Faculty of Engineering and Applied Science Winter 2002

Benchmarks

Memorial University of Newfoundland

It's a Bird, it's a Plane...

Engineering students Lloyd Smith, Ajay Sancheti and Jeff Newhook really know how to fly.

Students at the INstrumentation, Control and Automation (INCA) Centre, Engineering and Applied Science, are busy building an autonomous plane: RAVEN (remote aerial vehicle for environmental monitoring), is a multi-purpose aerial vehicle that can be used for locating icebergs, tracking wildlife, detecting forest fires, tracing oil spills…and the list goes on. Because of its versatility and low operating costs, it is of great interest to industry partners such as Environment Canada and the growing offshore oil and gas industry. For now, however, the focus is on designing the plane to locate icebergs and report their position back to a central station.

Ajay Sancheti, project leader, explains, "The plane will fly out by itself to an approximate area that has been identified on satellite imagery. Once it locates the object it will take a picture and the GPS position and send it back to the ground control station. This is the most efficient method of determining whether or not it really is an iceberg and, if so, its exact location."

Right now icebergs are tracked with satellites. The satellite takes an image, which is downloaded and analyzed, and the current and wind direction is determined. The autonomous plane will change all of this. "This plane will be able to take the data from the satellite reading, fly out and do a search pattern around the possible area of error, detect it very accurately and then send back, in real-time, exactly where the iceberg is," says Lloyd Smith, an engineering graduate student working on the project.

The plane is in the testing stage. It successfully completed its first flight a few weeks ago and is now being equipped with an autopilot device. The next

It's a bird **see page 7**

A Talk with Celia Desmond – President, IEEE Canada

Celia Desmond, president of IEEE Canada and of her own firm, World Class Telecommunications, was the invited luncheon speaker for this year's Newfoundland Electrical and Computer Engineering Conference (NECEC), held at the Battery Hotel in St. John's in November.

Ms. Desmond spoke about trends in telecommunications: specifically looking at the impact of technology as it affects competition in business and the whole environment,

Celia Desmond **see page 7**

Inside this issue

Message from the dean

The past two decades have seen a significant increase in scientific and technological innovations; innovations that continue to be an important engine for economic growth. With the development of new growth areas, many related questions arise. What does the future look like from the standpoint of an engineering education, for the industrial sector and the engineering graduate? How should the engineering community respond to these emerging challenges? Clearly, engineering professionals in Canada have devoted a considerable amount of effort to addressing these important issues.

Our own Engineering and Applied Science Advisory Council (EASAC) has set up subcommittees to look into the profile of the "future engineer" and the related aspect of faculty development. Two industry leaders, Frank Davis and Earl Ludlow, are spearheading these initiatives. In addition to core technical competencies, the future engineer will be required to handle innovative open-ended design problems in multidisciplinary team settings, manage complex projects, possess exceptional leadership qualities, and have a keen knowledge of computer and related information technology advances, just to list a few.

The trend in recent years is for more and more engineers to become involved in technological innovations. While the traditional engineering education will always remain central, engineering schools would be expected to encourage their students to choose paths of technological innovation and entrepreneurship, to better prepare them for future opportunities.

Universities will necessarily have to invest much more in the development of faculty members, technical staff and students in order to achieve this goal. EASAC views the linkage between academic knowledge and engineering practice as essential to faculty development opportunities. Such opportunities include industrial internships, strategic research and development opportunities, leading-edge training and education in industry, extensive networking with private sector players and active participation in professional engineering associations. Better preparing our students and our faculty members for the challenges ahead will help to ensure we are ready and able to respond.

Dr. R. (Sesh) Seshadri, Dean

Jumping Ship

Imagine if you could predict how quickly a ship could be evacuated in an emergency? Chad Oldfield, Term 5 ocean and naval architectural engineering, had the chance this past fall to work on a project that is doing just that. A Canadian company, Fleet Technology Limited (FTL) is busy creating and developing a software program specifically designed for the analysis of movement and/or evacuation of people on a ship or offshore structure. The program is based on an existing program, Exodus, produced by the University of Greenwich in the United Kingdom, which was designed to predict building evacuation times; however, this new program, maritime EXODUS, is designed for use in a marine environment. Both programs allow the layout of the ship or building to be imported from an AutoCAD*.dxf file. Once this is done, individuals are placed on the virtual ship and the entire evacuation procedure is played out. The program incorporates leading-edge modeling of realistic human behaviour such as aggressiveness, age, gender, waiting for family members, elderly having to stop for a rest, fire, smoke, knowledge of the ship, assigned muster (assembly) and abandonment stations.

Two primary changes allowed this technology to be transferred to a marine environment: the introduction of lifeboats and other abandonment systems, and the fact that a ship lists when it is damaged. Abandonment systems must undergo rigorous testing before being approved, so a large amount of data was available to be implemented into the program. The speed of a person walking on a sloped surface or with a lifejacket, however, was not well researched at all.

To accommodate this lack of data, FTL constructed the Ship Evacuation Behaviour Assessment (SHEBA) Facility, a model that will allow comparison of evacuation arrangements at the ship design stage, and will assist with determining the optimum layout of facilities, location of lifeboats, and even crew/passenger ratios. The facility consists of a simulator that comprises a passageway, a staircase, and a small cabin mounted on hydraulics so that it can be tilted. During the summer, test subjects helped simulate evacuations, and their walking speeds, individually and in groups, tilted and level, on stairs and in the corridor, etc., were measured.

Lights, camera, action . . . never a dull moment for the employees of FTL.

Recently the Discovery Channel took an interest in this new technology and ran an exposition of the project, new video was filmed using FTL employees as the test subjects. Chad Oldfield got to make his television debut as one of the test subjects. But this wasn't the only time he got to be involved in this project. "I helped a bit in the design of SHEBA, went solo on a trip to British Columbia to videotape a trial evacuation of a ferry and to record data from similar videos, helped manage the vast amounts of video from SHEBA tests, performed a part of the data analysis and checked the validity of the data. It is a fairly big project that is likely to have a noticeable impact on the cruise ship and ferry industry. It was an exciting project to be involved with."

Tom Zimmerman

Memorial University Launches Oil and Gas Lecture Series

What is the future of technology in the growing offshore oil and gas industry? How will research and training institutes respond to the increasing technological challenges? Responding to the need to address these and other questions of significance to the growing oil and gas industry, Memorial University has launched the Oil and Gas Development Partnership Lecture Series. On September 26, Tom Zimmerman, manager of the Technology Centre, Schlumberger Oilfield Services, Houston, Texas, gave the inaugural lecture titled The Role of Technology in Meeting our Future Energy Needs. President Axel Meisen officially opened the lecture series with an introduction to the Oil and Gas Development Partnership and an idea of what the lecture series will mean for Memorial and the general public.

The series continued in October with a lecture titled Reservoir Simulation and Geomechanics: A Powerful Tool for Understanding and Managing Reservoir Complexity, given by Dr. Antonin Settari, chair of petroleum engineering, University of Calgary.

Lecture ***see page 7***

Increased funding brings greater opportunities for offshore safety research

An additional $20 million will go a long way in helping the National Research Council (NRC) build upon its presence in Atlantic Canada. On October 9, Industry minister Brian Tobin, (who was also responsible for the NRC) announced the investment of $20 million to be used for the development of an ocean technology cluster in Newfoundland. He said, "Newfoundland already has the ingredients to be a world class leader in ocean technology. This initiative will build on that strength to foster greater science and technology needed to support a largely marine-based economy."

Last spring the federal government gave the NRC, under the Atlantic Investment Partnership, $110 million over five years to develop what they called 'technology clusters'. According to NRC president Dr. Arthur Carty, these words describe "the concentration and growth of innovative companies around a nucleus of R&D facilities." The funding will allow the NRC to significantly expand research and technology-driven initiatives at their Institute for Marine Dynamics (IMD) in St. John's. This will include the expansion of its research program, the establishment of a business incubator including a program for young entrepreneurs, and a community integration component that will bring researchers and business leaders together.

Ongoing research projects at the IMD have already begun to see the benefits of this program. MUN engineering alum Reeni Woolgar and grad student Dean Pelley are two of the first to be hired under this new funding. They are part of a larger research team including Antonio Simões Ré, a senior researcher at IMD, Brian Veitch, the Terra Nova Project Chair at Memorial, and co-op engineering students Matt Goldsmith, Pam Stone and Terry Finch. Their research is in the area of offshore safety, specifically offshore escape, evacuation and rescue.

The two main aims of their work are to evaluate lifeboat evacuation capabilities as a function of weather conditions, and to develop performance measures that have practical utility for new regulations. These goals were arrived at through consultation with many stakeholders, including the Canada-Newfoundland Offshore Petroleum Board. Ultimately, the project aims to "provide information and knowledge so that the people who are making decisions, whether for regulatory or design purposes, can make better, more informed choices," say Antonio and Brian.

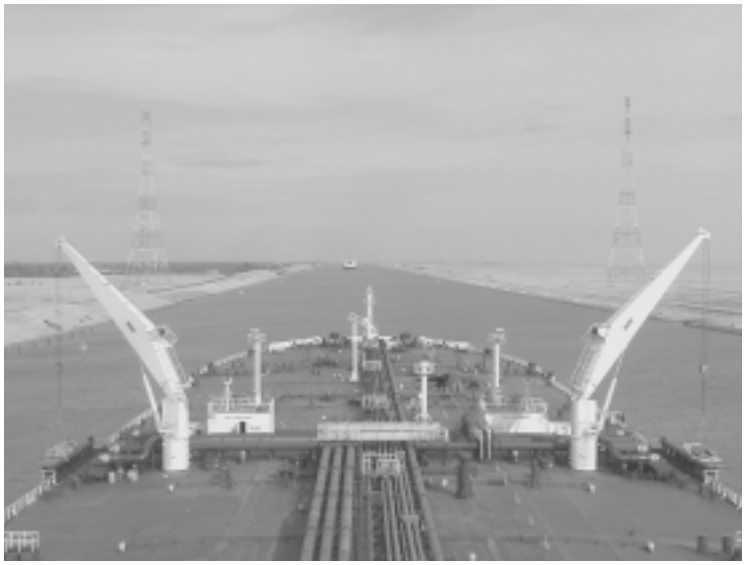
Members of the research team got a chance to speak with NRC president, Arthur Carty, Premier Roger Grimes and Industry Minister Brian Tobin.

Each of the students working on the project has gained considerable experience. As part of the research team they are involved in model testing at the IMD facilities, analysis of data, and development of an innovative control system. The work they are doing is moving the project beyond simply providing information, to making significant improvements in evacuation procedures. With funding from the NRC, the Offshore Development Fund, the Atlantic Canada Petroleum Institute, the Canadian Association of Petroleum Producers, Transport Canada and Natural Resources Canada, this research project will have a major impact on the way people make safety decisions in the offshore industry worldwide.

Engine Team Roaring . . .

The "drivetrain" team, responsible for the design and implementation of the engine, transmission, rear axle and electrical components, are moving right along. The 2002 season will see Formula MUN using a new Honda axle, Honda CBR 600, complete with a new wiring harness and a new Audi post-differential. Shifting gears will make a face-lift this year changing from manual to pneumatic shifting, allowing the driver to have both hands on the wheel at all times. In 2001, Formula MUN converted the Honda carburetor engine to a Tech II fuel injection program. To further improve this program the drivetrain team has designed an engine testing dyno in order to smooth out the program and increase horsepower and torque.

(L-R) Term 8 computer engineering student Darcy Ward learns how to ride in style.



Maneuvering through the Suez Canal is no small feat.

Steering Straight Ahead

Darcy Ward is a Term 8 computer engineering student who got to sail the Suez Canal on an Iranian oil tanker during the past semester. He just finished his last work term with a local company, CORETEC Incorporated, working on an advanced ship autopilot system (ASAS) for large ships. In December he traveled to Egypt, where they installed and tested the system. The difference between this technology and anything similar, according to Ward, is that "the majority of existing autopilot systems maintain a heading by keeping the ship moving in the predefined direction, not necessarily on track. This system interfaces with most of the ship's navigation instruments including the GPS, radar, gyro, wind speed and direction. It takes all of these inputs and does a theoretical analysis, using artificial intelligence techniques and a mathematical model. So it works to keep the ship on the exact course."

What is particularly unique about this technology is its ability to foresee the future and make allowances for it. "This device (the predictor) can forecast where the ship is going to be and it can compensate for any changes ahead of time. For instance, if the ASAS foresees there is a turn coming, it will compensate for this turn."

The technology that comprises the ASAS is based on the ship predictor system (SPS) technology, also developed by CORETEC. The SPS is an advanced system that provides, in real time, a short-term, high-precision prediction of a vessel's maneuvers, even in confined waterways. This prediction capability helps the autopilot system accurately maintain the vessel's track, thereby substantially improving the safety and fuel economy of its operation.

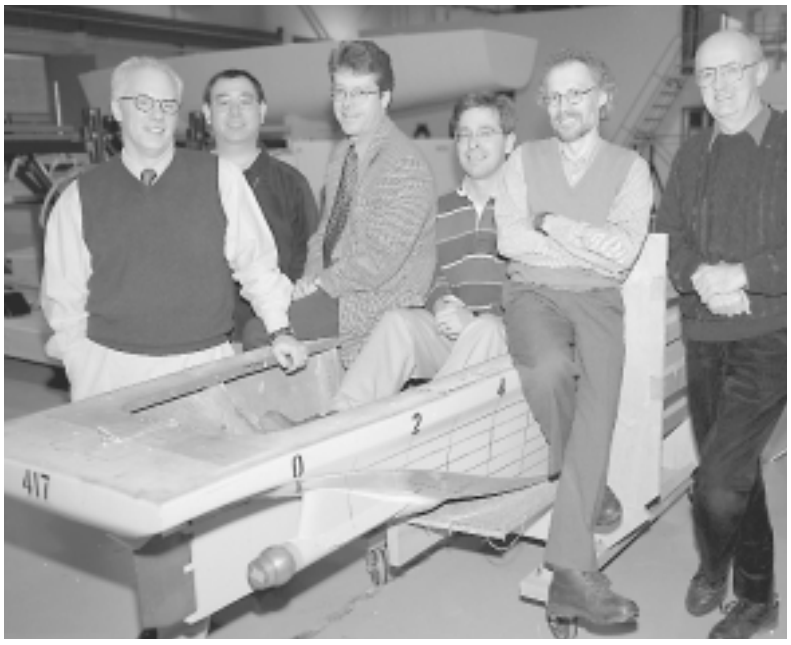
So how did a local company team up with an Iranian oil tanker? "Oil tankers are very interested in this technology – the ASAS system helps the ship conserve fuel. A seven or eight per cent save on fuel economy equates to a lot of money in the oil industry. This fuel saving is due to the fact that the system can predict with such accuracy that the vessels steering maneuvers are minimized. And compared to manual steering, it keeps the rudder movement much more consistent and steady, which in turn lessens the wear on the rudder itself. Furthermore, because it provides vessels with the ability to stay on track, the ASAS is of benefit to large vessels maneuvering through tight canals."

Ward has been working on the ASAS project since he started working at CORETEC in September 2001. His software program is the only one that the user interacts with, everything else being conceptual and behind-the-scenes. During his work term he also assisted in the final stages of design of the other components that make up the ASAS system. The system is very user friendly and has an inherent ability to compensate for the loss of required input parameters or the receipt of invalid data.

Overall, the experience working with CORETEC and traveling to Egypt and Spain was incredible for Ward. "We were in Cairo for two days and then we went to Suez. From there we got on the tanker and went through the Suez Canal to the Mediterranean Sea and Spain. It was a very different world from the one I am used to seeing."

New research project questions podded propeller performance

A new research project involving several cooperating organizations and industrial partners, and a large team of researchers, engineers, technicians, and graduate students, will investigate the effects of pod and propeller geometry on propulsion performance through systematic model scale experiments. The propellers will also be tested in oblique flow and ice using new instrumentation and manufacturing capabilities specifically developed for the experiments. Furthermore, new extrapolation techniques for predicting power based on self-propulsion experiments will be proposed and tested.



(L-R) The research team: Bruce Colbourne (IMD), Pengfei Liu (IMD), Dan Walker (Marineering Ltd.), Brian Veitch (MUN), Neil Bose (MUN) and Stephen Jones (IMD)

Naval students attend conference

Engineering students Alex Gardner and Deanne Petten and faculty member Dr. Brian Veitch attended the Society of Naval Architects and Marine Engineers (SNAME) annual meeting in Orlando Florida in October. The meeting is an expo of companies from North America and the world. Companies showcase their products and services to the naval architecture and marine market. During the meeting there was a congress of students from universities all over North America and beyond. There was a boat-building competition, and teams of six students were given a small baggie of materials and instructed to build an air cushion vehicle (ACV). Thanks to the Institute for Marine Dynamics, Women in Science and Engineering, Oceanic Consulting Corporation, Faculty of Engineering and Applied Science, Ocean Engineering Research Centre, SNAME student section, and SNAME Canadian Atlantic Section for making travel to the conference possible.

Far from home

Six students from Saudi Arabia graduated in September 2001 with a diploma in advanced studies in environmental engineering and applied science. The one-year program comprised eight courses in subjects ranging from environmental chemistry and toxicology to waste management and air pollution. The students also acquired skills in various software applications and had the chance to travel to Burlington, Ontario, to visit the National Laboratory for Environmental Testing.

(L-R, back row) The graduating class: Suliman Al-Rushoud, Dr. Mahmoud Haddara, Abdullah Al-Ghamdi, Ahmed Hawary, Khaled Al-Saif, Dr. R (Sesh) Seshadri (L-R, front row): Dr. F. Khan, Dr. Tahir Husain, Suleiman Al-Hedeithi and Dr. R. Sadiq.

News

Lecture ***cont'd from page 3***

In December Prof. Roland Horne, chair of petroleum engineering at Stanford University, visited and spoke about the Optimization of Oil and Gas Production. The next lecture is scheduled for February 28 with Dr. Judith Dwarkin, senior vice-president of the Canadian Energy Research Institute, speaking about the outlook for world oil markets.

The series will present two lectures per semester from leading experts from the oil and gas industry. The lecture series is intended to be an information session for the general public, faculty, students and industry partners, and a chance to exchange ideas. Providing information on new developments, issues, technologies and trends in the oil and gas industry, the lectures will help to ensure the public's participation in a rapidly growing industry. Lectures will cover a wide range of topics such as royalty regimes, options for offshore gas development, and environmental and social issues. As President Meisen said, "It is a public lecture series in oil and gas from a global perspective, not just Newfoundland or Atlantic Canada."

(L-R) Dr. Chris Loomis , Dr. Antonin Settari (lecturer), Dr. Sean Cadigan and Dr. R. (Sesh) Seshadri .

For anyone looking for more information about the Oil and Gas Development Partnership Lecture Series, please call 737-8287 or e-mail *tmills@engr.mun.ca*. Videotapes of each lecture are available to be borrowed.

Celia Desmond ***cont'd from page 1***

as well as the influences, standards, regulations and technology in the marketplace that come from outside. She gave an overview of the environment in which business in North America is operating. She spoke of the Internet being a main driver as to where the network and services are going to go next.

"When you look at the environment, basically we know that the stock market crashed, everything is over-provisioned, add to that September 11 and we have a world that is focused on the basics. People do not have the money to look for new innovative services and so we are looking at just keeping the basic network together. Even though some things will continue to develop, the market has slowed down considerably.

"The general feeling is that companies have to focus on what they do well, rather than trying to grow and expand in new dimensions."

When asked how she felt about the future of telecommunications, she said, "I believe that the future of telecommunications is positive. Telecommunications is going to survive, that is what's holding the world together."

Hosted annually by the Newfoundland and Labrador section of the IEEE and co-sponsored by the Faculty of Engineering and Applied Science, the conference provides an opportunity for professionals in electrical, electronic, and computer engineering and information technologies to present their work to the growing technical community within the province.

It's a bird ***cont'd from page 1***

phase of the project will be to switch the plane to autopilot after it has been launched by remote control. The plane will then fly around in a search pattern looking for a target that has been set up. Once it finds the target it will take a picture and then send the image over a wireless link to a ground control station to be identified.

Mr. Smith adds, "Eventually the plane's computer that we built will be able to recognize something on the ground and do its own image analysis. It may also be required to change its search pattern. We want the computer to be able to communicate with the autopilot so we can change the direction of flight if necessary, without the user having to interface with the autopilot."

Since the plane is a prototype, it is not equipped to withstand harsh weather conditions or fly for extended periods of time. But the project team is already making plans to install their hardware into a plane called Laima. Owned by Aerosonde, it was the first unmanned plane to cross the Atlantic in a record time of 26 hours and 45 minutes on Aug. 20, 1998.

This project, like others that are carried out at INCA, allows students to work in areas that have a high commercial viability. The information that is generated is given back to the industry sponsors or spun off and commercialized by student companies. "Building autonomous planes that can be used for surveillance and monitoring is an area that is being developed right now. This is a great opportunity for Memorial University to make its mark and create technology that is both innovative and essential to the growing offshore oil and gas industry in our province," says Mr. Sancheti.

Feature

Celebrating Marconi

Marconi Crystal Radio Contest

Memorial University and the local chapter of the Institute of Electrical and Electronics Engineers (IEEE) hosted the Marconi Crystal Radio Contest in the Music Building on Wednesday, December 12, 2001. Activities got underway at 8:45 a.m. as grade-nine students brought their handmade radios to the judging station to have them tested. The event wrapped up with an awards ceremony and live communication with Poldhu, England. Special guest Lieutenant Governor, Hon. Dr. A.M. House presented the awards and Mr. Yves Fontaine, Chair of the IEEE (Newfoundland and Labrador section) attempted to exchange greetings with Mr. Barry Maxwell, director of the Radio Communications Agency in England. Officials from provincial government, Memorial University, IEEE, the participating schools and invited guests, were also in attendance.

The Marconi Crystal Radio Contest celebrated the first transatlantic wireless signal ever received. On December 12, 1901 at Signal Hill, Newfoundland, a young Italian inventor named Marconi used a receiver and a wire connected to a kite to receive the Morse code dot-dot-dot from England, more then 2000 km away. The contest was also an opportunity for students to gain hands-on experience in electrical engineering using household items that are simple, inexpensive and fun, challenging them to be creative.

In November 2001, junior high schools across the province were given crystal radio kits developed by the INstrumentation, Control and Automation (INCA) Centre at Memorial University. From the parts included in the kit, each student constructed a crystal radio comprised of a tissue box, toilet paper roll, tinfoil, paper clips and copper wire. On December 12, 2001, representatives from selected schools in St. John's brought their crystal radios to the Music Building for the contest. Using a helium balloon, they raised the antennae, just as Marconi did in his experiments. The student whose radio received the strongest signal was chosen as the winner. At the end of the morning the winners of the contest were selected: Courtney Barbour of Leary's Brook Junior High for first place, Alex Goncharov of Brother Rice for second place and Sarah Watson of Beaconsfield Junior High for third place.

To mark the historic anniversary, members of the Marconi Radio Club of Newfoundland also conducted contacts with various sites. At 7 a.m. they made a direct two-way radio link with Tasmania. Using Morse code, they sent and received a greeting from His Excellency, Sir Guy Greene, Governor of Tasmania. Plans are already underway with IEEE (Newfoundland and Labrador section) to make the radio contest an annual event during engineering week.

In the afternoon, activities moved up to the Visitor's Centre at Signal Hill where students got to see the Marconi exhibit and watch the Society of Newfoundland Radio Amateurs (SONRA) send and receive signals all over the world from Cabot Tower. The day concluded with a live communication between St. John's, Newfoundland and the International Space Station. Ten students got the opportunity to ask astronaut Frank Culbertson a question of their choice.

Overall, the day was a great success and an excellent opportunity to transform an historical event into a learning experience for our future engineers.

a Big Success

Sounding it out

How many times have we stood at an outdoor concert and wondered how they arrange the speakers so that everyone can hear the music? Probably not often. Yet if we wandered out of the crowd and off to the side, we might wonder why we couldn't hear the music as clearly as before. These are the types of issues that graduate student Christopher Whitt is addressing in his research into the optimization of loudspeaker arrays for sound shaping and reinforcement applications.

Whitt has been involved in music for many years as a bass guitarist. He has played in school, church, orchestras, and in many bands. He has also worked intimately with sound systems in auditoriums and for large-scale performances as a technical director. "I like listening to music on a good quality sound system – something that reproduces the full range of music evenly and cleanly." He started reading about larger sound systems for concerts and discovered that with low frequency sounds, such as bass, it is very difficult to control the direction when you amplify the sound. You can make a lot of bass with lots of speakers, but it is hard to make that sound go in a certain direction. It is much easier to direct a high-pitched sound because the longer the wavelength, the larger the reproducing source has to be in order to guide where the sound goes.

"If you go to an outdoor concert and stand in front of the stage you'll notice you can hear everything. If you walk away to the side instead of walking straight back, you'll notice you can still hear the bass but the high, bright sounds drop off. That is because you can control where the high sounds go, but not the low sounds.

Whitt was interested in finding a theory for optimizing the quality of sound that people hear at an outdoor concert, in an auditorium, etc. "There is a fair amount of theory regarding an array of loudspeakers and how you can combine a large number of speakers and have them work together coherently, rather than just haphazardly. I started to wonder if it were possible to use statistical techniques to vary all the possible parameters that can be changed in an array in order to find a configuration that works well for a specific application." According to Whitt, an array of speakers, working together, will make the apparent size of the transducer larger. This is one reason why an array of loudspeakers might offer a solution to controlling the direction of low frequency sound.

Information on optimizing sound would be of great interest to loudspeaker manufacturers and those who produce sound for stadiums and outdoor concerts, and to consultants and acousticians who design sound systems for large auditoriums.

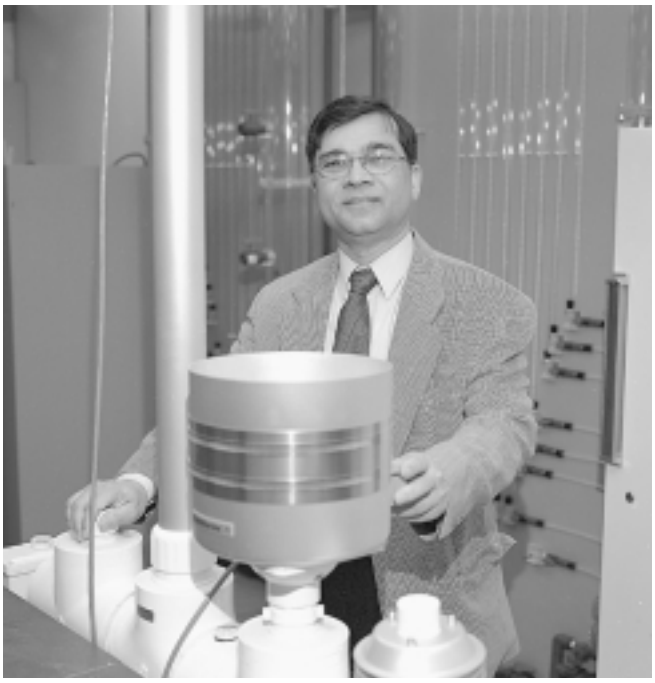
Whitt is very interested in presenting a new approach to sound reinforcement that is both interesting and practical. "My research is not going to be a good theoretical result with no practical application," he says. He draws attention to the example of not wanting to send sound up into the ceiling of a cathedral and have it bounce around. This is a practical problem. You have to be able to control its direction. Likewise, if you are having a concert in Central Park you need to control the sound so that it goes in the direction of the audience and not across the street to the apartment building.

Working for the past four semesters, Whitt has only two semesters left to finish up his research. He spends most of his time working in the Computer Engineering Research Laboratories (CERL) using MATLAB to simulate optimum arrays. Entering data such as arbitrary positions, volumes and frequencies for loud speakers, Whitt writes small programs that tell the computer how to do all the mathematical calculations repeatedly. He feels pretty confident that the results of his simulation work will translate to the real world.

Researching the theory behind loudspeaker arrays has the potential to change the way we hear music. And that is quite an accomplishment.

Building International Collaborations in Environmental Engineering

A new research contract with Saudi Arabian Mining Company Ma'aden will go a long way in further strengthening the Faculty of Engineering's commitment to international collaboration and technology transfer. The contract, signed in December by the Office of Research and Dr. Tahir Husain, project manager and principal investigator, involves developing risk-based remediation technology for a contaminated site. This is the second research contract that Dr. Husain has received for work in this area. The first, signed in January 2000 with Saudi Aramco, is a three-year study on the development of risk-based software for the remediation of hydrocarbon contaminated sites.



Speaking about this new project, Dr. Husain says, "This is a significant achievement for Memorial University's Faculty of Engineering. We have the opportunity to work on a project that crosses over into many disciplines and many areas of expertise. The possibility for future collaboration on a more detailed investigation into remediation technologies is certainly present."

The project, officially titled Contaminant Transport Modelling using Visual Modflow – Pump and Treat Method, involves developing a cost-effective solution to treat contaminated groundwater, identifying physical and chemical methods to contain pollutants within the source and conducting a detailed engineering and economic analysis of the selected treatment methods. Dr. Husain said many steps are involved. "The first step will be to examine the movement of contaminants. Then we can look at ground water modeling. We need to develop a contaminant transport model, but first we need to identify the potential source and understand the mechanism of movement of contaminants in the soil and groundwater. Because this Saudi Arabian mining company is well recognized for its efficient and effective exploration, development and operations, and also well respected and very conscious of handling issues related to health, safety, and environmental protection, the company has been collecting data for a number of years at the site. Consequently, there is a lot of essential start-up information available."

Using MODFLOW, a groundwater modeling package used to simulate a wide variety of groundwater flow systems, and MT3D, a comprehensive three-dimensional solute transport model, the transport of contaminants for different pumping and recharge scenarios can be evaluated. Dr. Husain adds, "Various commercially available technologies will be reviewed and the one most appropriate to site-specific situations will be selected for analysis. This will then be integrated with the contaminant transport modeling to assess the effectiveness in site remediation, and also to estimate the cost, and identify challenges associated with the implementation of such a plan."

Since coming to Memorial in 1995, Dr. Husain has been largely responsible for establishing a master of applied science in environmental engineering and graduating about 60 students from that program. He is very active in supervising a group of students for M. Eng. and PhD work with a focus on risk-based design in offshore oil and gas industries and ecological and human health risk assessment. He has also been successful in attracting students to the advanced diploma program in environmental engineering. These academic and professional training programs, along with applied research contracts, are just the beginning of what Memorial University has to offer the industrial environmental sector, locally, nationally and internationally.

Project Design Lab: A Team Effort

Engineering students Michael Snow and Andrew Menchions

How many courses can you take where you get credit for playing with a robot? Ray Gosine and Tariq Iqbal offer a project design lab for Term Six (electrical and computer) in which students do just that. Teams of students are required to design, build and demonstrate a semi-autonomous robot that can complete simple tasks independently in response to instructions from a remote computer. The course ends with a final competition between teams, which makes up a percentage of the final grade. This past term, however, because of technical difficulties, the final competition was replaced by a non-competitive demonstration of the systems. Although disappointing for most, it did not stop the class from learning a lot and having fun.

In September, every team was given the same project objectives and resources. First reaction to the course, according to student Lori Hogan, was that "we all have the same theoretical background, but not a lot of experience using what we've learned in the past five terms for something practical like this project." Classmate Jonathan Milley adds, "This course is very different from a lab. In a lab scenario they give you a list of things you have to do and a series of steps whereby if you follow them you will finish the lab and hopefully learn something. But in a project course they give you a list of things and tell you abstractly what it is you are supposed to do. And you have to go figure it out." And figure it out they did.

"It was great to be able to take what we had learned in circuits class and combine it with what we had learned in software design and put it into practice and see it work," says Hogan. All students agreed that the course brought together a lot of courses they had taken thus far, and made use of those skills. Plus it gave them the experience of working with a team, managing a large project and the opportunity to use their imagination. "It was a chance to do more than just analyze," says Richard Corbett.

The purpose of the course was to design a semi-autonomous robot (a tractor-like Bobcat vehicle) for automated transportation of blasted rock. Ingersol Rand donated the remote control Bobcat vehicles to the Faculty of Engineering and Applied Science when they learned about the project course from an undergraduate student, who had taken the course a few years ago. Working in a network of simulated underground mine tunnels, sensors on the robot follow reflective tape, which mimics how real mining robots currently navigate in a full-scale automated mine. The robot follows the reflective tape until it gets to the mouth of a branch tunnel. Then it stops, takes a picture using a wireless digital camera, sends this picture back to the computer where it is automatically analyzed, and the computer decides whether the branch tunnel contains ore to be loaded by the robot. The robot enters the branch tunnel if it is found to contain ore, navigates down the tunnel using optical sensors to locate the tunnel walls, loads the ore into its bucket and navigates back though the model mine to another tunnel where the ore is dumped. The objective is to design and construct a robot that can do all of this automatically or with as little help from a remote human operator as possible.

Each team spent the first few weeks learning about the sensors, cameras and other electronic components that might be used, as well as developing an overall strategy for controlling the robotic vehicle within the simulated mine. As the term progressed, the students carried out the detailed design and testing of the different subsystems, and finally worked to integrate the different subsystems into a complete, working system.

A lot of time went into making the robot fully operational and troubleshooting. As Milley points out, "There were some things we did not consider. For instance, the problem of putting two different systems together and hoping they would function. Once you throw it all together it is hard to figure out where the problem is actually coming from because there are so many variables to think about."

Project design ***cont'd on page 14***

Notables

Dr. Hesham Marzouk received the annual teaching award from the Association of Professional Engineers and Geoscientists of Newfoundland (APEGN). This award recognizes an exemplary contribution by an individual in the areas of engineering and/or geoscience education. Dr. Marzouk joined Memorial in 1986 after 10 years in industry, six as department head and lead structural engineer at Stearns Roger Ltd., where he was responsible for the design and procurement of several major heavy industrial projects in western Canada. He is also a fellow of the Canadian Society for Civil Engineering and a voting member on several ACI committees. The APEGN citation states that Dr. Marzouk "has proven to be an outstanding faculty member. His research is excellent and he teaches a wide range of subjects related to strength of materials and structural engineering. His years of experience in consulting prior to taking up an academic career have made him particularly valuable to the faculty because he is able to relate theory to practice and to illustrate his lectures with significant examples from real life."

Dr. John Walsh was awarded the title of professor emeritus at the fall convocation. Dr. Walsh received a diploma in engineering from Memorial University in 1966, going on to complete a bachelor of engineering (honours) at the Tech- nical University of Nova Scotia in 1968 and a doctor of philosophy in electrical engineering from the University of Calgary in 1971. After serving as postdoctoral fellow and assistant professor of electrical engineering at Concordia University in Montreal, he joined Memorial's Faculty of Engineering in 1972. In 1996 he was named honorary research professor. Before his retirement, Dr. Walsh served as technical director of Remote Sensing at C-CORE, and chair and then vice-president, research and development, at Northern Radar Systems Ltd. Since 1976, his research interests have focused on the areas of electromagnetics and applied mathematics applicable to electromagnetic phenomena. His research has led to the evolution of a new method for formulating and solving electromagnetic propagation and scattering problems. It has also led to the development of remote sensing techniques used by groups from the Department of National Defence and the Canadian Coast guard. His depth of theoretical and experimental expertise in the realm of engineering electromagnetics has been further exemplified by both the academic and industrial accomplishments of his graduate students. Congratulations to Dr. Walsh on receiving this honour and best of luck in all future endeavours.

Dr. John Quaicoe has been a teacher in Engineering and Applied Science since 1982. For the past 19 years he has built a reputation among students and faculty members as an instructor who is deeply concerned about learning. During his time at Memorial, he has served as chair of the electrical engineering discipline for nine years, and recently, acting associate dean (graduate studies and research). It is quite fitting that he should be chosen as one of this year's recipients of the Distinguished Teaching Award. Students have responded very well to Dr. Quaicoe's teaching philosophy; many of them have gone on to graduate studies or employment opportunities outside of Newfoundland. They all say that his encouragement and support is still remembered and greatly appreciated. One former student remarked, "He teaches with a patient, caring and enthusiastic approach that produces a very effective result, one that gives me the motivation to strive to teach at the same high standard." Speaking on his proven commitment, faculty members have said, "Many students rate him as the best professor they have ever learnt from at Memorial." They added that his courses are typified by excellent organization of material, meticulous preparation of class notes, and carefully crafted examples. According to one fellow faculty member and former student, "He exemplifies the best qualities one could hope for in a university professor." Dr. Quaicoe is quite pleased to be receiving this award, more for the Faculty of Engineering and Applied Science than for himself. When asked if this award will change the way he teaches he said, "I see it as a challenge to continue to do the best job that I can."

Ayman Mahfouz, postdoctoral fellow in Ocean and Naval Architectural Engineering, won in the Graduate Student Paper Competition (Ocean, Offshore, and Arctic Engineering division) for the American Society of Mechanical Engineers (ASME). The paper titled On-Line Prediction of the Hydrodynamic Parameters in the Coupled Heave and Pitch Motion Equations for Underwater Robotic Vehicles Using Measured Responses at Sea was selected as co-winner in the doctoral category. Adviser for the paper was Dr. Mahmoud Haddara, associate dean (graduate studies and research). Mr. Mahfouz completed his PhD in Ocean and Naval Architectural Engineering at Memorial in 2001. Prior to that he completed a bachelor's and a master's degree in naval architecture and marine engineering at Alexandria University in Egypt.

Notables ***see page 14***

Notables ***cont'd from page 13***

Dr. John Molgaard and Dr. Jim Sharp retired on August 31 and December 31 respectively. Dr. Molgaard taught at Memorial for 33 years in the mechanical engineering discipline. During that time he was an active member of the Medical Engineering Research Group; he served as chair of mechanical engineering and was recently named Honorary Research Professor. Dr. Sharp has been with the faculty since 1970. He served as chair of civil engineering and associate dean (graduate studies and research). Dr. Sharp was also actively involved in cooperation agreements signed with universities in China, Egypt, India, Indonesia and Scotland. The best of luck to you both in your future endeavours.

Dr. Molgaard

Dr. Sharp

Dr. George Mann has been appointed to the C-CORE Junior Chair in Intelligent Systems. Dr. Mann holds a bachelor's degree in engineering from the University of Moratuwa, Sri Lanka, a masters degree in computer integrated manufacture from Loughborough University of Technology, United Kingdom, and a PhD from Memorial. He is the current NSERC postdoctoral fellow in the Department of Mechanical Engineering, Queen's University. From 1999 to 2001 he worked as a research engineer in the Intelligent Systems Group at C-CORE. His research interests include classical/intelligent control, robotics, machine vision and automation.

Congratulations to Glen Crewe, programmer consultant, and his wife on the birth of baby girl Caroline on September 6, 2001.

It's Coming . . .

The Canadian Engineering Competition (CEC) 2003 is coming to Memorial University! This will be the first time that this competition has been held in our province. The competition will feature students from all across the country competing in categories such as: corporate design, explanatory communications, extemporaneous debate, entrepreneurial design, editorial communications, and junior and senior impromptu design. It is an excellent opportunity to showcase the talent of our students, as well as promote cooperation between students, industry professionals, government leaders and academia. As 2002 progresses, students will be busy planning and gearing up for the competition.
Let's all work together and help make CEC 2003 a huge success!

Project design ***cont'd from page 12***

As well as challenging team members to respond to setbacks, the design project gave them foundational experience in three electrical and computer engineering areas: computer systems, power and control, and sensors and instrumentation. According to Ray Gosine, one of the course instructors, "the course requires students to develop a strategy for solving a practical problem, generate and evaluate system design variations to implement that strategy and integrate the sub-systems into a complete working system." He added, "The course provides a framework in which students work in teams to integrate their knowledge of different technical areas. It is always interesting to observe how students interact with each other on a challenging project that has very tight deadlines. While there is obvious stress on the students as demonstration day approaches, the experience of dealing with this type of technical collaboration is one that students find to be valuable."

Overall, students found the course to be challenging and fun. Because of the competitive aspect of the project, teams find ways to be innovative and gain a technical advantage over other teams. Project marks take a backseat to team pride as students look for ways to make their robots faster and more efficient.

From the editor

In the past few months I have had the opportunity to find out about our engineering program and the faculty and students who make it so unique. I have heard stories of planes that can fly on their own and ships that can control and foresee their destination. And in my search for tales of adventure and innovation, I have had the opportunity to meet people who are making a difference in the world around them. Whether they are ridding the ground of contaminants, or helping to make sure that the loved ones of those who work on the rigs can sleep a little better at night, they are using their knowledge and expertise to make a difference.

We can all recognize that the world we live in is continuously changing. New industries are emerging everyday, modifying curriculum programs and the research that is in demand by industry leaders and government organizations. Our ability to adapt and respond to these needs is key to our success. Our programs give us a proactive edge on the job market. Our students are ready for whatever the world has to throw at them. And we don't need to focus on the downturn in telecommunications because we know it will bounce back. The future without wires is waiting.

With world-class research facilities right in our backyard, the possibilities for collaboration and partnership are endless. It is an exciting time for professors and students to be working together. There is so much to be learned and so many questions waiting to be answered just two hundred miles off our shore. With the oil and gas industry growing by the day, who says we cannot reverse the trend and keep more of our graduates at home? I think this place is changing. This rock is transforming. And there are a lot of surprises in store for us yet.

Tracey Mills

Sent to:

Alumni News

Dr. Robert McKim, B. Eng. 1978 (Civil) has recently accepted the Ken and Irene Hall Professorship of Engineering at Western Kentucky University. After his graduation from Memorial University in 1978, Dr. McKim worked in industry as a professional engineer in the transportation and petroleum industries. In 1986 he left industry to obtain his Masters and PhD degrees from the University of Waterloo in Civil Engineering. He served on the Civil Engineering Faculties of the Universities of New Brunswick and Waterloo until 1998. At the University of Waterloo he served as the Executive Director for the Centre for the Advancement of Trenchless Technologies. In this position he influenced the major research and education directions of underground infrastructure rehabilitation in Canada. In 1998 he accepted the position of Associate Director of the Trenchless Technology Center in Louisiana where he expanded his work to the North American and International arenas. He presently serves as a consultant to the United Nations, chairman of several professional societies, and remains as an Adjunct Professor with the Trenchless Technology Center. He can be contacted at *rob.mckim@wku.edu*

Rob Pilgrim, B. Eng. 2001 (Mechanical) has joined A.D. Boivin Design Inc. in Levis, Quebec as Project Engineer. The company specializes in aftermarket snowmobile suspension systems and are the inventors of a new hybrid motocross/snowmobile called the Snow Hawk. As Project Engineer for the Snow Hawk, Pilgrim oversees all changes and developments from gear ratios to body-work colour. His job gives him the opportunity to design, test and develop new concepts that have never been seen before. He recently appeared on the show Snow Trax, a snowmobiling show that runs on TSN every winter. Former classmates and anyone interested in finding out more about the Snow Hawk can contact him at *robpilgrim@adboivin.com* or by phone at (418) 838-3783.

WISE (Women in Science and Engineering) Newfoundland and Labrador and the NSERC/Petro-Canada Chair for Women in Science and Engineering are proud to lend support to:

The 12th International Conference of Women Engineers and Scientists

July 2002

Ottawa

Theme: "Women in a knowledge-based society"

Engineers, scientists, social scientists and students welcome.

More information is available at: http://www.carleton.ca/wise/icwes12/icwes12.htm .

Alumni:

We want to hear from you! Whether it's a promotion, new business, baby, marriage, traveling the world in a kayak, or an invention—share your great news with us, and let your fellow students know how they can get in touch with you. Contact the editor at one of the addresses indicated on the bottom of this page, or e-mail *tmills@engr.mun.ca*.

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Printed by MUN Printing Services
Published by the Division of University Relations for the Faculty of Engineering
007-542-02-02-3,500

ISSN: 1481-9198