Position: Student

Description of Proposal:

The undergraduate civil computer lab requires a major hardware upgrade. The current lab contains 42 computers that have not been upgraded in approximately 4 years. New hardware is required in order to keep pace with the requirements of the students using the lab. The civil computer lab is very heavily used by 2nd to 4th year civil and environmental civil students. It's quite rare to find an idle computer during the average school day. The civil department is looking at upgrading this lab, and some financial assistance would help this become a reality much sooner.

Proposal Benefits:

The new lab will be much more efficient in allowing more students to use the computers by reducing processing time. The current system results in a great amount of time wasted waiting for computers to log on to the Polaris network, and time wasted by the frequent lock-ups and system crashes. New hardware will also allow us to run better software on the system.

Cost Breakdown:

- P3 800mhz processor
- ASUS 133mhz motherboard
- 128mb ram
- 20gig hard drive
- 32 MB ATI Video Card
- Intel 10/100 Network Card

Cost per System: $1,233
5 systems @ $1,233

Grand Total: $6,165

Implementation Schedule:

ASAP

4. Mobile lift and positioning table

Submitted By:

Name: Richard Morrison
E-mail: rmorriso@uwaterloo.ca
Phone Number: X5834
Position: Civil Engineering Technologist

Description of Proposal:

Mobile lift table to be used primarily in Structure lab to position test specimens in load frames in a safe and controlled manner. Presently requires crane to position test beams or students attempt to lift specimens into position risking injury to themselves or others This piece of lifting equipment would also provide an adjustable work platform.

Proposal Benefits:

Civ. Eng. 126 with approximately 80 students
Civ. Eng. 126 projects
Civ. Eng. 205 with approximately 80 students
Civ. Eng. 205 Bridge building competition
Civ. Eng. 265 with approximately 80 students
Civ. Eng. 313 with approximately 80 students
Civ. Eng. 300 and 400 projects
Civ. Eng. 412 with approximately 50 students
Concrete toboggan teams
Other undergraduate labwork needs for coursework, team projects
Research activities

Cost Breakdown:

Lift Table - $2100 + Taxes

Partial funding: 50% of cost to be covered by structures lab overhead funds as authorised by Prof. Shuster

Implementation Schedule:

Immediately

7. E&CE Public Computer Room Upgrade

Submitted Winter 2001 By:

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 5 older computers in the E2-3339 E&CE Polaris computer room.

The older Pentium 133 MHz computers are too slow for any of the newer software. We propose to upgrade the computers to something capable of running Windows 2000 and high power digital design software that many students have been using in their 4th year design projects.

This computer room has been used for E&CE 4th year projects; but is going to be converted to an E&CE public computer room and possibly an open-to-everyone computer room.

Proposal Benefits:

E&CE 4th year projects - 4th year E&CE general computing

Cost Breakdown:

$1150 per Celeron 700 MHz computer with 128M, CDROM, 20G HD
1 ($1150), 2 units ($2300) upto 6 units [$6900]

Implementation Schedule:

Summer 2000

Additional Information:

The room currently has 15 new computers. The E&CE department has already purchased new 17" monitors for the computers which are being upgraded.

6. E&CE'30'Series 'Projects in Semiconductors and Electronic Circuits'

Submitted By:

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

Description of Proposal:

One Agilent Technologise Function generator Model # 33120A	$ 2300
One Agilent Technologise Dual output Power Supply E3620A	$ 700

Proposal Benefits:

These unit will be used for 4th year projects in electronic circuits.

Total Cost :

$ 3000

Implementation Schedule:

Spring 2001.

11. Fluid Dynamics Media Presentation

Submitted by:

Name: M. Kaptein, Mechanical Engineering
E-mail: rkap@surya.uwaterloo.ca
Position: Lab Director, Mechanical Engineering

Description of Proposal:

Since the early 1960's Mechanical Engineering has had super 8mm fluid mechanics instruction and demonstration material. At some time in the 1980's they were rebroadcast on videotape. However the quality of the instruction material is not very good.

Professor MacDonald is requesting new engineering video material to give more recent coverage of the subject of fluid dynamics. The Insight Media Company offers several choices; we would like the following:

a) Fluid Quantity and Flow
b) Fluid Mechanics
c) Fluid Dynamics of Drag

Benefits of the Proposal:

The above mentioned videos (a and b) can be used for ME 351 and ME 569, video c can be used as an introduction to ME 362.

Cost Breakdown of Proposal:

a) Fluid Quantity and Flow (Video)	$ 249.00 (U.S.)
b) Fluid Mechanics (Video)	269.00 (U.S.)
c) Fluid Dynamics of Drag (Video)	299.00 (U.S.)
Total in Canadian Dollars including tax	**$1,446.00**

Implementation Schedule:

March 2001

8. E&CE 4th Year Room - Computer Upgrade

Submitted Winter 2001 By:

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 two older computers in the E&CE 4th year student room.

The older Pentium 133 MHz computers are too slow for any of the newer software that the 4th year E&CE projects use. We propose to upgrade the computers to something capable of running Windows 2000 and high power digital design software that many students have been using in their 4th year design projects.

Proposal Benefits:

- E&CE 4th year projects
- 4th year E&CE students

Cost Breakdown:

$1150 per Celeron 700 MHz computer with 128M. CDROM. 20G HD
1 ($1150) or 2 units ($2300)

Implementation Schedule:

Summer 2001

Additional Information:

The 4th year room currently has 5 computers [2 of P133, 2 of K6-2/266, P2-233]. The P133 machines have 2G hard drives and 32M of RAM They monitors were recently upgraded to 17" monitors and do not need to be upgraded.

Additional Information:

ME-561 is a popular elective course, which attracts students from Mechanical, Systems Design and Electrical Engineering Departments. The course is offered twice a year with 40-45 students a term.

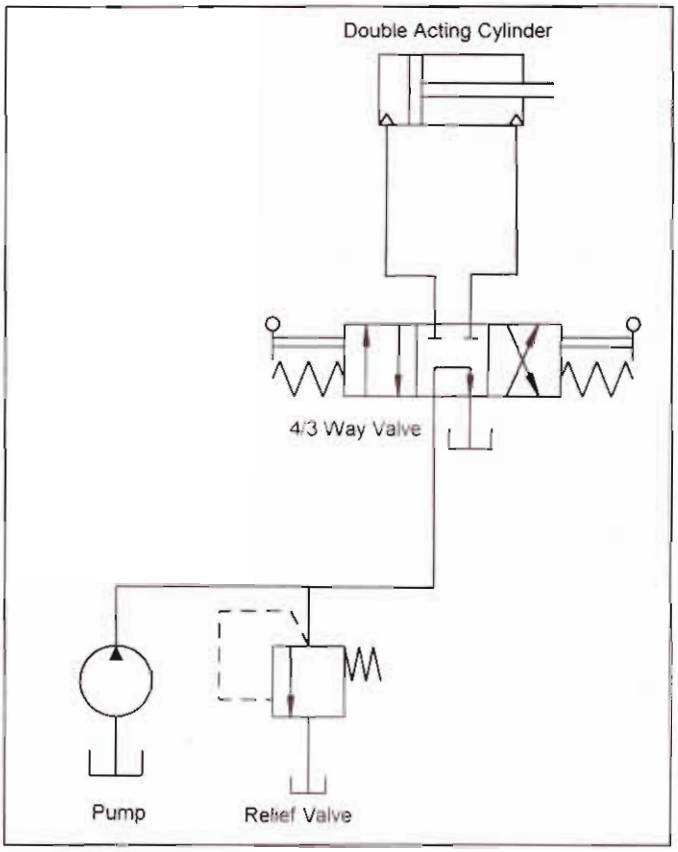


Figure 1. Hydraulic Circuit made of Clear Components

10. Audio Wireless Microphone System for room E2-3344

Submitted By:

Name: Ed Spike
E-mail: spike@engmail.uwaterloo.ca
Phone Number: x3716
Position: Laboratory Instructor

Description of Proposal:

Audio amplification was added to the laboratory to enhance the instruction listening by the students. The plan for the laboratory in room E2-3344 is to enhance the instructors audio presence with a wireless microphone system. The laboratory is long and narrow with 40 to 45 workstations in use. The instructor gives video instructions on three screens. Audio enhancement is available using the existing resurrected 25 year old audio amplifier equipment. The Laboratory Instructors have to move about between the computers, the test equipment, and the chalk board. The audio cables become a safety hazard to the students and the staff. The presentation then is interrupted. The instructor needs to talk from various locations within the laboratory without yelling.

Proposal Benefits:

The students will be able to hear while working at any workstation 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. 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 (old but working)		installed	-
Shielded cable (fire rated) 400 metres		installed	-
Microphone	Model WM4210 Vocal Hand Held	-	$226.87
Headset	Model WM4310A	-	$344.60
FM receiver	Model WT4800 64	-	$444.76
Miscellanies hardware		to be supplied	-
Installation:	by staff	?	-
	sub TOTAL	$?	$1016.23
	TAXES	$	$ 105.69
	TOTAL		**$1121.92**

Implementation Schedule:

01 March 2001.

Additional Information:

This is part of the audio-visual package to be installed. Three data projectors & three projection screens are installed. Audio enhancement at the workstations has been planned.

14. Systems Design Workshop Digital Multi-Meters

Submitted By:

Name: James Morrison
Email: jm2morri@thinair.uwaterloo.ca
Phone: X5218
Position: Lab Instructor, Systems Design Engineering

Description of Proposal:

This proposal is for 1 digital oscilloscope to restock the Systems Design Workshop Lab. Due to recent increased numbers in some of our lab courses 2 complete work stations have been moved from the Work Shop Lab to the Teaching Lab. Part of this equipment was 2 digital oscilloscopes which now need to be replaced for our students' use.

The department has 1 recently purchased oscilloscope that can be put toward this effort. We are approaching WEEF for funding for the other.

Proposal Benefits:

This proposal will help to correct the equipment shortage in our Work Shop Lab which was caused by the Teaching Lab Upgrade. This lab is used by students in each of their work shop courses (2B, 3B, 4A, 4B) as well as for other student projects and interests.

This proposal would benefit all Systems Design students by enhancing the Work Shop Lab.

Cost Breakdown:

Description	Part Number	Quantity	Unit Cost	Extended Cost
4-Channel Digital Oscilloscope	Tektronix TD3014	1	$7000	$7000
Total				**$7000**

WEEF Contribution (100%)				**$7000**
WEEF Contribution (50%)				**$3500**

The Systems Design Engineering Department has agreed to match any contributions that WEEF provides up to 50% of the total cost. (It should be noted that the department has already contributed approximately 50% of the total cost by purchasing the first oscilloscope outright.)

Implementation Schedule:

Immediate.

12. Hydraulic Transparent Components for ME561 Lab

Submitted By:

Your Name: A. Khajepour, Mechanical Engineering
E-mail: amir@suraj.uwaterloo.ca
Phone Number: 6159
Position: Professor

Description of Proposal:

ME-561 (Fluid Power Control Systems) has recently been equipped with a hydraulic/pneumatic training stand, computer and a data acquisition board. The course starts with introducing hydraulic/pneumatic components and their structures (takes about four weeks) and it continues with advanced topics in fluid power control systems such as modeling, control and advanced design techniques. Due to the time limitation, there is not enough time to study the advanced topics, which are very interested to students and are in great demand in industry. The proposed transparent hydraulic components can effectively reduce the introduction lectures to one or two weeks and help students to visualize the operation of a hydraulic circuit.

Proposal Benefits:

1. Students can see through the transparent components to understand the operation and structure of hydraulic components.
2. The proposed components can effectively reduce the time spent on elementary material and the course will be dedicated to more advanced topics in fluid power systems.

Cost Breakdown:

1.	Clear 4/3 Way Valve	$972.00
2.	Clear Double Acting Cylinder	$614.00
3.	Clear Relief Valve	$719.00
4.	Clear Gear Pump	$1,307.00

Total:
$3,612.00

The components will be used in the circuit shown in Figure 1.

Implementation Schedule:

The equipment will be used in spring 2001 term.

16. Systems Design Workshop Digital Multi-Meters

Submitted By:

Name: James Morrison
Email: jm2morri@thinair.uwaterloo.ca
Phone: X5218
Position: Lab Instructor, Systems Design Engineering

Description of Proposal:

This proposal is for 4 Digital Multi-Meters (DMM) to restock the Systems Design Workshop Lab. Due to recent increased numbers in some of our lab coursed 2 complete work stations have been moved from the Work Shop Lab to the Teaching Lab. Part of this equipment was 4 DMM's which now need to be replaced for our general work shop use

Proposal Benefits:

This proposal will help to eleviate the equipment shortage in our Work Shop Lab which was caused by the Teaching Lab Upgrade. This lab is used by students in each of their work shop courses (2B, 3B, 4A, 4B) as well as for other student projects and interests.

This proposal would benefit all Systems Design students by enhancing the Work Shop Lab.

Cost Breakdown:

Description	Part Number	Quantity	Unit Cost	Extended Cost
Digital Multi-meter	Fluke 45	4	$1100	4400
Total				**4400**

WEEF Contribution (100%)				**4400**
WEEF Contribution (50%)				**2200**

The Systems Design Engineering Department has agreed to match any contributions that WEEF provides up to 50% of the total cost.

Implementation Schedule:

Immediate.

13. High Resolution Image Analysis System

Submitted by:

Name: M. Kaptein, Mechanical Engineering
E-mail: rkap@mecheng1.uwaterloo.ca
Position: Lab Director, Mechanical Engineering

Description of Proposal:

Obtaining metallographic images from polished samples is a technique that is first introduced to the students in ME 215 and ME 230. All students enrolled in 400 and 500 level materials courses use these techniques to complete their lab projects. With the recent purchase of image analysis equipment (purchased with the help of WEEF funds), we have the ability to capture and store these images electronically and obtain quantitative measurements from them.

The image analysis system, which consists of an optical microscope, video camera, computer and image analysis software (i.e. IMAGE PRO) represents state-of-the-art metallographic analysis equipment identical to that used in industry. Therefore it is a valuable training tool. Over the two years in which it has been available it has enjoyed increasing use by professors in their courses and consequently by the students. It has reached the point where the single system is heavily used and represents a bottleneck in the ability for students to complete their projects on time

Our current analog camera limits the resolution of the electronic image. This limits the accuracy of our image analysis capabilities and means that photographs are still required in some cases to obtain a high quality printed image for project reports. The inclusion of a high resolution digital camera as part of our second system and upgrade of the analog camera on our current system, would allow the students to take full advantage of our new image analysis system and directly print the electronic image, avoiding the use of expensive photographic film.

Benefits of the Proposal:

All undergraduate students in ME 215, ME 230, ME 435, ME 531, ME 535 and ME 544 will benefit from this upgrade. WEEF provided $2,500.00 towards this project last term, a computer and the Image Pro software has been purchased

Cost Breakdown of Proposal:

Microscope	$10,000.00
High resolution digital cameras (2)	10,000.00
TOTAL FOR SYSTEM	$20,000.00

The entire system is expensive so we would accept partial funding at this time for specific components.

Implementation Schedule

Spring 2001

18. Faster, Simpler, General-Access Colour Printing

Submitted By:

Name: Paul McKone
E-mail: pdmckone@engmail.uwaterloo.ca
Phone Number: ext 2757
Position: Systems Manager, Engineering Computing

Description of Proposal:

Replace Engineering Computing's existing colour printer with a newer, faster machine, and streamline the printing procedure for easy-access, 24/7 "self-service."

Proposal Benefits:

Currently, general-access colour printing in Engineering is awkward at best. Though good quality, output is fragile and expensive, requiring special handling and filing. The existing Tektronix printer is old, slow, and costly to maintain.

Newer, faster, less expensive printers are now available. Configuring one as a "through-the-wall" on-demand printer – similar to the in-lab laser printers – would provide quick, convenient, colour output for Engineering undergraduates

Two models are under consideration, both from Hewlett-Packard: the 8550DN, and the 4550DN. The former is faster with a larger maximum sheet size (11" x 17" poster), and the latter is less expensive, 8½"x11" output. Specifications appear in the Additional Information section.

Cost Breakdown:

The HP8550DN costs $10,900, and the HP4550DN costs $5,400. Engineering Computing will contribute up to 20% of the cost of the chosen printer model.

Implementation Schedule:

As soon as practical after the new machine's arrival, and no later than September 2001. Hurdles that we need to overcome after its arrival:

- integration with current systems (relatively easy);
- implementation of accounting procedures (we're currently working on a new, improved watcard-related accounting system);
- installation and development of release mechanism (for printing on-demand, while-u-wait).

Additional Information:

Features / *Model*	*HP 8550DN*	*HP 4550DN*
Print Speed (B&W):	24ppm	16ppm
Print Speed (Colour):	6ppm	4ppm
Processor Speed:	300MHz	133MHz
Maximum Paper Size:	12" x 18½"	8½" x 11"
Paper Supplied from:	4 trays	3 trays
Total Paper Tray Capacity:	3,100 sheets	900 sheets

15. Systems Design WorkShop FPGA Development Platform

Submitted By:

Name: Mark Korhonen
E-mail: mdkornon@engmail
Phone: 519-880-0262
Position: student

Description of Proposal:

This proposal is for a set (quantity 4) of FPGA development boards which will be used by interested students in our work shop courses.

Proposal Benefits:

These development boards have a robust framework of resources and defined i/o already built-in and will allow our students to focus on developing their project ideas in a more efficient manner. These include audio in/out, video in/out, built in SRAM and FLASH memory, ethernet, serial port, parallel port, USB port, ps/2 port, and 2 expansion ports.

The core of the development boards is a Xilinx Virtex XCV100 FPGA with 100, 000 system gates available.

It is possible we may switch to an Altera 20K based board since we may be able to get the software free for those boards. The price for the Altera hardware is very similar.

These boards would be available for sign-out for Systems Design Students and student project groups (priority given to Systems' students in work shop courses). They would be of most benefit to the Systems Design Work Shop Lab courses.

Cost Breakdown:

Description	Part Number	Quantity	Unit Cost	Extended Cost
Virtex Development Board	Xess XSV-100	4	$749US ~ $1125CDN	4500
Xilinx Foundation Software	Xess XSE-2.1	4	$55US ~ $80	320
Total				**4820**

WEEF Contribution (100%)				**4820**
WEEF Contribution (50%)				**2410**

The Systems Design Engineering Department has agreed to match any contributions that WEEF provides up to 50% of the total cost.

Implementation Schedule:

Immediate.

19. Iron Warrior Colour Laser Printer

Submitted By:

Name: Peter Cresswell
E-mail: pcresswell@hotmail com
Phone Number: 519 635 5038
Position: Iron Warrior Editor

Description of Proposal:

The Iron Warrior, in order to better serve the engineering community, is in need of a new printer The HP 2100TN Laser printer fits the needs of a growing paper

Proposal Benefits:

Waterloo Engineers, EngSoc,and the Iron Warrior staff and the Iron Warrior as a whole.

Cost Breakdown:

(Include partial funding options)
1,099$ + applicable taxes for HP Laser printer

Implementation Schedule:

Purchase made as soon as possible. Target date March 31st, 2001.

Additional Information:

The iron Warrior is in desperate need. At present, the current rate of printing is 1 page per 30 minutes. Due to recent changes in the printing of the Iron Warrior, hard copies of the paper are now required. This means that the timeline of printing the paper is a full 24 hours of continuous printing. This is slightly unreasonable.

17. First Milling Machine

Submitted by:

Name: Clarence Wallace
Phone: 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 an additional 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 requested for Winter 20001 Term	$4.000 00
WEEF funding requested for Summer 2001 Term	$4,000.00
Engineering Machine Shop (funds from sale of old First Mill)	$3,684.00

Implementation Schedule:

Summer 2001.

Cost Breakdown:

(in order of priority)

Single Board Computer	$1000
Wireless Chipset Development Kit	$750
Motors	$500
On-Board Power Supply	$250

Total Requested $2500

Implementation Schedule:

Prototyping currently underway for completion Winter 2002.

Duplex Printing Capability:	Yes	Yes
Standard Configuration:	64MB memory	64MB memory
Maximum Capacity:	512MB memory	208MB memory
Maximum Resolution:	600dpi	600dpi

clutch is most appropriate for the team since its adjustability will be required in order to get the correct clutch set-up for the new 4-stroke engine.

A Sound Meter is required by the team and can also be used by Formula SAE and Ethanol Vehicle teams. We are required to have a noise level under full throttle acceleration less than 78 dB. Last year we were over that limit and received a 200 point penalty and were also deemed ineligible to win the best design award. This circumstance was created by not having the appropriate equipment to test the sound levels. The other teams also require their sound levels to be less than a maximum level designated by the competition rules. A simple hand held unit for effective field testing will be sufficient.

In order to attend the Clean Snowmobile Challenge competition in Jackson, Wy. from March 24 – April 1, 2001, and effectively represent Waterloo by bettering our 2nd place of 2000, we would like to ask WEEF's assistance with travel expenses. Due to our limited budget, we have decided to drive (72 hrs return) to the competition and our lodging will be subsidised by competition sponsors. Six students and one faculty advisor will be attending the competition and we plan on renting a mini-van for our trip.

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.

Ignition Expander and multi-channel ignitor, $552 USD, approx. **$828 CAN** plus shipping.

Fuel Pump and Regulator, $420 USD, approx. **$630 CAN** plus shipping.

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

Sound Meter: **$57.50** total

Estimated Travel Expenses **$2835 CAN**.

Total Cost: **$5225.94**

Implementation Schedule:

As the competition takes place in a month and a half, all funding is needed as soon as possible.

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. We are one of only two Canadian teams at the competition, it is our national duty to finish well at this competition.

20. RoboCup Soccer Robot Prototype

Submitted By:

Name:	Mike Kadour
E-mail:	mjkadour@uwaterloo.ca
Phone Number:	725-5071
Position:	RoboCup Team Member

Description of Proposal:

We are designing a robot for competition in the F-180 RoboCup robot soccer league (www.robocup.org). The prototype robot will be used for engineering graduate studies. In addition to being our fourth year project we envision this prototype as the basis of a student RoboCup team, under the guidance of Profs. Kamel (SYDE) and Gorbet (ECE). A student robotic soccer team is already generating a lot of interest, but it is based on an older generation of robots. Our goal is to design and build a new robot that is extensible, research friendly and mechanically competitive.

RoboCup robot soccer is played on a 2x3 meter field with up to five robots on each team. The robots are computer controlled, fit within a 15x15x15cm cube, are self-powered and communicate wirelessly.

The major components of the robot are a single board computer, wireless communication chips, motors, and a power supply.

Single Board Computer: This small device has the power of a standard desktop computer while fitting within the robot's frame. This computer is the "brains" of the robot, monitoring the sensors, controlling the motors and interfacing with the wireless link.

Wireless Chipset Development Kit: This kit provides the wireless communication modules for connecting the robots and the base station.

Motors: Specialised high precision, compact, permanent magnet DC motors complete with gear-set. The robot prototype requires two motors.

On-board Power Supply: The power supply consists of batteries, voltage regulation circuitry, and a charger unit. High energy density is a must.

Proposal Benefits:

The robot prototype will provide:

- A research platform for ongoing graduate studies
- A first step towards a Waterloo student RoboCup team
- Future student projects

- 2" sheets will reduce waste and extra time required to cut the same parts from 4" sheets

Cost Breakdown:

Complete Funding Option:

Item	Price
Tail Assembly Materials	$100.00
30m Measuring Tape	$30.00
Styrofoam (6 sheets @ $20/sheet)	$120.00
TOTAL	**$250.00**

Partial Funding Option:

Item	Price
Tail Assembly Materials	$100.00
30m Measuring Tape	$30.00
TOTAL	**$130.00**

Implementation Schedule:

Winter 2001	- Tail assembly research and development - Final tail assembly construction for competition - Test flights will use measuring tape to optimize the glide slope - Tail and some wing segments constructed from 2" styrofoam
Spring 2001 (and beyond)	- 2001 Competition, May 11-13, 2001 - Aerial 2001 aeronautical exposition – community interaction, with full-scale and third-scale model gliders - 2002 SAE Aero and Free Flight Glider teams can build on tail assembly research and development

Additional Information:

WEEF will be acknowledged online, in print and on the glider as a sponsor of the Free Flight Glider Team.

In addition to excellent competitive achievement, the Free Flight Glider Team participates in many local community events. During the summer of 2000, University of Waterloo gliders were present for Engineering and Science Quest demonstrations and our team had a booth at the Aerial 2000 event held at Kiwanis Park. We have already been asked to be part of this year's Aerial 2001 event. The Free Flight Glider Team also recently gave presentations to grade 5 and 6 students at a local elementary school. This is a project that is great for students because it is successful and it provides many opportunities to learn. This is also a project that is great for the university because it is successful and it is involved in the local community

21. Clean Snowmobile Challenge (CSC2001)

Submitted By:

Name: Andy Punkari
E-mail: aepunkar@engmail.uwaterloo.ca
Phone Number: 888-4567 x 6167
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 has been given to us in the past, with the support from WEEF we are currently completing our snowmobile that will be entered in the CSC and it looks extremely promising. For this term, I would like to propose that WEEF assist the team in the purchase of several items that are still required to complete our winning sled and attend the upcoming competition These items include an ignition expander and multi-channel ignitor for precise control of ignition timing, electronic fuel pump and regulator for our fuel injection system, a roller secondary clutch, sound meter and travel assistance.

Proposal Benefits:

The Clean Snowmobile Challenge, although one of the newer engineering competitions, has provided valuable experience for a number of students while helping them complete required course material. With the current publicity of the impact of snowmobiles on the environment, more so in the US than Canada, the CSC address a practical engineering problem.

The ignition expander and multichannel ignitor are essential for the precise external control of any distributorless ignition system. Better control of ignition timing will assist us in achieving improved emissions and performance, giving us an edge over our competitors. This system can also be used by other student teams to improve emissions and performance.

> Due to the design of both motorcycles and snowmobiles, we require an electronic fuel pump and fuel pressure regulator to complete the transition of our 4-stroke engine from bike, which has an in tank pump, to snowmobile, which has sealed tank and therefore requires an external pump. This pump and regulator are an integral part of our fuel injection system, which will help us to achieve optimum results in all aspects of the competition.

The chassis with which we intend to compete was purchased without a secondary clutch. A Trackmaster 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, increased fuel economy and reduced noise. This

22. Free Flight Glider Team

Submitted By:

Name:	Scott Redmond
E-mail:	smredmon@engmail.uwaterloo.ca
Phone Number:	519 588-3696
Position:	Project Leader

Description of Proposal:

The Free Flight Glider Team requires funding for the following items:

- **Tail Assembly Materials**
  Historically, the Free Flight Glider Team has competed with flying wings, without a tail or fuselage. This year, however, the team plans to add a lifting tail to the glider. This will increase total lifting area, so that more payload can be carried, and improve the glider's stability so that the glider will stay in the air longer with each flight. Both improvements will directly increase the team's final score in the May competition.

- **30m Measuring Tape**
  In order to determine the glider's efficiency, it is necessary to accurately measure how far the glider flies when given a light hand launch. Past efforts have been based on estimating flight distances by working on the football field near Columbia Lake. The measuring tape is inexpensive, and will help the team by providing greater precision and much greater flexibility in where the test flights can be conducted.

- **Styrofoam**
  The core of the UW Free Flight Glider Team's gliders has been constructed from housing insulation styrofoam for the past five years, with tremendous success. The team requests funding for 2" sheets of styrofoam, to be used for wing segments and for scale models. After being used for testing, many of the scale models have been historically used during community events.

Proposal Benefits:

Tail Assembly Materials:
- Increase competition flight points by increasing payload capacity and flight duration.
- Tail research and development will help current members who plan to enter the 2002 SAE Aero competition, and who must develop a more conventional design.

30m Measuring Tape:
- Improve the accuracy of glide slope calculation during test flights.
- Allow accurate test flights to be conducted virtually anywhere, rather than on marked athletic fields.
- Any other student projects will be welcome to use the measuring tape.

Styrofoam:
- As the core construction material, it is very important to have an adequate supply.

- computer for test platform: $2000
- PCB manufacturing costs for next-generation vision hardware: $1500
- parts for helicopter upgrade (upgrade blades, main gear, etc.): $800

Option 3: A little of each ($4800)

This option will help WARG to fund both its current (core) endeavours (see option 2), as well as its long-term preparation for future competitions (see option 1).

- new aircraft. $2000
- computer for test platform: $2000
- parts for helicopter upgrade (upgrade blades, main gear, etc.): $800

Implementation Schedule:

This is an ongoing student project that is expected to evolve for many years in the future. Funding for most of the above will be used for testing and implementation immediately

23. Waterloo Aerial Robotics Group (WARG) Equipment

Submitted By:

Name: Doug Hemingway
E-mail: djheming@warg.uwaterloo.ca
Phone Number: 888-4567 x5109
Position: Project Manager

Description of Proposal:

The members Waterloo Aerial Robotics Group are currently attempting to come up with solutions for the latest International Aerial Robotics Competition challenge. This competition will be very different from the 2000 competition and will require WARG to develop completely new systems. These systems, such as a fixed-wing aircraft will require new cameras and other sensors. If purchased, these new vehicles would require a great deal of modification to support the WARG systems. As well, improvements need to be made to our existing helicopter to increase its power At present, it barely has enough lift to get off the ground.

Specifically, WARG is requesting funding for the following items:

- new aircraft: $2000
- sensors for new aircraft (tri-axial accelerometers and rate gyros): $3000
- computer for test platform: $2000
- PCB manufacturing costs for next-generation vision hardware: $1500
- parts for helicopter upgrade (upgrade blades, main gear, etc.): $800

Proposal Benefits:

For the past three and a half years, the WARG team has been providing undergraduate engineering students with a unique opportunity to experience hands-on robotics development including the design of flight control, artificial intelligence and computer vision systems. The team has recently expanded to include nearly fifty undergraduate engineering students from all disciplines. The students working on WARG have a chance to get a lot more out of their education than what is presented in class. This equipment will help to maintain WARG's position as one of the very best teams competing in this international competition.

Cost Breakdown:

Option 1: Support for new vehicle systems ($5000)

This option focuses on helping to set up the foundation for new vehicles to help WARG compete in future competitions. Most of the work with these new vehicles will be done by the newer team members (especially those 1st and 2nd year students who will continue working with WARG for the next few years).

- new aircraft: $2000
- sensors for new aircraft: $3000

Option 2: Support for existing system only ($4300)

This option aims to help finish the work on the helicopter itself. This involves extensive controls testing on the indoor platform as well as helicopter modifications to get the required lifting power. This work will be the focus of most of the WARG team for the next several months.

24. University of Waterloo Alternative Fuels Team (UWAFT)

Submitted By:

Name: Eric Powell
E-mail: epowell@engmail.uwaterloo.ca
Phone Number: (519) 725-3490
Position: Team Co-ordinator

Description of Proposal:

This winter's proposal consists of 3 components.

i) Research is being continued from last term into the effects on performance, emissions and fuel economy of introducing hydrogen into the engine's incoming air stream. Also, UWAFT is continuing to develop strategies such as using hydrogen to aid in starting the vehicle in the extreme cold. There has become a need to be able to work with hydrogen safely and UWAFT is requesting financial support in obtaining a sensitive hydrogen detector. UWAFT made a proposal for this equipment in the fall term and received partial funding for it. Although, it was hoped that testing would be done last term, delays in the project prevented it from occurring and the detector has not yet been purchased. Research is still going on in this area and this is a necessary piece of safety equipment; however, the unexpected participation in the Tour de Sol has put a greater strain on UWAFT's budget and we are requesting assistance with the rest of the cost of the hydrogen detector.

ii) As of the beginning of this term, there were no appropriate competitions available for UWAFT to participate in so we intended to take time to do research. However, in the middle of January, we received an invitation to attend the 2001 American Tour de Sol and it is sponsored by U.S. Northeast Sustainable Energy Association (NESEA). The tour will have a total of 50 electric, electric hybrid, solar, fuel cell and ethanol vehicles competing respectively in areas such as fuel economy, emissions, range, reliability, performance, etc. Even though the May 19th-26th competition is quickly approaching, UWAFT is confident we can enter a successful vehicle. However, financially, we were not as prepared to enter a competition this year. The entry fee for the Tour de Sol is $500 US and we would like to request WEEF's support in paying this. UWAFT has sponsors that are able to provide technical donations and advice: however, direct financial assistance is difficult to acquire.

iii) UWAFT actively participates in promoting alternative fuels at various levels, from visiting with elementary school students to presenting to alternative fuel industry leaders. Whatever the situation may be, it often involves displaying our most recent vehicle, a 1999 Chev Silverado pick-up truck. Whether it is going to competitions, attending a sponsorship event, displaying at a conference, etc., we always have equipment or displays in the back of the truck. UWAFT is requesting assistance in obtaining a Tonneau cover for the back of the truck. It will not only protect our equipment, but it will reduce the drag on the vehicle and increase fuel economy.

Proposal Benefits:

i) Using a sensitive hydrogen detector is an effective method of checking for leaks in a hydrogen system, verifying joint integrity, ensuring test fixtures are assembled properly,

etc. UWAFT foresees the benefits of using hydrogen in several different automotive applications; however, safety is a high priority and a hydrogen detector is an investment that needs to be made to improve student safety and facilitate working with hydrogen.

ii) The participation of UWAFT in the 2001 Tour de Sol will be a benefit to the team members and Waterloo engineering as a whole. The competition will be hosting a great variety of technologies and industry leaders in alternative fuels and will be an invaluable experience for the team. We came in a very close second place in last years Ethanol Vehicle Competition, which involved 16 of the top technical universities and colleges from across North America. We are striving to win and are confident in our abilities. The Tour de Sol has conventionally had only American participants and therefore, a strong showing from UWAFT will do well in promoting the University of Waterloo and Canadian engineering.

iii) A Tonneau cover for the box of the truck will be a one time investment that will provide a great amount of benefit and convenience for the team. At some points, passenger space has to be used to carry equipment to ensure it will not be exposed to the weather and alternative arrangements have to be made for the transportation of team members. The Tonneau cover will provide added protection for our equipment and allow us to better utilise the space and resources we have. In addition, a Tonneau cover makes the overall shape of the truck much smoother and will therefore provide an improvement in fuel economy. This will be an added advantage when making trips Ottawa for testing or travelling to the competition in May. With the scarcity of ethanol refuelling stations, we have to carry our own fuel with us and therefore, any improvement in fuel economy is a help. It is a benefit that can be realized for the life of the vehicle and it can be reused after that, if required.

Cost Breakdown:

Option i): BW Technologies M3-FM H^2/CO Detector

US Dollars =	$1465.00
CDN Dollars (@ $0.662 US/CDN) + Tax =	$2213.00
Fall 2000 WEEF support ≅	$1000.00
Remaining required funds for detector =	$1213.00

Option ii): 2001 Tour de Sol Entry Fee

US Dollars =	$500.00
CDN Dollars (@ $0.662 US/CDN) =	$755.40

Option iii): Truck Tonneau Cover

Cdn Dollars (incl. tax) =	$230.00

Option iv): Options i), ii) & iii)

Total =	$2198.40

Although UWAFT considers all 3 proposals important and would greatly benefit from full funding (option iv), it is acknowledged that this may not be possible on WEEF's part. Therefore, the

options have been listed in order of importance to UWAFT. Funding for any option would be greatly appreciated, with priority being highest for full funding and then option (i), then option (ii), etc. The possibility of 75% or 50% funding would also be considered, however, it means we may have to hold back in some of the work we are doing preparation for the competition.

Implementation Schedule:

i) Currently a test method and apparatus is being designed to determine the effects of introducing hydrogen into the engine's incoming air stream and actual testing should happen this term. The hydrogen detector will be an immediate asset to UWAFT

ii) Registration must be completed by March 1st, 2001. If WEEF chooses to support this funding request but it is not possible to receive funding before then, we can make arrangements to cover the registration and accommodate the reimbursement afterwards.

iii) The truck Tonneau cover will be installed immediately on the UWAFT truck. It will provide a benefit in protecting our equipment as well as improving fuel economy whenever the truck is driven.

25. Midnight Sun VI Solar Car Project

Submitted By:

Name: Connie Kwan
E-mail: cmkwan@uwaterloo.ca
Phone: x2978
Position: Business Manager

Description of Proposal:

The Midnight Sun Solar Car Project strives to design and construct an efficient solar car. Every term, about 50 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 to complete our data acquisition system, which is a vital component in a successful car. Thus we approach WEEF for funding in the purchase of two pairs of serial radio modems, antennas for the modems and two DC-to-DC converters.

Lithium-ion Batteries Protection and Balancing Circuitry

Lithium-ion batteries are chosen for Midnight Sun VI over other battery types such as lead-acid, Nickel-Metal Hydride (NiMH) and lithium-polymer. Li-ion batteries are light, has a higher energy density than both lead acid and NiMH, but is cheaper than Lithium-polymer. Current applications for Li-ions include use in portable devices. We have tested Li-ion batteries from NRG Cells in comparison with other battery types, and have found Li-ion to excel in performance. Also, not only has NRG Cells provided supportive information on battery performance and safety requirements, they will also give us a small discount. In addition, the American Solar Challenge (ASC) race officials already approve Li-ion use on races. However, these batteries are not commonly used in large quantity applications. They can be unstable when overcharged and ASC would like to see that our battery pack is well protected during scrutineering. A balancing circuit is also needed to keep all the cells at the same voltage.

Weather Station

A weather station is used to collect weather data en route the race so that future teams can benefit from this data. A weather station accompanied a "mock race" last year when Midnight Sun joined forces with Massachusetts Institute of Technology (MIT) to scout the ASC 2001 race route. The data collected was used during the design phase of Midnight Sun VI, and will be used extensively by the strategy team as well. Our old weather station endured damage during the "mock race" and a new and better one is in the works.

Serial Radio Modems

In the past the radio modems that provide a real time link from the solar car to the chase vehicle have been the weak link in our telemetry system. We experienced many problems with our current modems from Fluke in the past two races. The modems had limited range and were unreliable. Without this wireless link the strategy team cannot make well-informed decisions. Problems with the solar car's systems can go unnoticed unless someone is monitoring them continuously during the race.

There are two unique situations where we need a wireless link to the solar car. One is during the qualifying race and the other is during the race itself. During the qualifier the solar cars race around a closed track and try to accumulate the most laps in the day. The strategy team is situated at one spot while the car races around them. This situation requires a pair of modems that have long range so that the strategy computer and the car are always in contact with each other. The other situation is the race itself where the strategy team is in the chase vehicle and is always close to the solar car. For the race we don't need the range that we did for the qualifier so a less powerful transceiver will save on wasted power and still provide a reliable link.

Antennas

External antennas are required to get the maximum range from these low powered radio modems. Two professionally built dipole antennas would be ideal for use in the race when the two modems are in close proximity to each other. However during the qualifier a larger antenna for the strategy modem is required to ensure that radio contact with the car is never lost during the race. This yagi antenna will help provide the necessary range for the modems to stay in constant radio contact

DC-to-DC Converters.

The DC-to-DC Converter converts the battery voltage of the solar car from 100Vdc to 12Vdc to power the secondary electrical systems. The secondary system includes all of the onboard electronics that monitor and control the car. This includes the radio modems, the data acquisition computer and the fans for the battery compartment.

We require two new 150W DC-to-DC converters for the solar car due to our increased battery voltage. Our new Lithium Ion battery pack has a nominal voltage of 100Vdc, which is well above the operation range of our old converters. A local company donated our previous converters however they are not able to supply us with a converter that will work in our operating range. This has necessitated the purchase of new converters for this car. Two converters are required since the car will not function without one and a full back up is required to ensure that failure of this device does not prevent us from finishing the race.

Proposal Benefits:

Students from many faculties are involved in designing and building subsystems for Midnight Sun. A recent recruitment meeting has brought in another 40 or so students from different faculties, with engineering as the most prominent percentage. Many students make research for the car's subsystems a student project and learn much from the experience. We currently have 5 mechanical projects for the ME481 course done by team members in that course. We also have an electrical research on MPPTs that is used to fulfill a course requirement. The MPPTs are a new type of MPPT which will be used on the canopy region of the car. 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), Molson Indy, High Tech Show and participates in local festivals such as Earth Day, Canada Day and the Oktoberfest parade.

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

Cost Breakdown:

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

	Item	Quantity	Amount	
Plan A				
	Battery Protection and Balancing Circuitry	1	$2000	
	RTCom – Global Transceiver	2	$1544.40	
	BIM-RS232 Transceiver	2	$417.90	
	Dipole Antenna	2	$120.75	
	Yagi Antenna	1	$149.95	
	Weather Station	1	$500	
	DC-to-DC converter	2	$450	**Total: $**
				$5183.00
Plan B				
	Battery Protection and Balancing Circuitry	½	$1000	
	RTCom – Global Transceiver	2	$1544.40	
	BIM-RS232 Transceiver	2	$417.90	
	Dipole Antenna	2	$120.75	
	Yagi Antenna	1	$149.95	
	Weather Station	1	$500	
	DC-to-DC converter	2	$450	**Total: $**
				$4183.00
Plan C				
	Battery Protection and Balancing Circuitry	½	$1000	
	RTCom – Global Transceiver	2	$1544.40	
	BIM-RS232 Transceiver	1	$208.95	
	Dipole Antenna	1	$60.40	
	Yagi Antenna	1	$149.95	
	DC-to-DC converter	2	$450	**Total: $**
				$3413.70

Implementation Schedule:

Items being requested will be purchased immediately upon the availability of funds. Please note that the development of a telemetry system is critical and time consuming, and the radio modems are crucial for its operation. The radio modems that we require have already been sourced from a company in Toronto. The DC-to-DC converters have a significant lead time and will be ordered once funds have been secured.

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 has funded all of the data acquisition system and is currently a **Silver Sponsor**.

26. UW Formula SAE Team Proposal

Submitted by:

Name: Jane Whittington
E-mail: FSAE@engmail.uwaterloo.ca
Phone Number: ext 5904
Position: FASE team finance and cost reporting

Description of Proposal:

- Formula SAE support is an excellent public/corporate awareness tool available to WEEF. We are the Top Canadian FSAE Team competing with over 100 other teams from around the world. Several large automotive (and related) companies sponsor the event. In order to remain competitive we must be able to keep pace by improving our testing and development equipment as well as build a superior car each year.

Proposal Benefits:

Option 1:

- Linear potentiometers are required to interface with data acquisition system and tune the car for optimum performance through competition and to provide data for future design.
- They can be reused on future cars with an estimated life of 2-3 years
- The wheels are required for the 2001 team entry into the competition.
- Future teams can reuse wheels for several years. It is anticipated the a set of wheels can be used for 2 years before they are beyond their service life due to normal wear and tear. After several tire mounting and dis-mountings, the wheels may not be true any longer and will need replacing (due to their ultra lightweight aluminum nature).

Option 2:

The value of the linear potentiometers is listed above.

- The steering wheel on the 2000 car has been in circulation since 1996 and needs to be replaced. it can be used for several years in the future.
- Safety equipment is another item that is used by multiple teams but subject to wear and tear and in need of replacement. An assortment of sizes is also required to accommodate different driver size
- MSD Ignition tool can be used for engine development for many years into the future.
- Smaller tools become property of the team and are used for many years in the future to build and tune the car

Cost Breakdown:

Option 1:

Wheels:	4 x $ 400.00	$ 1600.00
Linear Potentiometers:	4 x $ 250.00 =	$ 1000.00
Total		$ 2600.00

Option 2:

Linear Potentiometers:	x $250.00 =	$ 1000.00
Steering Wheel		$ 213.90
Safety Boots		$ 160.00
Safety Gloves		$ 105.00
Balaclava	2 x $ 62.00 =	$ 124.00
Tire Pressure Gauge		$ 80.00
Torque Wrench		$ 250.00
Channel-locks		$ 40.00
MSD Ignition		$ 800.00
Total		$ 2772.90

Any partial funding will be accepted.

Implementation Schedule:

Immediate upon receipt of funding.

Additional Information:

- 40 Undergrad Engineering Students
- Largest Mechanical Engineering Student Project
- Many Disciplines Participate
- Both streams
- First to fourth year