University of Saskatchewan

College of Engineering

Engineering Advancement Trust 2012 Funding Decisions

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2012 EAT Funding Decisions

The College of Engineering is committed to ensuring the quality of our undergraduate programs. The generous contributions from alumni into the Engineering Advancement Trust (EAT) continue to provide funding for our undergraduate laboratory equipment.

In 2012, the college has moved away from relying on an EAT funding allocation formula, and has instead adopted a process where programs, units and/or individuals submit proposals for projects that would utilize the EAT funds to transform or modernize our undergraduate labs. A call for proposals was made in April 2012 to the college and 22 proposals were received. Dean Ernie Barber and Assistant Dean Aaron Phoenix met on May 29, 2012 to review the submissions and recommend projects to the EAT Board. Selection of the projects was based upon 5 principles:

1. **Modernization and Transformation** – Highest priority will be given to projects that transform the way we teach our engineering programs to ensure our college is at the forefront of engineering education practices. Also invited are proposals for laboratory modernization projects that ensure our students are exposed to contemporary engineering tools. Lowest priority will be given to proposals for laboratory equipment maintenance.

2. **Partnerships and Leveraging** – Proposals that engage other funding partners or that can be leveraged for additional funding are encouraged.

3. **Urgency and Need** - The urgency and need for a piece of equipment will be considered when prioritizing proposals. Proponents should be committed to purchase and installation of the new equipment in a very timely manner once a decision is made to fund the proposed project.

4. **Collaboration** - Proposals that engage and impact multiple programs will be looked upon most favourably.

5. **Fairness** - EAT Fund distributions will, over a multiyear period, impact all engineering programs equitably.

After consultation with the College Executive, the dean recommended that the EAT Board approve the allocation of $478,000 from EAT funds towards 10 proposals in three important areas to the college undergraduate programs: Energy, mining and mineral processing; Optics and photonics for the 21st century; and Analysis and testing. Conditional allocation of an additional $160,000 was requested for a transformational project in the area of advanced materials.

On June 14, 2012, the EAT Board of Trustees met and approved all recommendations. A list of the projects selected for funding is given in Table 1, and a summary of the projects selected within the three categories can be found in the later sections of this document.

TABLE 1: Projects Approved for EAT Funding

Funding Area	Project	Cost ($)
Energy, Mining and Mineral Processing	Flotation Apparatus	37,000
	Hydrocylone	43,200
	Triaxial Testing System	71,400
	Combined Heat & Power	30,000
Optics and Photonics for the 21st Century	Advanced Optics Lab	73,000
	Optical Fiber Information and Communication Kit	40,000
Analysis and Testing	Laboratory Refractometer	22,000
	Advanced Flow Measurement System	33,915
	Signal Analyzer	62,500
	Impact Testing Facility	65,000
TOTAL REQUESTS		**478,015**

Conditional Requests

Advanced Materials	Direct Write Laser UV Lithography	160,000

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2012 EAT Project Summaries

Energy, Mining and Mineral Processing

The College is responding to industry needs and investing in the development of our capacity to deliver educational experiences relevant to the mining and mineral processing industries, and to the energy sector. A **flotation apparatus** and **hydrocyclone** experiment will add a new mineral processing stream to the chemical engineering undergraduate laboratories while the **triaxial testing system** modernizes the geotechnical labs used by the civil, geological and environmental engineering programs. A **combined heat and power experimental facility** will engage students in the mechanical engineering program to enhance their understanding of key thermodynamic principles using a modern energy conversion arrangement.

Flotation Apparatus ($37,000)

Department of Chemical and Biological Engineering

A benchtop laboratory kit exposes students to the industry practice of flotation, a common practice in mineral processing. Flotation, or more specifically "froth" flotation, is a physico-chemical method of concentrating ground ores. The process involves chemical treatment of an ore pulp to create conditions favorable for the attachment of pre-determined mineral particles to air bubbles. The air bubbles carry the selected minerals to the surface of the pulp, there forming a stabilized froth which is skimmed off and from which the pre-determined mineral particles are recovered. Other minerals remain submerged in the pulp.

Hydrocyclone ($43,200)

Department of Chemical and Biological Engineering

Giving students an opportunity to experiment with a process widely used by industry, this laboratory scale hydrocyclone is a device to classify, separate or sort particles in a liquid suspension based on the ratio of their centripetal force to fluid resistance. This ratio is high for dense (where separation by density is required) and coarse (where separation by size is required) particles, and low for light and fine particles. Hydrocyclones also find application in the separation of liquids of different densities.

Triaxial Testing System ($71,400)

Department of Civil and Geological Engineering

Replacing one of two triaxial testing systems within the Geotechnical Laboratory, this new system modernizes the laboratory experience through the use of digital pressure-volume (P-V) controllers instead of the burette and manually operated valves. The P-V controllers and real-time data management enhance the hands on experience as students manipulate cell pressures and and axial stress while measuring pore-water volume change or excess pore-water pressure in a soil sample.

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Combined Heat and Power Experimental Facility ($30,000)
Department of Mechanical Engineering

This project creates an undergraduate laboratory that includes a small commercial combined heat and power (CHP) unit, giving students hands-on insight into very important concepts related to energy utilization and vital issues surrounding environmental stewardship and sustainability. CHP systems use a fuel source (e.g. natural gas) to power a heat engine (e.g. Otto cycle or Stirling cycle) to power an electric generator. At the same time they use the heat rejected from the heat engine for space heating or water heating. Students will perform a complete thermodynamic analysis on all components of the system including efficiency calculations of each component of the system and of the overall efficiency. This will give students exceptional insight into the many ways that the efficiency of energy systems is specified (e.g. thermal efficiency, specific fuel consumption, heat exchanger effectiveness, isentropic efficiency, mechanical efficiency, etc.).

Optics and Photonics for the 21st Century

An understanding of optics and photonics is important for engineers working with spectrographic analysis, whether it be collecting atmospheric data from a satellite or measuring material properties using the Canadian Light Source. The proposed **advanced optics lab** modernizes the way optics and photonics are taught to our engineering physics and electrical engineering students. To introduce a new hands-on lab in our instruction of optical fiber communication, the purchase of two **optical fiber information and communication kits** has also been approved.

Advanced Optics Lab ($73,000)
Engineering Physics

This advanced suite of lab equipment and tools enable students to obtain essential and applicable knowledge in optics and photonics, which together constitute one of the most important emerging technology domains of the 21st century. The suite builds on existing strengths in optics but also significantly extends and enhances students' experiences through new course material on advanced optical system design, photonics (which may be defined as the production and manipulation of photons of light) and discussions of diverse applications of these technologies such as sensors, energy production, biomedicine, and space engineering. Optics and photonics are key components in many advanced engineering devices and systems, and optical and photonic techniques are used in many university research and industrial R&D and production facilities.

Optical Fiber Information and Communication Experiment Kit ($40,000)
Department of Electrical and Computer Engineering

The purchase of two optical fiber information and communication experiment kits introduces a new hands-on experience to students, giving them a better understanding of the characteristics of isolators, attenuators, optical switches, optical transmitters and amplifiers. The experiment is to be part of the new labs for a course in Optoelectronics and Photonics, an important area in modern communication engineering.

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Analysis and Testing

Analysis and testing remains a critical components of engineering and engineering education. Four projects were approved that modernize the analysis in undergraduate labs while enhancing our students' hands-on experience. A modern **refractometer** for the chemical engineering undergraduate labs will be used to supplement compositional analysis for both the third and fourth year students. The civil and geological engineering hydraulics lab experience will be modernized through the introduction of an **advanced flow measurement system** allowing the measurement of velocity profiles, bed profiles, and flow rates using an acoustic profiler and a Doppler velocimeter. Electrical and computer engineering students will benefit from the purchase of five new **Agilent signal analyzers** that allow examination of modern high frequency circuitry such as those found in cellular and Wi-Fi networks. A new **impact testing facility** for the mechanical engineering materials lab replaces aged and unsafe equipment and renews the department's capacity for hands-on experimentation to understand the changes of impact energy with temperature.

Laboratory Refractometer ($22, 000)

Department of Chemical and Biological Engineering

An important addition to the chemical engineering undergraduate laboratory, the purchase of a refractometer allows students to determine the refractive index and ethanol concentration of liquids. It will be used in conjunction with the current densiometer enabling the students to better and more simply quantify unknown samples for both density and concentration, allowing them to focus more on the principles of the unit operations rather than performing complicated analysis.

Advanced Flow Measurement System ($34,000)

Department of Civil and Geological Engineering

The advanced flow measurement project creates an advanced system for flow measurement to modernize the hydraulics laboratory. The new lab equipment exposes and trains students through acoustic Doppler velocity measurement techniques commonly used in industry practice while also building on their experience in computer controlled data acquisition.

Agilant Signal Analyzers ($62,500)

Department of Electrical and Computer Engineering

The purchase of five Agilent CXA N9000A Signal Analyzer modernizes the electrical and computer engineering laboratory, giving students the capacity to examine modern high frequency circuitry. Unlike the older spectrum analyzers, this new equipment allows students to test and debug their designs as well as allowing the students to better understand the practical side of high speed communications circuits such as those found in cellular and wireless technologies.

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Impact Testing Facility ($65,000)
Department of Mechanical Engineering

This project funds a modern impact testing facility, replacing an unsafe, defunct facility that is currently only used for demonstrations. The modern impact tester has much more sophisticated instrumentation and can characterize a more comprehensive set of material impact properties while introducing hands-on materials testing to the mechanical engineering labs. Experiments will measure the changes in impact energy with temperature, which given our climate, is a very important design consideration, and more advanced impact tests will enhanced upper year advanced materials electives.

Conditional Funding for Advanced Materials

The college is actively working to engage our undergraduate students in our research programs. This direction includes bringing more undergraduates into our advanced labs and allowing them direct involvement in the creation of knowledge. The funding proposed for a **laser UV lithography system** will be used to leverage addition Canadian Foundation for Innovation (CFI) funds allowing the purchase and installation of a state-of-the-art apparatus for the manufacture of nanomaterials. Undergraduates taking the senior-level nanomaterials technical elective would have an opportunity for hands-on experience to work with the equipment within the Canadian Light Source (CLS) facilities. This funding is available until September, 2014, and is conditional on the successful application for the additional CFI funds. If complete funding for the equipment is not in place by September 2014, the EAT funds will be rescinded.

Direct Write Laser UV Lithography System ($160,000)
College of Engineering

At a total cost of $400,000, EAT funds will be used to leverage Canadian Foundation for Innovation funds to procure a Direct Write Laser UV Lithography system for use in both the undergraduate nanomaterials elective course and for micro- and nanomaterial research within the College. The lithography system will be installed at the Canadian Light Source (CLS), giving our undergraduate students a modern, hands-on experience within their elective course while also engaging them in research and the CLS. It will expose students to the complete design, fabrication and inspection sequence in micro- and nanotechnology.

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