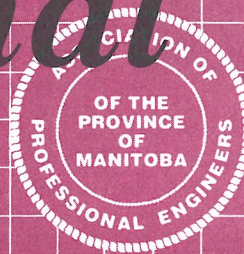
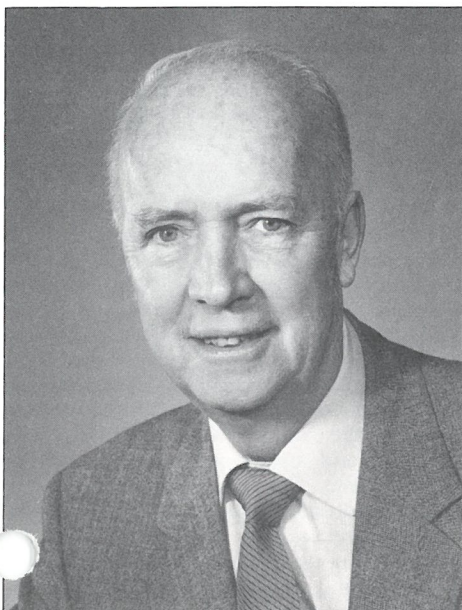


Professional Engineer



December, 1986



Speers at Helm

At your Association's Annual General Meeting, your Council elected Mr. E. A. "Ted" Speers as our President for the coming year. The following interview will help you "put your finger on" this important man in our Association's life.

MPE: What do you see as the major issues you inherit as you begin your term?

Speers: The major issues that are current include our fiscal policy; namely, making sure that our investments make as large a contribution as possible to increase the Association's assets. Husbanding our resources will keep our fees in line and allow funds for projects that improve or protect the image of engineering.

A second issue concerns the ethical use of the engineering seal. We have a sub-committee, ably chaired by Bill Newton, that has studied the subject extensively and has prepared a report to present before Council at the November meeting.

MPE: What issues do you want to pay particular attention to in the next year?

Speers: Emphasis will be placed on enforcement of the Engineering Profession Act, which requires that engineering work be designed by and constructed under the supervision of a registered Professional Engineer. The Act is enforced by provincial law in

(continued on page 2)

LIMESTONE GENERATING STATION FIRST YEAR OF CONSTRUCTION COMPLETE

By John Markowsky, P. Eng.

The first year of construction at the Limestone Generating Station has been an intense one with many key activities taking place.

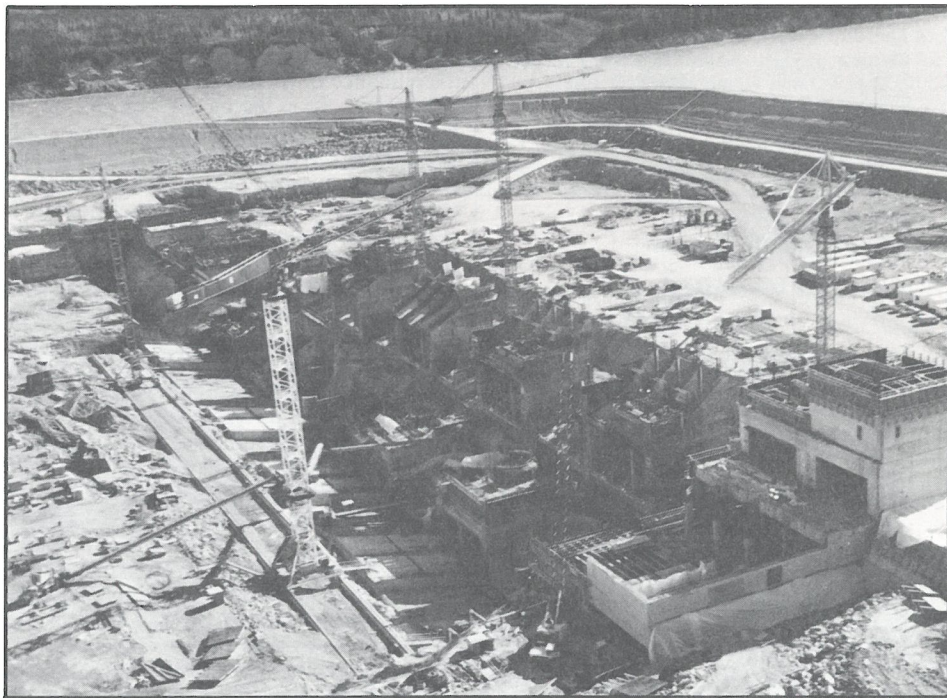
The year's activities can be summarized as: mobilization complete; rock excavation for structures areas complete; concrete placement nearly 30% complete with the main sequenced pours for the intake and powerhouse well in hand; the north dam 70% complete and in good shape for completion in 1987.

Although the actual concrete placement was short of the general contractor's sche-

duled quantity, Bechtel-Kumagai are confident they can meet next year's objective by getting an earlier start for concrete placement, and getting up to full production early in the year.

Next year is the peak season for the project. The completion of critical concrete work is necessary to coincide with gate works contracts commencing in 1987 and 1988, and ultimately river diversion in 1989.

The tight schedule combined with the rugged Canadian north makes the remaining work on North America's largest hydro electric plant currently under construction, full of excitement and challenge.



An aerial view of the intake and tailrace units, and powerhouse inside the stage 1 cofferdam looking southeast over the Nelson River.

Some Facts (all numbers rounded approximates)

Manpower—Peak Manpower—1986—1450.

Concrete—August 13, 1985 — Dewatering of Stage I Cofferdam commenced. May 13, 1986 — First Concrete in structures. October 8, 1986 — Service Bay topped up (1m of deck remaining). November 3, 1986 — Last concrete pour, 1986 season.

Reinforcing Steel—6800 tonnes placed out of a project total of 27200 tonnes.

Cement—30000 tonnes used out of a project total of 118,000 tonnes.

Concrete Production—177,000 cubic metres placed out of a project total of 600,000 cubic metres. Monthly average = 43,000 cubic metres.

Rock Excavation— 1.8×10^6 cubic metres excavated out of a project total of 2.5×10^6 cubic metres.

Earthworks—North Dam — 70% out of 1.2×10^6 cubic metres total. □



December 1986

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Vera Toth

Opinions expressed are not necessarily those held by the A.P.E.M. or the Council of the A.P.E.M.

By-Law Amendment

The recent letter ballots on amendments to by-laws nos. 35 and 47 are now complete. A majority of those voting were in favor of the amendments. Accordingly, the by-laws are amended. The amendments mean that Robert's Rules of Order shall govern all council and other Association meetings. The housekeeping change to the by-law on recognized branches of engineering now includes the corrected name — "The Canadian Engineering Accreditation Board".

W. B. Mackenzie, P. Eng.

Registrar

IN MEMORIAM

- M. A. DePauw, P. Eng.
- G. R. Kilgour, P. Eng.

Speers at Helm (continued from page 1)

order to protect the public from possible unsafe or inferior work.

MPE: What are your views on the perception the general membership has about the Association? Are you concerned about this?

Speers: I doubt that it is possible to specifically define the perception the general membership has of the Association because participation levels run from indifference to enthusiasm in the affairs of the Association. Those members who participate in the over twenty committees serving the A.P.E.M. receive the greatest benefit in membership — in addition to the free lunches, the wine and cheese party, and the social and business contacts that are made.

Increasing participation in A.P.E.M. affairs is an area which the Publication Committee could help improve by reporting developments at the committee stage, such as the Committee on the Ethical Use of the Seal, the Centennial Committee or the University Liaison Committee.

The University Liaison Committee concerns me because it needs help to function at its maximum level. Participation by any interested members of the Association would be welcomed.

MPE: Do you have any specific plans regarding non-registered persons practicing engineering?

Speers: Yes. The Statute requires that all engineers' work, as defined by the Engineering Profession Act, is to be done under the guidance of registered Professional Engineers. This is a matter of concern to all members of our Association, not only because of the legal ramifications, but also because engineering work by persons not registered has the potential to put the public at risk. A start has been made to resolve this difficult problem and it is the intention of Council to increase enforcement of the Act.

MPE: A number of other provincial Associations have attempted to enhance and expand their public profile and draw attention to our profession. Several articles in our publication have also stressed this and since 1987 is the Centennial of Engineering in Canada, the time "appears right" for such endeavors. What are your views on this and do you have any specific actions planned?

Speers: Our Centennial Committee, chaired by Past President Bob Foster, has arranged for an excellent permanent exhibit on engineering in the Museum of Man and Nature. In addition, our Association is participating in a public awareness project by detailing the engineering at the Old Pinawa Dam Site (now a provincial park).

I am convinced there are many other opportunities to enhance the public image of our profession. However, our public image can best be enhanced by each of us showing moderation, objectivity, and adherence to our ethical code in doing the best job we can.

MPE: Have you any changes planned in the structure of the Association?

Speers: Over the years, the structure of the Association has been built by succeeding Councils — we grow on the shoulders of others. No drastic changes are contemplated.

If difficulties become obvious, I would expect Council to consider the situation, take action, possibly through Committee, to rectify the situation.

MPE: Are there any Association Committees which you plan to monitor or pay particular attention to?

Speers: The important work of the Association goes on at the Committee stage, where I expect to be in attendance as often as possible. By November 12th, I will have attended six Committee meetings, in addition to an Executive and a Council meeting. Because many useful contacts can be made and the knowledge of the ethical side of engineering can be obtained in this manner, I consider work at the Committee level essential to understanding the Association.

MPE: Is there anything else you'd like to say?

Speers: Yes. I thank you for this opportunity to be interviewed and to express some firmly-held opinions on the profession that we enjoy. I doubt if there is any aspect of human life that is not touched in some way by engineering.

Many of our Canadian engineers are unemployed — at a time when there are great needs in the country. We need a political will to foster and support industrial research and development for this represents the most economical way to build to the pilot plant and beyond — thus opening up more employment opportunities.

Developing our people has many secondary advantages besides higher educational levels. We need increased capability through opportunity — engineering capability (Manitoba based). We have the know-how to build any plant or complex legitimately required. □

New Members Registered During October and November 1986

- | | |
|-------------------|------------------|
| H. Behamdouni | D. G. Naylor |
| L. P. Bielus | W. J. Oake |
| G. C. Brown | R. Rampaul |
| A. L. Celovsky | J. Read |
| J. J. Danko | F. M. Saunders |
| T. W. Dean | P. M. Schueler |
| C. L. Dristiansen | R. C. Senez Jr. |
| J. F. Horbay | J. P. Shewchuk |
| B. L. Kizvik | I. M. Sutherland |
| R. D. Loudfoot | N. T. Szoke |
| E. G. Martin | J. N. Szuck |
| W. H. McAdam | R. L. Tough |
| J. R. Mellors | H. M. Turanli |
| J. S. Mitchell | C. P. Wray |

Congratulations to **John Danko, Robert Loudfoot, Wylie McAdam, Frederick Saunders, Nicholas Szoke** for achieving 100% on the Professional Practice Examination.

Cannot Locate The Following

- | | |
|------------------|-----------------|
| W. B. Ashby | J. R. Lion |
| I. H. Bassin | E. R. McComb |
| G. W. Broadland | E. B. McGowan |
| S. V. Burr | M. Y. Marcus |
| J. P. Y. Chan | M. R. Orecklin |
| D. B. T. Davis | D. M. Phipps |
| B. N. Dick | W. J. Ripat |
| J. R. D. Gervais | A. J. Safronetz |
| D. F. Johnston | L. Stocco |
| V. Kukoraitis | R. S. Whitmore |
| R. J. Lewak | A. J. Zaidi |

Annual General Meeting and Awards Luncheon

October 24, 1986

By L. Ganetsky, P. Eng.

President Ted Clarke opened the 67th Annual General Meeting in the South Ballroom of the Downtown Holiday Inn.

Two differences were noted very early in the meeting: Publication Committee Member Vern Dutton subdivided the room in two, half for the smokers and half for the non-smokers, a much appreciated initiative. The second noticeable difference was that Secretary and Registrar Bill Mackenzie had nothing to say. I later discovered this was due to a sudden but severe case of laryngitis.



President Ted Clarke handing the gavel over to President-Elect Ted Speers.

The meeting began with the notice of meeting being read and the head table being introduced. Also introduced were the distinguished guests visiting us from other Provincial Associations and from the C.C.P.E.

The minutes of the 1985 Annual General Meeting were adopted as read. Mr. Clarke read the scrutineer's report announcing that W. D. Christie, E. A. Speers, G. E. Laliberte, W. McGilvery and K. J. Y. Kjartanson have been elected to Council.

The auditors' report was received and Sill, Strueber, Fiske & Company were appointed auditors for the coming year. Michael E. Van Den Bosch, David A. Ennis, and Ian H. McKay were appointed to the Nominating Committee. Other motions carried were the Recommended Salary Schedule for July 1, 1987, the proposal to amend By-laws 47 and 35, and the acceptance of the annual reports as published in the October 1986 edition of this periodical.

The meeting adjourned for coffee at 10:00 a.m.

At 10:25 the meeting reconvened for a panel discussion on "Professionalism and the Employee Engineer". Mr. Clarke introduced Jack T. Stevenson who spoke of the conflicts facing the engineer today.

Being a member of the profession and subscribing to a Code of Ethics gives you an obligation to the public as well as concern for their well being. On the other hand, being an employee engineer, as many of us are, imposes loyalty and confidentiality to your employer. Mr. Stevenson offered no easy solution to the problem but advised all engineers to enlist the aid of their Association in resolving specific conflicts. Mr. Stevenson presented his observations on today's trend to more and more professionals becoming employees. He cited examples of how many lawyers, doctors, nurses, and chartered ac-

countants, in addition to engineers, are joining large firms as employees.

Mr. Stevenson suggested that our Associations start realizing that the membership is composed of fewer and fewer self-employed engineers and more "employee engineers". He also commented that most of our problems are not technical problems but are people problems and that engineers should be educated more in communication and judgement skills.

This was followed by a question period with the discussion ending at approximately 11:30 a.m.

Following a magnificent lunch, the two Merit Awards, the Award for Outstanding Service, and the Honourary Life-Membership Award, described below, were presented by Past-President Roger Kane.

Two scholarships were presented to students who are in the process of completing their engineering education. The Canada Northlands Development Award was presented to Philip W. Tataryn a student at

the University of Manitoba, who has met the criteria of the award; having worked in Canada's Northland and having displayed qualities of initiative and potential leadership.

A special one-time scholarship in memory of David McKall, a deceased member of our Association, was awarded to Neil Richard Samuel Simons, presently enrolled in electrical engineering at the University of Manitoba.

The presentation of our Association's awards concluded with a unique event — the first presentation of the five scholarships from the Association's University of Manitoba Scholarship Fund. These went to: Roderick Edgar Wallace — Electrical; Sandra Ruth Janzen — Agricultural; Irene Romualda Mikawiz — Industrial/Computer Engineering; Michel Hermas Gregoire — Mechanical; Kimber Bernard Paul Osiowy — Civil.

The event turned out as it does each year to be an enjoyable and informative day. □

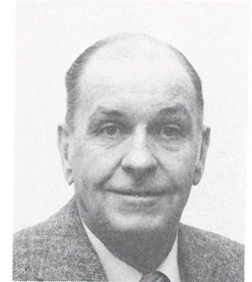
MERIT AWARDS

The terms of reference upon which Merit is judged are: a contribution to engineering literature showing scholarly achievement, the magnitude of engineering works successfully completed, the pioneering achievement in the field of engineering application, and outstanding public service. The recipients are:

Doug Allen graduated from Electrical Engineering in 1953 after attending McGill University and the University of Manitoba.

After working with RCA Victor he moved into private practice in 1964. Today, D.E.M. Allen & Associates is the largest engineering consultant specializing in the broadcasting and communication field in Canada.

As a volunteer, Doug staged the Disabled Skiing Association of Manitoba in 1974 and has since been the president of the Canadian Alliance of Disabled Skiers and the Chef de Mission for the Canadian Ski Team at the Disabled Olympics in 1984. He was also honoured with the Order of Canada for his involvement with skiing.



Lloyd McGinnis graduated from the University of Manitoba in 1956 with a Bachelor of Science Degree in Civil Engineering and received his Master's Degree in 1967 from Georgia Tech.

He has worked with W. C. Wardrop & Associates most of his career and was involved in developing their international business. His community involvement is very extensive. He is serving as chairman of the "World Community Service", and is a former Chairman of the Winnipeg Development Corporation, Past-President of Winnipeg Chamber of Commerce, Past-Director of the Winnipeg Convention Centre, Past-Director of the Winnipeg Micro-Electronics Centre, Past-Director of Junior Achievement and currently is Chairman of the Canadian Chamber of Commerce.

OUTSTANDING SERVICE AWARD

The Outstanding Service Award recognizes outstanding service rendered to, or on behalf of, our Association. The recipient of this award is:

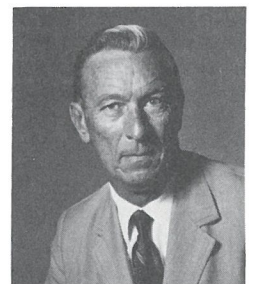
Wallace Raymond McQuade became registered with this Association on April 23, 1952, and his service to the Association dates back to 1956. This award is conferred on Mr. McQuade in recognition of his generous and remarkable achievement of having served on Association committees for a cumulative total of thirty-six years.

The Association is grateful for the time and support Mr. McQuade has given over the years and feels that he is a most deserving recipient of this award.

LIFE MEMBERSHIP AWARD

Life membership is granted by unanimous decision of Council to a member who has, in the opinion of Council, rendered meritorious service to the Association, who is no longer practicing engineering on a full-time basis, and who has preferably been continuously a member for not less than 35 years. This years recipient is:

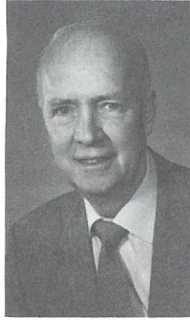
Lawrence William Blackman became registered with this Association on October 3, 1955. He has been a continuous member of the Association for 31 years. Mr. Blackman was a member of Council for five years and was President in 1969. He has served on Association committees for a cumulative total of seventeen years.



President Speers on Registration and Use of the Seal

President's Message

Ted Speers, P.Eng.



The operation of the Association of Professional Engineers of Manitoba is complex. Over twenty committees exist. Most of these are necessary to ensure that the legal mandate given the Association is carried out. The Legislation Committee, the Admissions Review Board, the Board of Examiners and the Practice and Ethics Committee are in this category. The Sports Committee, the Social Committee, and the Publication Committee are not, but they enrich the life of our Association.

The paramount consideration in exercising our engineering knowledge as professional engineers lies in the protection of the public. The Engineering Profession Act requires this, as does our Code of Ethics. Registration with the A.P.E.M. means that our qualifications at the time of registration have been vetted by our peers and found acceptable — capable in our engineering field and responsible in our application of knowledge.

Council and the Admissions Review Board have long considered the conditions of entry. A particularly thorny problem lies in the case of those individuals who, as engineers-in-training, are employed in companies where there is no professional engineer to supervise engineering practice. Entry to engineering may be considered as overcoming a series of hurdles.

After graduation in engineering, or entry through the Board of Examiners' examination route, the engineer-in-training (EIT) is required to gain experience under the supervision of a professional engineer. This two-year minimum training period involves engineering work experience consisting of orientation and routine training (25%) followed by work of increased technical complexity and responsibility (75%). The safety of the public must not be involved. The work is supervised and regulated.

Recently a "Log of Experience" route for EITs under the guidance of the Registrar has been tried for computer and industrial engineers finding employment in companies without professional engineering supervision on staff. A mentor route has been considered. Legal advice indicated that the liability insurance requirements negated this approach. The mentor route does not comply with the requirements of the Engineering Profession Act. (A change would be necessary to Section 14(2) of the Act and to Section 39 of the By-laws).

After the required experience; an open book Practice and Ethics Examination must then be passed. This covers knowledge

of The Engineering Profession Act of Manitoba, the By-laws, and the Code of Ethics.

Once an engineer has achieved P. Eng. status, a further problem arises: how and when to use his engineering stamp. Council set up an ad hoc committee on The Ethical Use of the Seal, chaired by W. R. Newton, P. Eng., which has just reported to Council. The report is summarized in tabular form below.

Setting out the parameters of the ethical use of the seal helps resolve those grey areas of uncertainty and it serves as a good discussion point. Your comments and input would be welcomed by the committee.

This brief message illustrates some of the complexities of the management of your Association. Ours is a high calling, requiring complete responsibility for our actions and a social conscience. Participation on committees will give valuable experience in corporate affairs. Discussions of problems in ethics and the work place can give one the sage advice of experienced members. Believe me — committees will welcome you. Involvement will lead to enjoyment and greater appreciation of your Association.

In the final analysis the stature of engineering in the eyes of the public can best be served by the example of the individual. □

SUMMARY OF SEAL USE

| Guidelines | Stamped | Discretionary Stamped | Signature P. Eng. | No Disclaimers | Remarks |
|--|---------|-----------------------|-------------------|----------------|--|
| Letters A. Little engineering content | | | | | |
| Letters B. Engineering content | | X | X | | |
| Memoranda A. Communication within working unit | | | X | | |
| B. Beyond working unit with engineer data | X | | | X | |
| Memoranda, reports; tentative Specifications | | | X | | |
| A. As part of pkg. | | X | | | |
| B. Stand alone | X | | | | |
| Preliminary drawings | | | | X | Marked "Preliminary not for construction" |
| Final drawings | X | | | | All originals and all sepias |
| Preliminary maps and field sketch | | | | | Marked "Preliminary" |
| Final maps, design and field notes | X | | X | | |
| Preliminary reports | | | X | | Mark "Draft copy" |
| Final reports | X | | | | |
| Electronic aids | | | | | Computer IO treat as design aids |
| A. Input-Output | | | | | |
| B. Printed data for others | X | | | | Duplicate in transparency and transparency stamped |
| C. CAD for others | X | | | | Duplicate in transparency and transparency stamped |

Multiple seals
Qualified stamps

Not allowed. It is not in accordance with the code of ethics nor is it the purpose of the seal. It is not ethical to limit or disclaim responsibility by qualification when sealing a drawing. All elements must be accounted for if sealed.

Imposed constraints on the use of the seal

An engineer may review on request the work of others and use wording "Reviewed by _____" without stamping. The Council, as the Administrator of the Act, shall be the sole arbitrator as to whether a drawing, which would normally be stamped, may not be stamped. Special dispensation may only be given by Council. An engineer not applying the seal on documents which should be sealed is in contravention of the Code of Ethics and an employer or client imposing a constraint on the proper use of the seal is in contravention of the statutes of the province.

*Note 1.

Under no circumstance shall the stamp of an engineer be programmed for automatic reproduction by an electronic process.

*Note 2.

Where more than one engineer is involved in the preparation of an engineering document, the team leader will stamp the drawing indicating responsibility for the supervision of its production. The names of other participants may be followed by P. Eng. and can be noted in the title block or by other means.

*Note 3.

An engineer shall use the stamp of the province of residence or in which work is normally conducted and may indicate other areas of registration by notation e.g. "Also registered to practise in _____".

IMPORTANT NOTICE RE FEES

Invoices for 1987 membership fees and a notice relating to change of membership status have been mailed. If you have not received these please contact the Association office.

C.C.P.E. Presidents Past

In this, the year in which the Canadian Council of Professional Engineers celebrates its 50th anniversary, it is appropriate that the Manitoba Professional Engineer acknowledge the contributions of the two members of our Association who have, in the past, served as president of the C.C.P.E. These two men are Russell Hood, P. Eng., and Les Wardrop, P. Eng.



Russell Hood, P. Eng.

Russell Hood is the Area Manager of the Manitoba and Northwestern Ontario Operations of UMA Engineering Ltd. in Winnipeg, as well as being a Vice-President of the UMA Group. He has senior responsibility for all projects undertaken in Manitoba and Northwestern Ontario, and national responsibility for the delivery of services in the transportation and agricultural sectors.

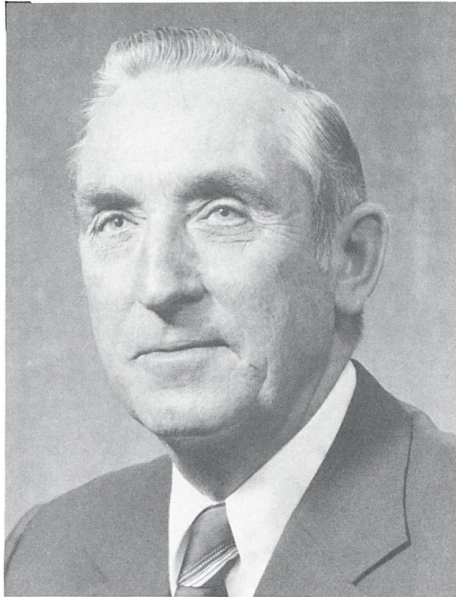
Russ was born in Sydney, Australia. He graduated in Civil Engineering in 1953 from the University of New South Wales, and in 1957 became an Associate with the Sydney Technical College. In 1958 he began a professional career with Underwood McLellan and Associates Ltd. as a resident engineer, and was then promoted to senior project engineer, chief engineer and then area manager.

Russ became registered with the Association in June, 1959. He served on the A.P.E.M. Council for five years. In 1970 he was elected Vice-President and in 1971, President of the Association. He has served on nine different committees of our Association. He also served for four years as our representative to C.C.P.E., and was elected President of the C.C.P.E. in 1974. For the variety of services rendered to our Association, Russ received the Outstanding Service Award in 1978.

He has served as Vice-President and President of the Engineering Institute of Canada. For his contribution to the engineering profession he was awarded in 1974 a fellowship of the EIC.

In addition to his membership in EIC, he is an associate member of the Institute of Engineers, Australia and a member of the Roads and Transportation Association of Canada.

In his community activities, Russ is a member of the Investment Review Committee at the Victoria General Hospital where he also served as a chairman of the Board of Directors, and President (1985-1986) of the Association of Consulting Engineers of Manitoba. □



Les Wardrop, P. Eng.

Les Wardrop was President of C.C.P.E. in 1962, the first Manitoba to hold the position. My recollection of that time is Les, furiously studying French so that he could address the Annual Meeting of the Quebec Order of Engineers in their language. It was the beginning of bilingualism in Canada.

Les came from a farm at Whitemouth, Manitoba. He graduated in Electrical Engineering in 1939 and returned to the University of Manitoba after the war, receiving a Civil Engineering degree in 1947. He and Olive were married in Kingston prior to Les leaving for overseas duty.

After graduation, Les joined the City of Winnipeg Engineering Department. When he left the city in 1955, he was Engineer of Waterworks and Sewage. At that time, the economy was growing as was the demand for engineering services. Les recognized the opportunity for Consulting Engineering services and began private practice in 1955. Under his leadership, W. L. Wardrop & Associates Ltd. grew to the significant organization it is today with 160 employees. Les retired from active practice in his position as Chairman of the Board in 1980.

His community services included President of the Winnipeg Chamber of Commerce and activities with the Salvation Army, Middlechurch Home, Rotary and the St. Boniface Research Foundation.

In addition to his A.P.E.M. and C.C.P.E. service, he was active in many technical organizations: President of the Canadian Institute of Pollution Control, Chairman of the Building Standards Board and more.

Olive and Les now reside on their Wardhaven Farm in East Selkirk, where Les "worries" over the weather conditions and the state of his crops. □

Engineer's Suggestions for Symphony Strike Receptive Note . . .

Joe Mepa's company has gone through contractions, usual to these times, cuts of about 35%. After cutbacks I, II and III, his Chief Executive Officer decided that there was room for further efficiency. He therefore created a committee (of which Joe was elected a member) to come up with a plan for reorganization.

In an unusual act of benevolence and as a show of appreciation for their hard work, he gave Joe and the other committee members a ticket to the symphony. It appears the committee misunderstood or succumbed to unrestrained zeal and came up with the following recommendations the next day:

1. For considerable periods, the four oboe players have nothing to do. The number of oboes should therefore be reduced, and the work spread more evenly over the whole orchestra.
2. All twenty violins play identical notes. This would seem to be an unnecessary duplication, so the staff of this section should be cut drastically. If a greater volume of sound is required, it could be obtained by means of electronic amplification.
3. Obsolescence of equipment is another matter warranting further investigation. The program noted that the leading violinist's instrument was several hundred years old. Now, if normal depreciation schedules have been applied, the value of this instrument would have been reduced to zero and the purchase of more modern equipment recommended long ago.
4. Much effort is absorbed in the playing of difficult passages, which seems to be an unnecessary refinement. It is recommended that all notes be rounded up or down as necessary. If this were done, it would be possible to use trainees and lower grade operatives more extensively.
5. In many cases, the operators use one hand to hold the instruments. The introduction of a fixture would free that hand for other work. Also it was noted, that excessive effort is being used by the players of the wind instruments; whereas one compressor could supply enough air for all instruments — and under more accurately controlled conditions.
6. Finally, there seems to be too much repetition of some of the musical passages. Therefore, scores should be pruned to a considerable extent. No useful purpose is served by repeating on the horns something, which has already been handled by the strings. It is estimated that, if all redundant passages were eliminated, the whole concert time of two hours could be reduced to twenty minutes — and there would be no need for an intermission. □

Engineering Under Pressure

by Samuel C. Florman, P.E.

The *Challenger* disaster was a classic example of engineering failure, but it was also a unique event. There was the drama of the decision-making process and the ensuing debate about it in a national forum. But the real revelation to me was that the men who made the fateful decision to launch somehow assumed that they could not at the same time be both engineers and executives.

The mission carried echoes of previous engineering tragedies. Once again a minute detail undid a grandly-conceived technological project. Once again it was demonstrated that engineers must deal with real materials — rubber, putty, steel — rather than idealized ones that behave as scientific formulas say they should. Real materials must be tested, and there wasn't enough testing.

We discovered anew that myriad multiplicative coincidences haunt complex engineering systems. Just as *Challenger's* primary O-ring gasket failed, a second gasket, intended as a backup, came unseated from its groove because the rocket casing moved under pressure. Small wonder that engineers speak of Murphy's Law. As President (and engineer) Herbert Hoover wrote in his memoirs, failure for the engineer "is the phantasmagoria that haunts his nights and dogs his days."

Of course, failures have always been part of technological advance. When the first jet airliner, the British *Comet*, was put into service in 1952, it had been test flown for almost three years. After two crashes — one in Calcutta in 1953 and a second in the Mediterranean the following year — all of the *Comets* were grounded. After undergoing extensive modification, the fleet went back into service, and a third *Comet* promptly disintegrated in midair. Eventually the fault was found to lie in fatigue cracks in the corners of windows, a possibility that at the time seemed unthinkable in such relatively new machines. (Rounding the corners solved the problem.) The space shuttle is more than just a new machine; it is practically a new technology, and viewed in the light of history, some sort of accident was almost inevitable.

But the loss of *Challenger* differed from the *Comet* crashes, the failure of the Tacoma Narrows bridge, the collapse of the walkway at the Hyatt Regency in Kansas City, and other disasters in that a number of engineers had predicted that it might happen and strenuously objected to the launch. Morton Thiokol engineers knew that cold affected the gaskets. The evening before the flight, as temperatures dropped into the low 20s, 14 Thiokol engineers unanimously concluded that the flight should be postponed. A conference call, set up with NASA officials to discuss the problem, quickly turned confrontational.

A five-minute recess stretched to half an hour. The 14 engineers remained unshakable. "We have to make a management decision," senior vice-president Jerald Mason declared. He asked Robert Lund, Thiokol's vice-president for engineering, to "take off his

engineering hat." Subsequently Mason and Lund, along with Joseph Kilminster and Calvin Wiggins, two other Thiokol vice-presidents, approved the launch.

Much of the discussion since the event has stressed that the findings of "engineers" were overruled by the judgment of "managers." When Mason was asked what he had in mind when he told Lund to replace his engineering hat with a management hat, he said that he meant "it was going to take a judgment rather than a precise engineering calculation."

That view of engineering rings false to me. The implication that engineering consists of precise calculation, while "judgment" is left to another class of person, demeans a profession that has always stressed art, imagination, and wisdom at least as much as exactitude. There are many instances in which engineering facts can and should be isolated from business or political choices, but the launch of *Challenger* was not one of these.

The four so-called Thiokol "managers" are, in fact, engineers. Mason has a degree in aeronautical engineering, Lund and Kilminster have degrees in mechanical engineering, and Wiggins has a degree in chemistry. George Hardy and Lawrence Mulloy, the two NASA officials who urged Thiokol to approve the launch, are engineers. So are the key NASA people above them. When they moved into management, they did not thereupon cease being engineers any more than a doctor who becomes director of a hospital stops being a doctor.

Were these engineer-executives under pressure to meet a launch schedule? Of course. But pressure goes with the job. It has often been said that engineering is doing for one dollar what any darn fool can do for two — combining electronic circuits so that radios can be made cheaper and smaller, say. It might with equal truth be said that engineering is doing in one year what any darn fool can do in two. Economy and schedule are inherent to all engineering projects. Given unlimited funds and time, the shuttle's design could surely be improved, but NASA and Thiokol engineers had no reason to expect either a blank cheque or freedom from a sense of urgency. Pressure can help explain — but can never excuse — an engineering mistake.

It is also unrealistic to cry "safety first" after the fact while ignoring the imperatives that drive the space program — national defense, scientific exploration, technological progress, even such intangibles as community morale, all to be enhanced — quickly — for an affordable price. If safety were to be the overwhelmingly dominant consideration, we would never in the first place blast human beings into space on top of rockets.

All we can fairly say is that safety was and is one very important aspect of the space program. NASA long ago established numerous safety measures; the required sign-off before launch by each major shuttle subcontractor is one of the most important. Shortly before the accident, the annual report of the Aero-

In the heat of the moment, *Challenger's* managers forgot that they were engineers, too. It may have been a crucial error.

space Safety Advisory Panel expressed general satisfaction with NASA's attention to safety. The system is sound. It should have worked. Fourteen engineers at Thiokol — not just one or two who may have been unduly apprehensive — recommended that the flight be postponed. It strains belief that four top executive-engineers at Thiokol, pressured by administrator-engineers at NASA, ignored the warnings and agreed to proceed. It was bad management. It was also bad engineering.

Should the junior engineers at Thiokol have blown the whistle that night — gone outside the chain of command or otherwise publicly aired their concerns? I cannot fault them for only arguing vigorously. They had no clear evidence, only clues and uneasy feelings. And they were pleading their case not to politicians or nontechnical administrators, but rather to sophisticated engineers like themselves.

There is bitter irony here. If the Thiokol managers and NASA administrators had *not* been technical experts, I submit that they never would have dared approve the launch. For administrators or politicians to go against the consensus of a scientific discipline or a profession "is extremely hazardous," says Don K. Price, former dean of Harvard's J.F. Kennedy School of Government. In his book *The Scientific Estate*, Price speaks of a social spectrum along which are situated four "estates": scientists, professionals (including engineers), administrators, and politicians. Each has a certain power and an ability to influence the others. Politicians usually have ample room to maneuver because technical experts are so often divided in their opinions. But in the case of a questionable shuttle launch, no sane politician or administrator would go ahead without solid support from professionals.

Whatever changes occur at NASA, there will always be risk decisions to be made in the midst of uncertainty. Doubtless we will hear about new techniques of risk assessment. It is tempting, particularly after a dramatic failure, to pin one's hopes to a new methodology. A few years ago a bill was introduced in Congress that would have required all federal regulatory agencies to apply comparative risk analysis in reaching their decisions. The regulatory agencies expressed strong and unanimous opposition. Peter W. Preuss, then the top health scientist for the Consumer Product Safety Commission, stated that statistical methods clearly are useful, but "the Commission's overall approach for setting priorities is to rely on its collegial judgment rather than on any set formula."

Collegial judgment. That, to my mind, is the heart of sound engineering decision making in the area of risk. And that is what was present in the unanimity of the 14 Thiokol engineers. Perhaps the *Challenger* tragedy will help restore respect for this time-honored feature of professional practice.

The writer, a civil engineer is vice-president of Kreiser Borg Florman Construction Co.

Whistle-Blowers Face Retaliation For Their Courage

Shortly after, Allan McDonald and Roger Boisjoly, two engineers from Morton Thiokol Inc., testified publicly that they had opposed the launch of the Challenger space shuttle, the company transferred them to jobs of lesser responsibility. Although they were later reinstated, their experience demonstrated one of the hard truths of corporate and public life: employees who blow the whistle on employers run high risks.

On the basis of a study of 55 whistle-blowers in government and industry, we have concluded that arbitrary transfer is the first step in a retaliatory process that leads often to demotion and even dismissal. Management isolates dissenters so they will no longer see sensitive documents, take part in conversations with colleagues, influence policy or reveal new information. Fellow employees learn that to confront authority is to invite retaliation.

The record is particularly grim in industry: not one of the industrial whistle-blowers we studied survived on the job. The experience of government employees is more complex. Some whistle-blowers in the public sector hold on to their positions, though at great personal sacrifice. In 1969, Ernest Fitzgerald testified about huge cost overruns in the Defence Department. He was isolated, assigned new duties and ultimately dismissed. A federal court later agreed he had been improperly discharged. Mr. Fitzgerald rejoined

a fundamentally unchanged bureaucracy and continues to work under the harsh scrutiny of the department's administrators.

Other whistle-blowers, in the Interior Department, Nuclear Regulatory Commission and Federal Aviation Administration, have also endured years of punitive transfer, unemployment and litigation. Many suffered profound depression and bitterness. They feel betrayed by their superiors but continue to believe they acted appropriately to protect the public from nuclear accidents or unsafe flying conditions or the waste of huge sums of government funds.

Is there anything that can shield ethical resisters from vindictive authority? Scientists and engineers at the Environmental Protection Agency who opposed director Anne Burford and other officials were saved from reprisals by congressional investigations that forced the resignations of the top administrators. Such a shake-up, however rare, provides the best protection for challengers of the power structure. As long as the old leadership remains intact, whistle-blowers have little hope of resuming a normal work life.

How much more retaliation will the Morton Thiokol engineers face? Mr. McDonald and Mr. Boisjoly were fortunate to have had powerful allies who called public attention to their plight, including William Rogers and the investigative commission he headed. And

Mr. McDonald recently appeared before a congressional group to discuss his work in redesigning the booster rocket.

But the two engineers and others who testified about the shuttle tragedy should not be lulled into a premature sense of safety. The Challenger explosion has forced a reappraisal of the entire space program. The stakes are high, and because many of the shuttle's problems were related to the institutional structure of NASA (National Aeronautics and Space Administration) and its subcontractors, whistle-blowers who called attention to the violation of fundamental safety standards will inevitably be defined as dangerous. And as national attention recedes, those who have a stake in preserving existing arrangements can be expected to make every effort to destroy the credibility of their critics.

Mr. McDonald and Mr. Boisjoly have acted in the public interest. Their careers deserve protection. How otherwise can we expect others to come forward before another national tragedy occurs? In the past two decades we have all gained enormously from a steady stream of courageous employees who have risked their careers in the name of public safety. We cannot afford to be without them. □

This article was reprinted from the August 14 issue of the Globe and Mail.

University and CN Rail Cooperate in Bridge Research

by Glenn Morris, P. Eng.

With 2,237 timber bridges comprising 18,614 spans and a total length of 182,280 feet, CN Rail has a great interest in the efficient design of timber railway bridges. At present, the company replaces 40 to 50 bridges annually, about one-half of which are in timber, at a cost of roughly \$5 million. A research project currently underway at the University of Manitoba could significantly reduce these annual costs.

Dr. Sami Rizkalla, Civil Engineering Department, and Mr. Shakoor Uppal, Regional Engineer, Bridges and Structures, CN Rail, are studying the dynamic response of timber railway bridges traversed by trains

travelling at different speeds. Funded by an \$8,000 grant from the University of Manitoba Transport Institute, the project is part of Mr. Uppal's Ph.D. program at the University.

During July and September 1986, dynamic load tests were conducted on two of CN Rail's bridges, located approximately 25 miles north-west of Winnipeg, near Grosse Isle. One bridge was of the open deck type, while the other had a ballast deck. CN Rail provided a work train consisting of a locomotive, two open-top hopper cars loaded with ballast, and a caboose. The bridges and adjacent sections of track were instrumented to measure such data as wheel-rail contact forces, deflections, and acceleration.

Five summer students and two technicians worked at the test site. They shared a 40 foot air-conditioned truck-trailer unit with a multi-channel data acquisition system, a 5 KW regulated power supply and a number of pieces of specialized measurement equipment. Measurements were recorded during many runs of the work train at speeds ranging from a crawl, to 50 mph (80 km/hr).

The large amounts of data that were recorded have not yet been analyzed completely. However, preliminary analysis suggests the following:

(a) Factors such as track irregularities, wheel flats, hunting and rolling of trains (which are a function of speed) had a significant effect on wheel-train contact forces, dynamic load factors and deflections. In general, the dynamic load factor decreased as the speed of the train increased.

(b) The load-deflection behavior of the bridge was linear, while that of the bridge approaches and the track sections was non-linear.

(c) The ballast-deck bridge was substantially stiffer than the similar open deck one. Both bridges were stiffer than the approaches, which, in turn, were stiffer than the track sections.

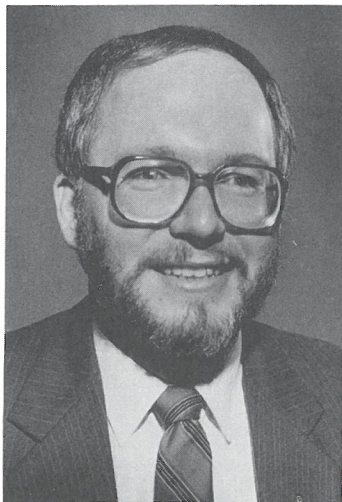
(d) Stresses in the various structural components, computed from the measured data, were smaller than anticipated.

In 1984, Dr. Rizkalla assisted the firm of Reid Crowther and Partners Limited in a similar project; a series of highly successful load tests of plate girder bridges on the Disraeli Freeway. □



Test train at bridge site near Grosse Isle, Manitoba.

October Elections Bring New Faces to



Councillor Kelly J. Kjartanson

by V. L. Dutton, P. Eng.

An experience shared by all teachers, hockey coaches, and piano teachers, to mention but three, is the satisfaction of seeing their students doing well "further along the road". The teachers at Daniel McIntyre Collegiate, and the staff of the University of Manitoba, must experience a sense of pride when they recall their former student, Kelly Kjartanson.

Kelly must be one of the youngest members of Council which should augur well for our Association. With energy appropriate to his age, Kelly is a member of the Manitoba Water and Waste Association, the American Water Works Association, and the Western Canada Water and Sewage Conference for which he has served on the Planning Committee for their last three triennial conferences in Manitoba.

Kelly is an Environmental Engineer with the Department of the Environment and Workplace Safety and Health. He is active in OPEEPM, The Organization of Professional Engineers Employed by the Province of Manitoba, in which he has served as secretary, president, and past president, and is currently the vice-president. These activities have given Kelly extensive experience with the problems of the employee-engineer which should make him a valuable Councillor in a vexatious area.

I had the pleasure of meeting Mrs. Kjartanson, Jennifer, at the President's Reception in October. A charming young woman from Ottawa, she keeps busy with their two children,

Bryan, four and Nicole, two in January. I hope she manages to find time to join Kelly in his curling and golf.

Each of us chooses how to spend our so-called leisure hours. We can be thankful that young men like Kelly have chosen to give a portion of their lives to further our interests. □

Councillor William McGilvery

by J. W. Bogan, P. Eng.

William McGilvery has recently been elected to Council to serve his first term. An interview with him prior to his first Council meeting indicated that he is concerned with the status of the employee-engineer within the Association, maintaining the standard of academic training in engineering, and making undergraduates aware of the meaning and responsibilities of the profession.

Mr. McGilvery obtained his Higher National Certificate in Mechanical Engineering from the University of Stathclyde, Scotland in 1955. That year, he decided to immigrate to Canada and gained employment with R.

M. Way and Associates, a consultant for thermal power plant design. After working with Ewbank, Tupper and Associates from 1957 to 1959, Mr. McGilvery joined Manitoba Hydro. Since registering with the Association in 1960, he has worked in project engineering, construction and mechanical design. Presently, Mr. McGilvery is the Manager of Engineering and Construction, Mechanical Department and is responsible for providing mechanical engineering services to various departments where required. He has been actively involved with the Manitoba Hydro Professional Engineers Association and served as their President from 1977 to 1978. Because of this involvement, the employee-engineer's position and status within the Association represents one of his greatest areas of concern.

Mr. McGilvery also hopes to encourage the A.P.E.M. to take a strong position of support for the Faculty of Engineering at the University of Manitoba. He feels adequate funding must be maintained to ensure a continuing high standard of academic training. Greater emphasis should

Council Reports

SEPTEMBER 15, 1986

by J.W. Bogan, P. Eng.

Council Considers a Request to Assist the Society of Engineers of M.T.S.

E. W. J. Clarke presided with G. A. DePauw, K. A. Buhr, W. R. Newton, W. D. Christie, E. A. Speers, L. A. Bateman, G. E. Laliberte, and G. W. Saunders present.

Salary Schedule Committee Recommendations

The proposed 1986 Salary Schedule curve was first introduced at the August 11th, 1986 meeting. At that meeting, after some discussion, the Salary Committee agreed to revise the curve to reflect the previous year's actual salaries plus inflation. At the September 15th, 1986 meeting, Council approved the revised salary recommendations.

Financial statements, licenses, transfers, registrations and one reinstatement were approved after a brief discussion.

Manitoba Telephone System Engineers

The Telecommunications Employees Association of Manitoba asked to represent as a bargaining agent, several hundred M.T.S. management employees, including professional engineers. At a previous Society of Engineers of M.T.S. (SEMETS) meeting, it was requested that the A.P.E.M. file an intervention on their behalf and commit financial assistance.

As a result, Mr. John S. McLeod, first Vice-President of SEMETS, attended the Council meeting as a delegation. Mr. McLeod explained SEMETS's position and requested that the A.P.E.M.: (a) define "the practice of engineering" applicable to certain positions if required by the Labour Board, and (b) provide financial support for certain legal

costs associated with Labour Board proceedings regarding "the practice of engineering".

After a lengthy discussion, Council agreed that the A.P.E.M. President should have an informal discussion with Mr. Glover Anderson, Assistant General Manager of M.T.S. to determine what course M.T.S. management are going to pursue on this matter. This discussion would help the Association decide its position and if any action would be necessary. The President was to report back to Council at its next meeting.

Act Enforcement Selection Committee

Council approved the following for the selection committee: Registrar, W. B. Mackenzie; one councillor, K. A. Buhr; two past presidents, R. A. Johnson and R. R. Foster; and a nominee from the Practice and Ethics Committee, F. M. Fowler, D. R. Grimes was nominated as an alternate member.

Continued Operating Funds

Council approved retaining \$134,000 to continue operations to December 31, 1986.

OCTOBER 14, 1986

Where Council Continues Their Attempt to Resolve the Unionization of MTS Engineers Problem

With President Ted Clarke in the chair and with all councillors except Roger Kane and Art Schwartz present, the meeting got underway at 3:30 on a pleasant fall afternoon.

After Council had dealt with and approved the monthly financial statements and applications for membership and licence, Council addressed itself to a number of current issues.

A.P.E.M. Council



William McGilvery, P. Eng.

also be placed on the meaning and responsibilities of the "Profession of Engineering" to under-graduate students.

Mr. McGilvery has served as the Chairman of the Manitoba Council of the Engineering Institute of Canada, Regional Executive President of the Canadian Society of Mechanical Engineering and Canadian Electrical Association Chairman-Elect of the Hydraulic Plant and Equipment Sub-Section.

We look forward to the con-

tributions Mr. McGilvery can make to Council and hope his ideas can be successfully implemented. □

Vancouver to Host World-Wide Assemblies

As part of the celebrations marking the Centennial of Engineering in Canada, Vancouver will host two important assemblies. The World Congress on Inshore Engineering in May 1987 will be followed by the 11th General Assembly of World Federation of Engineering Organizations.

The two day technical congress will examine the current status of engineering developments at or near the land-sea interface.

Following the congress, the CCPE and the B.C. Association will welcome delegates to the Assembly of World Federation of Engineering Organizations, an international federation of 80 engineering organizations originally sponsored by the United Nations.

Further information can be obtained from the B.C. Association at 2210 West 12th Avenue, Vancouver, B.C. V6K 2N6. □

ASSOCIATION MEMBER RECOGNIZED FOR EXCELLENCE IN TEACHING

by K. Hearson, P. Eng.

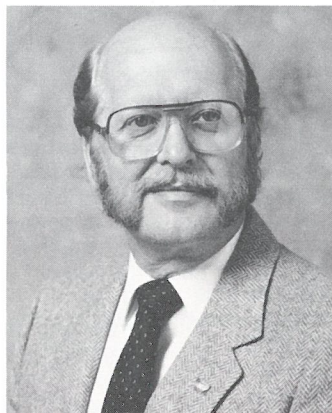
Dr. M. G. (Ron) Britton, P. Eng. has been recognized with the Saunderson Award for Excellence in Teaching. A Professor of Agricultural Engineering at the University of Manitoba, Britton was selected from among nominations solicited from the current graduating class, the graduates of the last three years, and colleagues of the nominees. A recurring observation in Britton's nomination was the high emphasis he placed on seeing each student as a person. Students commented on the ef-

fort put into learning their names, and on the willingness to meet with students outside of class to answer questions and discuss issues.

Britton joined the A.P.E.M. in 1964 and has been a past member of our Association's Board of Examiners Committee.

Licences Issued in October and November '86

G. A. Aldworth (Ont.)
H. Balodis (Ont.)
J. P. A. Bertens (Alta.)
M. Berezowski (Sask.)
N. A. Brais (Que.)
J. I. Daniels (Sask.)
B. R. Emery (Ont.)
E. C. Fok (Ont.)
R. J. Frehlich (Alta.)
A. A. Friedman (Ont.)
S. E. Hage (Alta.)
R. E. Harder (Alta.)
H. J. Hettinga (B.C.)
T. F. Hoffman (B.C.)
Z. A. Marsic (Ont.)
R. E. McCallum (Alta.)
J. R. Morris (Ont.)
H. J. Neumann (B.C.)
M. J. O'Conner (Alta.)
D. C. Pollock (Ont.)
G. C. Powell (Ont.)
B. G. Robb (Sask.)
J. T. Scarlett (Alta.)
K. W. Short (Ont.)
P. Szana (Que.)
G. W. R. Wark (Alta.)
W. C. Wong (Alta.)



Dr. M. G. Britton, P. Eng.

A.P.E.M. Appointees—University of Manitoba Faculty Council of Engineering

Pat Karras-Spangelo was appointed A.P.E.M. representative to the University of Manitoba's Faculty Council of Engineering. Vish Gupta was also appointed, subject to his acceptance.

MTS Unionization

The problems being experienced by members of the Association with the Labour Board and the attempt to force them into a union of M.T.S. employees were discussed along with a request for financial assistance to cover legal expenses. A detailed report by Mr. Clarke was considered which outlined the background of the matter. Council made no decision on the request for funds or a request for other types of assistance. They did, however, set up a watching brief monitoring committee to provide Council with information on future developments. Members of this ad hoc committee are John Adam, chairman and Councillor Bill Newton.

Professional Development Committee Requests Association-Wide Mailing

Ed Klein and Barry MacBride joined the meeting to register a request from the Professional Development Committee with Council for consideration. The P. D. committee wishes to distribute a Professional Development Reporting Form to the membership in the same mailing with the annual fee invoices. Council authorized the distribution of the form but it will be distributed with a mailing of "The Manitoba Professional Engineer".

Act Administration Officer Advertisement Decided

Council then discussed the method to be employed to advertise the position of Act Administration Officer. (The Association will take a Professional Engineer on staff for duties primarily connected with Act

enforcement). A decision was reached to advertise the position in the Winnipeg Free Press and The Engineering Digest with a deadline for receipt of applications of December 15th.

The meeting adjourned at 7:50 p.m.

OCTOBER 24, 1986

At Which Ted Speers is Elected President For The 1986/87 Term.

Immediately following the Annual General Meeting and immediately before the Association Awards Luncheon the new Council met, as required by the By-laws, to elect a new president.

Ted Clarke in his last official duty as president was in the chair and called for nominations for president. Ted Speers, Bud Christie and Garland Laliberte were nominated. Mr. Christie and Mr. Laliberte declined the nominations and Mr. Speers was elected.

Mr. Speers assumed the chair. He welcomed the two new councillors, Bill McGilvery and Kelly Kjartanson. A motion to postpone election of a vice-president and an executive member until the December Council meeting was carried unanimously. The current signing officers were retained until a vice-president was elected. The Council appointed Ted Speers as the Association's official observer to The Canadian Council of Professional Engineers.

Ted Clarke Thanked For His Excellent Leadership in the Past Year
Ostap Hawaleshka proposed a vote of thanks to outgoing president Ted Clarke and he received a standing round of applause.

The meeting adjourned at 12:00 noon and the Council members repaired to the reception for the Association's invited guests and then to the Awards Luncheon. □

FLEXIBLE AUTOMATION:

A New Challenge for Industry

by Andrew Kusiak, P. Eng.

Automation in manufacturing in the past was only considered where large quantities (mass production) were required, such as in the automotive industry and in the household appliance industries. This level of production automation could be accomplished only by transfer machines and dedicated lines of machines and then only for production of a limited variety of different parts. However, on a worldwide basis, 75 percent of all metalworking manufacture takes place in small batch production, limiting the benefits of automation.

Industrial automation has emerged from the past two decades with major changes in the technology and methods applied in production processes centering largely on development of computer controls. This transition in production is taking place on three levels of sophistication: first, by the use of stand-alone machining and turning centers with features and ancillary components to allow unattended operations for as much as one shift; second, through clusters of machines or cells producing parts in various machining combinations; and finally, flexible manufacturing systems (FMS) where a wide variety of parts can be manufactured with few or no people involved, while the system provides monitoring for correction of deviation from design requirements. The FMS concept has provided the ability to respond to product variation in lower volume production runs while remaining in a position to manufacture in a cost-effective and competitive manner.

"Through the years, technology on the shop floor has developed in a series of islands of automation...Manufacture in this conventional way...is no longer adequate to remain competitive."

Definition:**Flexible Manufacturing Technology**

Flexible manufacturing technology currently falls into three basic categories: stand-alone machines; the flexible manufacturing cell (FMC); and the flexible manufacturing system (FMS). The use of these three specific levels of flexible manufacturing technology is not intended to imply these are the only configurations in use in industry. However, the term FMS has been used to identify everything from the machining center to the unattended flexible manufacturing system. The earlier FMS were less flexible in scope and limited in control process and material handling. As more experience with current technology is gained and advances continue, a fourth category, the fully automated factory (FAF), is getting closer, albeit slowly, to a reality. FAF represents the full development of all aspects of computer integrated manufacturing (CIM), a term often used synonymously with Computer Aided Manufacturing (CAM).

How an FMS Works

While each FMS is unique in configuration and process, a general description of how an FMS might work is given. Numerical Control (NC) programs, and often computer-aided process planning, develop the sequence of production steps for each part. Then, based on inventory, order, and computer simulations of how the FMS could run most effectively, a schedule is established for parts that the FMS will produce on a given day. Next, the material and required tooling are brought from storage, either automatically or manually, and fed into the system. This is typically done by a special carrier that carries the fixture holding the part in place while it is being machined, and as a pallet for transporting the workpiece. Once loaded, the FMS essentially takes over. Robots, conveyors, or other automated material-handling devices transport the workpiece from workstation to workstation, according to the process plan. If a tool is not working, many FMS can reroute the part to other tools within the system. The essential features that constitute a workable "part family" for an FMS are common shape, size, weight, and tolerance range.

Applications

The engineering industries, and especially those subjected to strong international competition (automotive industry, computers, and telecommunications, etc.), regard systems integration as the key to survival for the 1980s. Most of the FMS operating today are in metal-cutting operations; about 75 percent of these produce prismatic (basically rectangular or cubic in shape) parts and 25 percent produce cylindrical parts. There are, however, other manufacturing processes where the FMS concept is and will be applied. These include metal forming, joining, assembling, welding, gluing, surface treatment, and non-metal manufacturing.

Benefits of FMS

The flexible manufacturing concept provides manufacturers with the ability to respond to changes in product design requirements and uncertainties of market demand. It also increases machine utilization on average by 30 percent, while reducing work-in-process inventory. FMS are able to reduce the number of machines required over conventional manufacturing, resulting in potential savings in capital spending. It provides for a reduction of leadtime, improved quality and less floor space.

Barriers to FMS

The FMS typically requires substantial initial outlays, the justification of which is often difficult. Only after a thorough review and assessment by all levels within the corporation will the direct and indirect cost savings and strategic benefits be realized. Since FMS is such a major investment, the business climate and confidence in the economy becomes a consideration in the final evaluation. Management must fully understand the FMS concept and its impact on corporate

strategy and its customers. Labor has not been a significant barrier, even though it is widely perceived that failure to automate will ultimately result in fewer jobs.

Policy Issues and Options

A company undertaking the purchase of an FMS incurs risk through a large initial dollar outlay followed by a lengthy installation period with little or no generation of a return until the system is operational. Accelerated depreciation, tax incentives, tax credits and additional support for schools where training supportive of this technology is pursued are among those actions that could be taken to offset the risk.

Through the years, technology on the shop floor has developed in a series of islands of automation, each working independently. Manufacture in this conventional way is no longer adequate for the manufacturer to remain competitive. Better control over the manufacturing process, including quality and process control, inventory management and overall system management is necessary. These islands can be united through standardization of the interface of machines and peripheral equipment. □

Engineering Student Night Dinner

Thursday, February 5th, 1987

Manitoba Branches of the Canadian Geological Society, The Canadian Society for Civil Engineering, The Canadian Society for Electrical Engineering, The Canadian Society for Engineering, The Canadian Society for Mechanical Engineering, and The Institute of Electrical and Electronics Engineers have undertaken to sponsor their Annual Engineering Student Night Dinner again in 1987.

Arrangements are presently being finalized to have a representative from Atomic Energy of Canada Limited's Whiteshell Research Establishment provide and update on what is happening at their Waste Research Laboratory, what they hope to achieve and what progress they have made.

When the details of time, place, and cost have been finalized the sponsoring committee will be contacting as many of you as is possible by mail asking for your support and attendance. Please keep this date open and be prepared to attend and sponsor a student for an evening of good food, interesting companionship, and an opportunity to be well informed and current on an important engineering subject which has potential effects on us all. If you have any questions or wish to attend please call: D. S. Simons, P. Eng., Chairman, Engineering Student Night Dinner Committee at 453-4080. □

THE PRESIDENT'S RECEPTION: Association Volunteers Offered Thanks

On Thursday, October 23rd, 1986, the evening before our Annual General Meeting, our president, Ted Clarke and his gracious wife Marnie were hosts at a wine and cheese reception at the Holiday Inn. Ted and Marnie welcomed out-of-town guests, award winners, past presidents, members of council and members of committees along with their husbands and wives to this premier Association social event.

The event is held to indicate appreciation by the Association for effort by all the Association members who take a special interest in the Association and volunteer their time instinctively. All who attended enjoyed a relaxed, pleasant evening renewing old acquaintances, making new acquaintances and partaking of a delightful variety of wines and cheeses.

Vice-President Ted Speers, on behalf of the Association, made a presentation to Marnie Clarke and expressed appreciation for the large amounts of her husband's time she had had to do without while he was attending to the business of the Association.

The convivial proceedings terminated shortly after the bar closed at 11:00 p.m. □



Presidents, Presidents, Presidents: From left to right, Past-President Doug Grimes, then President Ted Clarke, and then future President Ted Speers. Also conversing are Liz Grimes, Jean Speers, and Marnie Clarke, also from left to right.

Parking Structures Prone to Failures

The Safety in Engineering Practice Committee has recently investigated problems associated with failure by corrosion of unbonded post-tensioning tendons used in parking structures where they are exposed to road salt and prolonged wet conditions. Parking structures of all types experience difficulty in withstanding the harsh service environment which they are required to withstand. The danger peculiar to this system is that the corrosion and eventual loss of cables can take place while the structure appears to be in good condition without the telltale spalling and signs of corrosion. Moisture migrates into the cable sheaths either at anchorages or penetrating directly through the slab, often at points of least concrete cover. Rapid corrosion can occur in the cables with the salt-laden water and localized corrosion cells once started continue at an accelerated rate.

Engineers who have designed using this system are asked to contact the owners of such structures and ensure that they are checked on a regular basis.

Unfortunately, inspection and monitoring of the system is difficult and expensive since at this time it is necessary to break open the slabs and individually check cables.

Engineers contemplating designs for parking structures using this system should use caution and consider the costs of future monitoring. □

Spaniards Say Ole' to Engineers....

A gallop poll conducted in Spain shows that engineering in that country is in no danger of becoming an invisible profession.

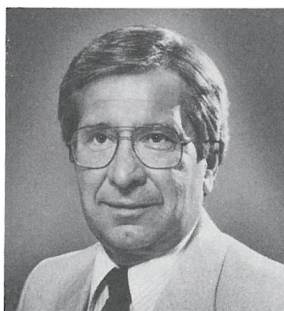
In a November 1985 public opinion poll, Spaniards ranked engineers as the most honest and moral of 21 occupation groups.

Radio correspondents and engineers were tied as the most appreciated by Spaniards with 77 points. Doctors and press correspondents, with 64 and 63 points respectively, were ranked third and fourth.

The clergy was ranked 10th with 20 points, members of parliament ranked 15th with -5 points, and real estate agents ranked last with -56 points.

Different points were assigned for ranking of very good, good, medium and so on.

However, according to comments attributed to Leon Krawczyk, P. Eng., in the May 1986 issue of the B.C. Professional Engineer, some of the rankings may be misleading because the social fabric of Spain differ from that in Canada. Mr. Krawczyk, who translated a Spanish newspaper clipping about the poll results for the B.C. Association magazine, also pointed out that the custom in Spain is to address an engineer by the title "ingeniero" in the same way Canadians use "doctor", and that this may enhance the image of the profession. □



Dr. G. E. Laliberte, P. Eng.

Laliberte Heads the C.E.A.B.

by K. Hearson, P.Eng.

Garland E. Laliberte, A.P.E.M. Council Member, is the Canadian Engineering Accreditation Board Chairman for 1986-87. Dr. Laliberte, a Professor with the Department of Agricultural Engineering at the University of Manitoba, has been a member of the C.E.A.B. since 1982.

Prior to coming to the University of Manitoba in 1967, Garland held positions at Colorado State University, Canada Dept. of Agriculture, at the University of Saskatchewan. He was elected to the A.P.E.M. Council in 1984.

Engineering Graduate Members Registered in Oct. and Nov. 1986

| | |
|-----------------|--------------|
| G. C. Cook | P. Kuffel |
| G. N. Cook | J. Paley |
| A. A. Clark | A. W. Ptak |
| P. A. Dalkie | W. R. Reimer |
| E. H. Garfinkel | J. N. Rempel |
| M. A. Harris | |

Some Christmases you never forget —
May this Christmas be one of them ...
Season's Greetings to all our members.



News from Other Associations

The Saskatchewan Association has initiated a \$5,000 per year grant to two provincial university libraries. In return, the universities granted the Association's request that members be able to borrow materials on the same basis as students and faculty.

In an attempt to predict future requirements for engineers in Saskatchewan, the Association of that province sent out a questionnaire to employers of engineers and engineering technologists. Responses projected a 2% increase in Engineering positions, and a surprising 5% increase in Technologist positions.

Representatives of the New Brunswick Association will begin making unannounced audits of plans submitted to that province's Inspection Branch, after concerns of substandard quality of engineering designs were raised. The submissions indicated a lack of acceptable knowledge of applicable codes, and in some cases were plainly beyond the competence of the designer. The Association may implement a charge for the examination of the drawings and their corrections. All members will now be aware that the Associa-

tion is playing a role in the quality control of their submissions.

The New Brunswick Association's newly-passed Engineering Profession Act, 1986, contains an enabling clause to permit the requirement for professional liability insurance.

Members of the N.W.T. Association who were part of a delegation which visited the Soviet Union in May/June of 1986 found themselves surprised numerous times. Public candor and "constructive criticism" appear to be encouraged by the present leaders. Also found surprising by delegation members were experiments to allow various companies to retain 75% of their profits to be distributed as seen fit. What was expected and found to be true is that the Soviets are behind in a number of Arctic engineering technologies.

The Nova Scotia Association, which employs a Mentor Program similar to the program Manitoba's Association has discontinued, are appealing to all members of 10 years standing or more to volunteer as a

Mentor. There is a shortage of Mentors in all areas of the province.

Registration of corporations is being considered by the B.C. Association.

The B.C. Association's Long Range Planning Committee is preparing a report on anticipated directions that engineering will take over the upcoming five, ten, and twenty year frames. They hope to anticipate possible changes in engineering and their effect on members and suggest alternative action scenarios.

The office of the Attorney General has granted a third deferment to the compulsory professional liability insurance implementation date in Ontario.

The Professional Engineers Act of Ontario now prescribes performance standards for inspection of buildings under construction.

At a Council Meeting of the B.C. Association, council members, during a "straw vote", arrived at a consensus against making continuing education mandatory for continued registrations, and also against subsidies for this.

UMA: 75 Years on the Prairies

UMA Group is an employee-owned engineering services and construction management firm begun in Saskatoon in 1911. The firm offers studies, design and construction management services in a variety of engineering disciplines from offices across Canada.

The engineering roots of UMA grow deep in the history of Manitoba and Northwestern Ontario. From its formative years, the firm has been involved in building and developing this part of Canada, beginning with sewer and water work for The Pas in 1913 when lumber was the economic mainstay. The firm's first branch office was opened in The Pas and it was home to Roy McLellan between 1928 and 1932. Today the town remains a valued client of a much-diversified UMA Group.

In the years before and after World War I, much of their work involved surveys, as both land and minerals were sought for development in Northern Manitoba. This set a tradition of involvement with that part of the province. The Mystery Lake area was first surveyed in 1913, the Flin Flon townsite in 1929 and the Thompson townsite in 1958.

During the war years of the 1940's, the firm was actively involved with the Department of National Defence in design and construction management services for air training bases at Rivers and Portage la Prairie.

In 1954, the Winnipeg Branch was established to supply engineering and survey services to Manitoba and Northwestern Ontario. Canada was undergoing rapid development by this time and community services were in demand. The firm was developing expertise in the new phenomenon of a growing Canada — subdivision development. In fact, among the first projects tackled by Winnipeg

Branch were Fort Garry and Assiniboia.

While UMA acquired broad-based experience in civil engineering projects, it was certainly not limited to this in Manitoba and Northwestern Ontario. Projects were diverse: fallout shelters for the Department of National Defence, Churchill River diversion studies on behalf of Manitoba, distilleries for Seagrams at Gimli, Monarch Industries foundry at Winkler, grain-handling facilities at Thunder Bay to mention a few.

It is the successful completion of all these diverse engineering projects that provides a proud legacy for UMA's continued growth in Manitoba.

University Scholarship and Endowment Announced: In recognition of its 75th anniversary, a major scholarship and endowment program for the engineering faculty of the University of Manitoba was announced by the Winnipeg branch of UMA Group.

Vice-president and branch manager Russ Hood said a \$1,500 scholarship will be awarded annually to an achieving student in the faculty of engineering and that the firm has also committed to the eventual provision of a permanent endowment in excess of \$50,000 for the university.

Hood made the announcement at a client reception to mark the firm's 75th anniversary. He said the scholarship was to recognize and reward engineering talent in Manitoba and to encourage achievement by engineering students at the University of Manitoba.

"We also want to support in some tangible way the educational institution that has provided many graduates, not only for our own firm but for the engineering profession in Manitoba", he said in announcing the permanent endowment. □

Winnipeg to Host Congress of Engineering Students

The University of Manitoba Engineering Society will host the Nineteenth Annual Congress of Canadian Engineering Students, Thursday, January 6 through Sunday, January 11, 1986. The Congress, to be held at the Holiday Inn Downtown, will be attended by student delegates from all engineering facilities in Canada.

A key feature of the Congress will be the noon luncheon addresses by the following outstanding keynote speakers: Wednesday, January 7 — Dr. James Stice, Director of the Teaching Effectiveness Centre, University of Texas; Thursday, January 8 — Mr. Lloyd McGinnis, P.Eng., President, Canadian Chamber of Commerce; Friday, January 9 — Captain Marc Garneau, Canada's first astronaut.

Speakers in workshops and panel discussions will include, Mr. Yvon Dupuis, President of CCPE, Ms. Claudette MacKay Lasonde, President of APEO, Dr. Martin Wedepohl, P.Eng., Dr. Carson Templeton, P.Eng., Dr. Angus Buneau, P.Eng., Mr. Ralph Bullock, P.Eng., Dr. Ken Adam, P.Eng. and Mr. William MacKenzie, P.Eng.

Members of the Association of Professional Engineers of Manitoba are cordially invited to attend any or all of the Congress Sessions. Admission to all sessions is free and luncheon tickets are \$14.00. For a Congress brochure, or to reserve luncheon tickets, please call the Dean's Office, Faculty of Engineering, University of Manitoba 474-9808. □