



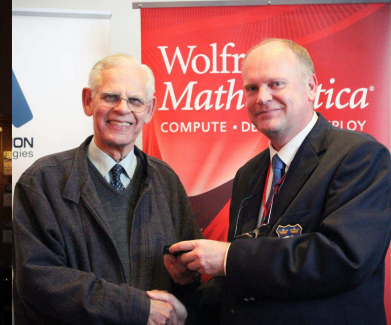
AT THE FOREFRONT OF ANALYTICS IN AFRICA



ORSSA Newsletter October 2013

www.orssa.org.za





FROM THE EDITOR

By MARK EINHORN (einhorn@sun.ac.za)
 ORSSA NEWSLETTER EDITOR



Mark Einhorn

Hello members of ORSSA and to all a warm welcome to the October issue of this year's Newsletter. As is customary, this edition of the Newsletter serves to highlight the recently passed ORSSA Annual Conference, and what a conference it was! As a member of the local organising committee (LOC) I sincerely hope that all of you who attended enjoyed it as much as we enjoyed organising it. To those of you

who couldn't make it, your presence was missed and we hope to see you next year in Parys.

This edition starts with a word from our President in his column *From the President's Desk*. This is followed by another ever-entertaining recap of the conference by my good friend Jacques du Toit, a PhD student at Stellenbosch University, which promises to deliver a chuckle or two. This is followed by the citations of the record number of seven recognition awards presented on the evening of the gala dinner of the conference. We then turn our attention to our first ever student competition medal winners, and, of course, this year's winner of the prestigious Tom Rozwadowski Medal. I would like to take this opportunity to once again offer my hearty congratulations to all the deserving recipients. The issue closes with another fascinating book review by Hans Ittmann. On both the front and back inner covers I have included photo collages of pictures that were taken during the conference, which are sure to bring back some fond memories of the conference.

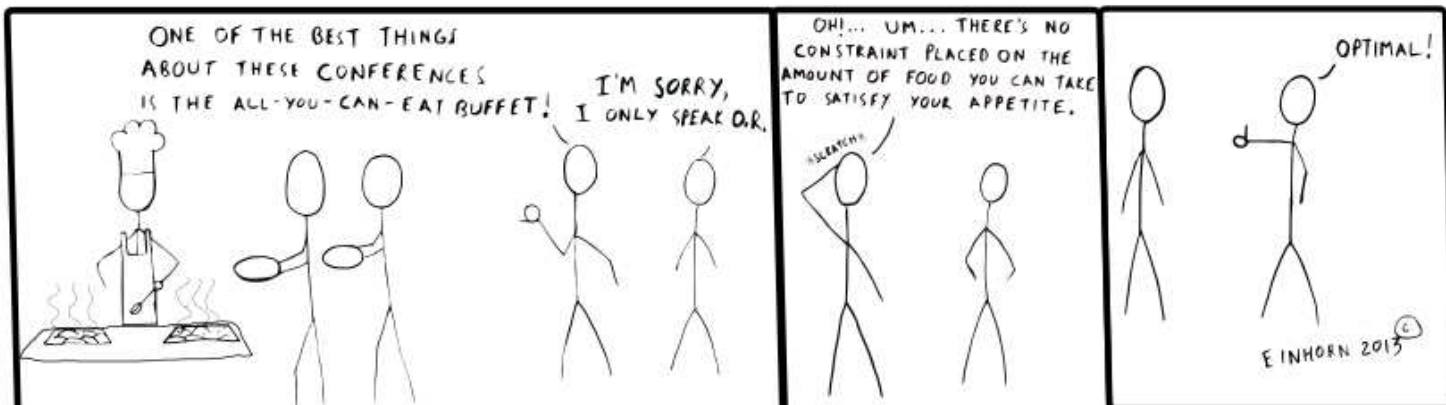
It really was good seeing all the familiar faces again at the conference, and I am already looking forward to next year's. Good luck to Lischen Venter and the rest of her local organising committee. That's all from me for now until December. Cheers folks and enjoy the read!

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QUERIES & CONTRIBUTIONS

Any queries or contributions to the Newsletter are most welcome, especially article submissions. For any queries or contributions, please contact the Newsletter editor at einhorn@sun.ac.za.



FROM THE PRESIDENT'S DESK

By JAN VAN VUUREN (vuuren@sun.ac.za)

ORSSA PRESIDENT



Jan van Vuuren

As I write this column, the 42nd Annual ORSSA Conference held at the Protea Hotel Technopark in Stellenbosch last month is still fresh in our memories. And what a memorable conference it was yet again! The conference opened, after the onsite registration, with a welcome reception in the form of a cocktail function overlooking the lovely Western Cape winelands during which it was good to see so many active ORSSA members, including a large contingent of student delegates and delegates from industry.

The conference proper started on the Monday morning with a plenary lecture entitled *Multicriteria decision analysis – An integrating framework for operations research* by the conference keynote speaker, **Theo Stewart**, who is affiliated with the University of Cape Town and the Manchester Business School. Thereafter the programme continued in the form of three parallel streams of contributed talks for virtually the rest of the conference. The 2013 AGM was held on the Tuesday, as was a very enjoyable banquet. The conference closed on the Wednesday at lunch time after a total of 74 contributed papers and a panel discussion in parallel streams as well as a closing plenary lecture entitled *Multicriteria decision aid to operations research for development*, again by **Theo Stewart**. I shall not dwell further on the nature of the conference programme, as Jacques du Toit has made his usual entertaining article contribution on the conference, which may be found on page 3 of this issue of the Newsletter. A number of lovely conference photographs are available online at www.orssa.org.za → *Archive* → *Photo Album* → *2013 Conference Photographs*.

The conference was memorable for a number of reasons, which I would like to outline below. First of all, the beautiful Cape winelands and surrounding Stellenbosch mountains contributed to an ideal conference breakaway location. The catering and the social aspects of the programme were also superb (even keeping in mind the high standards that ORSSA has maintained in this regard for decades). But the conference was also memorable because of the impressive individual achievements that we recognized and celebrated in Stellenbosch.

The 2013 Tom Rozwadowski Medal was awarded to **Jonas Stray** (University of Cape Town) for a paper emanating from his PhD work, entitled *An optimisation-based seasonal sugarcane harvest scheduling decision support system*

for commercial growers in South Africa, which appeared in Computers and Electronics in Agriculture. The illustrious Hall of Fame of this premier ORSSA award is available online in its entirety at www.orssa.org.za → *Awards* → *Tom Rozwadowski Medal* → *Hall of Fame*.

A record number of seven recognition awards were also presented at the conference:

- *Category I: To a retired member for outstanding contributions over a long period of time*
 - ◆ **Dave Evans** (formerly of the Development bank of Southern Africa)
 - ◆ **Giel Hattingh** (formerly of North-West University)
- *Category II: To a current member for a single, outstanding achievement*
 - ◆ **David Lubinsky** (OPSI Systems)
- *Category III: To a non-member for outstanding contributions over a long period of time*
 - ◆ **Jan Malan** (formerly of IMT and the Overberg Missile Test Facility)
- *Category IV: To an upcoming member of age 35 or below for excellence in OR practice*
 - ◆ **Margarete Bester** (XTranda)
 - ◆ **Angela Rademeyer** (OPSI Systems)
 - ◆ **Elias Willemse** (University of Pretoria)

More details about these awards may be found in this issue of the Newsletter and also online at www.orssa.org.za → *Awards* → *Recognition Awards*. Congratulations to these very worthy awardees!

Our students also excelled and were duly awarded at the conference. There were nine very high-quality entries on honours level and six excellent entries on masters level of our annual (written) National Student Competition. The runner-up on honours level was **Lumardt Groeneveldt** (Department of Industrial Engineering at Stellenbosch University) while the winner of the newly instituted *Gerhard Geldenhuys Medal* for the best honours or fourth year project went to **Robert Hagspihl** (Department of Logistics at Stellenbosch University). The runner-up on masters level was **Sivashan Chetty** (University of Kwa-Zulu-Natal) while the winner of the newly instituted *Theodor Stewart Medal* for the best masters thesis went to **Robert Bennetto** (University of the Witwatersrand). Congratulations to both Roberts (who are now both affiliated with OPSI Systems!) on having produced projects of exceptionally high quality. More details about the ORSSA National Student Competition may be found online at www.orssa.org.za → *Awards* → *Student Competitions*.

In addition, **Elmien Thom** (Department of Logistics at Stellenbosch University) won the prize for the best oral presentation by an honours student at ORSSA 2013,

Berndt Lindner (Department of Industrial Engineering at Stellenbosch University) won the prize for the best oral presentation by a masters student and **Linke Potgieter** (Department of Logistics at Stellenbosch University) won the prize for the best oral presentation by a doctoral student. Congratulations to Elmien, Berndt and Linke!

The conference was also memorable for three exciting new initiatives:

- The introduction of a new type recognition award, namely *Category IV: To a young and upcoming member for excellence in practicing OR*.
- The introduction of medals for the two categories of our National Student Competition from 2013 onwards (the *Gerhard Geldenhuys Medal for the best honours / 4th year project* and the *Theodor Stewart Medal for the best masters thesis*).
- FICO sponsorship to allow two finalists per category of our National Student Competition to attend our annual conference and present their work in an exciting special competition session.

Looking back at our eventful annual conference this year, I am yet again inspired by the vibrancy of our Society. I am encouraged by the increased number of student members presenting papers (and the high quality of their presentations!) as well as by the increased level of industry partic-

ipation at our conferences – this year alone we welcomed delegates from no fewer than fifteen industry partners: Armscor, CSIR, Eskom, Esteq, FICO, Necsa, OPSI Systems, RCS Decision Science, RTT Medical, Sanlam, Sasol, Shoprite, Stone Three Venture Technology, Transnet and XTranda. I was also impressed by the depth and range of the contributed paper topics at the conference.

Let me conclude by thanking every ORSSA member who attended the conference, presented a paper and/or helped organise the conference, for making our 42nd Annual Conference such a great success! In particular, let me thank the *Local Organising Committee* (LOC) of the conference for their superb and extremely time consuming job of organising the conference so well. The LOC members were: **Danie Lötter** (Chair), **Anton de Villiers** (Conference Treasurer), **Alexandre Colmant**, **Mark Einhorn**, **Antoinette Erasmus**, **Tanya Lane-Visser** and **Michelle van der Merwe**.

Our 43rd Annual Conference will be held at *Stonehenge in Africa* near Parys during the period 14-17 September 2014; the LOC of next year's conference will be chaired by our Vaal Triangle Chapter Chairperson, **Lieschen Venter**. Please diarise the event and join us then for another productive and enjoyable meeting in the beautiful Free State (more details at www.orssa.org.za → *ORSSA 2014*).

THE 42nd ANNUAL CONFERENCE OF ORSSA

By Jacques du Toit (jacques@dip.sun.ac.za)
Department of Logistics, Stellenbosch University

The views expressed in this article are the personal views held, only at the time of writing, by Jacques du Toit.

“On a small and obscure world in the middle of nowhere in particular, it was raining”. Not much though thankfully, and not nearly as much as the ORSSA conference of 2010 in Magoebaskloof. With the conference occurring ever so slightly on the wintry side of the spring equinox (September, 22), and with it being in the Western Cape, this was not at all unexpected (indeed, those familiar with the place can easily recount snowfalls in late October). The designated location for the welcoming reception was the main foyer of the hotel or, as the program said, the patio if the weather was permitting. It was. As the light drizzle earlier in the day had since subsided, delegates enjoyed the beautiful views of Stellenbosch Berg and Helderberg from the vantage point of the Protea Hotel. I've come to think of these receptions as the weddings in the life cycle of a conference. The delegate arrives at the venue, is given gifts and signs a register. This is all ordained by the local organising committee who then usher people into the reception

area. There we all are, married to the conference for the next three days but still close enough to the very beginning that there is only hope and optimism for what lies ahead. The newly weds trickled into the Omega Hall to enjoy tasty finger treats and a fine selection of wine with an aural serving of Chopin. Of the three, Chopin received the least attention; perhaps fairly so since delegates were excited to see old friends and make new ones (I'm not sure that this actually happened, it just sounds better). For some the welcoming continued briefly in the pub below the hotel, whilst others toiled with projectors and computers, and the rest likely turned in looking forward to the day that lay ahead.

“The ships hung in the sky in much the same way that bricks don't.” The honeymoon was over and it was time to get to business. The chair of the local organising committee, Mr Daniel Lotter, welcomed delegates and attempted to grease the wheels of the hulking conference machine with information. Information about the plenaries, information about the carding system which would prevent speakers from overrunning their allotted time, information about

the new student session, but most tellingly (if you care for the order), his first three titbits of information were where coffee, tea and lunch would be served, and where the abstractions could be found. The intellectual punctuated by the practical. The ORSSA president delivered his address thereafter and explored challenges and opportunities involving intertwinement. He specifically asked for permission to stereotype the roles of operations researchers (consultants and academics) and non operations researchers (clients and the public), and did a pretty darn good job of it. The keynote speaker for this 42nd conference was Theo Stewart who provided a “whistle stop tour of MCDA” on the occasion of his birthday. The approach seems to so widely applicable that he commented that his wife communicates with him using MCDA. He offered that “MCDA is a way of thinking, a life philosophy for the operational researcher.”

As delegates dispersed from the Omega hall they were treated to coffee, tea and scrumptious cupcakes in celebration of Theo Stewart’s continued and successful participation in the grandest of all endeavors, life.

“Just believe everything I tell you, and it will all be very, very simple. Ah, well, I’m not sure I believe that.” The parallel sessions got under way and I had to make choices. I chose to attend the Heuristics & Meta-heuristics session in which the differences & similarities between genetic algorithms and programs, a linear programming solution to a Dial-A-flight problem in Botswana and meta-heuristics for a parallel machine problem were discussed. A little legwork got me in the session on allocation and selection problems for an update on the diet problem.

“One of the things Ford Prefect had always found hardest to understand about humans was their habit of continually stating and repeating the very very obvious.” I was most pleased to see that the single queue lunch problem of the previous conference was solved by the ingenious introduction of a second queue. Just like the food, the results of this clever solution were glorious.

The session after lunch was dedicated to Theo Stewart. The papers presented in this session were published in **Vol. 29, No. 1** of ORiON. Firstly Hans Ittmann provided a historical review of the Tom Rozwadowski medal. He presented a few lovely black and white photos of Tom and his family and listed the journals in which the winning papers were published (ORiON is featuring strongly amongst them). In providing a breakdown of the recipients via their institutions, he pitted academic institutions, the CSIR and a category to subsume the complement of these against one another. The latter category came up trumps with 10 medals, the CSIR in a close second with 8.5 and Stellenbosch University received the meta-bronze medal with a

score of 7 (adjusted to eight now surely that Jonas Stray and Jan van Vuuren were this year’s recipients). Secondly, Ian Durbach reviewed a masters course offered at UCT and asked difficult pedagogical questions which he simplified with Swiss army knives featured in various states of preparedness. The session closed with a presentation by Jan van Vuuren on the evolutionary spatial prisoner’s dilemma in which he provided, amongst other things, insights into the probability of persistent cooperation on a cycle (graph).

The final tea-time on Monday was an important one, and not only for those who enjoyed the welcoming immensely, but as it was the longest session of the conference (at two and a half hours). I found myself in the machine learning and classification session which landed me my first session hot-streak (a session which features all that a delegate may want and does not require them to change venues for the duration of the session).

A cheese and wine tasting followed shortly after the close of play. We were treated to delightful platters and lively presentations of wines by a number of farms in the Stellenbosch region. Conflicting evidence was presented as to the role that American oak plays in the wine-making business but this was largely overlooked or ignored by an eager audience.

I started my Tuesday morning in the OR in Industry session wherein Ian Durbach presented an agent-based model he had devised in exploring the role of theft in the conservation of the Aloe dichotoma. In OR in Mining and Manufacturing, Frank Ortman bandied overly large numbers around when presenting on the optimization of circuits for superconducting super-computers. He stated that the (current) fastest supercomputer in the world is capable of 33.86 petaFLOPS on 3,120,000 cores. Furthermore, this massive machine guzzles a sizeable 17MW. Things got even more ridiculous when he spoke of data centres that cover 100,000 square metres and require 100MW of power. Wayne Bossenger followed with a presentation showing how far thinking, a single core and a few seconds can go to solving the problem of 2D irregular strip packing.

I was particularly interested in Dewald Engelbrecht’s talk on the fairness of the Super 15 schedule and so found myself in the Timetabling and Tournament Scheduling session. This talk inevitably featured a number of references to a certain red-card (not of the kind we were brandishing at the conference to indicate it was time to stop talking) incident at Eden Park in New Zealand. I was quick to change venues when Social Darwinism reared its head during the question session. Self preservation was high on my agenda and I was concerned that the discussion may lead to a fight to the death. In the Transport and Transportation session Hans Ittman outlined the challenges

faced in determining freight demand for Transnet. With planning horizons and forecasts spanning 30 years this seemed to be rather challenging. I finally made my way to the Student Competition session in time for the masters student presentations which saw the speakers presenting a dirth of work at an extraordinary speed. It was quite an impressive display. In the session that followed lunch, David Lubinsky (the session chair for that session) shared an interview question sometimes asked of prospective employees by OPSI systems. He didn't share the answer.

The underrated AGM delivered a number of enjoyable moments that were really best experienced in person. The treasurer, Jonas Stray, offered to sing for those gathered and it was established that the society is engaged in the real estate market (they rent a postbox for the princely sum of R340 a year). Lieschen Venter whet our appetites for next year's conference in the "Freestate's Franschoek" and assured us that things were going to "get rural".

"Don't panic." I suspect that it was around this time that I had lost the notebook I had been using throughout the conference. Having to pen this piece without quotes from ORSSA members has been unfortunate, hence my reliance on quotes from certain fictional [non-]ORSSA members.

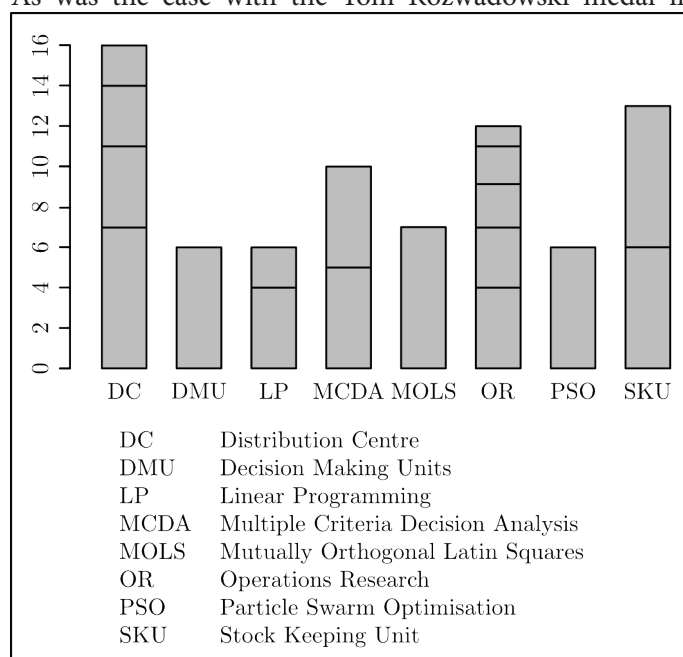
Delegates and guests arrived for the banquet to the delightful accompaniment of a string-duo featuring a cello and a violin. Seating was predetermined by the benevolent ORSSA fairies who placed a seating chart in the foyer and favoured a fine grained seating assignment over simple table assignments. Hans Itmann was the master of ceremonies and as things got under way he fired a playful warning shot across the bow of any potentially boisterous and rowdy delegates (last year's banquet was sometimes a noisy affair). His jest was not left unanswered as a set of delegates (possibly overlapping with the rowdy set) seated at various tables throughout the venue showed the master of ceremonies the five-minutes-remaining (green) card. Over four hours later, the Tom Rozwadowski medal was awarded and in-between three courses were served and seven recognition awards were made for contributions to the OR (the citations appear in this issue). The recipients of the Category III, II and I awards took to the podium to say a few words. All were very gracious in their acceptance thereof and a few recounted tales from colourful OR pasts.

"This must be [Wednesday]," said Arthur to himself, sinking low over his beer. "I never could get the hang of [Wednesday]." Although there were a few stragglers at the banquet the night before, things were far more subdued than in previous years (and of course, Dave Evans was not there, himself a member of the Noble Order of the Brave Stayers). Hans Itmann's statements regarding

the fact that young(er) members are not remaining with the society is increasingly in evidence at the post-banquet congregations. Of course, the more important business of learning was to continue and so I attended the Agriculture, Forestry and Land Use session where I caught Berndt Lindner's excellent presentation on optimal sawing and ripping of pine. I spent the remainder of the early morning in the Simulation session where I enjoyed a presentation on autonomous agents by Robert Hagspihl and a presentation by Prenitha Pooren on the use of stochastic simulation in the assessment of a new chemical plant.

Theo Stewart deftly delivered a very interesting closing plenary in which he discussed MCDA as an aid to operations research for development. He discussed four interesting case studies and introduced various tools, such as thermometer scales, causal maps, value trees and post-it brainstorming sessions, that were employed in interactions with stakeholders in identifying goals. The ORSSA elders then took to the floor to reflect on papers presented at the conference. I realised that I had missed an opportunity in not simply transcribing their words and passing it off as my report on the conference. Gerhard Geldenhuys solved the parallel session problem by pointing out that one should use tea-times to engage with speakers whose presentations might have been missed due to a conflict. He also revealed a passing interest in the abundance of acronyms and abbreviations in use at the conference. Inspired by this I quickly reviewed the abstracts and found that 41% of them do not feature any acronyms and, for the sake of it, I compiled a boxplot of the occurrences of abbreviations within the abstracts.

As was the case with the Tom Rozwadowski medal in



The eight most frequently used acronyms where the segments of the bars represent the number of times the acronym appears in an abstract.

the years 1971-1976, there will be no recipients of the we-didn't-win-conference-prizes-but-we-said-something-memorable awards. Not for lack of quality comments, but due to the terrible fate that had befallen my notebook.

The conference ended as it had began for the local organising committee, but they were now the pall-bearers ferrying unclaimed conference bags and a few driblets and drabs out of the hotel while delegates slowly

departed. Farewells were said and thanks were given. The local organising committee had succeeded in making the life of this conference a brilliant one.

“The Answer to the Great Question... Of Life, the Universe and Everything... Is... Forty-two,” said Deep Thought, with infinite majesty and calm.”

ORSSA: CATEGORY I RECOGNITION AWARD PRESENTED TO DAVE W EVANS

Citation by Wim Gevers



Dave Evans

David William Evans was born in England on 11 December 1946. After completing his schooling in Yorkshire, he enrolled at Cambridge University and graduated with an MA in biochemistry. He continued his academic endeavours and read for an MSc in Operations Research and Management Studies at Imperial

College in London. Not only did he distinguish himself academically, but he was also an accomplished sportsman playing first team basketball and cricket, and he also achieved a Half Blue for Basketball at Cambridge.

He spent the first years of his working career in the United Kingdom, then joined the Imperial Chemical Industries' South African subsidiary, AECI, in the early 1970's, and received permanent residency in South Africa in 1974. During the early part of his career he was involved in a variety of challenging OR problems, including simulation modelling of animal metabolisms, the simulation of optimal storage facilities for AECI's multimillion Coalplex project, geostatistical ore reserve estimation for an open cast phosphate mine, investment modelling of a fertilizer complex, optimising profitability and operations in the multi-million rand chlor-alkalis and plastics business, and computerised decision support models for complex decentralisation decisions and various forms of multi-million-per-annum contracts between AECI and the Chamber of mines. His responsibilities in AECI grew as he successively became Information Systems Manager during the second half of the 1980s, Logistics Manager during the early 1990s and Information Technology Manager during the later 1990s.

After a brief stint as an independent Strategic Management and IT Consultant, he joined Kohler Packaging as divisional IT director and subsequently was senior consultant at Value Analytics where he was intimately

involved with the development and implementation of executive information systems, IT and strategy consulting for a number of clients. From 2003 onwards he became the Senior Strategic Planner at the Development Bank of Southern Africa where he supported the CEO and the executive management team (including the Chairman and Governor) in analyzing and planning strategy for the bank. He remained there until his retirement earlier this year.

Throughout his challenging business career he has remained a dedicated and loyal member of ORSSA and has served the Society in a variety of roles. He has served on the National Executive at various occasions, holding the portfolios of Newsletter Editor, Vice President and finally President in 1985. He later returned to the National Executive, serving first as Treasurer and then again as President during the period 2009-2010. In addition he has served the Johannesburg Chapter over an extended period of time as Chairperson, Secretary and Treasurer. He has refereed many papers for ORiON, and has served as guest editor for a special edition in 1998. He has organised numerous conferences. The practical experience and insights that Dave has developed over the years has formed the core of some twenty papers presented at conferences and seminars of ORSSA and other professional societies.



Hans Ittmann was on hand to receive the award from Jan van Vuuren on behalf of Dave Evans.

Dave has been involved at the University of the Witwatersrand's School of Mechanical Engineering as Advisory Board member and external examiner for courses in Operations Research as well as for numerous MSc theses. He has also been invited as guest lecturer at the Universities of Cape Town, Stellenbosch and the Witwatersrand, as well as at the Gordon Institute of Business Science. In addition to being a member of ORSSA, he is also a member of the Computer Society of South Africa and the South African Production and Inventory Control Society.

Dave Evans is the epitome of an operations research specialist who developed into a respected business leader and manager, while staying true to his roots in operations research. For his services to and impact on operations research in general, his leading role in promoting operations research in industry, his services to ORSSA over a period of close to 40 years, Dave William Evans was, on the 17th day of September 2013, duly awarded a Category I ORSSA recognition award.

ORSSA: CATEGORY I RECOGNITION AWARD **PRESENTED TO JOHANNES M HATTINGH**

Citation by Marthi Harmse

Johannes Michiel Hattingh (or Giel as he is known) was born in Parys in the then Orange Free State on 16 May 1940. Fifteen years later he matriculated in the same town. Crossing the Vaal River, he enrolled for a BSc degree with majors in Mathematics and Statistics at the then Potchefstroom University for Higher Christian Education, a degree he obtained cum laude in 1962. A year later he completed an honours degree in Mathematics, two years later a masters degree in Statistics, and in 1971 a doctorate in Statistics and Operations Research, all at the same university on the banks of the Mooi River.

At a young age Giel started working as a technical clerk at SASOL (1957–1960). After obtaining his masters degree, he started lecturing at his alma mater in 1966. Three years later he was promoted to senior lecturer and in 1976 to full professor of Computer Science. From 1981 to 1984 Giel was Director of Computer Services and from 1985 to 1989 Chief Director of Planning and Information at Potchefstroom University. In 1990 he was appointed Chairman of the Department of Computer Science and Information Systems and in 1998 Head of the TELKOM Centre of Excellence, as well as of the Research Subprogramme on Computer Science, Informatics and Operations Research in the Focus Area on Business Mathematics and Informatics. He remained at North-West University until his retirement last year.

Giel has been a member of ORSSA for many years and was, in fact, one of the first members to be elected Fellow of ORSSA in 2005. He is also a full member of the South African Computer Scientists and Information Technologists Society, of which he was President in 1997 and 1998. He has been graduate advisor to many masters and doctoral students in Statistics and Operations Research, Computer Science and Information Systems as well as from the Business School in Potchefstroom. Some of his past students have gone on to play prominent roles on the local operational research landscape and within ORSSA.

He has published extensively, especially in the fields of Decision Support Systems, Mathematical Programming and Artificial Intelligence. He has also been involved in large-scale, industry-sponsored collaborative research projects with partners in Germany, the United States of America and elsewhere. Giel has also undertaken various study tours and has attended a large number of local and international conferences over the years, many as keynote speaker.

For his services to and considerable impact on operations research in general (both locally and abroad) and his role in educating and nurturing a long line of post-graduate students in Computer Science and Operations Research at the then Potchefstroom University for Higher Christian Education, now North-West University, Johannes Michiel Hattingh was, on the 17th day of September 2013, duly awarded a Category I ORSSA Recognition Award.



Hennie Kruger was on hand to receive the award from Jan van Vuuren on behalf of Giel Hattingh.

ORSSA: CATEGORY II RECOGNITION AWARD PRESENTED TO DAVID LUBINSKY

Citation by Jan van Vuuren

David Lubinsky holds a Masters Degree in Statistics from the University of the Witwatersrand and a PhD in Computer Science from Rutgers University in the United States of America. He worked at Bell Laboratories in its Intelligent Systems Research Group for four years upon completion of his doctoral studies before returning to South Africa in 1992. Pursuing a role in education at the Department of Computer Science at the University of the Witwatersrand, he was promoted to associate professor in 1995 before leaving academia in 1997 to form the consulting company OPSI Systems together with two of his graduate students.



David Lubinsky receives his award from Jan van Vuuren.

OPSI Systems provides software solutions and consulting for transport planning and optimisation, encompassing a wide variety of applications, including vehicle fleet scheduling, routing and management, as well as auditing of vehicle fleets by means of GPS tracking. The products of OPSI Systems are integrated into the optimisation of all aspects of vehicle logistics for companies in the small, medium and enterprise space: from fast-moving consumer goods to courier services, from dedicated vehicle fleets to outsourced operations. The aim of these products is to help companies, such as SAB-Miller, Transnet, Clover, DHL, Imperial Logistics and St Gobain, as well as a large number of other clients, to reduce their costs, improve their efficiency and optimise their supply chains.

Dr Lubinsky is managing director of OPSI Systems, which has indeed become a premier developer and supplier of routing and scheduling systems to the South African road and rail communities. David has been involved in the algorithmic design of all the products of OPSI Systems. Three products deserve particular mention.

The first is FLO, a vehicle operations planning tool devel-

oped in 2005, which takes as input variables on-time depot departure statistics, levels of route schedule adherence, customer estimated times of arrivals and on-time delivery statistics in order to address and improve the efficiency, customer service and driver management of a delivery fleet. SAB-Miller is one of many OPSI Systems customers to experience significant improvements both in their key performance indicators as well as customer and distribution load planner satisfaction as a result of the implementation of FLO.

The second product is PLATO, a suite of enterprise-level software modules for dynamic, multi-day planning, scheduling and controlling across both the primary and secondary product distribution environments. It incorporates a large number of factors in the modelling of complex transport operations, including shift-changes, outsourcing to external contractors, loading bay configurations, and variable stop times based on loading and offloading profiles. Through the interaction with external systems and the integration with multiple tracking and GPS service providers, the distribution department of a company is able to improve the efficiency of its operations significantly using PLATO. Examples of companies benefiting from this tool include British American Tobacco, DHL and others.

The third product is ORBIT, an optimal route building and information tool designed to create and compare routes and nominated delivery days for delivery vehicles and sales representatives. It incorporates the demarcation of sales regions, visitation profiles and client clustering to facilitate an understanding of the subtle interactions between the various operational demands in a visual fashion. It provides several tools and functions for collecting, arranging and displaying client sales and routing information for the generation of optimal master routes, visitation profiles, nominated delivery days and multi-day sales representative routing.

The Executive Committee of ORSSA has decided to recognise the significant contribution David Lubinsky has made and the role he has played and is still playing in the local consulting landscape, where he has established a professional home for a large number of operations researchers working in the logistics and supply chain environment. As a current member of ORSSA, this award is conferred on him for his single, outstanding achievement of founding and leading OPSI Systems to become one of the most successful transport planning and optimisation consulting firms in South Africa.

ORSSA: CATEGORY III RECOGNITION AWARD PRESENTED TO JAN GOTTLIEB MALAN

Citation by Jan van Vuuren

Jan Gottlieb Malan was born in the Western Cape town of Paarl on August 6th, 1940. He matriculated as dux student from the well-known Paarl Boys' High School in 1958, where he achieved the second highest matric mark in the then Cape Province. The following year he enrolled for a BSc degree at Stellenbosch University, majoring in physics. This degree was conferred on him with distinction in 1961, and was followed up with an honours degree in physics in 1962 and a masters degree in physics in 1965, both with distinction and both from Stellenbosch University. In 1968 he obtained a doctorate in nuclear physics at Stellenbosch University under the supervision of Wynand Mouton. He also holds an advanced management diploma from the University of South Africa, which he obtained in 1980.



Jan Malan receives his award from Jan van Vuuren.

In 1968, however, Dr Malan started his career as nuclear structure researcher at the Atomic Energy Board, based in Pelindaba. There he co-authored more than twenty research papers published in international peer-reviewed journals. After spending a post-doctoral research year at Duke University in the United States during 1970, he moved to the Department of Planning and the Environment in Pretoria in 1974. There he rose through the ranks to the position of Deputy Director: Energy before relocating to Simon's Town in 1977, where he joined the then newly formed Institute of Maritime Technology, or IMT. In 1981 he was promoted to the position of Head of IMT. In this capacity he was instrumental in building up the institute into a world-class research and development centre. He moved to Bredasdorp in 1988 to head the Overberg Missile Test Facility until his retirement in 2005. There he played a pivotal role in turning that facility into a highly profitable concern.

Dr Malan has served on a wide variety of advisory committees over the years, including that of the National Research Institute for Mathematical Sciences at the CSIR in Pretoria, the National Institute for Oceanographic

Research in Stellenbosch, the Magnetic Observatory in Hermanus and the Faculty of Engineering at Stellenbosch University. He has also served the community in various capacities, including on the governing bodies of a number of schools in the Western Cape.

It was during the period 1981–2005, however, that Dr Malan made his considerable contribution to the profession of operations research by spearheading the establishment of two scientific research centres of the highest order which became the professional homes of large groupings of military analysts and scientists who did work of an operational research nature, first at IMT in Simon's Town and later at the Overberg test facility in Bredasdorp.

The brief of IMT was then and remains to this day to provide the South African Navy with decision support in respect of research, development and acquisitions. Under Dr Malan's leadership the institute developed into a hive of operations research-related activities during the 1980s. These activities included hosting large-scale war games (under the expert guidance of Johannes Tredoux, Gerhard Geldenhuys and others), a considerable amount of seminal work on search theory (under the leadership of Gerhard Strumpher) and the development of a large linear programming model which was used to advise the navy with respect to an ideal force composition.

At the time of the new political dispensation in 1994, when the national space programme was abandoned, the missile test facility at Overberg was a mere one and a half years away from achieving a fully functional satellite launching capability. In the years that followed, Dr Malan oversaw a complete redesign of the facility into the profitable and reputable international missile testing ground that it is today.

Jan Malan was nominated for this award because he has firmly supported the sustained inclusion of operations research as a fundamental research and development component within the South African military domain over a period of twenty five years. Although never being a member of ORSSA himself, he appreciates the value that operations research is capable of adding to the quality of military decision making, and he has helped to establish and nurture an entire generation of military operations researchers. For this contribution to the profession of operations research in South Africa, Jan Gottlieb Malan was, on the 17th day of September 2013, duly awarded a Category III ORSSA Recognition Award.

ORSSA: CATEGORY IV RECOGNITION AWARD PRESENTED TO MARGARETE J BESTER

Citation by Jan van Vuuren

Margarete Joan Bester (née Louw) was born in Bellville on May 21st, 1979. After matriculating from Hottentots Holland High School in 1997, she enrolled for a bachelor's degree in the mathematical sciences at Stellenbosch University in 1998. She obtained this degree, majoring in mathematics and applied mathematics, in 2000, and went on to obtain an honours degree in applied mathematics cum laude from the same institution in 2001. Her honours year project entitled *Finding Good Nursing Schedules* won the best project award in the ORSSA national student competition of 2002 and was subsequently published as a case study in the authoritative Journal of Scheduling. The same year she enrolled part-time for a masters degree in operations research at Stellenbosch University, a qualification she received cum laude in 2006 based on a thesis on production scheduling and facility floor layout optimisation.

husband, Francois. She remained a managing member of Oprecon, which had major clients in the credit risk, forestry and supply chain industries, until the company was incorporated into the larger XTranda last year. Margarete is now Operations Director at XTranda in Cape Town, where she is responsible for product research and development.

While previously at PIC Solutions and Oprecon, and also now at XTranda, Margarete has been involved in a large number of exciting and very successful operations research consulting projects, often taking a leading role. These projects include the development of a model of automated harvest scheduling for large players in the forestry sector, the design of decision support systems aiding in floor layout planning and production scheduling for production facilities, and the design of a decision support system for duty scheduling of nurses at large hospitals in the Western Cape. Margarete has also adopted a mentoring role with respect to new operations research recruits at all three these companies and her passion for guiding and training young talent has seen her making a very valuable contribution towards nurturing a new generation of operations research practitioners in the Western Cape.

In addition to her seminal involvement in all of the above-mentioned capacities, Margarete joined ORSSA in 2001 and served on its Executive Committee as chairperson of the Western Cape Chapter of ORSSA during the period 2004 to 2012. She has also coordinated the ORSSA national student competitions for a number of years and has been a member of the South African Statistical Association since 2004.

In recognition of the excellent quality of the operational research projects in which she has been involved since 2004, as well as the leading roles she has played in the operations research consulting companies Oprecon and XTranda, Margarete Joan Bester was, on the 17th day of September 2013, duly awarded a Category IV ORSSA Recognition Award.



Margarete Bester receives her award from ORSSA president, Jan van Vuuren.

In the meantime she started working as a scoring analyst at Processing Integration Consulting, or PIC Solutions in Cape Town in 2004, moving to Metropolitan Life in 2006, where she was a senior data miner. In 2007 she moved back to PIC Solutions, this time holding the position of scoring consultant. It was in 2008 that she founded the operations research consulting company Oprecon in Bellville together with her

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ORSSA: CATEGORY IV RECOGNITION AWARD PRESENTED TO ANGELA L RADEMEYER

Citation by Jan van Vuuren

Angela Liza Rademeyer was born in Johannesburg on September 9th, 1983. After matriculating with full academic colours and straight As from Holy Rosary School in Edenvale in 2001, she enrolled for a bachelor's degree in actuarial science and mathematical statistics at the University of the Witwatersrand in 2002. She obtained this degree with seven exemptions from the Faculty and Institute of Actuaries in 2004, and went on to obtain an honours degree in mathematical statistics cum laude from the same institution in 2005, also winning the Liberty Life Gold Medal for Mathematical Statistics in that year. In 2006 she enrolled part time for a master's degree in mathematical statistics and operations research at the University of the Witwatersrand, a qualification she received with distinction in 2008. She followed this up by enrolling for a PhD at Wits on a part time basis in 2009, and she has just successfully defended her doctoral thesis entitled *Algorithmic approaches to solving multi-period sales force and delivery vehicle master routing problems*.



Angela Rademeyer receives her award from ORSSA president, Jan van Vuuren.

While still enrolled for her masters studies in 2006, she started working as analytic consultant at OPSI Systems, an operations research consulting firm based in Rosebank, Johannesburg, which specialises in transport planning

and fleet optimisation. Here her duties included algorithm design, software implementation and testing, as well as training of new recruits. In 2010 she was promoted to managerial level with the portfolio of consulting and optimisation, a position she still holds at OPSI Systems and in which her duties include the development of computerised optimisation tools, project management on various fronts, meeting with clients on a regular basis, and the preparation of tender documentation.

During her stay at OPSI Systems, Angela has been involved in a variety of exciting and very successful large-scale operations research consulting projects, often taking a leading role. These projects include country-wide route planning for sales representatives of SAB-Miller in South Africa and Ghana, fleet-sizing and delivery route optimisation for Clover South Africa and Unitrans-Nulaid, the design of new master routes for various depots of Steiner Hygiene, the scheduling of deliveries for Take-5, the design of a demand simulation decision support system for the Smollan Group, the development of a customer zoning and delivery schedule for Pioneer Foods, and decision support with respect to optimal facility location and visitation routes for sales representatives of Coca Cola and delivery routes for Woolworths.

In addition to all of the above-mentioned responsibilities, Angela also keeps up to date with new developments in her field of expertise by regularly attending international conferences and winter schools. For example, she attended the Winter Schools on Network Optimization and on Optimization in Logistics and Transportation in Estoril, Portugal in 2011 and 2012, respectively, and has published her work in various national and international peer-reviewed conference proceedings. She is also a member of the Golden Key International Honour Society. Finally, Angela is no stranger to ORSSA. She is a regular contributor at the annual conferences of the Society, having won the prize for the best presentation by a doctoral student during the 2012 conference at Aloe Ridge. She has also featured in the ORSSA Newsletter's member column.

In recognition of the excellent quality of the operational research projects in which she has been involved since 2006, as well as the leading role she has played at OPSI Systems since 2010, Angela Liza Rademeyer was, on the 17th day of September 2013, duly awarded a Category IV ORSSA Recognition Award.

ORSSA: CATEGORY IV RECOGNITION AWARD PRESENTED TO ELIAS J WILLEMSE

Citation by Jan van Vuuren

Elias Jacobus Willemse was born in Pretoria on July 26th, 1985. After matriculating from Eldoraigne High School in 2003, he enrolled for a bachelor's degree in industrial engineering at the University of Pretoria in 2004. After being awarded this degree in 2007, he went on to obtain an honours degree in industrial engineering from the same institution in 2008. The following year he enrolled for a master's degree in industrial engineering at the University of Pretoria. The quality of the work he did for his master's thesis on a problem in vehicle routing was, however, so good that his thesis was upgraded to PhD-level in 2011. He is currently in the process of finalising his doctoral thesis in industrial engineering at the University of Pretoria on a part-time basis.



Elias Willemse receives his award from ORSSA president, Jan van Vuuren.

During the period 2005 to 2007 Elias worked as student worker for Teqcon, an exporter and local supplier of hi-tech perimeter detection technology, where he designed a tracking system capable of capturing and maintaining product information and configurations at installation sites. In 2008 he joined the Built Environment Unit at the CSIR in Pretoria, where he was involved in a variety of fascinating operations research-related projects, including waste collection and transportation optimisation for Ekurhuleni Metropolitan Municipality, electricity expansion capacity planning for Eskom, production optimisation and scheduling for AngloGold Ashanti Technology Innovation Consortium, integrated renewable energy systems modelling, road deflection analysis (that is, determining the structural stiffness of road pavement structures), and security guard routing

optimisation for Midfield-Estate in Gauteng. In 2009 he also joined the Department of Industrial and Systems Engineering at the University of Pretoria on a part-time basis, where he was responsible for presenting operations research courses to postgraduate students of the department.

He remained full-time at the CSIR until 2012, when he relocated to LTS Consulting, an engineering firm specialising in industrial engineering consulting, logistics and technology solutions. There he was, likewise, seminally involved in a number of very interesting operations research projects, including the determination of optimal locations for bulk resource road-to-rail consolidation terminals, the development of an automated workflow planning tool for assisting in the identification of resource requirements when performing molecular tests in a laboratory, and the streamlining of production and sales processes at nurseries in the Western Cape. At LTS Consulting he has also been the manager of a project involving the redesign of an analytical radiological laboratory for the National Nuclear Regulator as well as of a business process re-engineering project for managing the technical data of Eskom. In August this year he was appointed as lecturer in the Department of Industrial and Systems Engineering at the University of Pretoria on a full-time basis.

In addition to his involvement in all of these operations research consulting projects, Elias has served on the Executive Committee of ORSSA since 2010 and has been the editor of ORSSA's peer-reviewed conference proceedings since their inception in 2011. Last year he was co-opted as member of the Executive Committee of the South African Institute of Industrial Engineers, or SAIIE, and has since spearheaded the Operations Research Special Interest Group of SAIIE. In 2012 Elias also registered with the Engineering Council of South Africa as a professional industrial engineer.

In recognition of the excellent quality of the various operational research projects in which he has recently been involved, as just outlined, Elias Jacobus Willemse was, on the 17th day of September 2013, duly awarded a Category IV ORSSA Recognition Award.

SOCIAL MEDIA

- **Facebook** — Please visit (and like!) our page at www.facebook.com/ORSocietySA.
- **Twitter** — [@_ORSSA_](https://twitter.com/_ORSSA_).

STUDENT COMPETITION AWARDS

This year saw the first awarding of the *Gerhard Geldenhuys Medal* and the *Theodor Stewart Medal* for the best Honours/4th year project and masters project, respectively. There were nine entries in the honours/4th year category and six entries in the masters category. In the end, two projects were chosen from each category with the authors of each project being generously sponsored by FICO to present their work at the 42nd ORSSA annual conference in Stellenbosch.

The first of the two competitors in the honours/4th year category were Lumardt Groeneveld, whose work formed part of his 4th year project as an industrial engineering student at Stellenbosch University, and now works at Esteq. His talk was entitled *A decision support tool to locate and operate a DC in the Western Cape for MediClinic*. The second honours/4th year student was Robert Hagspihl. Robert was an operations research honours student at Stellenbosch University and now works at OPSI Systems. The title of his talk was *The number of pickers and SKU arrangement on a unidirectional picking line*. The winning project was that of Robert Hagspihl, in which he performed a case study on the Durban distribution centre of Pep Stores Ltd in which he modelled the picking line using an agent-based simulation which was able to provide decision support for the choice of the number of pickers for a specific picking line. Well done Robert!

the Bulk Freight Train Scheduling Problem of full loads without track congestion, but extends to cover operational constraints as well as flexible resource allocation and hubs. Well done Robert!



Robert Benetto receives the very first Theodor Stewart Medal from its namesake for the best project by a masters student.

Thanks to Bluestallion Technologies who sponsored three *Wolfram Mathematica* licenses which were presented to each of the winners as well as the runner up in the masters category. Special thanks is also given to Margarete Bester who was instrumental in organising the student competitions and garnering sponsorship from them.



Gerhard Geldenhuys was on hand to present Robert Hagspihl with the first ever Gerhard Geldenhuys Medal for the best project by an honours/4th year student.

In the masters category, the two final contestants were Robert Benetto and Sivashan Chetty. Robert completed his masters degree at the University of the Witwatersrand and now works at OPSI Systems. The title of his talk was *Dynamic bulk freight train scheduling in an uncongested rail network*. Sivashan completed his masters degree at the University of KwaZulu-Natal and the title of his talk was *Studies in heuristics for the Annual Crop Planning Problem*. The winner was Robert Benetto whose thesis focussed on

In addition to the awards for the best student projects there were also awards for the best presentation by an honours/4th year student, masters student and PhD student at the conference. The recipients of these awards were Elmien Thom, Berndt Lindner, and Linke Potgieter, respectively, all of Stellenbosch University. Well done to all three of them! Thanks to Wim Geervers for convening the student presentation awards and for tallying the scores of all the entrants.



Elmien Thom, Berndt Lindner and Linke Potgieter, winners of the best presentation by a student in the honours/4th year, masters and PhD categories, respectively.

THE TOM ROZWADOWSKI AWARD 2013*By Hennie Kruger (Hennie.Kruger@nwu.ac.za)***ORSSA Vice President and 2013 Rowadowski Award Convenor**

The Society's premier award, the Tom Rozwadowski medal, is annually awarded for the best written contribution to Operations Research made by a member of the Society during the previous year. The 2013 medal was recently awarded at the 42nd ORSSA annual conference in Stellenbosch. A total of 18 papers were entered of which 15 were eligible for review. Four referees had the difficult task to determine a winner which was based on the following criteria: Originality; Quality of theory developed; Interaction between theory and practice; New areas of application; New opportunities created for OR; and, Clarity of exposition.

The referees started off by ranking the papers according to the criteria and the idea was to repeat the ranking exercise until consensus was reached. The competition was very stiff and it was not unusual to see notes from the judges where they would make statements like "I have ranked paper X as number 1 on my list but numbers 2, 3 and 4 could also be ranked as number 1". In the end consensus was reached and it was unanimously decided that the winning paper is "An optimization-based seasonal sugarcane harvest scheduling decision support system for commercial growers in South Africa" authored by Jonas Stray, Jan van Vuuren and CN Bezuidenhout.

The paper details an ongoing sugarcane decision support research project in South Africa which is aimed at developing a decision support system capable of providing computerized support to those charged with the task of

scheduling sugarcane harvesting operations in South Africa. The optimization models underlying the decision support system are based on a time-dependent travelling salesman problem formulation and were solved approximately by means of a tabu search technique.

Well done and congratulations to the winning authors – and thanks to all the other authors who entered their work. The Society is proud of the high-quality research outputs that are continually produced by its members.

Finally, a word of thanks to the judges who gave generously of their time and expertise to assist with the important task of adjudication. We are all looking forward to the 2014 competition and trust that the number of entries will even be more than in 2013.



The Tom Rozwadowski Medal

20th CONFERENCE OF THE INTERNATIONAL FEDERATION OF OPERATIONAL RESEARCH SOCIETIES

I F O R S
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This triennial conference will be held from 13-18 July 2014 in the city of Barcelona, on the Mediterranean coast of Spain. We are working to prepare an attractive scientific program with a diverse and high quality number of participants sharing their knowledge and experience of operational research.

The venue is Barcelona International Convention Centre, which was built for Barcelona's International Cultural Forum in 2002 and is one of the facilities to host major conferences. Barcelona is a dynamic, open, and inviting city, which displays the characteristics of major Mediterranean cities and inherits a rich tradition in science, art and commerce.

We invite you to learn, enjoy, and be part of the great IFORS community by participating in IFORS 2014. Organize a session, give a talk and experience this great city! More details are available at www.ifors2014.org.

BLACKETT'S WAR – THE MEN WHO DEFEATED THE NAZI U-BOATS AND BROUGHT SCIENCE TO THE ART OF WARFARE

By Hans Ittman (hittmann01@gmail.com)

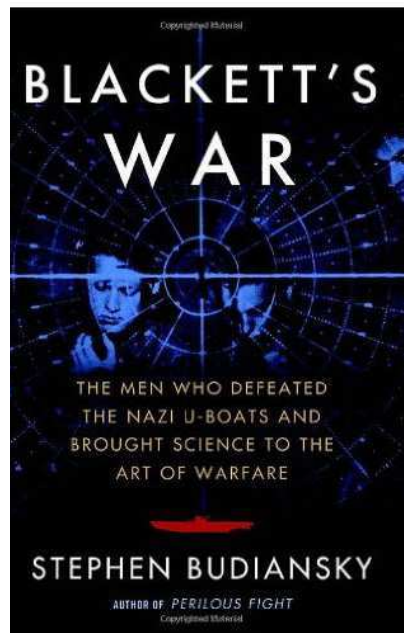
Operational Research originated in the period just before and during World War II. A number of books on the topic have been published, both by scientists and military historians. Blackett's War is an addition to this collection with a focus on the defeat of the U-boats and the scientists who made it possible. It is the story of scientists who confronted operational problems of the military during the war with their arsenal of simple mathematics and probability theory. In so doing, they played a central role in turning the tide against the devastating onslaught of the U-boats and in the process, developed the new discipline of Operational Research. The book is about the hurdles thrown along the way, the dedication of the scientists that it spawned, and the eventual realization by everyone that science in war can make an impact.

The book contains three main storylines with a spattering of shorter ones to come up with a coherent whole that is easy to read. The background and history of the U-boats comprises one of the important storylines. The development of the submarine from its origins is tracked, how the Germans built up a sizeable fleet of U-boats before World War I, and how they used these very successfully during that war. In an unprecedented and humiliating event, Germany had to surrender all its submarines at the end of the war, in compliance with the Armistice that was reached. It was not long after when private companies were contracted by the Germans to build a new fleet of U-boats in secret.

A second main storyline centres on Patrick Blackett and other scientists who got involved in the war effort. Blackett as a youngster joined the navy and by the end of World War I, witnessed the devastation caused by U-boats. After the war, the Navy sent him to Cambridge University where he realized that "the intellectual life of a place like Cambridge" was what he was cut out for, and therefore resigned from the military. After graduating, he joined the famous Cavendish Laboratory at Cambridge as a research fellow working under Nobel Laureate Rutherford. In 1932, he started the work that earned him the Nobel Prize in physics in 1948. These achievements, which include the

discovery of the positron, were backed by a "make sure you gather plenty of data", "the importance of statistics" and "minute, critical and accurate study of rare individual events" work ethic that proved critical during the war. Notwithstanding his left-wing almost Marxist liberal views, he and many other prominent scientists campaigned for involvement in the war effort. The publication of a booklet Science in War proved to be very convincing in this regard.

The third storyline of note is that of the German U-boat campaigner, Commander Karl Dönitz. He was involved in World War I and ended the war as captain of a U-boat. An excellent naval officer who remained very loyal to his political leaders and his country, he inculcated in his men a "spirit of selfless mission readiness". He took command of the U-boat Flotilla in 1935 and a year later, of the entire U-boat force. The early years of World War II saw this unit as very successful in waging a devastating onslaught on merchant shipping which impacted the supply of food and other necessary goods to Britain. Many, including Churchill, feared these immense losses could be the Achilles heel of the entire war effort.



The scientific endeavor even before the war is described in detail. There were rising concerns about how Britain will be able to defend itself against a possible future air attack. Influential people, including Churchill and a close friend Prof Lindeman, lobbied hard to get scientific advisers for the military. A scientific committee was established with three prominent scientists including Patrick Blackett. Through their efforts, more scientists were subsequently involved. One of the first tasks was to investigate the feasibility of using radio waves to detect aircraft, leading to the birth of radar. The next step was how to integrate this with the air defense system. Using radar to determine the location of aircraft through a system of tracking stations erected along the south east coast, a proper air defense system was in place when the war started. This work prompted one of the scientists to coin the term "operational research" to describe their efforts.

While scientists were continuously drawn into supporting the military, it was far from smooth sailing. The book details

the difficulties of telling generals and admirals how to do their jobs and how military bureaucracy made it very difficult to draw civilians into the defense environment. In addition Churchill, although supporting the science endeavor very strongly, sometimes became over excited about, and pushed ideas that were just not workable, detracting the focus from real problems and real solutions. The egos and personalities of many of those involved and the preconceptions that clouded their thinking were indicative of the obstacles faced. Closer cooperation with scientists from the USA was another endeavor that was welcomed by scientists on both sides but was met with distrust and skepticism from the military and political authorities on both sides. This was eventually overshadowed by the continuing intensification of the threat, making collaboration possible in the end.

The Battle of Britain during 1940 saw large air raids over London. Blackett was named Anti-Aircraft Command scientific adviser to assist in addressing this dangerous situation. He recruited a small team of scientists into his Anti-Aircraft Command Research Group which the Army officers began referring to as "Blackett's Circus". Its members were diverse in background, including three physiologists, two mathematical physicists, one astrophysicist, one surveyor, one general physicist, two mathematicians and an Army Officer. The anti-aircraft used to defend London were terribly inefficient. Among others, it was soon realised that the available radar data were not being used to calculate the proper bearing and elevation of the guns used, a process called "gun laying". A method was developed to address this while the deployment of 30 batteries of 4 guns each was altered. Half of the batteries did not have access to radar data and by concentrating the guns into 15 batteries of 8 guns each, the odds of engaging successfully was significantly increased. Within a year the scientists were able to reduce the number of shells required for a "hit" from 20 000 to 4 000!

The increasing threat from the U-boats contributed to the transfer of Blackett to Coastal Command where one of the scientists in his group, EJ Williams, began to work on possibly the most cited example of OR during the war. Through relatively simple calculations and data analysis, Williams was able to point out a number of flaws in the fight against the U-boats, including, among others: the depth charges had a success rate of only 1%; they went off at the wrong depth; the attack on a U-boat should happen before it was able to submerge too far and "escape"; direct hits were required to damage or destroy a U-boat; during daylight, U-boats can sight aircraft early enough to submerge and avoid being hit. Blackett installed a philosophy of improving available tools and methods already on hand rather than inventing new ones to solve problems.

Another critical issue in the antisubmarine war was "what

should the size of convoys be"? Bigger convoys were clearly preferable but it was counter intuitive and proved difficult to get adopted. In the fight against the U-boats intercepting signals and communication, decoding the Enigma generate codes was critical to the ultimate success of the effort - a topic covered in detail. The result of this entire endeavour was that by the end of 1943 and early 1944 the U-boat menace was virtually eradicated. Germany lost almost 70% of its U-boats and their crews by the end of the war.

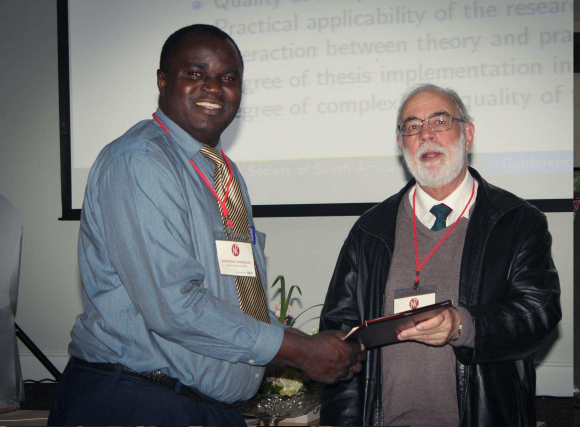
It is interesting to note that after the war, Blackett and some of his colleagues, mainly on the political left, sought to transfer their expertise from military concerns to the scientifically planned society they had dreamed of for so long. Their effort was largely a failure with most of those involved in the scientific war against the U-boats returning to their old jobs, getting on with their lives and careers. There were exceptions. In the USA, Morse and Kimball published a book that drew mainly on examples from the antisubmarine war, to show how OR might be applied to other problems.

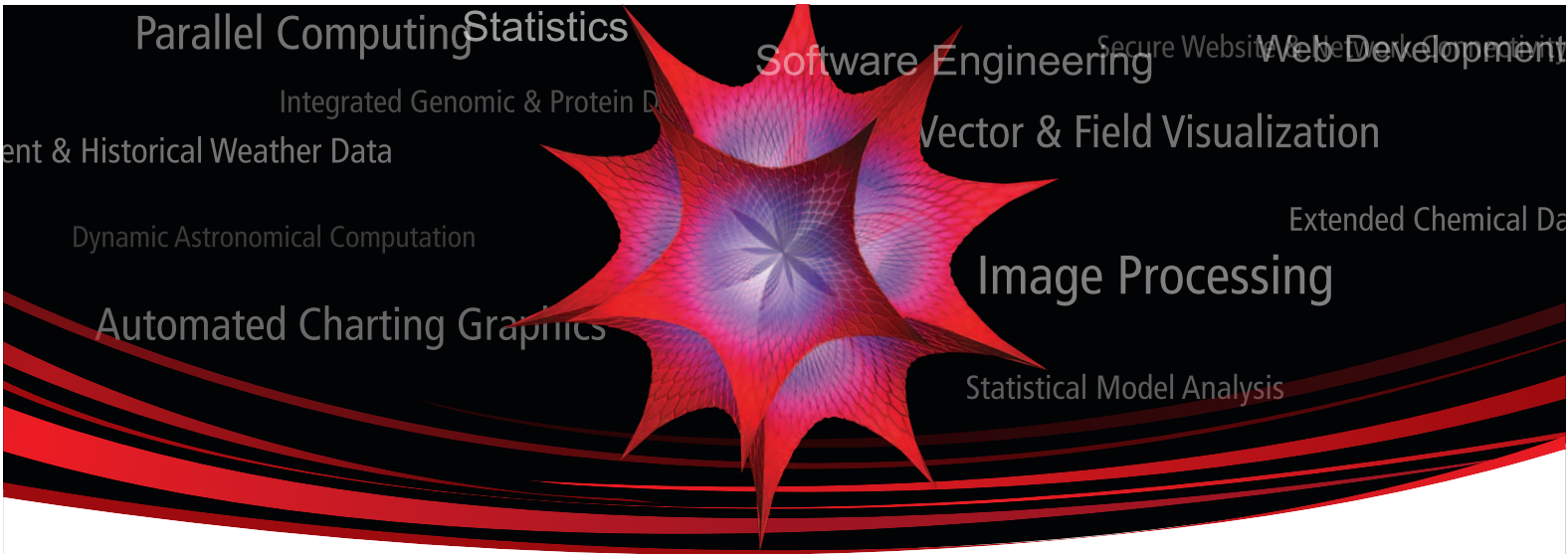
The contribution of Operational Research to winning the war cannot be overstated. Quoting from Blackett's War: "As the official British history of the scientific contribution to the war observed, it was this more than anything that ultimately defeated Hitler, a man who had a romantic view of war . . . Hitler and his generals failed to produce any operational research comparable to the British development, if they had, they would probably have won the submarine campaign and the war". Finally, the scientists involved in this effort, the "Operational Researchers", are described as follows: "As human beings they were prideful, touchy, opinionated, and sometimes mistaken, human failings too widespread to merit much condemnation. They were also selfless, incorruptible, and absolutely determined to let the facts lead where they will and damn the consequences, human virtues so rare as to seem, at times, almost otherworldly to the men burdened by politics and plans and career ambitions, to whom they showed the way to victory".

A fascinating book on an enthralling topic, Blackett's War is not just another book about the origins of OR. It is an exciting must-read for those interested in a close-up and personal look on the impact that OR has made on the art of war.

(This book review was originally published in the June 2013 IFORS newsletter and is published here with the kind permission of IFORS.)

Book info: Blackett's War – The Men Who Defeated the Nazi U-Boats and Brought Science to the Art of Warfare by Stephen Budiansky, 2013. Alfred A Knopf, New York, USA. pp 306, ISBN 978-0- 307-59596-6, \$27.95.





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