OR NEWSLETTER

March 1998

Operational Research Society of New Zealand (Inc.), PO Box 6544, Wellesley St, Auckland or PO Box 904, Wellington, New Zealand *http:// www.esc.auckland.ac.nz/Organisations/ORSNZ/*

EDITORIAL

Well, here is first issue of the newsletter from your new editorial team. An era has ended, Hans Daellenbach has stepped down, and a new editorial team has taken over. Bob Cavana, John George and I are sharing the editorial role, with Tricia Lapham handling the production management side. If it does indeed appear on your desk in March, it will be largely thanks to Hans' clear guidance and good example. If not, then bear in mind we're on the steep part of the learning curve, and it's been a hectic time of year for us with university starting (though thankfully the team is Wellington-based and we haven't had an energy crisis to contend with).

We have a hard act to follow. The mere fact that it takes 4 of us to replace Hans should be the highest accolade in itself. To maintain the strict schedule of 4 issues per year, that he established and adhered to, will be our goal. We hope to carry on much as he did, with a few innovations as time goes by. Stay tuned.

So what stays the same? Our eagerness to accept your articles. These can be emailed to any one of us, though we would prefer that you email them direct to Tricia. When I drafted this editorial in February, I noted tongue-in-cheek that we were "overwhelmed by the flood of material coming our way". Consequently we planned on a 12 page newsletter. Since then, reports have indeed flowed in, so we have rapidly had to alter the format as well as this editorial to applaud all you eager readers for your contributions. This is what I mean by the learning curve: next time we'll leave writing the editorial till later. Since we do not have the same high profile as Hans, we wondered whether it might be appropriate to introduce ourselves to our readers. But we will leave that for a future newsletter when we are short of copy . . . that should be an incentive for you to contribute!

The lead article in this issue comes from the UK Operational Research Society, featuring Patrick Blackett, the "father of OR". We also include an interview with 1998 ORSNZ Visiting Lecturer, Professor Ed Silver from the University of Calgary - that was sent between powercuts by our Auckland correspondents; and an article on the Theory of Constraints. So read on and we hope you enjoy and are stimulated to put pen to paper or digit to keyboard. Our email address is listed at the foot of the page: we welcome your contributions.

Vicky Mabin

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Publication dates: March, June, September, December
Deadline for submissions: on the 15th of February, May, August, November (for following month's issue)
Send submissions by email to Production Manager, *Tricia.Lapham@vuw.ac.nz*

BLACKETT CENTENARY

18th November 1997, the date of this year's Blackett Memorial Lecture, marks the centenary of the birth of Patrick Blackett. *Nigel Cummings* describes this remarkable man's career*

The Father of OR

In 1997 the annual Blackett lecture carries an added significance in view of the fact that it takes place exactly 100 years after the birth of Patrick Maynard Stuart Blackett (later Lord Blackett) who was born on 18 November 1897.

We know Blackett as the man who made an outstanding contribution to OR, though he did not invent the subject, and the man who together with his writings on Operational Research provided vital elements in its successful transfer to civilian life.

However, it is doubtless important to remember how he first achieved eminence in science in order to place his life in perspective.

Blackett's first calling was for the navy. He trained as a regular officer at Dartmouth (1912) and started his career as a naval cadet (1914), taking part, during the First World War, in the battles of Falkland Islands and Jutland. At the end of the war he resigned with the rank of Lieutenant, and began studying physics under Lord Rutherford at Cambridge.

His BA degree followed in 1921 shortly after this time he commenced research with cloud chambers which resulted, in 1924, in the first photographs of the transmutation of nitrogen into an oxygen isotope. During 1924-1925 he worked at Gottingen with James Franck, and then he returned to Cambridge, and in 1932, together with a young Italian scientist, GPS Occhialini, he designed the counter-controlled cloud chamber, a brilliant invention by which they managed to take photographs of cosmic rays.

Blackett became Professor at Birkbeck College, London, in 1933, and continued his cosmic ray research work. In 1935 he was appointed to the Tizard Committee which made a decision to concentrate on the development of radar as the primary means of air defence. In 1937 he succeeded Sir Lawrence Bragg at Manchester University, Bragg himself having succeeded Rutherford there; his school of cosmic research work continued to develop, and since the war the Manchester laboratory had extended its field of activity, into that of the radar investigation of meteor trails under Dr. Lovell.

OR Group

At the start of World War II, Blackett joined the Instrument Section of the Royal Aircraft Establishment. Early in 1940 he became Scientific Advisor to Air Marshall Joubert at Coastal Command, and started the analytical study of the anti U-boat war. By August of that year the Operational Research Group was established in Anti-Aircraft Command, and Blackett was put in charge of it. In January 1942 he became Director of Naval Operational Research.

Blackett's most famous achievements at this time related to the anti-submarine war, particularly concerning the tactics associated with aircraft attack, and the size of convoys. His pragmatism and delivery of simple solutions belied the fact that the route to arriving at such conclusions required inspiration, careful testing of hypotheses and innumerable man-hours of research.

After the war was over Blackett resumed studies of cosmic rays at the University of Manchester: in particular on the further study of cosmic ray particles by the counter-controlled cloud chamber in a strong magnetic field, built and used before the War. In 1948 Blackett followed up speculations about the isotropy of cosmic rays and began speculating on the origin of the interstellar magnetic fields, and in so doing revived interest in some 30-year old speculations of Schuster and H A Wilson, and others, on the origin of the magnetic fields of the earth and sun. Although these speculations are not now considered as likely to be valid, they led him to take an interest in the history of the earth's magnetic field, and so to the newly born subject of the study of rock magnetism.

Blackett (centre front row) at Manchester University in 1947

Considerable accomplishments

It can be argued that Blackett's *real* achievement was to alter the meaning of the words "scientific adviser". It no longer simply meant "advisor on the use and development of scientific devices"; it now included scientific advice on matters of strategy and tactics.

The essential features which Blackett saw in Operational Research can be explained in his own words. In October 1941 he wrote a Report on Operational Research which can be considered as the canonical statement in which its birth was announced. Regarding the employment of scientists at the operational level Blackett said:

> "The object of having scientists in close touch with operations is to enable operational staffs to obtain scientific advice on those matters which are not handled by the service technical establishments .. Operational staff provide the scientists with the operational outlook and data. The scientists apply scientific methods of analysis to this data, and are thus able to give useful advice. The main field of their activity is clearly the analysis of actual operations, using as data the material to be found in an operating room, e.g. all signals, track charts, combat reports, meteorological information, etc. . . ."

Regarding the schedule of typical operational research he had this to say:

> "The records of some war operations (e.g. air attacks on U-boats for the previous six months) are taken as the data. These are analysed as quantitatively as possible, and the results achieved are 'explained' in the scientific sense, i.e. brought into numerical relation with the operational facts and the known performance of the weapon used. When this has been done, consideration is given to possible modification of the tactics to improve the operational results."
>
> "The first step, that of collecting the actual data, is by itself of enormous importance, for it is not uncommon for operational staffs to be unacquainted with what is actually being achieved. An Operational Research Section is not in general concerned with 'hot news' though they should be prepared to so concern themselves if specifically requested to do so."

One of the most successful features in Blackett's proposals during the war concerned his emphasis on the importance of collecting actual data and monitoring, as precisely as possible, whether particular courses of action were in fact bringing about the desired effects. An exemplar of this came at the end of 1942. At this time pilots were dropping depth charges on surfaced U-boats and were claiming considerable accuracy in their aiming. But the reality presented a somewhat different picture, as evidence accrued from various sources seemed to indicate that very few U-boats were actually being sunk.

At this time air staff debated whether it would be better to utilise larger depth charges, weighing 600 lb. instead of the standard 250 lb., or to go for a larger number of smaller 100 lb. charges, which some people argued would make it impossible for the U-boat to escape by a lucky chance of being located mid-way between two explosions.

Blackett insisted the first thing to do was to discover the true facts. He felt the only way to do this was to fit rear-facing cameras, which would actually photograph the positions of the depth charge explosions in relation to a submarine. As soon as camera-equipped charges were employed, several interesting facts emerged. Firstly, the accuracy of attack on visible targets was much lower than the pilots had claimed; secondly, when U-boats succeeded in diving before the aircraft reached bombing position, the accuracy became even worse; and thirdly, pilots tended to make too great an allowance for the forward movement of their target during the period of fall of their depth charges.

Following on from these observations Blackett recommended pilots make no aim off for the forward movements, and for a change in the setting of the depth charge so that it would be more effective against vessels still on or very near the surface. He also stressed the importance of employing a more powerful explosive filling. When all these steps were implemented the percentage of visible U-boats attacked which were actually sunk rose from a likely 2 or 3% to nearly 20%. This was not enough it seems, as monitoring of all aspects of the factual situations occurring during the attacks continued, and by the end of the war the "lethality of attacks on surface U-boats" had been brought up to over 45 percent - this high figure effectively ruled out those U-boats which had not been fitted with the Schnorkel device. (an invention which allowed them to remain submerged whilst recharging their batteries.)

With the benefit of this and much other experience behind him, in May 1943 Blackett wrote what is regarded as one of the basic discussions of the methods to be followed in Operational Research. Two different approaches were described, the *a priori* method and the variational method. Regarding the *a priori* method, Blackett said:

> "One possible method of procedure is to attempt to find general solutions to certain rather arbitrarily simplified problems . . . The procedure is to select, out of the numerous variables of a real operation of war, certain important ones which are particularly suitable for quantitative treatment, and to ignore the rest. Differential equations are then formed and solutions obtained."

Of the variational method he had this to say:

> "Another method of attack is to abandon the attempt to construct from 'first principles' a complete imaginary operation something like the real one under investigation, and to replace it by the attempt to find, both by experimental and by analytical methods, how a real operation would be altered if certain of the variables, e.g. the tactics employed or properties of the weapons used, were varied."
>
> "The result of any operation of war is denoted by quantities Y1, Y2 etc., called the yields. Then these yields must be considered as functions of a large number of operational parameters or variables X1, X2, ...,Xn. Some of these can be given a quantitative measure but some can only be expressed qualitatively. An attempt to find the form of such a function:
>
> $$Y = F(X1, \ldots, Xn)$$
>
> from first principles is, in general, of limited value, owing to the complexity of the problem and the non-quantitative nature of many of the variables."
>
> "The common-sense procedure is to use the result Y of some past operation under known conditions to predict the result Y' of a future operation under new conditions . . ."

Summary

Blackett was awarded the Royal Medal by the Royal Society in 1940 and the American Medal for Merit, for Operational Research work in connection with the U-boat campaign, in 1946. He was awarded the Nobel Prize for Physics in 1948 for his development of the Wilson cloud chamber method, and his discoveries with or in addition to that in the fields of nuclear physics and cosmic radiation. He was the author of numerous books which include Military and Political Consequences of Atomic Energy (1948), Fear, War and the Bomb (1949) and Atomic Weapons and East-West Relations (1956).

The 1950's saw his appointment as Head of the Physics Department of the Imperial College of Science and Technology, London. He retired in July 1963, and then continued at the Imperial College as Professor of Physics and Pro-Rector.

Although the post-war development of operational research owed so much to Blackett's wartime work, he personally played little part in its development. The reasons for this are not fully understood, but his energies often engaged him in the development of new scientific interests.

In his later years he identified a tendency towards the excessive use of complex mathematics in Post War Operational Research, which he feared obscured the real issues. He also expressed concerns about the development of Operational Research as yet another discipline or *scientific closed shop*. Irrespective of these concerns Blackett maintained contact with the subject and the Society for the rest of his life, to the extent that he was regularly sourced for advice. Blackett died in 1974.

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NEWS IN BRIEF

* Peter Checkland, an ORS member has been honoured with a Gold Medal Award by UK Systems Society

* OR e-newsletter for UK ORS can now be found at: http://www.orsoc.org.uk

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  OR-Objects is a library of Java™ classes for developing Operations Research applications. The purpose of OR-Objects is to provide a foundation of reusable software to speed the development of OR applications and make them more reliable.

  OR-Links is a collection of links to Operations Research resources on the World-Wide-Web. OR-Links is designed to be an educational resource for those new to the field and provide a convenient reference for seasoned Operations Researchers.

TREASURY NEWS

You will by now have received your subscriptions request for the 1997/98 year. Please return these promptly, even if you have nothing to pay, as this allows us to keep our database up to date. We also need to know if you wish to maintain your subscription to the APJOR journal; this has now been replaced with the ORSNZ Conference Proceedings, so personal APJOR subscriptions cost extra. We are also requesting your authorisation to publish your name and details on our Web list. I've tried to make the form quick and easy, so please post it off promptly.

Thanks

Andrew Mason
Treasurer

THEORY OF CONSTRAINTS (TOC): BARRIERS REAL AND IMAGINARY

Vicky Mabin and Steve Balderstone, School of Business and Public Management, Victoria University of Wellington.

Since the Theory of Constraints (TOC) stream at APORS, we have had many comments and enquiries about TOC. Also we have searched the literature on TOC over the last 16 months, and it seems timely to report on some of the issues raised by colleagues and the literature.

Since its roots 20 years ago as a manufacturing scheduling method, the TOC methodology has come a long way. The basis philosophy behind the TOC is that the performance of any system is limited by its constraints: in order to improve the system, one must improve the performance of the constraint(s). The analogy of the weakest link in a chain is often used for the constraint. As well as the general area of operations management, TOC has been extended to consider the project management, accounting issues, and other application areas such as marketing and distribution. Recent developments in TOC provide a general framework for problem solving - a systems methodology - and this aspect in particular has much relevance to OR/MS. In addition to this, it has a credible track record of practical results.

However there are significant barriers - some real, some merely in perception - for those attempting to understand and use TOC for the first time, and this article attempts to examine some of these barriers.

The first thing people usually comment on is the terminology. Every professional field has its own terminology - TOC is no different, though some of the terminology is perhaps more obscure. Some of the terms derive from Biblical sources, such as Jonah, the reluctant prophet-cum-physics professor in The Goal; or legends, such as the surname of the hero, Rogo, in The Goal; or from other books, such as the notion of evaporating clouds (from Richard Bach's Illusions); or from Eli Goldratt's own culture or physics training. And as for clouds, trees and bananas? our experience suggests that this special terminology adds a touch of colour and humour especially in the classroom!

Then there is the technical jargon: which has been necessary to formalise and develop the theoretical underpinnings of the methodology to a point where it can be generalised and taught to others. The basic elements are present way back in Goldratt's early books, but have been captured and refined by teams of Goldratt's colleagues. Those trained in the terminology can communicate quickly and easily yet precisely, with each other. It's the equivalent of mathematical theorems.

However, some of the eclectic terminology chosen by Goldratt has caused confusion unnecessarily. The title of the field itself is one example: the term "Theory of Constraints" is probably the most correct, though the term "Constraint Management" is preferred by many users of TOC.Another example is in Goldratt's definition of the term "throughput". The accounting profession knows sales revenue less total variable costs equals contribution margin. Goldratt chose to label contribution margin as "throughput". There is no conceptual difference in the two labels. However, Goldratt emphasises that sales revenue should comprise actual revenue for goods actually sold; not those sitting in a warehouse or distribution channel. It is also unfortunate that "throughput time" is known to operations manager to mean the same thing as lead time. Thus, further confusion is created.

TOC is still regarded in many quarters as a radical methodology, and has yet to achieve common acceptance. Thus, the language of the methodology is not ingrained in our everyday dialogue, as is the case with more established approaches. Let's consider the example of one of the labels, for a component of TOC's problem structuring methodology. "Trees" as a label, may not relate a credible approach that can be easily accepted by those new to the methodology. In contrast, the decision "tree" label used for years within decision analysis is readily accepted, and does not seem to be regarded as waffly at all. Colin Eden, who developed SODA, preferred to call his diagrams "cognitive maps". The term cognitive map was first used by Tolman (1948) and has been widely used since then by researchers in a wide variety of disciplines. A definition of Eden's cognitive maps (Rosenhead 1989:27) indicated that conceptually they are similar to Goldratt's diagrammatic representations. Maybe Goldratt would have experienced less resistance if he had used Tolman's term as did Eden. Many examples of TOC trees and clouds can be found in Noreen, Smith and Mackey (1995).

TOC is still in its infancy and is developing fast. People within the TOC circle are aware of the problems of terminology, and are seeking to make the methods available and reliable (i.e. conceptually fail-safe) for those without the in-depth knowledge. Already there are signs of newer developments (such as Dettmer's term "Conflict Resolution Diagram" instead of "Evaporating Cloud") that promise to be far easier for newcomers to use. Hopefully the terminology is just a function of the state of development of TOC. If you find it too off-putting now, maybe you'll have to wait till it becomes available for the mass market like LP on spreadsheets, or invent names that you find more acceptable.

A paradox for the TOC methodology is that it can be both naively simple and rather hard to understand. The basic tenets can be stated very simply, and indeed the popular novels, The Goal, It's Not Luck and Critical Chain, appear to be amazingly simple. But this belies the complexity and rigour of the inherent systems methodology, including the so-called Thinking Processes, and the Categories of Legitimate Reservation, that underpins them. These can be frightening terms, but they provide us with a remarkable sensible set of guidelines for ensuring that cause and effect assumptions, and our deductions that stem from them, are valid. Moreover, they also give us guidelines on how to question other people's assumptions and deductions in a non-threatening, constructive way. The Appendix to Noreen et al (1995) provides an excellent introduction to the entire Thinking Processes.

To us, one of the most attractive things about the TOC methods is that if they serve a functionalist paradigm, they strive for win-win solutions. For example, with regard to EOQ's, TOC provides a methodology for surfacing the assumptions underlying the trade-off, and providing a number of win-win solutions, including (and providing a rationale for) those discovered by JIT and TQM. See Goldratt (1990b). Compromise is almost always thought of as sub-optimality, and is most often avoidable. It can be frightening to realise that so much of OR/MS involves trade-offs or constrained optimisations that are in fact compromises.

People are sometimes suspicious of the fervour with which people speak of TOC. People only speak in such a way when something has had a remarkable effect on them personally. One of the first organisations to use TOC (or OPT as it was then) in New Zealand, became a hotbed of enthusiasm for the method, even though the implementation was far from complete or classic. Why? Because it gave them results no other method had produced, and helped them perform far better than the majority of firms in their industry (Mabin and Alvos, 1990).

TOC - perhaps like MCDM - often tells a manager something which seems obvious after the event but which was not obvious before. This aids implementation but perhaps makes it more difficult to demonstrate the skills that are required to apply it properly.

We find it hard to hide our enthusiasm, and recognise that excessive enthusiasm can stifle objectivity. But we much also be aware that objectivity can be defined as "the group

think that won". We have tried to achieve a balance between enthusiasm and objectivity; as well as a balance between TOC and other OR/MS methods (Mabin and Gibson, 1998; Mabin, 1997). But sometimes TOC has made us challenge our ways of thinking based on our respective OR/MS and accounting training, e.g. on EOQ's, LP, multi-criteria decision making, and transfer pricing. In each of these areas it can bring new insights, and it would behove us to examine the TOC methodology enough to reexamine our other OR/MS tools in light of this new methodology.

Some people seem wary of attending training courses in case they get indoctrinated, a view expressed by Petty (1997) and which we have shared in the past. So why should one attend the training programmes at all? The reason is that much of the material is not readily available in the public arena, and one really benefits from first hand instruction to speed up the learning process. Published material on TOC mirrors the state of TOC as a fast developing methodology. Goldratt's own books tend to be either discursive, (Goldratt, 1990a and 1990b), or written in novel form (Goldratt, 1992, 1994, 1997). Dettmer's (1997) book is excellent, but not for a beginner. Good overviews are, however, provided by Noreen, Smith and Mackey, (1995) - especially the Appendix; Finch and Luebbe, (1995); Simatupang et al (1997); and Balderstone (1998). Training courses include one day Management Skills Workshops, courses on specific applications such as project management, and the "Jonah programme". Whilst the cost of this training/reward is considerable for industrial people, for academics, Jonah training, and many of the other courses run by the Goldratt Institute are practically free. (Contact the AGI or us for more info.)

And now, what you've all been waiting for, the results of applying TOC. This is what initially drew Vicky to look at TOC (or OPT as it was then), and Steve to explore this topic. We have updated our literature search on TOC, which provides considerable further evidence of the beneficial results of TOC. There is a significant trend evident in the data. The nature of the organisations applying TOC has changed since the early years of its development. Early applications tended to be in reasonably obscure medium sized US manufacturing organisations. More recent applications include industry giants such as General Motors, Ford Motor Company, and Proctor and Gamble. This trend indicates a greater acceptance of TOC as a viable management methodology. A brief summary of results of TOC applications is presented below. A cursory examination of these results will explain in part the enthusiasm many academics and practitioners have for this 20 year old management philosophy. We hope this will whet your appetite and encourage you to explore this methodology further.

A summary of results of some applications of the Theory of Constraints:

Date	Authors	Organisation	Results
1991	Reimer	Valmont/ALS	Net profit increase 600% over 4 yrs. cashflow increase 60%, due date performance increased 20%, scrap reduced 15%.
1994	Gardiner, Blackstone, Gardiner	Proctor and Gamble	US$600 million saved in operating expenses.
1995	Adelman	Hannah's Donut Shop	Retail sales increased 55%, wholesale sales increased 67% total revenue increase 61%, profit increased 47%.
1997	AGI and Company Motors	Ford Motor (Electric Division)	Lead time decreased from 8.5 days to 1 day, customer satisfaction increased by 75%,responsiveness to customers increased 300%,floors space increased 20%, investment decreased 25%, material handling and tracking decrease 50%. scheduling process decreased from16 to 1 day, operating expenses decrease US$100 million.
1997	APICS and Wall Street Journal	General Motors USA	Offer any car in their range within 24 hours, to customers exact specifications, to any dealership in continental.Lead time reduced from 8-12 week to 1 day. Reduced distribution costs.
1997	Stadnyckyj	P.G.Bell	Sales increased 62%, profits increased 134%, work shifts reduced from 1.8 to 1 shift per day. Lead time reduced.

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1998 ORSNZ Visiting Lecturer: Professor Edward A. Silver

Shane Henderson, Department of Engineering Science, University of Auckland.

Professor Edward A. Silver is the 1998 ORSNZ visiting lecturer. He gave two talks at the University of Auckland on his way to the University of Canterbury, where he will hold a Visiting Erskine Fellowship for 5 weeks starting March 2. He will be speaking to the Wgtn Branch on March 30th.

Dr. Silver is a Professor and the Carma Chair in Operations Management at the University of Calgary, Canada. He has a Science Doctorate in Operations Research from MIT, and following 4 years with the international management consulting firm, Arthur D. Little Inc. , spent 12 years as a faculty member at the University of Waterloo. He has consulted and provided executive training for numerous organisations on topics including inventory management, business process improvement, production planning, and the use of quantitative modelling to aid in decision making. He has had over 120 articles published in professional journals. He is the past president of the Canadian Operational Research Society and the International Society for Inventory Research.

SGH: *How did your interest in OR and Operations Management (OM) arise?*
EAS: I was always interested in using mathematics in an applied way. I always liked numerical things, and I was looking for an area where they could be applied to real-world problems. While at McGill as an undergraduate, two events stood out. I took a non-credit course in OR, and also I attended a Summer camp with a friend who often talked about OR. These two events were enough to switch my focus from civil engineering. Then, when I joined the business school at Calgary, it became clear that from the standpoint of business students, the OM perspective was more relevant than the OR perspective.

SGH: *You worked for 4 years for Arthur D. Little Inc. What motivated your switch to academia?*
EAS: Let's back up. I became interested in research and teaching while at university, but I saw that many faculty members had little or no real world experience. I felt strongly that I needed some real experience before entering academia. The real question was how long I would stay with Arthur D. Little Inc. There were two triggers that brought me back. First, we started to repeat things over and over. We tended to "firefight"problems, rather than getting to the root causes. Second, the people who successfully rose within the company were those who specialised more in marketing of studies, and management of people, rather than those more interested in the execution and technical aspects of the projects. I should say that my consulting experience has proved invaluable throughout my teaching career as a source of examples. It has also been an excellent source of research problems.

SGH: *Where are the main research challenges in OM today?*
EAS: One of them is focussing back more on the interdisciplinary perspective, whether it's just OM and marketing, or the original OR principle of a multidisciplinary approach to complex problems. I think we've moved away from this over the years, and the main reason is related to the way faculty members are evaluated. There is typically a large degree of risk associated with multidisciplinary projects, and if the project is unsuccessful, well. . . .

SGH: *What organisations could most benefit from the use of OR/OM approaches that have not yet bought into the idea?*
EAS: Our own university!

SGH: *How do you view the roles of business, engineering, and math schools in OR research and education?*
EAS: The audience and audience interests differ in each type of institution. Business schools should primarily be involved in making future managers aware of the power and availability of OR methodology. I believe that business schools should emphasise applications, and the problem solving approach. Engineering is perhaps closest to consulting, in that engineers often adapt new scientific concepts and algorithms to practical problems. I see engineers as "interpreters" of theory. Mathematical schools should focus more on methodological issues and the mathematical underpinnings of OR.

SGH: *It has been said that there is a trend towards teaching "soft OR" at the expense of "hard OR" in business schools. Is this a fair assessment? If so, why is it happening, and what are its major implications?*
EAS: I believe that a business school should familiarise students with the power of OR techniques, but not get into mathematical details such as how algorithms work. With such a goal in mind, it is far more effective to focus on modelling and example applications, than to discuss algorithm details. My colleague at the University of Calgary, Tom Grossman has recently redesigned an introductory management science course to reflect these principles. The course motivates the use of OR techniques through the discussion of actual problems of interest to managers. Spreadsheets are used extensively in calculations, e.g., in solving linear programs. The students also do a project on the application of modelling methodology to a problem in a local organisation. Since these changes, we have seen increases in the number of students enrolled in our follow-on electives, and student evaluations of the course clearly demonstrate that the students appreciate the new approach.

SGH: *What do you believe is the ideal OR curriculum in a business school?*
EAS: I'd have to answer that question in the context of the University of Calgary. I believe that the introductory course that Tom Grossman has developed is excellent. Students need strong motivation for OR methods, and this is provided by real-world cases. Toy problems from textbooks don't have the same effect. I believe that sequential decision making under uncertainty, and the value of information, are extremely useful concepts. Courses that help students to think in these terms are of great value. It is also important for students to appreciate the impact that uncertainty has on decision making. Perhaps an introductory course on simulation. I'd like to comment on one in particular. It is a capstone field investigation where the students are formed into teams and each team does a major project for a downtown organisation on some aspect of OM. We have no other OR electives as such. All our other electives arise from the operations management courses.

SGH: *Some believe that OR in North America is too theoretical. What do you think?*
EAS: I agree with some aspects of this comment, but you cannot categorically say this. OR, by its very nature, relies on both real problems and theoretical work. In terms of my own research philosophy, much of my research is based on real problems that I encounter. I believe balance is the key.

POSITION WANTED

Dr. Vladimir Krichtal
52 Tremewan St, Tawa, Wellington, New Zealand
Phone: 04-232-9806; Fax: 04-232-9802; Email: Vladimir.K@xtra.co.nz

Employment objectives: Operations Research

* Strong experience in mathematical modelling in economy, agriculture and finance.
* Main interest: dynamic models of economy, theory of production function, differential equations, problems of mathematical programming, numerical methods.
* 19 years of experience in creation of applied software.
* High education in Physics, Mathematics, Statistics, System Analysis, Operation Research.

NEWS FROM AUCKLAND

As term approaches at Auckland University, it's time to put aside our research projects and prepare for another year of teaching. Andy Philpott is able to avoid all this; he's currently on leave, visiting Eddie Anderson at the Australian Graduate School of Management, University of New South Wales. Andy recently attended the Australia and New Zealand Industrial and Applied Mathematics meeting in Coolangatta. This has an OR stream, but unfortunately there were very few OR papers presented. This conference is to be held in Auckland in February 2000, and we expect a strong OR representation there.

We welcome the return to Auckland of Dr Shane Henderson. Shane completed his PhD at Stanford University, and is taking two years leave from a position at the University of Michigan to study yacht racing (as well as more serious stochastic pursuits). He will be making a valuable contribution to our teaching this year. (He's already earned a place in my heart for helping with the marking in our big OR course - 500 students a year make a lot of scripts!) and he's already helping the ORSM - see his interview with Professor Edward Silver. Professor Silver is the 1998 ORSNZ visitor, and will be visiting Wellington and Christchurch with financial support from your subscriptions. He opened his seminar series with a very interesting talk on "Suggested Heuristic Approaches for Dealing with Probabilistic, Combinatorial Decision Problems", and will also be talking on "Continuous Process Improvement and its Relationship to OR". His first talk has already stimulated new ideas in our work with Voice Technology on Call Centre management; the ideas are also useful for handling the uncertainty in our Customs rostering work.

Most of you will know that this year's conference is at Auckland. We have a well established team working to ensure this year's conference at Auckland meets the high standards set by the 1996 Christchurch team. Further information on the conference is included with this newsletter. I look forward to seeing you in August.

Andrew Mason
University of Auckland

MAINLAND NEWS

With the recent departure of John George to PHB Asia Pacific in Wellington along with Bruce Lamar leaving in August last year, life for the OR side of the Management Department has been very busy. The process of deciding on new appointments is well underway. The up side to all this is that we do get to meet some interesting OR people and have some interesting OR seminars. Currently we have two positions in Operations Research and another newly created position in Services and Operations Management. All positions have now closed, so watch this space for information on our new arrivals!

In other news, Tristram Scott successfully defended his PhD in December and has now been accepted. Tristram's thesis is entitled "Hydro Reservoir Management for an Electricity Market with Long-Term Contracts". This thesis deals with the management of a mixed hydro-thermal system in a competitive electricity market. He is now working as a Research Associate for the Energy Modelling Research Group. Ed Silver has also arrived in Christchurch and we are looking forward to his seminars and his input over the next few weeks.

Ross James
University of Canterbury

MEETINGS CALENDAR FOR 1998 AND BEYOND

INFORMS/CORS Montreal Spring 1998 Meeting: 26 - 29 April 1998
Queen Elizabeth Bonaventura Hilton, Montreal, Canada
General Chair: Paul Mireault, Ecole des Hautes Etudes Commerciales, 5255 Avenud Decelles, Montreal, Quebec
Paul.Mireault@HEC.CA

3rd Int. Conference on Multiple Objective Programming and Goal Programming: 31 May - 3 June 1998, Quebec City, Canada
Information: Jean-Marc Martel, University Laval, Sainte-Foy, Quebex, G1K 7P4, Canada
jean-marc.martel@fsa.ulaval.ca

XIV Int. Conference on MDCM: 8 - 12 June 1998
University of Virginia, Charlottesville
Chair: Yacov Y. Haimes, University of Virginia
mcdm98@virginia.edu
http://www.virginia.edu/~risk/mdcm98.html

INFORMS Israel International Meeting 1998: 28 June - 1 July 1998
Chair: Jacob Hornik, Tel Aviv University, Recanati Grad. School of Mgt., Ramat Aviv 69978, Israel

EURO XVI: 12 - 15 July 1998, Brussels, Belgium
Contact: Jacques Tegham
euro@mathro.fpms.ac.be.

3rd Int. Conference on Systems Science And Systems Engineering: 25- 28 August 1998, Beijing
Contact: Prof. Jian Chen, School of Economics and Management, Tsinghua University, 100084, Beijing, China
jchen@mail.tsinghua.edu.cn

OR40: 8 - 10 September 1998, Lancaster, UK
Information: Operational Research Society, 12 Edward Street, Birmingham B1 2RX, UK.
email@orsoc.org.uk
http://www.orsoc.org.uk
Deadline for paper submissions is mid-March 1998

4th Annual Australia New Zealand Systems Conference: 7 - 10 October 1998
University of Western Sydney, Hawkesbury, NSW, Australia
email: *g.wallace@uws.edu.au*

INFORMS Seattle Fall 1998 Meeting: 25 - 28 October 1998, Seattle: Washington
Chair: Marisa Altchuler, Boeing Computer Services, P.O. Box 24346 M/S 7A TH, Seattle WA 98124-0346
marisa.altschul@boeing.com

Int. Conference On Nonlinear Programming and Variational Inequalities: 15 - 18 December 1998, Hong Kong
Contact: *maopt@cityu.edu.hk* or *http://www.cityu.edu.hk/ma*

INFORMS Cincinatti Spring 1999 Meeting: 2 - 5 May 1999
Chair: David F. Rogers, University of Cincinnati, Ohio, 45221-0210, USA
david.rogers@uc.edu

IFORS'99 Beijing: 16 - 20 August 1999, Friendship Hotel, Beijing, China
Contact: Ms Loretta Peregrina, IFORS Secretariat, Richard Ivey School of Business
University of Western Ontario, London, Canada N6A 2K7
IFORS@Ivey.uwo.ca
Deadline for electronic submission of abstracts: December 31, 1998
Follow instructions on *http://www.IFORS.org/leaflet/triennial.html*
or *IFORS@Ivey.uwo.ca*, subject: HELP ABSTRACT
Abstract fee (non-refundable) payable by December 31, 1998: US$100
IFORS OR in development prize: contact Dr Elise Del Rosario, *elisear@sanmiguel.com.ph*

Application for Membership

This form should be filled out and sent to:

Membership Secretary
ORSNZ
P O Box 6544
Wellesley St
Auckland
NEW ZEALAND
Fax: +64 9 3737468

If you have any queries, Email: a.mason@auckland.ac.nz

Please enrol me as a member of the Operational Research Society of New Zealand, at the membership grade indicated below. I enclose the following fees.

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Newsletter Only (Libraries)	$15
Conference Proceedings	$20

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Name of Instructor or Head of Department _____

Date _____
