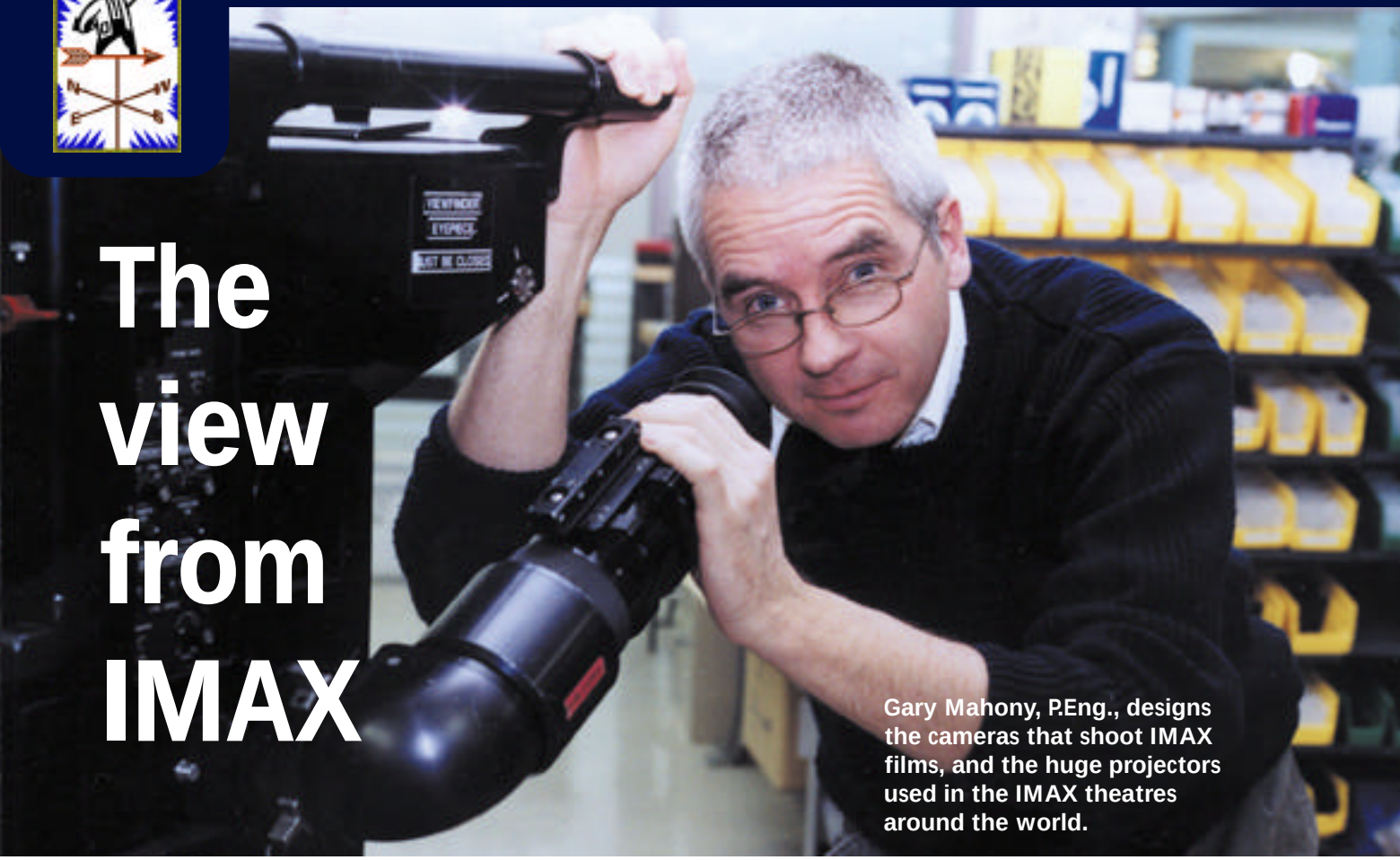
Eyes on the future

Cool jobs for today and tomorrow

BY KAREN HAWTHORNE

From 3-D celluloid images on screens eight-storeys high, to artificial legs that help kids walk better, and strategies that enable companies to prevent environmental contamination–the work of engineers emerges in an incredible range of fields. There are over 80 engineering program specialties accredited by the Canadian Engineering Accreditation Board. And our rapidly changing world will see nontraditional fields of engineering continue to evolve and become more and more specialized. Meet three Ontario engineers with jobs in three specialties to watch for in the future.

The view from IMAX



Gary Mahony, P.Eng., designs the cameras that shoot IMAX films, and the huge projectors used in the IMAX theatres around the world.

Back in Grade 8, Gary Mahony, P.Eng., had a passion for developing black and white pictures in his dark room at home. Little did he know his interest in photography would take him to the Canadian company that has revolutionized the film industry, bringing celluloid images projected onto screens up to eight storeys high in special cinemas, and allowing audiences to interact with motion pictures like never before.

Mahony is a design engineer for IMAX Corp. in Mississauga, the company that just hosted the premiere engagements of Walt Disney Pictures' Fantasia 2000, a new version of the animated classic featuring both new and vintage segments. Mahony, an Etobicoke father of two, is one of the people behind the movie magic, designing everything from small, delicate camera mechanisms, to big devices for projectors weighing over several hundred pounds.

"What I do is take ideas from the back of a napkin stage, to detailed engineering documents that are used to build something that really works–motion picture equipment," says Mahony, on a recent tour of the shop floor of IMAX. There, you'll see film platters the size of dining room tables that store the 70 millimetre film, and white-coated employees testing the giant projectors in designated laboratory test bays.

Much of Mahony's time is spent "glued to the computer screen," using computer software to make virtual models of the lenses, optics, sprockets and shutters of the equipment he designs.

The biggest challenge? Designing devices that are capable of handling the supersize IMAX film format, which is 10 times the size of conventional 35mm projection systems. The 70mm film image is magnified over 300 times, making inaccuracies of less than 0.002 centimetres noticeable on screen. Another big problem is keeping the film "pristine." IMAX films on rides at Walt Disney World, for example, are expected to go through 10,000 "passes" without compromising the visual content. Typically, the film travels at 3.6 metres a second, during which time it must come to a full stop 48 times with minimal shaking that's undetectable onscreen and without tearing itself up into a disastrous mess on the floor.

Although the projectors have to be extremely sturdy and heavy, the cameras Mahony works on have to be light and durable, such as those used to shoot a trek up Mt. Everest.

Design engineering at IMAX means problem-solving and continually making improvements. For the 3-D projectors, Mahony has to figure out how to incorporate the 3-D lamphouse into the design without blocking the film image during projection or burning the projector frame. "There's a lot of heat given off," he says of the 15 kilowatt lamps. "The lamp could set a 2 x 4 on fire in about 10 to 20 seconds." Special cooling systems, including a huge, accordion-like exhaust pipe, safeguard against cracking of the expensive optical components caused by high heat.

He's also helped redesign the monstrous 2-D projector into a version less than half the size of the original, with several design improvements to make assembly and operation easier. While the 3-D projectors have two projection lenses, one for the right eye and one for the left, the 2-D projector has only one lens to project the more conventional, but equally stunning IMAX photography shown in specialty theatres without the 3-D requirement for polarizing glasses.

"Basically, though,it's a team effort," Mahony says of the men and women like himself in IMAX research and development. "And it's a great job."

Like many of us, Alan Morris, P.Eng., watched the heart-wrenching journey of Terry Fox on television, as he attempted to run across Canada to raise money for cancer research. For Morris, though, it sparked an interest in developing a better artificial limb to help kids with disabilities become more agile.

Taking better steps

That's why he decided to become a biomechanical engineer. Recently, he developed the prototype for a lightweight, flexible, compact prosthetic limb, which he's tested on kids at Toronto's Bloorview MacMillan Centre, a research and rehabilitation centre that specializes in assistive technologies for people with disabilities.

"I'm sure I'm like any engineer with their first device, having someone try it out," says Morris, a Thornhill resident and new dad. "It's interesting working with a prosthetic limb because it's a body part. We tested it on one child, who was quite interested in it. It was lighter than what she had, allowed her to do a bit more, but it wasn't quite good enough to be a final product, so there's a lot of trial and error."

As a research engineer in the centre's Gait Laboratory and a doctoral student with the University of Toronto Institute for Aerospace Studies (UTIAS), Morris continues to redesign the prosthetic limb with the help of graduate students on placements at the centre. His latest project is a collaborative effort with UTIAS, the university's faculty of medicine and the Bloorview MacMillan Centre: robotics research to determine the best surgical techniques for kids with cerebral palsy.

Children with cerebral palsy have been deprived of oxygen for a short period at birth, resulting in impairment of their motor control systems, Morris explains. Signals from the brain to the muscles don't function properly, so movements like walking are difficult, resulting in stiffer joints, limited range-of-limb movement and less stability. A common procedure to help correct these problems is to surgically alter muscle and tendon lengths. Enter Morris, who convenes with surgeons on the best orthopaedic technique to use. To help make these decisions, he's customized a computer software/hardware system to analyze quantitative data on the "robotics" of walking.

Alan Morris, P.Eng., uses a computer system to measure how the bones and muscles of kids with cerebral palsy like David Heller function when they walk.

"What we're trying to do is develop a computer model of the body in terms of muscle and bones," he says, hooking up cerebral palsy client David Heller, 7, to a host of coloured wires. David takes small steps along a taped floor line, as software processes information on his body movements.

The idea is to use the software to recreate a child's movements, Morris explains, encouraging David to repeat the exercise. The computer model can then be used to rotate bones or move muscles into different positions, to see how these changes would affect a child's walking–indicating what type of surgery would be the most beneficial.

A child like David may have at least five surgeries to lengthen or replace muscles. So far, Morris has collected the data–before and after surgery–on several children, so the project is in the homestretch.

"It's challenging putting engineering into physiology," he says. "I'm hoping we can use biomechanics and movement analysis to help predict what surgeries and therapies will benefit kids. That would be great," he adds with obvious enthusiasm.

He says that, if all goes according to plan, the computer modelling system will provide parents and kids with the peace of mind of knowing with certainty the results of surgery.

No more risky business

At the Markham office of Jacques Whitford Environmental Limited, Diana Del Bel Belluz, P.Eng., is a dedicated spokesperson for safety in industry. That's a big part of her job–talking about how risk affects the safety and health of company employees and the greater community.

"It's trendy," Del Bel Belluz says of her work to help companies examine their management systems, identify risks and comply with the law. She says there are a lot of companies that want to be prepared and proactive, especially those in environmentally sensitive areas that tend to attract a lot of attention from the public, regulators and local government. "Companies are downsizing, and want to reduce costs, liabilities and duplication of resources," she explains.

Site contamination–and not being prepared to answer for it–can break corporate reputations. While she's on the phone and in meetings with clients, a major part of Del Bel Belluz's work is helping companies establish proactive risk communication and risk management programs. Rather than waiting for an environmental crisis, companies need to communicate to stakeholders what the environmental risks of their operations are, and what's being done to prevent harmful situations.

Del Bel Belluz says effective risk communication and risk management programs can be a saving grace, avoiding the need to call in public relations consultants when publicity goes from bad to worse in the volatile media. "It's about providing accurate and current information to stakeholders," she says of the importance of strong communication and forming strategic, technical and public consultation committees to make timely decisions and carry out specific tasks.

A risk management specialist for an engineering and management consulting firm, Diana Del Bel Belluz, P.Eng., helps companies set up programs to safeguard against machinery accidents, chemical spills or hazardous materials playing havoc with the environment.

"I like problem-solving. It's very creative, not cookie-cutter stuff," she says. "The risk side is multidisciplinary, bringing together economists, toxicologists, geologists, while the management aspect is the softer side:" communication and leadership skills. Del Bel Belluz heads up internal research and project teams to customize appropriate management and communication programs for her clients.

"It's really a good field for me," she notes. "I like the math, the detailed analysis and the social aspects. Good management is pretty central to business."

There aren't any typical days and plenty of long hours, Del Bel Belluz says of her packed schedule of meetings, organizing internal project teams and conference presentations. She must also find the time to write business development plans and reports, along with investigating the best interests and goals of the companies on the client list.

She brings a wealth of knowledge and experience to her current post, including a master's degree in systems design engineering and nine years at the Institute for Risk Research in Waterloo, where she focused on risk assessment and risk management in transportation, process safety and loss management, and environment and health issues, including the Red Cross' tainted blood crisis. Del Bel Belluz recommended the expert panel on risk management that provided input to the inquiry into the safety of the blood supply system. She notes that the crisis called for application of the same kind of principles that are applied to any high-risk situation: "the management aspects, the technical aspects [lab testing] and the health risks."

One of the most interesting parts of her current job is bringing together people from different areas of a company, like health and safety departments and industrial processes, and facilitating discussion. "Making those connections, when people come up with some great ideas, I think 'wow,'" she says. ◆