The
CSEM Newsletter

Canadian Society for Engineering Management
Société canadienne de gestion en ingénierie

A member Society of the Engineering Institute of Canada — Une société adhérente à l'Institut canadien des ingénieurs

October 1998
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CSEM's mission is to represent the interests and enhance the capabilities of engineers in management in order to advance and promote efficient management of commerce, industry and public affairs.

FROM THE PRESIDENT

**CSEM President,
Ken Putt, P.Eng., FEIC.**

Recently, the Ottawa Chapter held a "Breakfast Eye-Opener" to discuss reasons why engineers can fail to be good managers. Of course, the corollary was also discussed: "What makes a good manager?". Six people attended this meeting. In October, the Ottawa Chapter attempted to hold a day-long workshop on improved coaching skills as a means to retain technically skilled employees. Only one person registered for the event and it was subsequently cancelled. Getting people to pay money to attend any professional development event is a great challenge. Yet, Ottawa Chapter events on "Making Technology Happen", intellectual property law and licensing are well attended, highly praised and even make some money.

So... does money talk and do soft skills walk? Do engineers care about their "soft skills"? Do engineers think they know as much about people as they do about their technical skills? Ask an engineer about human resources and she will probably delve into probabilistic and stochastic models on span of control, organizational size and efficiency. No doubt, if the Ottawa Chapter were to hold a seminar on these topics they would be well-attended revenue generators.

Those of us who supervise know that the greatest resource to the engineering manager is people. While a steel girder may bring a means of physical support to a project, people bring the creativity, innovation and energy which makes the project begin, proceed and finish on time and under budget. An engineering manager who fails to lead people to their best efforts may very well end up crushed under her own felled decision tree. Kipling, a great friend of the Victorian engineer, puts it best in his "Hymn of Breaking Strain":

The prudent text-books give it
In tables at the end
The stress that shears a rivet
Or makes a tie-bar bend
What traffic wrecks macadam
What Concrete should endure
But we, poor Sons of Adam,
Have no such literature
To warn us or make sure!

Human behavior cannot be accurately quantified or predicted. A given set of stresses will result in unique responses depending upon the personality of the individual. Knowing how to manipulate personality is often the key to successful leadership. Learning soft skills is mandatory for the modern engineering manager. Learning soft skills can avoid having to learn hard lessons. CSEM promotes management and leadership skill training as a means to make a better engineer. I encourage all engineers who participate in professional development to spend some of that time and money on learning the "soft skills". I understand the Ottawa Chapter is rescheduling its coaching seminar for sometime in 1999.

HAVE YOU SEEN OUR WEB PAGE AT

WWW.CSEM-SCGI.CA

ARE YOU KEEPING UP ON LOCAL BRANCH EVENTS? WHAT WOULD YOU LIKE TO SEE THERE? LET US KNOW.

CSEM has engaged the services of a young HTML pro (William Enns) to assist us in keeping our web site current. Chapters have only to submit their changes to Gord Thomson by e-mail who will then forward them to our web master for uploading. By-laws are now on the web site. Please take a look at the site periodically and give us some suggestions on how it can be improved to serve membership better. Thanks for your help William!

THIS ISSUE

FROM THE EDITOR

THE PARTNERSHIP GROUP FOR SCIENCE AND ENGINEERING

I had the opportunity to attend a meeting of The Partnership Group for Science and Engineering on Tuesday, October 6th, at the National Press Club in Ottawa. The theme of the meeting was INVESTING IN CANADA'S FUTURE. Six high profile speakers presented their views on Canadian innovation, research and development past and present. Speakers included Arthur Carty, President, National Research Council; Hon. Ronald J. Duhamel, Secretary of State for Science, Research and Development; Peter Jollymore, Vice President, new Business Development of NB Tel and Lewis Branscomb of the Robert and Renée Centre for Science and International Affairs, Kennedy School of Government, Harvard University. In attendance were over 100 engineering and science professionals from corporations, government and technical societies and associations. The EIC, a member of the Partnership Group was represented by its Executive Director Mike Bozozuk, P.Eng., FEIC. Here are a few highlights from the various speakers:

- 50% of the US GDP results from R&D investments;
- R&D accounts for growth rates in the services sector of over 100%;
- The University of Alberta tops all Canadian universities in generating royalty income from its R&D at $4.5 Million per annum;
- Four technologies will drive telecommunications innovations: Devices (hardware), software, wireless and optical. The challenge is to create integrated systems and networks to support the services derived from these technologies in order to better serve the consumer;
- 60% of chemical products and 90% of chemical processes are the result of catalysis. Although an active area of research and development, there is a need to speed up the rate at which new catalysists are discovered;
- R&D in Canada are under funded.

Gord Thomson, P.Eng., LL.B.
Editor

THE PARTNERSHIP GROUP FOR SCIENCE AND ENGINEERING

308 - 255 Metcalfe St., Ottawa, Ontario K2P 1P9

THE PARTNERSHIP GROUP FOR SCIENCE AND ENGINEERING (PAGSE) is a cooperative association of more the 20 national organizations in science and engineering formed in June, 1995, at the invitation of the Academy of Science of the Royal Society of Canada to foster common interests and address issues concerning research and applications of science in Canada.

Member organizations of PAGSE provide core support for its meeting and activities. These include defining the economic benefits of research in Canada and the effects of shrinking research budgets, analyzing intellectual property issues and other potential impediments to improving academia - industry symbiosis, examining the international dimension of research projects and associations, and informing the public about science and engineering and their importance to Canada

PAGSE represents an extensive resource that, through contracts, can hold events and undertake studies and assessments of benefit to government departments and agencies, to non-government organization, and to the general public. The Royal Society of Canada acts as the agent for PAGSE for any contracts or agreements involving PAGSE projects.

LE COLLECTIF EN FAVEUR DES SCIENCES ET DE LA TECHNOLOGIE

308 - 255 rue Metcalfe, Ottawa, Ontario K2P 1P9

LE COLLECTIF EN FAVEUR DES SCIENCES ET DE LA TECHNOLOGIE (CFST) est un association coopérative regroupant plus de vingt organismes nationaux oeuvrant dans le domaine des sciences et de la technologie. Il a été constitué en juin 1995 à l'invitation de l'Académie des sciences de la Société royale du Canada pour faire valoir des intérets communs et étudier les grand dossier intéressant la recherche et l'application des sciences au Canada.

Le financement de base des réunions et des activités du collectif est assuré par les organismes membres. Il s'agit en l'occurrence de mieux définir les avantages économiques de la recherche pour le Canada ainsi que les répercussions de l'ameunuisement des budgets de recherche, d'analyser les questions relative à la propriété intellectuelle et autres obstacles qui risquent d'entraver la progression de la symbiose université-industrie, d'examiner les projets et associations de recherche ayant une dimentsion internationale et d'informer le grand public au sujet des sciences et de la technologie et de l'importance qu'elles revêtent our le Canada.

Le CFTS est une ressouce de grand envergure qui, par le biais de contrats, est à même d'organiser des activités et de conduire des études et des évaluation utiles pour les ministères et organismes de l'État, les organismes non gouvernementaux et le grand public. La Société royale du Canada est l'agence officiel du CFST ou tout contrat ou entente intéressant un projet confié au collectif.

MAINTAINING PROFESSIONAL COMPETENCY: WHAT YOU SHOULD KNOW

by Hira Ahuja, P.Eng., and André Rollin, ing. This article appeared in the July/August 1998 edition of PEo's of "Engineering Dimensions" and is reproduced here with permission of the authors.

Today, organizations are relying more and more on employees with very specific technical skills. Organizations that must respond to global markets quickly and effectively are modifying their approach to continuing education-as are the engineers they employ. A few of the new trends are learning on demand, onsite training and distance education, and a tendency to shift away from conventional university credit programs. Decisions to upgrade the professional skills of engineers are generally being made at the project management level. Project managers are looking to engineers to demonstrate instant improvement in performance on projects as proof of acquisition of new knowledge and skills.

Another factor shaping the lifelong learning activities of engineers is increased public interest in the accountability and continued competence of licensed professionals. Although learning does not equal competency, it is a necessary condition for it. Therefore, professional development has become a voluntary requirement of responsible behaviour and, in a growing number of jurisdictions in Canada and the United States, a requirement for maintaining a licence to practice professional engineering.

Although different jurisdictions have different rules, licensing bodies for engineers support the involvement of their members in professional development activities for which, in many cases, members are required to record and even report their involvement. In 11 states in the United States, it is mandatory for professional engineers to participate in professional development activities. In Canada, eight provincial licensing bodies either have mandatory professional development programs in place or are in various stages of implementing them.

BENEFITS FOR EMPLOYEES AND EMPLOYERS

Should employers support the continuing professional development of employee engineers and, if so, to what extent? Before the advent of the information age, employers were often reluctant to support the education and training of employees. Their reluctance stemmed from concerns about whether an employee with enhanced competence would stay with them or be lured away by the competition. In the information age, the question is not whether employees who are lifelong learners will stay with the organization, but whether employees who are non-learners will reduce it to a non-learning or stagnant and noncompetitive organization.

Today's employers are generally convinced of the benefits of supporting employees who want to continue learning. It's no longer necessary to impress on employers the need to support continuing engineer ing education.

As for employee engineers, by improving their competency, they can not only contribute to the prosperity of their organization and advance in their careers, but also be better prepared to face the possible future reengineering of the company. Mobility is another important factor. With the ever increasing trend for North American jurisdictions to implement various systems for ensuring the continued competency of engineers, it's clearly in an engineer's best interests to keep learning.

CATEGORIES OF LIFE LONG LEARNING

Lifelong learning activities are generally categorized as either continuing education activities (CEA) or professional development activities (PDA). CEA are learning activities that meet the standards introduced by the International Association of Continuing Education and Training (IACET), while PDA include a relatively wide spectrum of activities-most of which are recognized by professional associations. IACET standards cover such areas as instructional personnel, technical content, identified learning outcomes and learning evaluations by participants. Universities, colleges, technical societies, corporations and private providers follow these standards to develop formal learning activities, including short courses and work shops on technical, computer and management topics. Continuing education units (CEUs) and professional development hours (PDHs) have been adopted in some constituencies as a measure of participation. IACET defines a CEU as "ten hours of participation in a continuing education program in compliance with IACET standards, under responsible sponsorship, capable direction and qualified instruction." Both credit and non-credit courses are included in PDAs, with one course hour being equal to one PDH. Seminars, workshops and symposia are generally measured in CEUs, with one CEU being equal to 10 PDHs based on the hours of participation. CEAs and PDAs considered eligible for the purposes of meeting professional development requirements vary from one province or state to another. They can include such formal and informal learning activities as:

(Continued on page 4)

- taking graduate courses and postgraduate certificate or diploma programs;
- attending in-house seminars, workshops and conferences;
- attending external workshops, conferences, congresses, symposia and courses offered by equipment providers;
- making presentations for seminars, courses and conferences;
- authoring technical articles, books, research reports and papers;
- attending meetings of technical or professional associations;
- participating in audits;
- participating on task forces, committees and review teams for codes and standards;
- teaching, learning and making presentations; and
- preparing research proposals and design submissions.

TABLE 1. EIC CONSTITUENT SOCIETIES & CONTINUING EDUCATION PARTNERS

Constituent societies

Canadian Society for Chemical Engineering	www.chem-inst-can.org
Canadian Society for Civil Engineering	www.csce.ca
Institute of Electrical and Electronics Engineers (Canada)	www.ieee.ca
Canadian Geotechnical Society	www.cgs.ca
Canadian Society for Engineering Management	www.csem-scgi.ca
Canadian Society for Mechanical Engineering	home.istar.ca/ csocme/

Continuing education partners

Canadian Standards Association	www.csa.ca
Canadian Wood Council	www.cwc.ca
École Polytechnique	www.polymtl.ca
EPIC Educational Program Innovation Center	www.epic-edu.com
National Research Council of Canada	www.nrc.ca
Royal Military College	www.rmc.ca
Ryerson Polytechnic University	www.ryerson.ca
University of Calgary	www.ucalgary.ca
University of Ottawa	www.uottawa.ca
University of Toronto	www.ecf.utoronto.ca/apsc/cee/index.htm

RESOURCES FOR LIFELONG LEARNING

As shown in Figure 1, Canada has four national engineering associations that represent the legal, technical, commercial and historical facets of the profession: the Canadian Council of Professional Engineers (CCPE), the Engineering Institute of Canada (EIC), the Association of Consulting Engineers of Canada (ACEC) and the Canadian Academy of Engineers (CAE). CCPE's provincial member associations determine on an individual basis competency requirements for their members.

The EIC, in partnership with its six constituent societies and continuing education providers (see Table 1), is committed to the lifelong learning of Canadian engineers. Through participating partners, it provides continuing education activities that meet IACET standards. These activities comprise hundreds of courses, offered in a variety of formats and covering a variety of subjects.

The EIC has a computer registry capable of receiving electronically from its participating partners reports on the continuing education activities of engineers. The EIC registry maintains records of learning activities for seven years. Individual engineers may use the registry system to obtain and transmit transcripts of their activities to their licensing bodies, as part of meeting requirements for mandatory reporting of learning activities. For this purpose, they should contact the EIC at 613-742-5185; fax: 613 742-5189; e-mail: ici.eic@nrc.ca.

Formal courses in continuing education are also provided by universities, community colleges, consultants, the in-house training departments of government and businesses, professional associations, technical societies and private educational organizations.

SELECTING CONTINUING EDUCATION PROVIDERS

As a lifelong learner, you will invest a great deal of time and money in the courses you take. How can you be sure that your investment will help you meet your goals, and gain the skills and knowledge you need to do your job more competently? The quality of a course depends on the skills of the instructor, and the system and resources of the continuing engineering education provider. To evaluate continuing engineering education providers and the courses they deliver, ask the following tough questions:

- What is their history, and how many years of experience do they have?
- How many engineers receive professional upgrading courses from them?
- How many people have they trained from your company, and what were the results?
- Are they independent, and do they specialize in the professional

development of engineers? Some consultants and manufacturers offer courses with the objective of selling their products or services. In addition, some universities (including the larger ones) commit few resources to continuing engineering education.

- Do they offer a broad range of course topics that will satisfy current and future education and training needs?
- Do they use a formal instructional design process, and what does it involve?
- Are their course applications oriented multidisciplinary and developed by teams of specialists?
- How do they ensure a wide perspective, so that course content does not represent a single point of view?
- How often do they review and update their courses to include new technological developments?
- How do they select their instructors? What is the typical profile and background of their instructors? Do they have the practical experience required to answer all of your questions?
- How is the performance of instructors evaluated, and what standards are expected of them? What specific items are covered in student evaluations of instructors?
- What do they do to guarantee the quality of their courses? Ask them what they would do if, for any reason and at any time, you are not satisfied that the course met your educational objectives.

SELECT THE RIGHT COURSE

To select the right course or seminar for you, you should define your individual education needs. Once you find a course that meets your needs, review the course description to be sure this is the one you must attend. Since the course has not been specially designed for you (unless it's individualized), it probably makes sense to take it as long as the majority of topics it will cover are of interest to you.

The EIC's website (www.eic.ici.ca) is linked to the web pages of its continuing education partners. You can visit these sites to obtain information on the courses EIC's partners provide.

If you find that the course(s) you need are not being offered by the EIC's partner organizations, contact the partner of your choice to inform them of your needs and about other groups with similar requirements. Since these organizations must respond to current education needs, it's likely they will make every effort to offer the course you desire. You can also contact your professional engineering association and/or its chapters about the possibility of organizing the course you want.

CUSTOM-TAILORED?

Another solution to the lack of a perfect match between your requirements and available courses is to organize an in-house course custom-tailored to your requirements. This solution is particularly applicable to large organizations in which there are many other staff requiring similar training to yourself. A custom-tailored course can fill in the gaps in employees' knowledge and help them meet their current responsibilities and career goals. Your training department may design the course and invite an instructor in to teach it. If you work on your own rather than as part of a team, individualized courses may be for you. Private sector providers offer courses that use the latest technology to meet individual needs.

PARTICIPATION IS EVERYTHING

Once you have selected the course you need, the next step is attending it. If the subject matter involves a new area you want to become familiar with, the instructor should be transferring knowledge in small packages in a logical sequence. He or she should help you build up your understanding of the new subject gradually, so that you finish the course feeling knowledgeable about it. If there are aspects of the course material you are not sure of, ask questions to get clarification. Remember, you get more out of a learning experience if you participate actively, rather than receiving information passively.

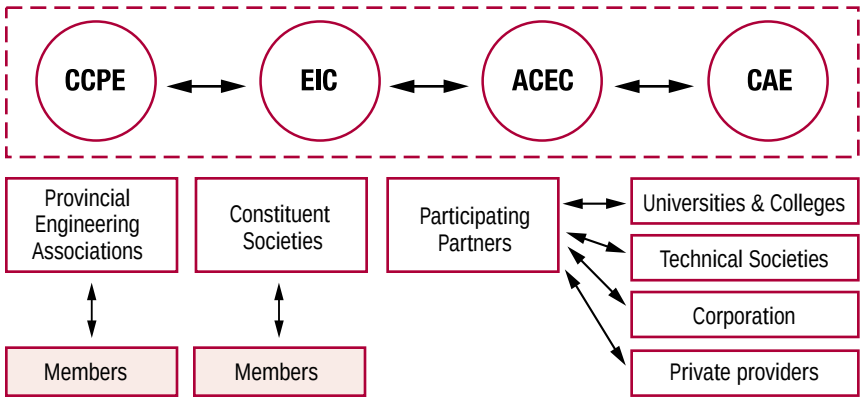
Another way to enhance the benefits of your participation is to interact with other engineers taking the course. They may be working on projects similar to your own. You can exchange business cards in order to contact them and discuss common problems long after the course is finished.

CONCLUSION

You owe it to yourself to maintain and enhance your competency in your field of expertise. Select carefully the courses you need and participate actively in them. Collectively, we can increase the public's esteem for the engineering profession by keeping our knowledge and skills current. Happy lifelong learning.

Hira Ahuja, MASc, P.Eng., FCSCE, is president of EPIC Educational Program Innovations Center in Mississauga. André L. Rollin, ing., PhD, is president-elect of the EIC and director of Interface aux Industries with Solmers International, Longueuil, Quebec.

FIGURE 1. RESOURCES FOR LIFELONG LEARNING



WHAT MAKES A GOOD DIRECTOR?

by Brian Lechem, P.Eng. Mr. Lechem is a director of CSEM and editor of "Boardroom" published by Boardroom Advisory Services from which this article is taken with permision.

There have been many, disparate, perspectives on what makes a good director. Those who are strong advocates of tradition believe, sincerely, that previous indoctrination as CEO of a successful business is all that is necessary to contribute to board deliberations at another company. Others would suggest that an eminent political career or as a senior civil servant, will provide the contacts necessary to justify one's existence at the board table. Despite strong suggestions to the contrary by some leading executive search firms, the concept of the professional director has not yet attracted the attention that it deserves.

With the slow but inevitable increase in shareholder activism, coupled with the attempts by various regulatory bodies to make listed companies more accountable, there is little doubt that two things will begin to happen. The first is that the multiple directorship syndrome will begin to decrease. No longer will companies be quite so willing to spare their CEO to sit on more than one or two other boards, as evidenced by the NACD Blue Ribbon Report on Director Professionalism. Second, while some high-profile directors obviously have the energy and enthusiasm to handle the ten to fifteen appointments that the Directory of Directors shows against their entry, more and more are indicating that four or five are now enough.

The drivers for this realization are not necessarily legal liability exposure, although this remains a constant potential threat. There is little doubt that board responsibilities, particularly at high profile listed companies, have become significantly more onerous. The six days a year syndrome, plus a few hours to read board papers on the way to the meeting, has been replaced with a minimum of some twenty days when one includes committee and other ad hoc demands on one's time.

"It is one thing to be critical. It is quite another, and much harder, to bring positive alternatives

Pre- and post-board homework can also realistically devour the equivalent of another ten or twelve days a year. Hence the four or five board limit is a realistic constraint.

On the positive side, recognition of the board role and compensation for it, increasingly in stock, is now reaching much more respectable levels, even though still, in the main, below US counterparts. Therefore, the need to generate income has been replaced to a degree by the demands of fulfilling a constructive board role, which is a much better way of ensuring independence.

The audio tape Selection of Outside, Independent, Directors sets out an eclectic list of qualifications for directors, some thirteen in all. Many directors intuitively or by experience, possess a great many of these. However, as Sir Graham Day would have it, even good directors are the better for receiving some training in the art (or science) of fulfilling their role. Unfortunately, it is only within the past year or so that a majority of directors appear to have come to the same realization. The need for director education was further reinforced in the recently issued UK Hampel Committee report (reviewed elsewhere in this issue). Knowing what is expected of one when taking a seat at the board table can be significantly different from having the ability to demonstrate how one intends to apply it.

Philosophical business compatibility would probably rank number one if the potential director is known to several of his or her future board colleagues. Breadth of business experience and outlook would be another priority if the director had been recruited to assume a specific position in the make-up of the board. Ability to judge people and personnel qualitatively and quantitatively is a trait honed usually in one's past career. However, David Coulter, Chairman and CEO of BankAmerica corporation stated in a recent article in NACD Director's Monthly (February, 1998) that it was important to be

independent, "but not to the point of eccentricity." He continued: "Directors must be strong enough to express dissenting views when they think a company policy or strategy is heading in the wrong direction. But independence should not be confused with constant naysaying or second guessing. 'The Devil's Advocate' makes a good book or movie title. It's a lousy nickname for a director."

Coulter also makes the point that one should try and be constructive. "It is one thing to be critical. It is quite another, and much harder, to bring positive alternatives - different courses of action - to the table. There are always a number of different options to be considered, and it is important to hear all views to arrive at the most effective conclusion." Perhaps the most important traits of an effective director, and to be good one must also be effective, would be three more much less tangible capabilities:

- Capacity for long-term thinking and planning, and an ability to analyze quickly.
- A strong, and intuitive, financial sense and sufficient knowledge of accounts and reporting systems to know when things may not be what they seem.
- Not least, independence, financial, political and, above all, intellectual, so that views can be expressed under no constraints whatsoever. Much as we respect Anthony J.F. O'Reilly, chairman and CEO of H.J. Heinz, who argues that corporate performance is what really matters. "Why should shareholders care what rules or procedures govern board discussions, or if directors defer to rather than debate the CEO?" Mr. O'Reilly may have his opinion, but we can't help thinking that the days of having a rubber-stamp board of a successful company may be drawing to a well-deserved close. No wonder Heinz achieved a third from bottom score in the recent Business Week survey of the best and worst boards (December 8, 1997).

Interested in knowing more? Call Brian at (613) 494-1440

CSEM Newsletter

DO YOU HAVE A SHORT ARTICLE OR ANNOUNCEMENT YOU WISH PUBLISHED?

WOULD YOU LIKE TO PLACE AN ADVERTISEMENT IN THIS NEWSLETTER?

IF SO, PLEASE WRITE EDITOR@CSEM-SCGI.CA

Next issue will be published on December 31 1998. The deadline for articles or advertising is November 30, 1998.

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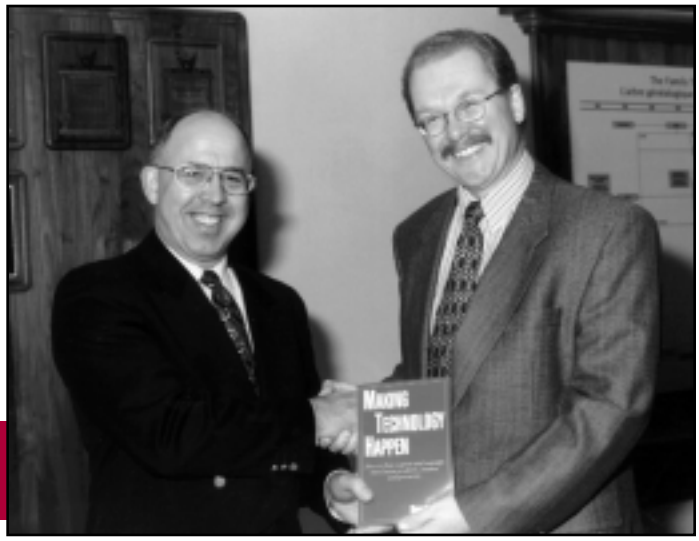
MAKING TECHNOLOGY HAPPEN WITH DENZIL DOYLE

OTTAWA, SEPTEMBER 17TH, 1998

COMMUNICATIONS RESEARCH CENTRE

The Ottawa CSEM Chapter held a very successful day-long seminar on "Making Technology Happen". The speaker was Denzil Doyle, one of Ottawa's most respected entrepreneurs. Mr. Doyle spoke on ways to find, exploit and manage innovative products, services and processes. The seminar was well-attended and CSEM Ottawa Chapter is once again grateful to Communications Research Centre for letting us use its auditorium, organizing lunch and tours of its Broadband Applications Laboratory. At right, Gord Thomson (R) presents a copy of Mr. Doyle's book to Graham Taylor (L) of CRC in appreciation for CRC's hosting the event.



This seminar was so popular that CSEM Ottawa received a call from London, Ontario requesting that we hold a similar event there hosted by the London Economic Development Corporation on November 6th. We hope that Mr. Doyle will consent to giving his very popular presentation annually through the Ottawa Chapter of CSEM. At left, Making Technology Happen Seminar Participants.

If you are interested in obtaining a copy of Mr. Doyle's book MAKING TECHNOLOGY HAPPEN ($28.50 including GST and Shipping) please contact:

Silvan Publications, Suite 605 , 45 Rideau Street, Ottawa, Ontario K1N 5W8
Phone 613 562 3648 - Fax 613 562 3649 - www.silvan.com

CONFERENCE ANNOUNCEMENT

oceans limited

"In recognition of the importance of the ocean, the marine environment and its resources for life on earth and for sustainable development, the United Nations has declared 1998 as the International Year of the Ocean"

The Environmental Science Students' Union and the Faculty of Science at Simon Fraser University announce the launching of the "oceans limited"web site at

www.sfu.ca/oceans/

Interested persons are invited to participate in the Oceans Limited 1998 Program, November 17-20th, 1998 in Vancouver, B.C. The themes of the conference include: marine pollution; biodiversity in marine ecosystems and global climate change and oceans. For more information please visit **www.sfu.ca/oceans/message.htm** or contact Laurie Wood, Program Assistant,Continuing Studies in Science, Simon Fraser University, Tel.: (604) 291-5466; Fax (604) 291-3851.

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Brochure Enclosed with the Newsletter

Is offering two comprehensive seminars providing all you need to manage your projects effectively. Take either seminar separately, or enroll for the four day consecutive program.

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Organizing People for Projects:

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Project Planning and Control

In Ottawa: November 24-26
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TECHNIQUES FOR CHANGE: TEAM BUILDING MEANS MANAGERS MUST CHANGE

By Janice Calnan who is a Senior Consultant with Calian - an HST Company, Kanata. Janice can be reached at 613 599 8600 (x299)

Managers who excel at the task of team building learn to think differently. While a manager and his team believe that each is the source of some problem both must learn how they individually contribute to the problems. While ultimately both must change, it's the manager that must go first.

- Let go of the need for one right way. A catch 22 exists. When you think that you know what to do with a people problem, you are likely already using "in-the-box-thinking". To minimize this risk and to slip out of the pattern begin to ask your team directly and in the presence of each other about what they think is going on. Let them know that you don't have all the answers and they don't have to know all the answers either - there is a need to approach situations together. As soon as you do this you begin to step out of the box of "having the answer".

- Pay for communication improvement. Research suggests that technical experts are less concerned with good communications than with their technical projects. Yet without good communication, technical projects are at risk of low buy in at the time of implementation. Improving communication does not cost a lot of money especially when you compare it to buying technical improvements. Hire a consultant or professional who is skilled in human interaction and who really understands how communications break down. S/he will help you listen to feelings of frustration and anger that always degrade the project.

News release

August 31, 1998

ANDRÉ L. ROLLIN, ING., MSCA, PHD
NEW PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA

The Engineering Institute of Canada is pleased to announce that André L. Rollin was elected President at its Annual General Meeting held June 21, 1998 in Ottawa. Mr. Rollin replaces John Seychuk, who has completed his term of office.

A former Professor of École Polytechnique and Dean of Continuing Engineering Education until 1997, Mr. Rollin is presently involved part-time in the development of national and international professional development programs for the consulting firm, SOLMERS International. Mr Rollin has worked for many years in environmental engineering research, specifically In the field of geosynthetics, He has been chair of numerous technical committees and a member of the Board of Directors of the North American Geosynthetics Society (NAGS) and the Canadian (Council for Human Resources in the Environment Industry (CCHREI). He is presently a member of the Editorial Board of the International Journal on Geotextiles and Geomembranes and also the Geosynthetics International Journal. He is the convenor of the International Standard Organization (ISO) and chair of the Canadian General Standard Board on Geosynthetics.

Mr. Rollin pledged his support to EIC's Vision and to devote his time and energy to ensure that the Institute becomes the leading proponent of continuing education and technology development for the Canadian engineering profession as a whole.

The Engineering Institute of Canada evolved from the Canadian Society of Civil Engineers which was established in 1887 and subsequently became the EIC by an Act of the Dominion of Parliament in 1918. It is concerned with all aspects of engineering in Canada and as a national federation, it pursues the common interests and cooperation of its six member societies. EIC boasts a combined membership of 30,000 engineers, geoscientists and engineering technologists and technicians.

For additional information, please contact The Engineering Institute of Canada at (613) 742-5185 or email at ici.eic@nrc.ca or visit our website at: www.eic-ici.ca

REVERSE ENGINEERING: A DESIGN APPROACH WHOSE TIME HAS COME?

B.S. Dhillon, P.Eng.
This article appeared in the September/October 1998 edition of PEP's "Engineering Dimensions" and is reproduced here with the author's permission.

Reverse engineering is a special type of systems engineering used to rectify defects in, or to extend the capabilities of, existing products, systems or equipment. It's being used increasingly in industry as a cost-effective approach to solving engineering design problems.

It appears that the modern reverse engineering concept had its beginnings in the 1980s, when it was used by the Ford Motor Company to maintain a competitive advantage over General Motors Corporation (and vice-versa). Today, it's being used increasingly in industry-at-large because it offers several benefits, including reducing design and development costs and maintaining high-performance manufacturing capabilities. It can also be used as an effective stopgap measure for improving system productivity, until the resources required for full modernization are within reach. In general, it may be said that reverse engineering is directed at modernizing single system elements, rather than total systems, for the purpose of maintaining or increasing system productivity.

CLONES OR SURROGATES?

A technologist generally interprets reverse engineering as the task of developing a set of functional specifications for a product, system or piece of equipment, based on an analysis of an existing product, system or piece of equipment.[1]

When planning a reverse engineering project, it is necessary to determine whether the desired end result is to produce a clone or a surrogate. In the case of producing a clone, reverse engineering means the exact reproduction of the original (at least as far as circumstances will permit). The clone reproduction must have the same function, form, operating mechanism and fit as the original item/system/equipment. In contrast, the surrogate item may carry out the same function(s) as the original, in addition to being sized to fit in the same place as the original, but may neither appear to be the same, nor use the same operating mechanisms. Obviously, the reverse engineering process is far more extensive in the case of a clone than a surrogate. The increased complexity and sophistication of modern equipment has made the task of producing clones even more difficult.

BASIC CONSIDERATIONS

There are various, basic considerations associated with the reverse engineering effort, including:

• *design factors*. Reverse engineering is more cumbersome than executing an original design. The reasons for this include the inability, in general, to determine the following factors: thinking of the original designer, crucial parameters with respect to performance, treatments applied to the materials and elements critical to the item's operation;

• *indirect influences*, which include manufacturing philosophy, potential product users, maintenance policy, logistical support philosophy and tactical deployment of equipment. During the reverse engineering effort, these are usually a one-time consideration. However, giving careful consideration to indirect influences prior to undertaking reverse engineering can contribute immensely to its effectiveness;

• *an original specimen of the item to be cloned*, which is quite useful for making various kinds of decisions during the reverse engineering process, such as testing hypotheses when everything else fails. Therefore, it is absolutely essential to have at least one specimen of the item/product/system to be cloned in its original form;

• *technical expert involvement*. The reverse engineering effort usually takes input from various technical specialists. Therefore, it is often crucial to have input from relevant technical experts during the reverse engineering process, since they can provide valuable information.[2]

THE PROCESS

The reverse engineering approach is based on two assumptions: the item/product/system under consideration can be characterized as a hierarchical structure, and the process is repeatedly applied to the item/product /system until it is reduced to piece parts or components. The reverse engineering process comprises the following five steps.

1. *Systems engineering* to develop hypotheses based on available data and to highlight the measurement/test needs. This step requires you to assimilate existing data about the item to be reverse engineered, including its operation within the overall scheme of things. It also requires element identification, a process by which you postulate how the item is reduced into its component parts.
2. *Disassembly*, to the level necessary to verify or modify the 5 hypotheses and conduct supporting tests. This step is concerned with isolating the item parts, highlighting the interconnection among the parts, and developing the interfaces between the parts and the world outside the item.
3. *Further systems engineering*, based on all available data to establish new hypotheses and prepare for additional measurement and testing.
4. *Further disassembly*, measurement and testing, to validate hypotheses and obtain new information.
5. *Preparing specifications and other documentation*, which requires you to continue the process until your level of understanding is adequate to do so.

DOCUMENTATION PROCEDURES

Since the findings of the reverse engineering process will have to be communicated to others, it is useful to adopt a suitable documentation scheme. Every effort should be made to ensure that the documents used to record information discovered during the reverse engineering process are compatible with the method used to guide the process. The documents created for reverse engineering cover the:

- *equipment breakdown hierarchy or structure*, to provide a mechanism to order the item's subsystems, and their assemblies, subassemblies and elements (of a specified subsystem), in order to expedite the development of specifications. The equipment breakdown hierarchy document acts as a vehicle to guide the reverse engineering effort and is critical to the development of functional specifications. This document is also used to develop the configuration document;
- *configuration*, to describe interconnections between various components of a particular item, specifics of the flow of information, energy or materials between these components, and the function(s) performed by them. The configuration document comprises several interrelated parts, including functional description(s), block diagram(s) and interface tables;
- functional and dimensional specifications. The purpose of functional specifications is to describe the workings of the product/system/ equipment and its associated subsystems and their interactions. Dimensional specifications include item/part dimensions, materials used in the fabrication of such items/parts, parameter values and their tolerances, and the description of the assembly of those parts during manufacturing. Generally, reverse engineering makes use of a two-step strategy:
  - developing functional specifications to the level where you understand the operating mechanisms fully, which requires hardware decomposition to a point where some assemblies may be identified and
  - disassembling the remaining assemblies, isolating all of the parts and then measuring the parts to determine their dimensions.
- performance specifications, to record the performance specifications for the item by formulating a specification tree with the same structure as the equipment breakdown hierarchy or structure. At all levels but the lowest (e.g. piece components), specification tree entries describe the item's functional aspects. The performance specification entries at the piece component level are basically of the dimensional type.

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Communiqué

Le 31 août 1998

ANDRÉ L. ROLLIN, ING., MSCA, PHD
ÉLU NOUVEAU PRÉSIDENT DE L'LNSTITUT CANADIEN DES INGÉNIEURS

Lors de l'assemblée générale annuelle tenue le 21 juin 1998 à Ottawa, l'Institut canadien des ingénieurs (ICI) a élu M. Andre Léo Rollin, ing, président de l'Institut, en remplacement de John Seychuk, qui terminait son mandat.

Professeur titulaire de L'École Polytechnique jusqu'en 1997, il a été Directeur du Centre de formation continue de l'École Polytechnique et il est présentement à la direction de la formation et des relations internationales de la societé Solmers Internationale Actif depuis 1974 dans le domaine de l'environnement, il a oeuvré principalement dans les applications des géosynthétiques. Il a éte président du comité technique de la conférence internationale Geofilters'96, vice-président de la «North American Geosynthetics Society» et membre du comité éditorial de la revue «International Journal on Geotextiles» et «Geosynthetics Journal». Il a été membre du conseil d'administration du Conseil canadien des ressources humaines en environnement et est membre actif de plusieurs associations professionnelles: Ordre des Ingénieurs du Québec (membre du comité de formation continue); «Intemational Standard Organization»; l'Office des normes générales du Canada, et autres.

Dans son allocution, M. Rollin a promis d'aider l'Institut canadien des ingénieurs a realiser sa vision de devenir la pierre angulaire de la formation continue pour assurer le maintient de la compétence professionelle des ingénieurs au Canada.

L'Institut canadien des ingénieurs a pour origine la Société canadienne d'Ingénieurs civil fondée en 1887. Cette évolution a été reconnue par un acte du parlement canadien en 1918. L'ICI represente les intérêts de près de 30 000 ingenieurs, geo-physiclens, technologistes et techniciens membres de six sociétés constituantes. L'ICI collabore étroiternent avec les associations professionelles et les organismes nationaux dans la promotion du maintient de la compétence professionelle et de la reconnaissance des activités de formation continue.

Pour de plus amples informations, communiquez avec l'Institut canadien des ingénieurs au (613) 742-5185 ou par courrier électronique: ici.eic@nrc.ca ou visitez notre site web: www.eic-ici.ca

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THE REVERSE ENGINEERING TEAM

Performing reverse engineering is not a one person task. It requires a group of specialists, including engineers, estimators, shop personnel, draftspeople, technicians and production workers. From time to time, specialists in such areas as circuit design, vibration analysis, metallurgy and ceramics are also required. However, there are usually only a handful of people who form the core reverse engineering team. Nevertheless, it is generally important to keep the same core team members from project to project to maintain consistency and enable them to build on their experience.

The person selected to lead the team should be a generalist, with some knowledge of engineering disciplines in such areas as electrical and mechanical engineering, manufacturing and electronics. Since the team leader will need to interact with various people, he or she should also have good managerial abilities.

TIPS FOR SUCCESS

The selection of items for the application of reverse engineering requires careful consideration. Usually, good reverse engineering candidates have such characteristics as excessive cost, a high failure rate and high usage. To determine whether an item will make a suitable candidate, you should consider such issues as potential return on investment, economics, technical complexity and criticality, and logistics.[3] Additional factors to consider include patent rights for the item (e.g. Who owns them?), the adequacy and availability of technical data on the item, support obsolescence (e.g. support items are out of date) and lack of supply of required parts.

To help ensure that your reverse engineering effort is successful, you should:

- generally, aim for a return on investment on prescreened candidates of at least 25:1. Your expected return on investment for high-risk projects should be at least 200: 1;
- expect that a good reverse engineering program will take from two to five years to become self-sufficient;
- aim for a minimum 25 per cent reduction in the item's unit cost; and
- make only a moderate investment during the initial stage of the program, to avoid spending too much money without some certainty of success.

B.S. Dhillon, P.Eng., is professor of mechanical engineering at the University of Ottawa and the author of 19 books and over 250 scientific articles. He has served as director/chairman of the university's Engineering Management Program and Mechanical Engineering Department for over 10 years.

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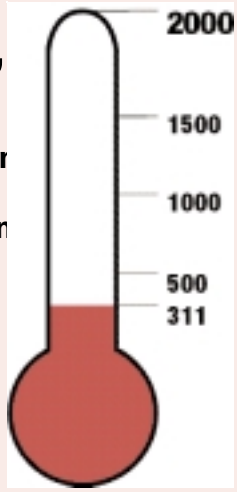
CSEM "Project Y2K"

To celebrate the new millennium CSEM is undertaking an aggressive recruiting campaign Our goal —



2000 members by the year 2000

We'll be calling on all members to assist us in achieving this goal. Watch this corner for updates.

PROFESSIONAL DEVELOPMENT SURVEY RESULTS

Here is a summary of the survey results from the June CSEM Newsletter. I do not give the results any statistical significance whatsoever and they are presented here as merely a guide to programming efforts within CSEM.

Potential List of Seminar Topics
(not in any order of preference):

- Project management
- Strategic Alliances and Partnerships
- Personal Career Management
- Finance Issues (personal and corporate)
- Managing technology and innovation
- Engineering ethical issues
- Occupational Health and Safety Law
- Liability Issues (professional, directors and officers)
- People Management and Leadership
- Writing and Presentation Skills
- Engineering Law/Intellectual Property Law

Preferred Length of Seminar: Full Day.

Preferred Cost for a Full Day Seminar: $300 - $400

Preferred Cost for a Half Day Seminar: $150

When?	**Where?**
Fall or Winter Months.	Hotel conference room
Monday to Friday	or similar setting.

I wish to thank everyone who participated in this survey. CSEM will use these results for future professional development programming. I am happy to see such a great interest in things legal.

Gord Thomson