A state-of-the-art teaching and research facility on the fifth floor of the Macdonald Engineering Building is significantly advancing our Faculty’s ability to tackle major challenges in environmental engineering.

Named the Benedek Integrated Laboratories in Environmental Engineering, the 5,165-square-foot facility is a gift from husband-and-wife team Andrew Benedek, BEng‘66, DSc‘05, and Diana Mourato-Benedek, BSc ‘81, MSc‘83, PhD‘90.

The laboratories are helping McGill Engineering to move further into new and emerging areas of study in sustainable engineering — everything from developing biosensors that detect pollutants and pathogens to greenhouse gas management and research to mitigate climate change.

**Star scientists**

Another interesting feature of the new facility is its use of integrated research teams. In the Benedek laboratories, undergraduates work side by side with senior professors and graduate students. The physical layout, coupled with this creative teaching approach, enable students at all levels to fully pursue inquiry-based learning.

Associate Dean for Research and Graduate Education, Andrew Kirk, says the work underway in the Benedek laboratories will result in many practical applications inspired by recent advances in nanotechnology, molecular biology and green chemistry.

**Examples include adaptive technologies for:**
- resilient biological wastewater treatment systems;
- rapid and effective restoration of aquifers and brownfields contaminated with toxic industrial wastes;
- protecting water resources from chemical pollutants and pathogens;
- carbon capture and storage of carbon dioxide emitted from industrial smokestacks.

Although housed in the Department of Civil Engineering and Applied Mechanics, research in the Benedeks’ ultra-modern laboratories will involve active collaboration with star McGill scientists in many departments and units. Among these are the Department of Chemical Engineering, the Brace Centre for Water Resources Management and the Faculty of Agricultural and Environmental Sciences. (cont’d on page 2)
Dean’s Message

Alumni often ask if I’ve heard about a remarkable new program at university x, y or z, or perhaps inquire if we’re considering doing such-and-such to better prepare students for the job market. My answer to both questions is almost always “yes, but we lack funds right now to set the program in motion.”

Information elsewhere in this newsletter points out that 97 per cent of our budget is allotted to existing teaching and research. The only wiggle room we have to invest in creative ideas and new areas of study is annual donations to the Alma Mater Fund — a sum that currently averages less than $1-million a year, the remaining 3 per cent of our operating budget.

Those of you who have heard me talk at Homecoming and other Faculty events know that McGill Engineering has ambitious goals. We want to strengthen our human capital, develop closer ties with industry and offer constantly improving world-calibre teaching and research.

Major benefit

No matter how hard our students and professors work, however, those goals will only be achieved with additional alumni support. Major designated gifts, like those described on pages 1 and 3 of this issue, are enormously important, but unrestricted Annual Fund gifts provide equally essential support for undergraduate summer research internships, more scholarships, competitive fellowships and solid, practical advising and job counseling to help our students succeed after graduation.

The record shows that we have used past Annual Fund gifts wisely. For those who are already helping McGill Engineering to fulfill its mission, thank you. For those who are still considering doing so, your support would bring major benefit.

To one and all, please accept my warmest wishes for a happy holiday season and a satisfying 2011.

Christophe Pierre
Faculty of Engineering

Andrew and Diana Benedek’s gift has increased Civil Engineering’s environmental engineering laboratories space by almost 40 per cent. It also provides a host of new amenities. The laboratories’ major features include:

- chemical fume hoods and biological safety cabinets for the safe handling of toxic pollutants and pathogens;
- advanced temperature control and ventilation systems;
- a clean room for cutting-edge, sensitive analytical instruments;
- chemical resistant flooring and extensive and well-equipped bench areas to conduct experiments.

The laboratories also boast a unique, cold temperature facility to develop innovative techniques to clean sites contaminated by toxic chemicals in cold, northern regions. Advances in this area could help to restore fragile northern ecosystems that have been damaged as a result of oil spills, mining operations and past military activities.

Dr. Andrew Benedek and Dr. Diana Mourato-Benedek are recognized internationally for their scholarly contributions to the field of environmental engineering. Andrew is a leader in the development of advanced membrane technologies used for water and wastewater treatment. Diana, a fellow scientist and business partner, has had an equally successful career developing water treatment technologies. She is also a member of McGill Engineering’s Faculty Advisory Board. The husband-and-wife team are currently concentrating their energies on developing alternative energy sources from waste materials.

The duo toured their new laboratory space in mid-June just as the finishing touches were being applied. The two scientists then took part in a symposium and a poster session on environmental engineering organized for students and researchers across McGill. In addition to the new laboratories, the Benedeks are also funding graduate fellowships in the Faculty of Engineering.

Program teaches ‘soft skills’ valued by industry

McGill Engineering is heading a six-year university-industry training program to better prepare students in the design, fabrication, integration and packaging of integrated sensor systems. The project is led by Andrew Kirk, Director of the McGill Institute for Advanced Materials and our Faculty’s Associate Dean for Research and Graduate Education. NSERC awarded Professor Kirk a $1.6-million grant to train 104 graduate and undergraduate students. The initiative involves expertise from the U.S. and Japan (Cornell and Kyoto universities); Québec (École Polytechnique, Université de Sherbrooke and Institut national de la recherche scientifique); and industrial partners such as DALSA Semiconductor, IBM, Perkin-Elmer Optoelectronics and CAE-LETI.
Engineers in the year 2010 must be adept in a broad range of skills and techniques to tackle increasingly complex technological, social, economic and environmental challenges. One of the most important skill sets is the ability to function in the multidisciplinary teams that are now routinely assembled to design and build major projects.

Promoting interdisciplinary curiosity and cooperation has become a major goal throughout McGill Engineering, and nowhere more so than in two institutes established recently in areas of strategic importance to the Faculty: the Institute for Sustainability in Engineering and Design (ISEAD) and the McGill Institute for Aerospace Engineering (MIAE).

Both new units are distinct from the five departments and two schools that nourish them, and yet are integral to the teaching and research process.

“We need structures that cut across boundaries, that promote networking,” says Engineering Dean Christophe Pierre. “Institutes do all of this and more, serving as important windows on the world.”

ISEAD and MIAE join a proud list of Faculty of Engineering institutes and centres established over the decades to develop and improve teaching and research. Among others, they include the McGill Institute for Advanced Materials; the Brace Centre for Water Resources Management; the Centre for Advanced Systems and Technologies in Communications; the Centre for Intelligent Machines, which is celebrating its 25th Anniversary this year; and the McGill Metals Processing Centre.

The following is an overview of the two newest institutes and their raisons d’être.

Established this past summer, ISEAD’s ambitious plans include:

- working with existing academic units to create new courses and programs that focus on sustainability principles and practices
- encouraging summer research and industry internships
- hosting a distinguished visiting speaker series
- running a summer school in Engineering and Design for Sustainability that is open to students as well as industry and government employees
- encouraging undergraduate design and research projects

ISEAD: Making the planet greener through engineering

Finding sustainable solutions to the complex challenges that societies face demands a concerted and collaborative effort to ensure that the technologies we adopt and the infrastructures we use are sustainable in terms of energy, materials, water, food and the production of waste.

“Engineers, architects and urban planners play an essential role in creating these technologies and infrastructures,” Professor Pierre says. “They help to ensure that energy and natural resources are used efficiently, with minimal waste and with acceptable social, environmental and economic impacts.”

“The Institute for Sustainability in Engineering and Design that was established this past summer helps to ensure that today’s students have a thorough understanding of sustainability and the many issues associated with it,” he says. “We want them to graduate from McGill with the knowledge they need to incorporate sustainable engineering and design principles in their day-to-day work.”

ISEAD Director Geza Joos, a specialist in renewable and alternate energy at the Department of Electrical and Computer Engineering, says ISEAD was formed to harness the full potential of the many excellent, but somewhat unconnected teaching and research activities related to sustainability at the Faculty of Engineering.

It will also serve as the driving force to propel McGill to the forefront of teaching, training and research in the field.

The institute addresses universal problems, such as energy, climate change, water, resource scarcity and infrastructure degradation.

“It has a two-pronged mandate,” Professor Joos adds, “to embed a culture of sustainability at the Faculty of Engineering — and across McGill — and to work with academic, industry and government partners to promote sustainable principles and practices.”

Inside McGill, ISEAD is forging research and teaching links with units such as the Office of Sustainability, the McGill School of Environment, the Brace Centre for Water Resources Management and faculties such as Agricultural and Environmental Sciences, Law, Management and Science.

A leadership role

Externally, ISEAD promotes an exchange of best practices and ideas. It also strengthens industrial and government partnerships to ensure that McGill teaching and research respond to these stakeholders’ needs.
School of Architecture Director Michael Jemtrud, whose students and professors form part of the “design” component in ISEAD’s name, says that sustainability and interdisciplinarity are integral to architects’ work. “In fact, there isn’t a class we teach here that doesn’t touch on sustainability.”

Professor Jemtrud says he hopes the new institute will serve as a catalyst to bring McGill people, projects and industry together, and present exciting new options and opportunities for research. “Sustainability is one of the key challenges of our time,” adds Professor Joos. “The possibilities for progress in this vitaly important sphere of human endeavor are enormous. If ISEAD succeeds, we will help to contribute to a better quality of life.”

Part of the funding for the new sustainability institute was provided through generous gifts from alumni Ram Panda, MEng’71, MBA’77, and Lorne Trottier, BEng’70, MEng’73, DSc’06. Both are members of the Faculty of Engineering Advisory Board.

MIAE: Linking student, research and industry needs

BY PATRICK MCDONAGH

Like ISEAD, the McGill Institute for Aerospace Engineering (MIAE) has a two-pronged mandate: to help students develop the knowledge and skills necessary in aerospace engineering and to create strong networks among faculty researchers and industry representatives. Along the way, it is redefining McGill’s local, national and international aerospace engineering profile.

Jeff Berghthorson of the Mechanical Engineering Department says one of MIAE’s great strengths is “starting conversations” between academia and industry. “In my case, my research network was established ad hoc — the result of a chance conversation between my department chair and someone in industry. But we shouldn’t be running a system based on chance. There should be a proactive aspect to this, and MIAE will supply that.”

“It will get industry people together and find common ground. It will track who is doing research at McGill Engineering, then go out and talk about it, saying to industry, ‘This is what we can do for you; what are your needs?’”

Professor Berghthorson is currently part of major aerospace industry collaborations exploring alternate fuels: one with Pratt & Whitney Canada, the other with Rolls Royce Canada.

For fellow Mechanical Engineering professor Marco Amabili, Canada Research Chair in Vibrations and Fluid-Structure Interaction, the conversations are already paying dividends. Much of Professor Amabili’s work focuses on thin-walled shell structures, such as airplane fuselages or rocket casings. Largely due to meetings that MIAE helped sponsor, he has just committed himself to a project called “superpanels” which brings together Canadian, Italian, Belgian, United Kingdom and New Zealand researchers to develop strong, resilient panels that could be used in building air and space craft.

Mathieu Brochu of the Mining and Materials Engineering Department points out that MIAE provides particular benefit to younger researchers like him who don’t usually start with many industry connections. The institute has already linked Professor Brochu to companies in Quebec, arranged meetings with visiting delegations from abroad and organized symposiums — one last month with aerospace industry and government representatives from the German state of Bavaria and another this month with Indian researchers.

Aerospace engineering demands coordinated expertise. MIAE connects researchers and students with Montreal’s vibrant aerospace industry and, from there, to global industry players.

“MIAE clearly has an international vision,” he says. “Its activities are growing and the institute is really putting out the word that McGill is doing high-quality aerospace research.”

MIAE’s key beneficiaries, though, are McGill Engineering students. Working with the Montreal Aerospace Institute, an umbrella organization that includes partner groups at Concordia University, École de technologie supérieure and École Polytechnique, MIAE is successfully organizing internships for students in the local aerospace industry. Students are selected both for academic achievement and leadership qualities.

The internships normally last 500 hours — about four months of work — but many of last year’s students had their projects extended. (cont’d on page 6)
A Faculty on the Move Needs Annual Donor Support to Ensure Success

The Faculty of Engineering is undergoing a remarkable transformation.

During the past five years:

- 37 new professors have come on board;
- PhD enrolments jumped 62%;
- undergraduate enrolment rose 21%;
- research funding grew by 60%;
- and impressive initiatives have been sprouting up, such as the McGill Engineering Student Centre and teaching and research institutes in sustainable engineering and aerospace engineering.

Operating expenses at the Faculty of Engineering are dependent on three revenue streams: government grants, tuition fees and donations from alumni. The first two sources cover day-to-day costs, such as salaries, but our students and professors have to rely on philanthropic support to pay for other necessities, including scholarships, fellowships, internships and high-tech study and research space.

Approximately 13% of our Faculty’s 20,000 engineering, architecture and urban planning alumni contribute to the Annual Fund; 1% are loyal donors who provide leadership gift amounts of $750 or more. If the 87% of alumni who are not yet contributing made a determined effort to add their support, who knows what heights might be achieved?

**The Challenge:** By definition, government grants, research funds and designated gifts (such as endowments) are restrictive; they provide no maneuvering room, no leeway to seize opportunities for advancement in new and emerging areas of study. Annual Fund gifts from alumni are essential to provide seed money for new, cutting-edge programs, services, equipment and facilities. Your Annual Fund gift helps the Faculty of Engineering to remain competitive and stay at the forefront of engineering education.

* Designated gifts normally come in the form of an endowment, meaning that the gift is invested to produce endowment income for a specific purpose identified by the donor. The capital is never touched. It is the annual interest income that is spent.

* The Annual Fund is money solicited on a yearly basis for ‘undesignated’ — what is sometimes termed ‘unrestricted’ — operating purposes. Designated endowment gifts provide money “to grow by”. Annual Fund revenue is money “to live by” — money for the “here and now”.

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**BUDGET BREAKDOWN**

- Government Agencies & Industry Partnerships
- Operating Budget $34 M
- Research Budget $35 M
- Designated Gifts (including interest from endowments) $5 M
- Annual Fund Gifts $1 M

**OPERATING BUDGET REVENUE**

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Grants &amp; Tuition Fees</td>
<td>82%</td>
<td>$28 M</td>
</tr>
<tr>
<td>Designated Gifts</td>
<td>15%</td>
<td>$5 M</td>
</tr>
<tr>
<td>Annual Fund Gifts</td>
<td>3%</td>
<td>$1 M</td>
</tr>
</tbody>
</table>

Approximately 1 dollar in 6 comes from gifts

**PHILANTHROPICT PARTICIPATION**

- 2,435 Alumni (12%) participate yearly at <$750
- 265 Alumni (1%) participate as Leadership Donors at >$750
- 17,300 Alumni (87%) do not participate

Total number of alumni = 20,000
Fifty-four engineering and architecture professors participated in the Faculty of Engineering’s innovative Summer Undergraduate Research in Engineering (S•U•R•E) program this year, providing 106 undergraduates a unique opportunity to expand their intellectual horizons while earning money to support their studies.

Architecture student Eve Lachapelle (right) worked alongside Annmarie Adams, William C. Macdonald Professor at the School of Architecture, to evaluate best practices in the design of long-term residential care facilities. Professor Adams is one of 25 interdisciplinary researchers from six countries sharing a $2.5-million grant to study ways that help ensure dignified treatment for residents and workers.

Adams and Lachapelle are interested in lessons to be learned from older medical facilities. They are seen here studying decades-old blueprints drawn by architects for a healthcare institution in Ottawa.

And after graduation, these students will be at the head of the queue for job hiring. “These are high-level projects, so the internship is like a five-hundred-hour job interview,” says MIAE Director Stephen Yue, Chair of the Department of Mining and Materials Engineering and Lorne Trottier Chair in Aerospace Engineering.

Paul Axais, a fourth-year mechanical engineering student, is MIAE’s student president and serves as an informal liaison and resource point between the institute and its 60 students.

He interned last summer with Rolls Royce Canada, streamlining the process for identifying and coordinating the connection specifications for a turbine engine that had six variants. The experience was obviously a success for him and the company because Axais will return on a second Rolls Royce Canada internship next month.

“The ultimate goal is to get your foot in the door,” Axais says, “and then to get a fulltime position when you graduate. The program opens opportunities for jobs you might otherwise never be exposed to.”

“Our students are our best ambassadors,” adds Pascal Hubert, another of MIAE’s Mechanical Engineering researchers. “Students tell industry engineers about the work their professors do and that helps us to create a network.”

Professor Hubert spent much of a recent sabbatical year working with industry professionals at Bombardier. “When CVs were being circulated among staff, they would come to me and say ‘What do you think of this student?’ I’d say, ‘Oh, I know him or her, that’s a good choice.’ So you can see the mechanism is working.”

Professor Hubert, who holds the Canada Research Chair in Advanced Composite Materials, is pursuing research that is fundamentally interdisciplinary, involving mechanical, materials and chemical engineering in areas that are central to aerospace engineering. “Every company is interested in this,” he says, noting that the decision to spend his sabbatical working with Bombardier was guided by a desire to understand the interest better. “I wanted to see how industry sees us and to learn how we could correct anything we need to correct.”

Professor Hubert says a formal research institute creates a tool that has much more force than a single professor. “MIAE means we can reach out to industry to show them all the good things we can do. It also encourages greater internal communication and exchange among professors at McGill.”

MIAE researchers are developing methods to predict vibration and noise in large-scale, complex structural systems. Above is a three-dimensional model of a misaligned stacked disk rotor assembly for a jet turbine engine. The misalignment causes imbalance and an undesirable vibration.

McGill Engineering’s 2010 Alma Mater Fund goal is $1-million. Thank you for your past and future support.