ORSNZ NEWSLETTER

September 2002

A Beautiful Yet Tortured Mind

By Nigel Cummings, ORSOC

Recently, Hollywood released a film based on the life of mathematician John F. Nash, a mathematician whose work on games theory has contributed much to Operational Research.

John F. Nash

John F. Nash was born on June 13, 1928 in Bluefield, West Virginia, USA, A sister, Martha, was born about two and a half years later on November 16, 1930. Nash was described as solitary and introverted as a child, he developed an interest in books whilst still very young, but showed little interest in playing with other children.

His father was an electrical engineer and had come to Bluefield to work for the electrical utility company there that was and is the Appalachian Electric Power Company. He was a veteran of WW1 and had served in France as a lieutenant in the supply services and consequently had not been in actual front lines combat in the war. He was originally from Texas and had obtained his B.S. degree in electrical engineering from Texas Agricultural and Mechanical.

His mother, originally Margaret Virginia Martin, but called Virginia, was herself also born in Bluefield. She had studied at West Virginia University and was a schoolteacher before her marriage, teaching English and sometimes Latin. It has been said that his mother responded to this behaviour by enthusiastically encouraging Nash's education, both by seeing that he got good schooling and also by teaching him herself.

Nash's teachers at school certainly did not recognise his genius, and it would appear that he gave them little reason to realise that he had extraordinary talents. They were more conscious of his lack of social skills and, because of this, labelled him as backward. The reverse was true, school life did not stimulate him, in fact he was extremely bored at school. By the time he was about twelve years old he was showing great interest in carrying out scientific experiments in his room at home. (It is fairly clear that he learnt more at home than he did at school.)

Nash first showed an interest in mathematics when he was about 14 years old. Quite how he came to read E. T. Bell's *Men of Mathematics* is unclear but certainly this book inspired him. He tried, and succeeded, in proving for himself results due to Fermat which Bell stated in his book. In later years Nash described his time at school and said:

> I also remember succeeding in proving the classic Fermat theorem about an integer multiplied by itself p times where p is a prime.

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The excitement that Nash found in the work of Bell and Fermat, was in contrast to the mathematics that he studied at school that failed to interest him.

He entered Bluefield College in 1941 and there he took mathematics courses as well as science courses, his favourite topic was chemistry. During this time he began to show abilities in mathematics, particularly in problem solving, however, he still remained a 'loner' and was viewed by his associates and peers as 'brilliant' but somewhat eccentric. He had not considered a career in mathematics at this time, however, which is not surprising since it was an unusual profession. Instead, he preferred to study electrical engineering, but he continued to conduct his own chemistry experiments and was involved in making explosives, which led to the death of one of his fellow pupils.

Eventually Nash won a scholarship in the George Westinghouse Competition and was accepted by the Carnegie Institute of Technology (now Carnegie-Mellon University), which he entered in June 1945 ostensibly as a student of chemical engineering. Soon, however, his growing interest in mathematics had him take courses on tensor calculus and relativity.

At Carnegie-Mellon, he came into contact with John Synge, who was Head of the Mathematics Department and taught the relativity course. Synge and the other mathematics professors quickly recognised Nash's remarkable mathematical talents and persuaded him to become a mathematics specialist. Nash rapidly aspired to great things in mathematics.

Whilst still at Carnegie-Mellon he took one elective course in "International Economics" and as a result of that exposure to economic ideas and problems, arrived at the idea that led to the paper "The Bargaining Problem" which was later published in Econometrical. This idea in turn led to his interest in the game theory studies that had been stimulated by the work of von Neumann and Morgenstern.

Surprisingly Nash took the William Lowell Putnam Mathematics Competition twice, and did not make the top five. It was a failure in Nash's eyes and one that he took badly. The Putnam Mathematics Competition was not the only thing going badly for Nash. Although his mathematics professors heaped praise on him, his fellow students found him a very strange person; he behaved oddly and was prone to tantrums - in their eyes he was seen as immature and eccentric, but it was perhaps their own *immaturity* that caused them to fail to recognise that Nash actually had a mental problem. (He was later diagnosed as schizophrenic.)

Despite his behavioural problems Nash received a BA and an MA in mathematics in 1948. By this time, he had been accepted into the mathematics programme at Harvard, Princeton, Chicago and Michigan. At this time, he felt that Harvard was the leading university and so he wanted to go there, but their offer to him was less generous than that of Princeton. Nash felt that Princeton were keen that he went there while he felt that his lack of success in the Putnam Mathematics Competition meant that Harvard were less enthusiastic.
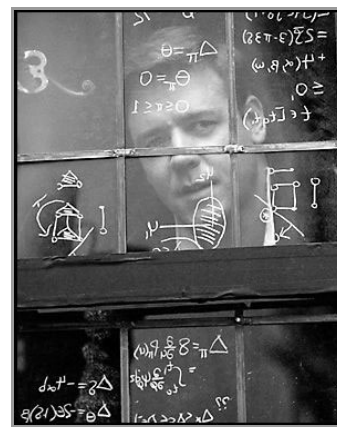
Russell Crowe in *A Beautiful Mind*

Although he received considerable encouragement from Synge and his fellow professors, he took a while to make his decision, it was only when Lefschetz offered him the most prestigious Fellowship that Princeton had, that Nash was finally persuaded to study there. In September 1948 Nash entered Princeton where he showed an interest in a broad range of pure mathematics - topology, algebraic geometry, game theory and logic were among his interests but he seems to have avoided attending lectures and learning mathematics "second-hand" (as he described it) but rather to develop topics himself.

In many ways, this approach was successful for it did contribute to him developing into one of the most original of mathematicians. In 1949, while studying for his doctorate, he wrote a paper which 45 years later was to win a Nobel Prize for economics. During this period, Nash established the mathematical principles of game theory. P. Ordeshook wrote: "The concept of a Nash equilibrium n-tuple is perhaps the most important idea in noncooperative game theory...

Whether we are analysing candidates' election strategies, the causes of war, agenda manipulation in legislatures, or the actions of interest groups, predictions about events reduce to a search for and description of equilibria. Put simply, equilibrium strategies are the things that we predict about people."

In 1950, Nash received his doctorate from Princeton with a thesis entitled Non-cooperative Games. In the summer of that year he worked for the RAND Corporation where his work on game theory made him an expert on the Cold War conflict that dominated RAND's work. He worked there periodically for the next few years as the Corporation tried to apply game theory to military and diplomatic strategy.

However, whilst he was back at Princeton in the autumn of 1950 he began to work seriously on pure mathematical problems. Though Nash's work was not seen at the time to be of outstanding importance and he saw that he needed to make his mark in other ways. We should also note that it was not really a move towards pure mathematics for he had always considered himself a pure mathematician. He had after all, already obtained results on manifolds and algebraic varieties before writing his thesis on game theory. His famous theorem, that any compact real manifold is diffeomorphic to a component of a real-algebraic variety, was thought of by Nash as a possible result to fall back on if his work on game theory was not considered suitable for a doctoral thesis.

In 1952, Nash published real algebraic manifolds in the Annals of Mathematics. The most important result in this paper concerned the fact that two real algebraic manifolds are equivalent if and only if they are analytically homeomorphic. Although publication of this paper on manifolds established him as a leading mathematician, not everyone at Princeton was happy to see him join the Faculty there.

There was nothing wrong with his mathematical ability that everyone accepted as outstanding, but his reputation for eccentric and sometimes aggressive behaviour preceded him, some mathematicians were worried about associating with a notably aggressive personality. From 1952, Nash taught at the Massachusetts Institute of Technology but his teaching was deemed quirky; as a result, he became unpopular with students. His examining methods, too, were seen to be highly unorthodox. Nash's research on the theory of real algebraic varieties, Riemannian geometry, para-

bolic and elliptic equations was, however, significant in the development of all these topics. His paper, *Isometric Imbeddings* was published in 1954.

During the years 1956 - 1957 Nash was awarded an Alfred P. Sloan grant and chose to spend the time as a (temporary) member of the Institute for Advanced Study in Princeton. He also managed to solve a classical unsolved problem relating to differential geometry that was also of some interest in relation to the geometric questions arising in general relativity. This was the problem to prove the isometric embeddability of abstract Riemannian manifolds in flat or "Euclidean" spaces.

Nash continued to develop this work in the paper, *The Imbedding Problem for Riemannian Manifolds* published in 1956. This paper contains his famous deep implicit function theorem. (Proof of Nash's theory can be found in a document held at magnus.poly.edu/~yang/gunther.pdf - it makes for fascinating reading.)

Russell Crowe in *A Beautiful Mind*

Following this, Nash worked on ideas that would appear in a paper he titled Continuity of solutions of parabolic and elliptic equations that was published in the American Journal of Mathematics in 1958. Nash, however, was very disappointed when he discovered that E. De Giorgi had already proved similar results by completely different methods.

"While I was on my 'Sloan sabbatical' at the IAS in Princeton I studied another problem involving partial differential equations which I had learned of as a problem that was unsolved beyond the case of 2 dimensions. Here, although I did succeed in solving the problem, I ran into some bad luck since, without my being sufficiently informed on what other people were doing in the area, it happened that I was working in parallel

with Ennio de Giorgi of Pisa, Italy. And de Giorgi was first actually to achieve the ascent of the summit (of the figuratively described problem) at least for the particularly interesting case of elliptic equations."

During his time at MIT, Nash encountered many personal problems with his life – these problems were in addition to the social difficulties he had always suffered. One highpoint however, was his meeting Eleanor Stier. (They had a son, John David Stier, who was born on 19 June 1953.)

In the summer of 1954, while working for RAND, Nash was arrested in a police operation to entrap gay men - as a result of this he was dismissed perhaps unfairly from RAND. A year later one of Nash's students at MIT, Alicia Larde, became friendly with him and by the summer of 1955, they were seeing each other regularly. In 1956, Nash's parents found out about his continuing affair with Eleanor and about his son John David Stier. The shock may have contributed to the death of Nash's father soon after but even if it did not, Nash in his fragile mental state may have blamed himself and plunged even further into the depths of his illness as a result.

In February of 1957 Nash married Alicia, and by autumn 1958 she was pregnant, unfortunately Nash's mental state deteriorated further at about this time, and he became very disturbed. From this time on, Nash had to endure periods of hospital treatment; he would make temporary recovery, then lapse and need further treatment. The strain was too much on the marriage and Alicia eventually divorced him, although she continued to try to support him emotionally.

Nash entered a prolonged period of extreme mental torture and became even more remote from ordinary society. (Nash spent 50 days under "observation" at the McLean Hospital, and then travelled to Europe in order to attempt to gain status there as a refugee.) Although he spent much of his time in the Mathematics Department at Princeton in between recurrences of his illness.

During these 'interludes' however, Nash still managed to succeed in doing some respectable mathematical research. Such as the research for "Le Probleme de Cauchy pour les E'quations Differentielles d'un Fluide Generale"; the idea that Prof. Hironaka called "the Nash blowing-up transformation"; and those of "Arc Structure of Singularities" and "Analyticity of Solutions of Implicit Function Problems with Analytic Data".

Slowly, and over a period of thirty years or so, Nash recovered, so much so, that he was able to deliver a paper at the tenth World Congress of Psychiatry in 1996 describing his illness. In later years Nash spoke up about his prolonged period of mental anguish, it was ironic that in 1958 he was described as "…the most promising young mathematician in the world." Yet the 'reality' for him at that time was different:

> ...the staff at my university, the Massachusetts Institute of Technology, and later all of Boston were behaving strangely towards me. I started to see crypto-communists everywhere. I started to think I was a man of great religious importance, and to hear voices all the time. I began to hear something like telephone calls in my head, from people opposed to my ideas. ...The delirium was like a dream from which I seemed never to awake.

Despite the seriousness of his illness Nash's mathematical work continued unabated – he was to have success after success. He recently said:

> I would not dare to say that there is a direct relation between mathematics and madness, but there is no doubt that great mathematicians suffer from maniacal characteristics, delirium and symptoms of schizophrenia.

John F. Nash, April 2001

During the darkest period of illness Nash became a ghost, rambling and wandering the halls of Princeton in dishevelled or eccentric apparel and suffering in a private Hell. Then, in the mid-1980s, the disease lifted and Nash could do mathematics again. Meanwhile, game theory had become an essential tool of business and economics. (Virtually all the writing in that field points back to Nash's seminal work.)

Nash was awarded (jointly with Harsanyi and Selten) the 1994 Nobel Prize in Economic Sci-

ence for his work on game theory. In 1999, he was awarded the Leroy P. Steele Prize by the American Mathematical Society: "... for a seminal contribution to research."

Nash could yet be in line for more awards, or at least present at many, as it appears the film about his life has become a runaway success. The film starring Hollywood actor Russell Crowe as Nash, is based on the book, A Beautiful Mind, by Sylvia Nasar. The film, which should be on release in the United Kingdom at the time of reading this, has already achieved a Golden Globe award, speculation mounts that the Hollywood Oscar awards could well be next!

Nigel Cummings, cummings@orsoc.org.uk

"A Beautiful Mind" took four Academy Awards: Best Picture, Best Director, Best Support Actress, and Best Screenplay. John Nash's web site is www.math.princeton.edu/jfnj. Nigel's nice article was reprinted with permission. – *Editor.*

Call for ORSNZ Visiting Lecturer Scholarships in 2002

The number of scholarships awarded is normally at most two per year. ORSNZ will award scholarships to worthy candidates, according to available funds.

A Visiting Lecturer Panel, appointed by the President, will consider making awards twice yearly. The emolument of each scholarship is up to $1,000. ORSNZ will not normally entertain the payment of additional costs to Visiting Lecturers.

> *…it would be a shame if we fell into the ISO trap…*

Each Visiting Lecturer must give a talk on some topic of general interest to ORSNZ members at each of Auckland, Hamilton, Wellington, and Christchurch. A plenary address at the ORSNZ Annual Conference is acceptable as one of the talks. However, in this case, a talk on a different topic must be given at the other three centres.

Each candidate must be nominated by an ORSNZ member ("the Champion").

The Champion must coordinate the visit of the Visiting Lecturer to each of the four centres.

Enquiries concerning, or nominations for, ORSNZ Visiting Lecturer Scholarships for 2002 should be sent to Les Foulds, President, ORSNZ.

Letter from the President

You may know that, at the last conference in Christchurch, there was a Council meeting to discuss knowledge management, as it might be applied to ORSNZ processes. That is, the documentation of our Society's processes to reduce relearning, or the loss of members' knowledge, of these processes due to changes, especially in personnel. There is evidence in the literature (e.g. Neel) of the worthiness of this suggestion. There was almost unanimous agreement at the meeting that this was simply good management practice and it fell to me to action the idea.

I wrote to various officers of the Society, past and present, to ask if they would kindly document the processes concerning their roles. It was important that we use this occasion to improve current processes to incorporate best practice. That is, it would be a shame if we fell into the ISO trap, an example of which is the meticulously documenting of how to manufacture life jackets out of lead! So the plan was to document what people believed should be practised, with a note as to any deviations from current practice.

I am pleased to be able to report that the members concerned have responded very well. Soon, the ORSNZ webmaster will be asked to display the documentation of Society processes at our site. I encourage you all to look over the descriptions of the portfolios that you will find there. Naturally, any observations, or suggestions are welcome.

My sincere thanks to those members who contributed.

Reference: Neel, D., "Making the case for knowledge management: the bigger picture," *Management Decision* 37 (1999) 72-78.

Les Foulds, President, ORSNZ, lfoulds@waikato.ac.nz

Les Foulds invited to WACEIO

Les Foulds has been invited to be Visiting Professor at the Dept. of Mathematics and Statistics, and their newly established Centre, the Western Australian Centre of Excellence in Industrial Optimisation (WACEIO), Jan 4 – July 4, 2003. He expects to be helping to advance work on Positive Linear Systems. Congratulations, Les!

37th Annual ORSNZ Conference

28-30 Nov 2002, University of Auckland

Second Call for Papers

We welcome papers on all aspects of Operations Research, in particular practical applications. Please submit your abstract of 200 words or less, in plain text, to the conference organizer and proceedings editor Matthias Ehrgott (conference@orsnz.org.nz). We prefer submission by email, but you may also send a printed abstract by mail or fax. **Submission deadline: 30 September 2002**

Following acceptance of your abstract, we will ask you to submit a full-length paper for publication in the conference proceedings. The proceedings will be made available for all participants of the conference. Full papers should be submitted by email in PostScript (ps) or Adobe Acrobat (pdf) format. Guidelines for preparation of manuscripts will be published on the conference web site www.orsnz.org.nz/conf/. **Submission deadline: 31 October 2002.**

Registration and Fees

The conference fee includes breakfast, lunch, morning and afternoon tea on 29 and 30 November, a copy of the proceedings volume and a banquet ticket. In order to register for the conference, please fill in the registration form (available at www.orsnz.org/conf/), complete both sides of the form and return it by fax or post, together with your payment. Refund of paid fees is only possible by notice in writing or by email before 15 November 2002.

ORSNZ member: NZ$240, student NZ$65.

Non-member: NZ$280, student NZ$80.

New member, including 2002-2003 membership: NZ$290, student NZ$ 80.

Discount for registration before 15 October 2002 NZ$40, student NZ$15.

Conference participants should make arrangements for accommodation. We recommend you book as early as possible. The quarterfinals of the Luis Vuitton Cup challenger races for the America's Cup will coincide with the conference. Therefore, hotel rooms might be in short supply. We have organized a limited number of rooms in O'Rorke Halls of Residence, which need to be booked before 15th October using the registration form.

Programme and Venue

The Department of Engineering Science of the University of Auckland will host the conference. The scientific programme, breakfast, lunches and teas will all be organised in the School of Engineering, see the campus map on the conference website.

The programme features the following highlights:

- **ILOG/ORSNZ Workshop** "Using Optimization Software in Practice" on Thursday 28 November (additional fee applies)

- **Young Practitioner's Prize**: The Young Practitioners competition is open to authors under 25 years of age on 1 Jan 2002. Papers must be singly authored. More details are contained on the registration form. The Prize is NZ$1,000, to be split between the author(s) of the best paper(s), according to the judges' discretion.

- **Plenary addresses** by Sanjay Saigal, ILOG, on "Decision-Support System Development Beyond Linear Programming" and by Ralph E. Steuer, University of Georgia, Athens, Georgia, on "Multiple Criteria Optimization in Portfolio Selection."

- **Thematic sessions** on "Operations Research in Radiation Oncology" and "Group Decision Making."

- **Social programme** consisting of a pre-conference gathering at 7 p.m. on 28 November, at Old Government House, University of Auckland and a conference banquet to be held on the evening of 29 November.

> *…includes breakfast, lunch, morning and afternoon tea…*

For registration forms, maps of the venue, guidelines for preparation of papers and further details on the programme visit the conference website at www.orsnz.org/conf/. The conference organizers can be reached by email at conference@orsnz.org.nz, by fax 9 373 7468, or mail to ORSNZ Conference, Dept. of Engineering Science, Univ. of Auckland, Private Bag 92019, Auckland.

Matthias Ehrgott, m.ehrgott@auckland.ac.nz

The Young Practitioners' Prize, to be Awarded at the 37th Annual Conference of ORSNZ

Full-time students who will be under 25 years of age on 28 Nov 2002, are members of ORSNZ, and plan to present a single-authored paper at the above conference, are invited to compete for the ORSNZ Young Practitioners' Prize.

> *Full-time students…*
> *are invited to compete…*

When registering for the conference, competitors should request that their paper be scheduled in the Young Practitioner's Prize Session and must provide evidence of their eligibility.

The level of emolument of the prize, or prizes, awarded will be decided by a Prize Panel at the time of the conference.

Les Foulds, President, ORSNZ,
lfoulds@waikato.ac.nz

Student Grants-In-Aid for the Annual Conference of ORSNZ, Auckland, November 2002

Full-time students who are members of ORSNZ, and plan to present a paper at the above conference, are eligible for travel assistance from ORSNZ to attend the conference.

Applications, countersigned by the student's supervisor or Department Chair, confirming that the applicant is enrolled in a full-time university course, together with the abstract of the planned paper, should be made to the President of ORSNZ by 1 September 2002. Grants, including the level of emolument, will be decided at an ORSNZ Council Meeting, later this year.

Les Foulds, President, ORSNZ,
lfoulds@waikato.ac.nz

Free ORSNZ Membership to Top Students

Free student membership to ORSNZ for one year is to be granted to up to three top OR students at each NZ university each year. Each student can be given at most one such award. Apply to your ORSNZ branch chair, given in the directory listing at the end of this Newsletter.

Matthias Ehrgott Nominated As ORSNZ Young Researcher for ORSN in 2002

Matthias Ehrgott

Commemorating the 40th Anniversary of The Operations Research Society of Japan (ORSJ), ORSJ has initiated the "International Cooperative Program for the Promotion of Operations Research." Consequently, ORSJ invited a Young Researcher from ORSNZ to present a 20-minute contributed paper at the Fall Annual Conference of ORSJ, to be held in Hakodate, Hokkaido, Japan, 11-12 September 2002. The Young Researcher must be a member of ORSNZ and be under 40 years of age at the time of application.

> *Congratulations, Matthias! We*
> *hope you have a productive trip.*

The ORSNZ Young Researcher Panel, unanimously nominated Matthias Ehrgott of the Department of Engineering Science at the University of Auckland to be this year's ORSJ Young Researcher from New Zealand.

Congratulations Matthias, we hope you have a productive trip. We look forward to your report on the conference in the December Newsletter.

Les Foulds, President, ORSNZ,
lfoulds@waikato.ac.nz

Andy Philpott elected to Royal Society Council

Associate Professor Andy Philpott was recently elected – unopposed – as the Maths and Information Science and Technology representative to the Royal Society Council. Congratulations, Andy!

The Royal Society web page is www.rsnz.org.

Stephanie Pegg and Beca win ACENZ Gold!

In August, Beca Carter Hollings & Ferner Ltd was awarded one of three ACENZ Gold Awards of Excellence. "In a world first, Beca developed and installed on-line cost-minimisation software to improve efficiency of Wellington Regional Council's water treatment plants and reservoirs, resulting in an estimated cost saving to the Council of $85,000 per year."

The prize announcement is on www.acenz.org.nz/awardframe.htm.

Wrote Stephanie, "Many smiley emoticons!"

A Wellington water treatment plant, now managed with Derceto

NZ Institute of Mathematics and Its Applications (NZIMA)

The NZ Institute of Mathematics and its Applications (NZIMA) has been established as one of the five Centres of Research Excellence selected by the NZ government in March 2002.

The NZIMA is hosted at the University of Auckland and headed by Fields Medallist and Distinguished Alumni Professor Vaughan Jones (Berkeley) and Professor Marston Conder (Auckland), with involvement of many of the best pure and applied mathematicians and statisticians from across the country.

The principal aims of the NZIMA are to

a) create and sustain a critical mass of researchers in concentrations of excellence in mathematics and statistics and their applications

b) provide NZ with a source of high-level quantitative expertise across a range of areas

c) act as a facilitator of access to new developments internationally in the mathematical sciences, and

d) raise the level of knowledge and skills in the mathematical sciences in NZ.

The NZIMA will build on the activities of the NZ Mathematics Research Institute Inc. (NZMRI), which was set up some years ago with similar aims. Since 1994, NZMRI has organised annual summer meetings to which world experts have been invited to engage in research with NZ mathematicians and statisticians and to give short courses of lectures accessible to graduate students.

The extension of the NZMRI to the NZIMA is being modelled on similar mathematical research institutes in other countries, notably the Fields Institute (Canada), MSRI (Berkeley), and the Newton Institute (UK). In particular, it will place considerable emphasis on world-class research in fundamental areas of the mathematical sciences and the use of high-level mathematical techniques in modern application areas.

:) :) :) :) :) :) :) :) :)

Its key activities will include

• the organisation of 6-monthly programmes on themes drawn from a range of fields of significant interest,

• associated workshops held at various locations around NZ,

• establishment of postdoctoral fellowships in the theme areas,

• establishment of PhD scholarships in the theme areas,

• establishment of a small number of scholarships for open competition to research students (from NZ or worldwide) in unrestricted areas of the mathematical sciences, on a merit basis,

• establishment of annual Maclaurin Fellowships, to enable mathematical scientists from NZ or worldwide to take time out from their usual occupations and undertake full-time research in New Zealand (or partly overseas if based in New Zealand).

(Richard Cockburn Maclaurin was a graduate of Auckland University College who went on to study at Cambridge, where he won the Smith Prize in Mathematics and Yorke Prize in Law, and was appointed as Foundation Professor of Mathematics at Victoria University College in 1899, and later Dean of Law and Professor of Astronomy. In 1908, he was invited to become President of the Massachusetts Institute of Technology (MIT), and helped transform that institu-

tion into the world-class research-based techno-logical university it is today.)

The NZIMA is now inviting proposals for thematic programmes and applications for Maclaurin Fellowships, postgraduate student scholarships, and possible other forms of support. Details (including the expected format of proposals and applications and other information) are available on the NZIMA's website www.nzima.auckland.ac.nz.

The closing date for this first round of proposals and applications is 15th September 2002. Contact details are also on the website.

Marston Conder, www.math.auckland.ac.nz/~conder

Auckland News

The Department of Engineering Science has been busy promoting Operations Research. Our overseas correspondent David Ryan has been spreading the gospel in Europe on OR/MS as a practical discipline. David will give a plenary address at INFORMS in San Jose in November. In an ORSNZ clean sweep, David, Matthias Ehrgott and Mikael Ronnqvist gave talks in the same session "Optimization in Action" at the recent IFORS meeting in Edinburgh.

> *…David Ryan has been spreading the gospel in Europe…*

In July, we ran a special function to honour the three top students in our Year 3 Operations Research class. The students are Richard Kramer and Jack Lee from Engineering Science, and Wendy Lau from Statistics. These students were awarded complimentary student memberships of ORSNZ. Watch out for these names in upcoming Young Practitioner Prizes. The function was an opportunity for all the student members of ORSNZ to get to know each other and the faculty. We regard this activity to be an enjoyable and essential part of the education of the next generation of OR/MS professionals.

Also in July, the Electric Power Optimization Centre (for details see www.esc.auckland.ac.nz/Organisations/EPOC/index.html) held its inaugural Winter Workshop for electricity market participants. This workshop was intended to introduce participants to models for optimizing supply and demand in pool markets, and was attended by about twenty-five industry participants.

Andy Philpott has been promoted to a Personal Chair in Engineering Science. He has also been elected to chair the Royal Society Standing Committee on Mathematical and Information Sciences for two years.

Matthias Ehrgott has been very busy putting the finishing touches to the organization of the ORSNZ Conference 2002. This conference will be supported by ILOG who will host an optimization workshop in the School of Engineering on the day prior to the conference (see advertisement in this issue). We hope to see many of you at both events.

Andy Philpott, a.philpott@auckland.ac.nz

Canterbury News

The arrival of daffodils in Hagley Park signals the start of spring and, going along with the theme of things fresh and new, the Management Science group at the University of Canterbury is pleased to announce that in 2003 an Operations Management stream will be introduced to our B.Com Honours degree. This stream will involve students taking some specialist Operations Management papers in combination with our Honours papers in Management Science and Management. The industry project component of the degree is the same as that for the Management Science programme.

On the staff front, John Giffin, formerly of Massey University fame, has joined the MSCI team at Canterbury. John adds to our strengths in the areas of Logistics and Heuristics. Welcome on board, John. Ross James has also arrived back from Study leave after 12 months, most of which was spent at Kansai University in Osaka Japan and Lehigh University in Pennsylvania, U.S.A. He reports that his time away was very enjoyable and productive.

On the PhD front, Stephen Batstone has left us for the bright lights of Auckland. He has submitted his PhD and is awaiting his examination. Steve has made a substantial contribution to the department in his time here, teaching and tutoring many courses over the years. Thanks Steve for all your work – you'll be missed. Steve is going to be working for Mighty River Energy as a Strategy Analyst. We wish him well in his new appointment.

On the conference front, Nicola Petty attended the IFORS 2002 conference in Edinburgh in July where she presented a paper entitled "An ORMS approach to allocating resources for special edu-

cation" and attended some interesting presentations on the teaching of modelling, and OR in Health. In August, Vicky Hanna attended the IEEE International Engineering Management Conference (IEMC 2002) in Cambridge UK where she presented a paper entitled "Inter-firm Co-operation: A New Zealand Perspective".

Ross James, ross.james@canterbury.ac.nz

Waikato News

Sabbatical Leave Comes in Different Phases for Many of Us.

John Scott has returned safe and well from his sabbatical in A Semester. Here is his informal "report" on what he did:

Here are a couple of my five phases, while in and around the University of Cambridge, last semester. The second phase was centred around my attic room in Merton Hall, the second oldest building in Cambridge, "out the back" of John's College. Fifteenth century buildings might have their charm, but living and trying to work in one has its … well, interesting aspects.

Take the floor, for instance. It sloped like you had to see to believe. When the wardrobe door was open, there was no gap at the hinge end, but a 10cm (3 inches in the old money) gap to the floor at the open end. Fine if you want to cheat at sit-ups, but trying to make a desk stable for working on was another matter. Being an attic room, the ceiling sloped inwards on two sides. Again pretty quaint, except that the plumbing was along the outside wall. So where do you put the hand basin? Well in front of the window of course, as that is the only place you wouldn't hit your head while brushing your teeth. So the prime view and natural light is given to the hand basin.

Well I stayed in my attic for two weeks, before getting a flat in Clare Hall for the month of May. With the Clare Hall flat only available until the end of May, came the opportunity for a "walk-about, work-about" in early June. This third phase began with a very special, 3-day weekend: a retreat on Self-Managing Leadership, held at the Brahma Kumaris Global Retreat Centre, 20 minutes out of Oxford.

The centre was originally the country estate of an earl to the court of King James, and it has a bank of the Thames River as one border. Brian Bacon, a very successful management consultant, ran the retreat, using standard stages of strategic plan-

ning, but with emphasis on self-change rather than instructing others to change. Reflective Inquiry, which uses relaxation and guided meditation to unearth relevant aspects of self in each phase, was the main process. Half of me was doing the activities; the other half was "being the teacher": looking for aspects of process and content I might use back at WMS. Right brain, left brain; both at work together.

Start at 7:30am, work through to late lunch, then late afternoon session 4:30-7:00pm., followed by dinner. No "grave-yard shift" straight after lunch. Worked really well. Quite a synergistic atmosphere, intertwined with two lovely afternoon runs, in the free time, through the paths and fields of the Oxford countryside.

> *Right brain, left brain; both at work together.*

What was even more refreshing was the cost: it was "free"; donations accepted (anonymous if you wish). The Brahma Kumaris have a principle that knowing yourself is a human right and should not have a price tag attached. A refreshingly different attitude. Made me wonder if perhaps course charges (for exec and adult courses) could be made up of basic direct cost plus donation, based on perceived benefit. Would keep the advertised cost down, plus open up some honesty in course evaluation for both parties.

Warm, sunny (sic) wishes for the B(etter) semester, *John Scott.*

Wellington News

David Boland, Chairman, Wellington Branch

Puzzle Corner: The N-Queens Problem

Consider a regular chessboard and the given chess pieces: rook (castle), bishop, knight, king, and queen. A collection of problems can be posed in which one has a large number of pieces of exactly one type. One problem is to decide how to place the maximum number of pieces of a single type on the board (at most one per square) so that no capturing can occur. As an example, we consider the *Queens Problem*. We wish to place as many queens as possible on the chessboard so that no two can attack each other. A queen can be moved in any direction, horizontally (along a *rank*), vertically (along a *file*) or diagonally, along any number of vacant squares

in any straight line. Hence, once a queen is placed it will not be possible to place another on the same rank file, or diagonal. Thus, *8-Queens Problem* (8QP) can be stated as finding a set of squares such that:

i) no two queens are on the same rank, file, or diagonal, and

ii) the number of squares in the set is a maximum.

Obviously, the colour of the squares (whether black or white) is irrelevant. Since the chessboard has only eight ranks (and files), it is obvious that no more than eight queens can be placed.

> *...place as many queens as possible on the chessboard so that no two can attack each other...*

The general version of the problem just described, concerned with locating queens on an NxN chessboard, was first posed by Bezzel. There is a related problem, that of placing the minimum number of queens on an NxN chessboard so that every square is either occupied by a queen, or under attack by at least one queen. This, the so-called *queens domination problem*, NQDP was first posed by de Jaenisch. The NQDP was analysed thoroughly by Burger. More recent results for the QDP, for N = 15, 3 5, 3 9, and 45 have been provided by Burger and Mynhardt.

The 8QP was first solved by Gauss in 1850 and eight queens was quickly found to be the solution. For the next 60 years, there was debate as to how many solutions exist. At first Gauss concluded that there were 76, changed his mind to 72 and finally settled upon 92, which is correct. Bennett later showed that there are only 12 distinct solutions (i.e. solutions that cannot be obtained one from another by either reflection or rotation of the chessboard.

The 8QP was extended to the *N-Queens Problem* (NQP), for a chessboard with 17 ranks (and files), Glaisher, who was the first to pose the NQP was unsuccessful in an attempt to solve it using determinants. He conjectured that the solution was N queens for any N, and this was proved by Hoffman, Loessi, and Moore. The combinatorial methods of Yaglom and Yaglom can be used to calculate how many distinct solutions there are for a given N.

The relationship between the NQP and MS comes about through the fact that the NQP can be represented by both graph theoretic and integer programming models, as demonstrated by Johnstone and Foulds. Surveys of the NQP and the NQDP have been given in Fricke et al and Hedetniemi et al.

Les Foulds, President, ORSNZ, lfoulds@waikato.ac.nz

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Are You Creating ORMS Educational Materials? INFORMS would like to know!

A few years ago, the IFORS Educational Resources Initiative was launched to catalogue materials from across the globe so that all faculties could have the benefit of an international perspective, and of the creativity of colleagues worldwide, when teaching ORMS. Although some materials have been catalogued (www.umsl.edu/~sauter/ifors), the list is significantly biased toward materials available in English, and available in North America. While they are great resources for anyone to use, they do not fulfil the mission of the committee which was to provide an international catalogue that crosses the barriers of language, application and country of origin. (We realize the current catalogue also suffers because it is not easily searchable; we are working on ways of improving that aspect now.)

Clearly, we are already aware of some people who are creating, cataloguing and supporting ORMS educational materials worldwide. However, we suspect we are not aware of even a fraction of the materials that are available. In particular, we know we are ignorant of materials that do not appear in English, or which have a particular national focus.

For example, one resource of which we have only recently become aware is the Portuguese-English Dictionary created by APDIO (www.apdio.pt/DicIO/), which contains translations of over 1500 ORMS terms. Clearly, this is a wonderful resource that needs to be included in our catalogue, but which we would not have found without the help of the Portuguese Operational Research Society.

Another example is the work in Community Operational Research (originally an ORS initiative) housed at the Lincoln School of Management, which highlights ORMS practice, and some work undertaken by students under supervision of ORMS faculty. Publicity of such an initiative can encourage other faculty to begin similar efforts, and may even motivate capable students. We would not have found this without help of people at ORS.

This makes us wonder what other wonderful resources might be available, but of which we are not aware.

So, the Committee is requesting YOUR help! Please share your secrets with us.

Do you use materials in your classes about which we might not be aware? PLEASE TELL US ABOUT THEM!

Have you created ORMS Educational Supplements? PLEASE TELL US ABOUT THEM!

Do you know of someone who is involved with the creation of ORMS Educational Supplements? PLEASE TELL US ABOUT THEM!

Are you interested in developing some innovative teaching resources? PLEASE TELL US ABOUT THEM!

We REALLY want to know about the resources available for faculty and students. If you know of resources, please send us a list of them and how they might be acquired (URL for web materials; email or snail mail address for other materials). If you know of people involved in the creation of materials, please tell us who they are. Of course, if you are interested in working on this project, we welcome you!

> *... the help of the Portuguese Operational Research Society.*

We would be grateful for a response from you at your earliest convenience. You can send information to me at vicki.sauter@umsl.edu, or via conventional mail at 226 CCB, College of Business Administration, Univ. of Missouri - St. Louis, 8001 Natural Bridge Rd, St. Louis, MO 63121-4499 USA.

Passion & Fun in the Classroom!

Extract from a recent INFORMed newsletter.

When I started my term as editor of the "Issues in Education" column, I read all of the previous columns starting with the first one written by Erhan Erkut (1996). In this column and in other issues of OR/MS Today, I found a recurring theme when I noticed several examples of faculty displaying passion and having fun in the classroom.

For example, Robert Bosch teaches mathematical programming by having students study a diet problem using actual menu items at a McDonalds (1993). Norman Pendegraft (February 1997) uses Legos to teach the economics of linear programming. Henk ten Wolde (August 2000) developed a simulation game using Legos, called Legostiek Management, that helps the student to learn the building blocks of logistics. Jim Cochran (April 2001) explains how he uses the

format from Who Wants to be a Millionaire to reinforce the topics covered in class. Arvid Johnson (February and April 2002) developed a simulation to help students understand the impact of variability in a process flow.

All of these examples remind me of an experience that I had a few years ago when I had my car detailed. When I returned to the carwash, a young man led me to my car that looked like it just came from the showroom. He took at least ten minutes to carefully explain what he did to my car. He used a special attachment to his vacuum that cleaned in small crevices where the dirt could not be seen. He made sure that there was no wax residue left anywhere on the car. He hand-cleaned all of the controls on my dash and shampooed the carpet in my trunk. He even found 70 cents that I never knew I lost.

> *After introducing chocolate chip cookies, we never heard any comments about the complexities of performing the pairwise comparisons.*

As I watched this unfold, I could sense the passion, excitement, enthusiasm, and even fun that this young man possessed for a task as seemingly boring as detailing my car. He was proud of his work and I learned something very important that day.

Here are a few other examples that I have used in class to attempt to capture the same passion displayed by my car detailer. Whenever I teach Operations Management, I use one of my hobbies to explain its definition – MAGIC! I show three dirty handkerchiefs and a box of laundry detergent. I explain that we can pretend that the box is a washing machine. I next place the dirty handkerchiefs inside the top of the box, shake the box from side to side, turn the box around several times to simulate a washing machine, and stop when the box is upside down. When I remove the handkerchiefs, they are clean.

At this point, there is embarrassing silence, as the students believe that I had the clean handkerchiefs in the bottom of the box the whole time and left the dirty ones inside the top of the box. I explain that I never told the class that I was a good magician! When I tear open the box to show that it is completely empty, the students do not understand how that happened. However,

they begin to understand (and maybe more importantly remember) that the definition of Operations Management is to obtain resources (dirty clothes, washing machine, detergent, etc.) and transform them into goods or services (clean clothes).

Many undergraduate students indicated that they did not understand how pairwise comparisons were actually done when using the Analytic Hierarchy Process. The example that we use in class deals with a company who must choose a chocolate chip cookie recipe. We turned this example into a class exercise where actual chocolate chip cookies are used for comparison purposes. When dealing with taste, for example, a group of students can sample the various cookies and then discuss, argue, and eventually reach a consensus for the necessary comparison. After introducing chocolate chip cookies, we never heard any comments about the complexities of performing the pairwise comparisons.

All of the examples mentioned here illustrate that you can have fun in the classroom by being creative and having passion. This should lead to an environment where students are more likely to learn, understand, remember, and implement what is being taught. As editor of "Issues in Education," I will attempt to have individuals write about their successful examples of experiential learning that display passion and have fun in the classroom!

From Issues in Education Editor, INFORMed Newsletter August 2002,

Deceased: Vyacheslav Tanaev

Dear Presidents of IFORS Member Societies:

It is with much sadness that I send you the news of a death in the OR community. The President of the Byelorussian Operational Research Society, Vyacheslav Tanaev, died July 19, 2002. Please note, a brief obituary and information for sending expressions of sympathy may be found below.

Yesterday (19.07.02) Vyacheslav Tanaev died. Academician Vyacheslav Tanaev was the President of the Byelorussian Operational Research Society and Director of the Institute of Engineering Cybernetics of the National Academy of Sciences of Belarus.

Vyacheslav Sergeevich Tanaev was born on March 28, 1940 in the village of Akulovo (Russia). He graduated from Crimea Pedagogical In-

stitute (Ukraine). In 1963, he started to work in the Byelorussian Academy of Sciences (Minsk). He had PhD degree (1965) and Doctor of Sciences degree (1977) in Physics and Mathematics. He was a Corresponding Member (1994) and Academician (2000) of the National Academy of Sciences of Belarus (NASB).

From 1987, he was a Director of the Institute of Engineering Cybernetics of the NASB. He was a President of the Byelorussian Operational Research Society from creating this society in 1996. He was an author of 7 monographs on Scheduling and Optimization (among them the first published in the former USSR book on scheduling theory (1975) and two books on scheduling published in Kluwer Academic Publ. (1994)). He was a Winner of the State Prize of Belarus in Science and Engineering (1998).

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From Mary Magrogan, IFORS Secretary

Meetings Calendar

EURO/INFORMS, Istanbul, 6-10 July 2003, 1st Announcement

EURO/INFORMS 2003 has asked me to organise and chair two sessions under the Asia Pacific cluster with the following titles:

I. Mathematical modelling/Programming and simulation

II. Soft computing (Fuzzy Logic, Neural Networks, Genetic Algorithms,…)

Interested researchers are kindly invited to consult the web page www.istanbul2003.org for more details. The paper submission and evaluation process for these two sessions of this cluster will be administered in Australia. Please check the web site regularly for updates and follow the deadlines. Should you have any question, wish to submit abstracts, or volunteer to referee papers, please contact the following address and email, marking the subject area by INFORMS 2003 Asia Pacific Cluster.

Dr E. Shayan, IRIS, Swinburne University of Technology, John St, Hawthorne, Vic 3122, Australia, Tel : (+613) 9214 8452, Fax: (+613) 9214 5050, eshayan@swin.edu.au

*29-30 Nov 2002,
37th ORSNZ Conference,
University of Auckland*

29 Sep - 3 Oct 2002, 5th Biennial Conference of the Engineering Mathematics and Applications Conference, Gardens Point Campus, Queensland University of Technology, Brisbane, Australia. www.icms.com.au/emac02.

30 Sep 2002 Abstract deadline for the 37th Annual Conference of the ORSNZ.

30 Sep – 3 Oct 2002, AustMS 2002, Newcastle, Australia. 46th Annual Meeting of the Australian Mathematical Society. Registration forms may be downloaded from the conference website: maths.newcastle.edu.au/austms. Submit abstracts and other details on-line: maths.newcastle.edu.au/austms/rego.html. Contact: austms@newcastle.edu.au

30 Sep – 3 Oct 2002, Industrial Optimisation Symposium and Optimisation Day, Western Australian Centre of Excellence in Industrial Optimisation, Curtin University of Technology, Perth, WA. www.maths.curtin.edu.au/ios.html Prof. Lou Caccetta, Symposium Chair, email: caccetta@maths.curtin.edu.au

4 Oct 2002, Conference of the International Association of Maritime Economists (IAME), Lisbon, Portugal. http://rirl2002.iscte.pt/

4-6 Oct 2002, 3rd UQ Mathematical Physics Workshop, Calypso Plaza, Coolangatta, Gold Coast, following the 46th Annual Meeting of the Australian Mathematical Society in Newcastle. Abstract deadline: 1 Sep 2002. http://www.maths.uq.edu.au/~cmpworkshop, email cmpworkshop@maths.uq.edu.au.

31 Oct 2002 Full paper deadline for the 37th Annual Conference of the ORSNZ.

17-20 Nov 2002, INFORMS Annual Meeting, San Jose CA, www.informs.org/Conf/SanJose02.

18-22 Nov 2002, Joint meeting, 4th Asia-Pacific Conf. on Simulated Evolution and Learning, 9th International Conf. on Neural Information Processing, International Conf. on Fuzzy Systems and Knowledge Discovery, Orchid Country Club, Singapore. Paper summary deadline 30 Apr 2002. www.ntu.edu.sg/home/nef.

29-30 Nov 2002, 37th Annual ORSNZ Conference, University of Auckland, Auckland, NZ, http://www.orsnz.org.nz/conf.

3-5 Dec 2002, IC-SEC 2002, Intern'l Conference on Scientific & Engg Computation Raffles City Convention Centre, Singapore, http://www.ic-sec.ihpc.a-star.edu.sg. Dr. W. Summerfield, FAustMS, School of Mathematical and Physical Sciences, Univ. of Newcastle, Callaghan NSW 2308, william@maths.newcastle.edu.au

9-12 Dec 2002, ICDM '02, IEEE International Conference on Data Mining, Maebashi TERRSA, Maebashi City, Japan. The 2002 IEEE International Conference on Data Mining. Professor Ning Zhong (ICDM '02), Department of Information Engineering, Maebashi Institute of Technology, zhong@maebashi-it.ac.jp, http://kis.maebashi-it.ac.jp/icdm02.

27-30 Dec 2002, International Conference on Operations Research for Development (ICORD 2002) under the auspices of Operational Research Society of India (ORSI) will be held at Anna University, Chennai (Madras), India. The announcement and call for papers is released. www.annauniv.edu/orsi-chennai/icord2002/

2-5 Jan 2003, Fourth International Conference on Operations and Quantitative Management (ICOQM), National Cheng Kung University, Tainan, Taiwan. www.icoqm.itgo.com.

4-6 May 2003, INFORMS 2003 Conference on OR/MS Practice, Sheraton Wild Horse Pass Resort and Spa in Phoenix, Arizona. Conference chair is Grace Lin, gracelin@us.ibm.com.

6-10 July 2003, EURO/INFORMS Joint International Meeting, Istanbul, Turkey. Gulay D. Barbarosoglu, meeting chair, barbaros@boun.edu.tr, Murat Tarimcilar, organizing chair, muratt@gwu.edu.

7-9 July 2003, CTAC 2003, Computational Techniques and Applications Conference, Sydney Convention and Exhibition Centre, a meeting embedded in ICIAM 2003 July 7-11. Papers will be reviewed for publication after the meeting. Students are encouraged to submit papers. www.aeromech.usyd.edu.au/ctac2003, www.iciam.org, Jerard Barry, ctac@iciam.org.

7-11 Jul 2003, 5th International Congress on Industrial & Applied Maths, Darling Harbour, Australia, http://www.iciam.org.

28-30 Aug 2003, POSTA 2003, A Multidisciplinary International Symposium on Positive Systems: Theory and Applications, Univ. of Rome, Italy, http://www.dis.uniroma1.it/~posta03/.

Abstract deadline for the 37th Annual Conference of the ORSNZ

30 Sep 2002

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