

Editorial

The year 2009 is rushing to an end and there is still so much to do! The OR community has been very busy as well – in July 2009, EURO had its 23rd conference in Bonn, Germany; the Chinese OR society had its meeting in the last week of September while INFORMS will have its annual meeting the second week of October in San Diego. In Africa the Operations Research Society of Eastern Africa (ORSEA) held its 5th conference in August while the Operations Research Society in South Africa (ORSSA) celebrated its 40th anniversary together with its annual conference in September 2009. We plan to report on these two conferences in the December edition. On top of all these activities, and there were surely many other events elsewhere in the world, the leader of the party in Japan who won the recent elections, Dr. Yukio Hatoyama, is a PhD in OR from Stanford. OR is indeed going places!

This edition of the newsletter is packed with interesting material. There is a short newflash on the new Prime Minister of Japan. The editorial by one of the Vice-President of IFORS, Tatsuo Oyama, addresses a very important matter, namely OR in the public sector. Professor Oyama shares his experiences and views from many years of involvement in teaching and practical involvement.

There are two feature articles; one relating to OR in sports and the other one on election forecasting. These are two very diverse topics but both hopefully very interesting. Over the past number of years OR has been used increasingly in various ways in the field of sports. One of the main areas is in assisting with the very complex problem of scheduling of sporting events. In his article on this topic, Mike Wright covers a whole range of issues where OR has contributed. It illustrates very vividly how OR is impacting on this area.

South Africa held its 4th democratic elections in April this year. A team from my organisation has been involved in the past in forecasting the results of such elections. I took the liberty to include an article on this very exciting event in this edition. This is possibly one of the most actions-driven and adrenalin-filled projects that our team has been involved in and it happens every five years.

IFORS has a tradition of IFORS Distinguished Lectures which go back many years. This year at the EURO conference, Professor Christo Papadimitriou was the IFORS distinguished lecturer. We include a short article on this event. In Denmark, a well known OR personality, Arne Jensen passed away and it is appropriate to pay tribute to this remarkable individual. Finally Jonathan Rosenhead, who is well known internationally, celebrated his 70th birthday last year. The London School of Economics, where he still teaches, celebrated this occasion with a two-day conference in his honour.

Three short articles from scholars who were supported by IFORS to attend summer schools are included in the newsletter. A range of other diverse articles and conference announcements are also presented.

Finally, as always, I would like to extend an invitation to anyone that wants to contribute to the newsletter in whatever way. Please don't hesitate to send me any material.

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INSIDE THIS ISSUE

<i>OR Activities for the Public Sector in Japan</i>	2
<i>OR in Sport</i>	4
<i>Election Night Forecasting 2009</i>	6
<i>Winter School on Biomathematic</i>	8
<i>IFORS Distinguished Lecture at EURO XXIII - Bonn</i>	9
<i>Arne Jensen - the second operational researcher in Denmark</i>	10
<i>Tribute to Jonathan Rosenhead At 70</i>	11
<i>Euro Summer Institute 2009 - IFORS Fellowship Report</i>	13
<i>ELAVIO 2009</i>	14
<i>New Survey of OR Practice Around the World</i>	15
<i>Analytic Support for Maritime Domain Awareness and Counter-Piracy</i>	16
<i>Transportation and Logistics Workshop</i>	17
<i>ALIO/INFORMS</i>	18
<i>9th International Conference on Operations Research</i>	19
<i>Registration Form - 9th International Conference on Operations Research</i>	20



NEWSFLASH

The new Prime Minister of Japan Yukio Hatoyama (62), whose party won the recent elections in Japan, is a trained operations researcher. From 1970 to 1976, he dedicated himself to OR, studied for, and earned, a PhD in OR from the University of Stanford in the USA.

The international OR community wishes him well in his challenging new position!

◀ *The new Prime Minister of Japan, Dr. Yukio Hatoyama.*

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OR Activities for the Public Sector in Japan

Tatsuo Oyama, IFORS Vice-President (APORS) ►



The author, currently a Dean and Vice President at the National Graduate Institute for Policy Studies (GRIPS) in Japan, has been involved in both masters and Ph.D programs for educating and training mostly government officials from domestic central and local governments, and internationally, from 40 different countries, people from various ministries, central banks and universities every year. He is also the IFORS Vice President representing APORS (the Asia-Pacific Operational Research Society) since 2006. In addition he has been very actively in ORSJ (the Operations Research Society of Japan) over the last roughly 35 years as Vice President (2006-2008), Fellow and Council Member since 1996 for Editing Committees, International Committee, Prize Committee, and so on. The author believes that it is, or at least it may be true that OR has contributed greatly in the military as well as the private sector in making strategically and tactically desirable and optimal decisions. However, he has to conclude that we have not been so successful in applying OR theory and techniques to public sector decision making in which the author has been working.

ORSJ was established in 1957, four years after the foundation of ORSA and TIMS in the USA. The total membership of the ORSJ was around 350 in 1957, increasing to 1000 in 1967, and 2000 in 1975. However, the total membership has decreased slightly since 1997, while most Japanese academic societies have seen drastic reductions in their membership by as much as half in the last 10 to 15 years. In 2005, the total membership of ORSJ amounted to 2570, including 85 institutional members. In 2007, ORSJ held its 50th anniversary conference in Tokyo, inviting five distinguished guest speakers from such areas as business, industry, academia and even politics. Incidentally, the plenary guest speaker from the politic environment at the conference was Dr. Yukio Hatoyama (his Ph.D degree is from Stanford majoring in OR), who was then the Secretary General for the Democratic Party of Japan and will be Prime Minister for Japan very soon. We have been holding academic conferences twice a year regularly. One is in the Tokyo area in spring, and the other outside

Tokyo in one of six different areas in fall. Reviewing all presentations given at the annual ORSJ spring and fall meetings in the past 48 years (see Miura[05]), we see an increasing trend in the total number of sessions in the last 40 years, from around 50 in 1955 to more than 80 in 2004. Usually, there are 3 or 4 presentations in each session. We find that as a general trend, theoretical areas such as mathematical programming or queueing theory are declining from 21.8% and 9.1% during the period 1975-85 to 9.8% and 4.3% in the period 1996-2000, respectively, while applied areas are growing. These applied areas include AHP, DEA, public sector problems such as public policy, traffic, city planning, social systems and so on. In these areas the growth has been from almost 0.0% in the first period 1975-85 to roughly 5% in the final period 1996-2000. Private sector problems related to production planning, management, information systems and so on have also been gaining interest.

In Japan, policy studies have been conducted in various schools in university and government research institutes. Public and private universities, in particular, have been very active in creating many policy-related schools and departments in the last 20 years. In 1997 GRIPS was established, the forerunner of which was the Graduate School of Political Science (GSPS) that was part of Saitama University over the period 1977 - 2001. At the time of writing this article more than 1400 foreign government officials from a total of 60 different countries have been trained at GRIPS and GSPS. In total, we have educated more than 2100 master's students from Japanese and foreign government offices in the last 30 years. Master's programs emphasize such areas as policy analysis, public policy, public administration, development studies, social systems analysis and so on. In 2008, GRIPS accepted 250 master's students while it also had 60 Ph.D students.

As in other countries, public sector organizations are divided into both central and local governments. We find that each public sector segment is described by a huge amount

of statistical data that are obtained by various processes such as surveys, sampling, and other collective means. Such "reliable" data, however, needs to be used more efficiently and effectively, as we now find the need for various kinds of policy planning, implementation, and evaluation becoming more important. However, past contributions of OR, both theoretical and applied, have not been strong enough in these areas, even though it has contributed to some degree. Here is where OR can be applied more actively and positively, and, thus, we see a "bright future" for OR in Japan, especially in the public sector.

Educational activities of OR for the public sector are mainly covered in graduate schools having policy-related programs such as public policy, public administration, public management, business administration, development studies, urban planning, and so on. Statistical courses are given in most policy-related public and private graduate schools in various forms such as introductory statistics, (intermediate) statistics, statistical analysis, quantitative data analysis, statistical methods for policy analysis, introductory mathematics for statistics, and so on.

Technical courses such as an introduction to simulation, decision analysis, mathematical modeling for policy analysis, and theoretical methodology oriented courses, such as the introduction to mathematical programming, optimization model analysis, game theory, discrete optimization, and AHP and DEA, are taught in some school graduate programs. In addition to common econometrics courses, specific statistical courses such as categorical data analysis, experimental designs, multivariate analysis, and time series analysis are offered in graduate schools of business administration and public policy.

In most policy-related graduate programs students are required to write a master's thesis where research topic is mostly related to their own interests. In the case where students are from central and local governments, they tend to choose master's thesis topics closely related to their own work in their offices where they have greater access to original data.

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"The author believes that it is, or at least it may be true that OR has contributed greatly in the military as well as the private sector in making strategically and tactically desirable and optimal decisions."

Policy evaluation has become more necessary, important, and also very common with the emerging attention to new public management (so-called NPM). Also, a large amount of quantitative data have been gathered and prepared by all Japanese government organizations. However, we note that OR theory and techniques that take advantage of this data have not been applied effectively so far (this may also be the case for most public sectors in other western countries). There are also many policy issues and societal problems that have not been considered seriously by OR researchers, even though their solutions are important and needed very urgently. These global problems arise in the areas of the environment, energy resources and complex societal policy problems such as public administration system, recycling, information technology industries, natural disasters, lifeline managements, social welfare, pension system, population problem, aging society, and other related research issues such as risk analyses, risk managements, and effective countermeasures for the emergent situations. These all require appropriate policy decision making very urgently. They are worthy challenges for OR researchers.

The author believes that OR shouldn't be focused upon just "mathematical modeling" even though it may be a major part. At least we shouldn't concede that "OR means mathematical modeling". OR is "a scientific approach" or "a way of thinking" for solving various types of societal problems. Thus our "solution" which leads to decision making should be based upon actual data processing and analysis, not necessarily on an optimal solution of a certain mathematical model. The author believes that the most important process for OR workers would be based upon the fact that actual data should be collected, investigated, processed, and utilized.

In Japan, high-level government officials are highly selective given that they passed the very competitive recruitment examination and they were employed by major ministries. Educating and training government officials has a long history in Japan, and the style, system, goals and review process have undergone continual change over the years. The aim of the education and training system need to be focussed on allowing each official to obtain certain specialty and expertise in various public policy and public administration functions, so that he or she can show his or her capability at the highest level in such areas as policy planning, policy implementation, policy evaluation, and policy analysis.

We have been educating and training these officials for a long period. However, our curricula need to be revised continuously so that they can adapt to the social needs. We believe we have contributed enough in order that those officials with academic backgrounds in social

science area such as law and economics become more familiar with quantitative theory and techniques such as statistics, systems analysis, OR and so on. However, we still have a lot of societal problems which we require to solve urgently, and here there is a strong possibility that we can probably apply OR theory and techniques. In this sense, we expect that public sector OR has a "bright future" even though a lot of uncertainty still exists in the face of our unsolved difficult problems.

Government officials need to have broader, international and global viewpoints and understandings, and every government official has to be equipped with some specialty in his or her job area. Also an evaluation and review system for monitoring each government official's work accomplishments needs to be introduced in the Japanese civil servant system which will impact on their promotion and salary. In order to reform the government bureaucracy constructively and effectively, it is important to create a review process for evaluating existing programs and determining how to organize and modify the education and training of government officials. We strongly believe that the success in public OR activities fully depend upon us OR researchers and our efforts to teach OR theory and techniques to high level Japanese government officials.

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OR in Sport

There are many in the OR community who do not regard sport as a proper area for OR people to get involved with. "Why are you wasting your time on sport?" my Head of Department commented in my appraisal a few years back. "Why not try something a bit less frivolous?". I decided not to take any notice of him. He is no longer my Head of Department, but just the other day he was still muttering about my "peculiar predilection for sport".

◀ Mike Wright

At least three possible reasons can be put forward for regarding sport as a serious field of OR study:

- more and more mathematical theorems are being proved concerning the timetabling of sports tournaments
- there is an enormous amount of money involved in professional sport
- sport is an important feature in the lives of literally billions of people

I personally am not a mathematician, and am not overly interested in megabucks, so the first two reasons do not explain my own interest. However, the third reason seems to me incontrovertibly strong. Given how much of the world's time is spent thinking about, discussing, watching and participating in sport it would be a very major omission if no OR people were looking into it at all. All sport of course involves complex decision-making and so does OR. They are natural bedfellows.

Decisions, decisions

Decision-making in sport takes place at many different levels and by all sorts of people – individual players, team captains, referees or other officials, coaches, trainers, groundsman, managers, owners, chairmen, administrators of leagues, national associations, international governing bodies, local or national governments, the media, fans, gamblers and probably others.

Of course, not all decisions are susceptible to OR analysis. When a cricket umpire decides whether to give a batsman out lbw, or a football referee decides whether to give a penalty, the decision is based solely upon what the official has observed. I suppose it is possible that these officials may be influenced by prior knowledge and observation – how often does this bowler swing the ball enough for the ball to have missed the stumps, how often has a specific player dived in the past – and that such information could be used to set up an OR model, but this is probably rather far-fetched, and thus the connection with OR is pretty tenuous.

However, many individual decisions during play could in theory be analysed using OR. Whenever a golfer addresses his ball he is making a decision as to how to hit the ball, with what club, with how much allowance for wind, for the relative horrors of the rough on

left and right, on bunker or stream positions, the position of the flag on the green, the contours of the green, etc. He has an objective which will often be to minimise the expected number of strokes taken for the hole, but which may in other circumstances (such as when he is chasing the leader near the end of a tournament) be to maximise the probability of a birdie. His decision will depend upon his perceived continuous probability distribution of where the ball might end up conditional on where he is trying to get it to end up. What is going through his mind is OR.

While it is not clear that real-time OR analysis can actually help the golfer playing his shot, or a cricket captain deciding where to place his field, there are plenty of real-time decisions made by individual players that can be helped by prior OR guidance. Many such decisions have come under scrutiny from OR analysts, for example:

- How close to the takeoff line should a long jumper aim for? Too far away and she is losing valuable centimetres, too close and she risks a no-jump.
- Under what circumstances "should" a footballer commit a professional foul to prevent a certain or likely goal, assuming his only objective is for his team to do as well as possible? Probably not worthwhile in the first minute of a match, probably a good idea in the final minute with his team leading by a single goal, but at what time and score does a bad idea turn into a good idea?
- How much protection should a good batsman give to his number 11 partner? Ideally he may want to keep him off strike altogether, but this may be very difficult especially as the opposing captain will be trying to thwart him, and anyway he may need to score runs as well.
- Where on the board should a darts player aim for? Even top players don't always score treble twenty when they aim for it, and a slight error may mean a score of just one.
- When should a tennis player use her fastest serve? If the serve goes in it has a high probability of winning the point, but it is quite likely to go out. The answer will depend upon the skill of the player and the score in the game as well as other factors.

There are also decisions to be made by managers and coaches while play is in progress, for example:

- When should a substitution be made in football? If your team is losing it is accepted that you should make an attacking substitution, but how long should you wait?
- Should a night watchman be used in cricket? Some captains do – England's Jimmy Anderson has been used in this way frequently – while other captains don't – Australians seem to regard it as a sign of weakness.
- When should an ice hockey coach pull his goalie? Too soon and there is too much risk of the opposition scoring an easy goal – too late and the extra non-goalie may not have enough time to have any effect.

At a higher level still are issues to be decided before play starts, such as:

- What relay team should be chosen for a swimming semi-final? It may be advantageous for a strong team to rest its best swimmers but it still needs to be sure of qualifying for the final.
- What route should an orienteer choose? The short but steep and hilly route or the longer route with fewer and shallower ups and downs?
- At what height should a pole vaulter enter a competition? Too low and this may cause unnecessary exertion and anxiety – too high and she may not register a height at all (as notoriously happened to Yelena Isinbayeva in the recent world championships).

And there are further decisions to be made well away from the action:

- When should a football manager be sacked? As soon as things start going badly, or should you give him plenty of time to get things right? Are practices different in different countries?
- What training schedule should be used by a decathlete? How should he divide his time between the ten different disciplines, and between general fitness training and technical work?
- What clothing should be used by speed skaters to optimise their performance?

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- What new players should a team buy, at what price? How do the players fit together best to produce the most effective team?

All of the examples above, and more, are the subject of papers in the academic OR literature, and can be found using the survey paper given as reference number [2] at the end of this paper. Techniques used include dynamic programming (especially valuable for many complex within-play decisions), probabilistic and statistical analysis, simulation and decision support systems. Most such papers are one-off, produced by academics out of their own interest rather than for a customer. Anecdotal evidence suggests that the active readership of such papers is much higher than that of most other OR studies in any field.

The scope for further analysis of this type is very large. There is probably no sport that could not benefit.

Scheduling/timetabling decisions for organisers and administrators

A very different style of OR study concerns the scheduling/timetabling of sporting events and competitions and their officials. Timetabling sports fixtures can in some cases be very easy and uncontroversial, yet in other cases it can be a major headache with large numbers of interested parties to try to satisfy.

Consider a league competition going on over the space of several months. Often this will be organised on a double round robin basis, i.e. every team plays against every other team twice, once at each team's ground. For any team, the fans will want to have a good pattern of home matches (but may not agree as to what this means) and may have strong preferences for particular days of the week; the marketing people will want to fit in best with corporate guests and avoid clashing with other events that may take spectators away; the TV companies will be thinking of their schedules; the sponsors will want to be in the spotlight at the right place at the right time; the players will be concerned about travel; the team management will want to avoid playing against the same team twice close together and may also want to avoid long gaps between matches; the police may want to avoid certain matches on certain dates; the ground may not always be available when ideally required; there may be traditional fixtures at specific times; etc. And what is preferred by one team may be totally different from what is preferred by another.

Similar issues apply to the knotty problem of assigning officials – referees, umpires, judges etc. It may well be important to spread officials out among the competitors or teams, so that they don't see each other too often. Sometimes it may be important to keep sets of officials together, but on other occasions it may be desirable to give each official experience of working with as many other officials as possible. Travel considerations are almost inevitably important, especially if long journeys are to be made in short spaces of time during periods of heavy

traffic. It may also be important to balance the work of officials fairly evenly throughout the season, but in other cases the officials may be able to dictate exactly when they should and should not be used. Officials may be of various grades and it may be important to use the most experienced or highly-qualified officials for the most high-profile matches, etc. Neutrality may also be an important issue, especially if some of the officials are also former (or even current) players. And on top of all these considerations (and more) the officials themselves will be looking out for ways that they may have been treated less well than their colleagues.

Given this complexity, many professional leagues and sporting organisations have turned to OR people (though they may not always be called OR people) for help. This help may come from internal sources, from an external consultancy company or from academics, who may then write about their experiences in papers published by academic journals. These papers cover a wide variety of sports including football, American football, rugby union, cricket, baseball, basketball, tennis and ice hockey. The OR methods used have included integer programming, goal programming, heuristics and metaheuristics.

While case studies reported in the OR literature are almost inevitably one-offs, some academics have turned sports scheduling into an area of mathematical research by considering relatively simple problems. These include the "minimum-break problem" – the problem of constructing round-robin schedules in such a way as to minimise the occurrence of "breaks", i.e. two home matches in succession – and the "travelling tournament problem" which concentrates on minimising team travel distance. Such approaches can indeed lead to successful implementations for some relatively simple scheduling problems, but all too often the literature concentrates solely on the mathematics and the practical applications appear to be largely forgotten.

Duckworth and Lewis

There are two people whose work deserves a section of its own, not so much because of its technical ingenuity (though it is quite ingenious in the way it is implemented) but because it has completely revolutionised the way in which cricket – the world's second most popular sport – is played in professional competitions throughout the world. The technique they devised governs how targets are reset and winners are determined for cricket matches which have been shortened, usually because of rain or bad light. Although the technique is of necessity quite complex in order to ensure fairness, it can be applied using a single table which is reasonably easy to interpret and to use.

They are easily the best-known practitioners of OR in Sport in the world, and probably also very comfortably the best-known OR practitioners of any kind. If you were to travel to the Indian subcontinent (population 1.5 billion) and mention the Duckworth/Lewis method, it is almost certain that at least one person in three

– that's half a billion – would know at least approximately what you were talking about. Most of us would be ecstatically happy with the extent of our fame being measured in thousands or even hundreds.

Other types of decision

There are many other types of OR study which have been undertaken. For example, some involve forecasting and betting, which could prove very fruitful for the experts – after all, the amount spent gambling on sports every year is enormous – and there are many other one-off implementations and studies which can be hard to categorise. This paper does not try to cover everything, but has instead concentrated upon the main and most important areas.

There are of course a host of other decisions made all the time relating to sport at a further remove. For example, local governments make decisions on building sports centres and other facilities; companies decide which teams and individuals to sponsor and how much money to spend on sponsorship; TV companies make decisions about what sporting events or fixtures to televise; national governments make policy on sports within schools; etc. However, the objectives, criteria and methods used for making such decisions do not usually depend to a large extent on the precise details of the sports in question, at least when compared with the examples described earlier, and so are not generally considered as part of "OR in Sport".

Where does OR in Sport fit into the OR community as a whole?

From rather slow beginnings, OR in Sport is now enjoying increasing prominence, and it is now widely recognised as an important application area for OR analysis. Survey articles have been written, special issues of journals have been produced, every major OR conference has its sports stream and there are specialised conferences covering OR and cognate areas such as statistics and economics as applied to sport.

If you are interested to find out more, a good starting point would be the two articles referenced below. They in turn have large reference lists which will enable you to enjoy the myriad delights that OR in Sport has to offer.

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ELECTION NIGHT FORECASTING 2009



◀ The CSIR team from left to right:
Zaid Kimmie, Rosalie de Villiers, Jan Greben
(project leader), Chris Elphinstone,
Peter Schmitz and Hans Ittmann.



▲ Jenny Holloway

(This article appeared in the June 2009 newsletter of the Operations Research Society of South Africa and is published with permission from the editor)

INTRODUCTION

A telephone call from Izak Minnaar, Head of Radio Research of the South African Broadcasting Corporation (SABC) in October 2008 started the process. They were gearing up for the coming general elections and wanted to involve the CSIR (Council for Scientific and Industrial Research) forecasting team again during the 2009 elections. Ever since the second democratic elections in 1999, the CSIR has been involved in election night forecasting (forecasting the final results of the election using the results as these are being declared). Since 2004 they have done so under contract by the SABC, both for the national and the municipal elections. A number of meetings were held with the SABC after October 2008 and, closer to the election date, the CSIR team ensured that all its systems, models and programmes were working. Results from the Independent Electoral Commission (IEC) are fed to the SABC and the CSIR obtain its data from the SABC. After standing in long queues on election day and after the polling stations closed, some of the CSIR members made their way to the IEC election headquarters at the Pretoria Show Grounds for what would be a long, exciting night and next day or two!

APPROACH

In South Africa, an electoral system of proportional representation is followed. In this system every vote is tallied and seats in the National Parliament are allocated on a proportional basis. Provincial Legislatures follow the same electoral system for voters registered within their boundaries. The system is therefore different to that used in a lot of other countries in that there is no allocation of constituency seats. There are also a large number of parties contesting the elections with the national elections of 2009 consisting of 26 parties.

The technique used to forecast the elections involves clustering all voting districts on prior knowledge. The method used in 1999 was to cluster the voting districts according to the demographic profile of their population, with the assumption that people of similar race, education, income, language and age would vote in similar ways. This was done using census data recorded in 1996. Subsequent to this, all applications of the election forecasting methodology have involved the same clustering technique but have been based on previous voting patterns, rather than on demographics. The reasoning behind this choice centered around the fact that the previous election results were more recent than the available census data and they also did not rely on the subjective assumptions about the importance of certain census parameters for voting behaviour. In the

2004 elections the clusters were based on the 1999 national election results and in 2009 the clusters were derived from the 2004 national election results. Various analyses were done on previous elections to determine the best number of clusters to use to obtain sufficient accuracy at an early enough point during the count and the final number selected was 20 clusters. The model used a fuzzy clustering technique [Ref. 1,2], so that each voting district has some membership in each cluster, but may have a stronger membership in one cluster than in others. The Euclidean distance was used as the measure of distance and in 2009, 19726 voting districts were clustered.

On the election night and during the following days, until the final count is known, the available results that have been counted are used to determine a prediction for each cluster based on the known results of voting districts belonging to each cluster. The predictions of each cluster are then in turn used to provide a prediction for the uncounted voting districts aligned to that cluster. All results are weighted by the registered voters in each voting district and the expected turnout, calculated again on a cluster by cluster basis. In this way, a prediction for the final percentage results expected for each party can be calculated.

The simplest forecast would be to merely take the available results at any time and extrapolate these to the final result. However, this is only acceptable if the voting districts counted at any one time is a random sample of all voting districts. This has proved not to be the case in previous elections and therefore the success of our model is based on countering the bias in the order of the incoming results.

RESULTS – 2004

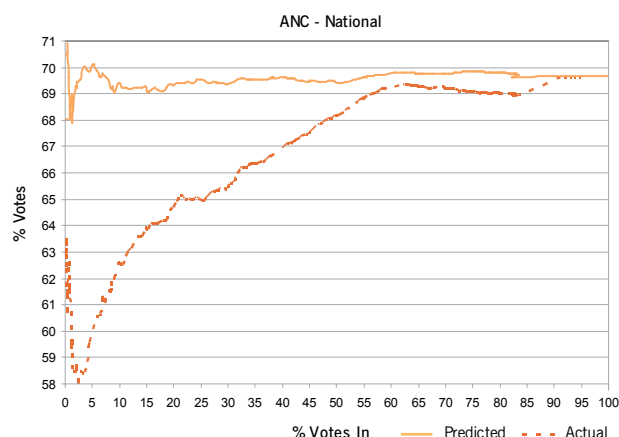
In 2004 the model performed well for the parties which obtained a large percentage of votes, namely the ANC, DA and IFP as well as for the NNP, ID and ACDP which each got between 1% and 2% of the vote. The first forecast was released, at 01h20 on the morning after the elections, after 2% of the votes had come in, stating that the ANC would get 69% while the actuals at the time were 60% for the ANC. The predictions for the ANC remained fairly stable throughout the count, never moving outside of the 69% to 70% band and finally converged with the final results at the end of the count at 69.7%. The predictions for the DA were initially over estimated, gradually dropping from a prediction of 14% after 5% of votes were counted (when actuals for the DA showed 22%) until it converged at a final result of 12.4%. The early predictions therefore performed much better than an extrapolation of the actuals at that time,

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even though the model could not remove all the bias resulting from the order in which the voting districts came in. The graph in Figure 1 shows the predictions for the ANC in 2004 against actual results.

Figure 1: ANC Actual results versus Predicted results - 2004



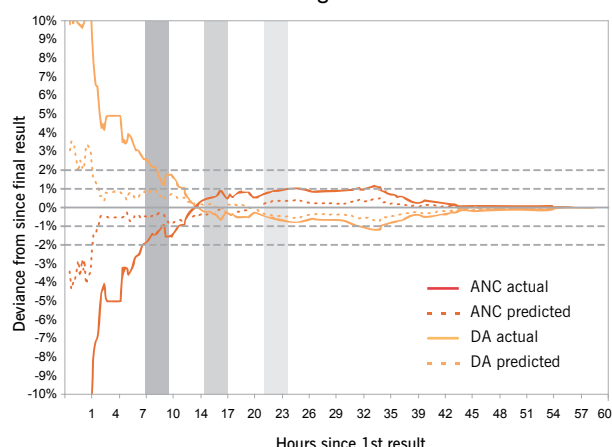
RESULTS - 2009

The elections were held on Wednesday 22 April 2009, with the polling stations closing at 9:00 p.m. Typically, results start coming in an hour after the closing time. Although this was also true of 2009, the rate at which voting districts results were being declared by the IEC was considerably slower than in 2004. Consequently, the SABC, together with the CSIR team, decided that we would not make any forecasts before 05h00 on the Thursday morning. There were also data problems and a break in the communications with the IEC results database early on that Thursday morning. The CSIR nevertheless had forecasts by 06h00 a.m. The data problems impacted on our ability to forecast voter turnout, but the rest of the model was fairly robust in handling the data problems.

Leading up to the 2009 elections, our team, had some concerns as to how well the clustering of 2004 voting patterns would behave in the 2009 elections due to the emergence of a new party COPE, which split off from the ANC. Pre-election market surveys indicated that COPE would get around 15% of the votes. The issue was whether this support would behave in a manner consistent with the clustering of voting districts. In the end, both the actuals and forecasts for COPE remained reasonably stable throughout the counting process with their final tally coming in at 7.4%.

The graph in Figure 2 shows the deviations of the predictions and the actual results from the final results, for the DA and ANC parties, at different times since the polling stations closed.

Figure 2: Absolute deviances during election count - 2009



The three vertical bands on figure 2 indicate the main news time slots during which the forecasts were being broadcast and discussed on television panel interviews. The first time band corresponds with the breakfast news show in which the deviations for both the ANC and DA were less than 1% off their final result. The predictions given during this time interval were 65.6% for the ANC (with their final result ending at 65.9%) and 17.3% for the DA (whose final result ended at 16.7%). The other two time bands in figure 2 indicate the lunch and evening

news slots and during both these intervals the predictions were close to the final result.

One can clearly see the benefit of our predictions, as the actual results (which are reported on an ongoing basis by all news media) were initially out by 4%, while our predictions for the ANC and the DA were accurate to within 1%. Overall, however, the performance of the model in the 2009 elections did not fair quite as well as in previous elections with regard to the stability of the ANC and DA percentage votes over time. Where in 2004 the prediction stabilised early on and remained fairly constant after about 40% of the votes were declared, in 2009 the predictions for both these parties fluctuated right until the end.

Various reasons for this instability of predictions have been identified and they mainly centre around the following two key assumptions that are inherent either in the model itself or in the software containing the model:

1. The forecasting software assumes that national and provincial results are released at the same time. However, in the 2009 election, the IEC frequently released provincial votes for a voting district while the national votes were held back. When we became aware of this problem during election night it was too late to adjust the software.
2. In order for the model to work it makes the assumption that people vote in the same voting stations as where they are registered. Although one has previously been able to vote outside of one's voting district, there was greater publicity and awareness around this option in 2009, resulting in many people voting elsewhere.

The violation of these two model assumptions had several knock-on effects which impacted the model, namely:

- Voter turnout calculations in the model were affected which in turn affected the predictions.
- Voting districts ran out of ballot papers with the result that ballot papers had to be exchanged between various voting districts. This resulted in delays for the people voting but more critically it caused huge delays for the IEC in terms of cross-validating results and checking that all papers were accounted for. The results from large areas were therefore kept back by the IEC until all voting districts in the area were validated and then the entire area's results were released in one batch. This caused the actual results to fluctuate considerably and likewise the predictions.

Nevertheless, the CSIR predictions with 15% of the votes out (at 06h45 on Thursday 23 April 2009), at national level, for the main parties against the final results were the following:

Table 1: Predicted versus final results at national level

	FORECAST	FINAL RESULTS
ANC	65.6	65.9
DA	17.3	16.7
COPE	7.0	7.4
IFP	4.1	4.6
ID	1.5	0.9
VF plus	1.2	0.8

Given the data problems these turned out to be fairly good! There were also predictions at provincial level for all the nine provinces and these too were fairly accurate although the forecasted percentage predictions for smaller parties were always going to be difficult because of the relatively little support.

MEDIA INTERACTION

Working with the SABC meant a lot of media exposure for the CSIR predictions both on radio (through news bulletins and radio interviews), TV (through the two spokes persons namely Zaid Kimmie and Hans Ittmann) and the printed media. As the predictions are computed the CSIR team feeds the SABC research team with news items which are placed on the SABC intraweb where all the different radio and TV stations can access these for use in the different news bulletins.

>>



ELECTION NIGHT ... CONTINUES >>

Any interesting news story that can be picked up from the results, predictions and the analysis thereof is formulated as news items with the SABC journalists. This brings a whole new exposure and experience to members of the CSIR team. Everything happens on the run and immediately, one cannot dwell on things. The first predictions are always very exciting since these will be used by all the media and obviously the team want to make sure these are "good predictions". The question is always how long we wait before releasing these first predictions!

Interacting with the media on radio and TV is also very exciting and different, not something modellers or statisticians do very often. This time round the CSIR possibly got more exposure than ever. What typically happens is that the predictions are "hot news" during the morning after the elections and everyone wants to interact, talk to the CSIR and hear our views.

When it becomes clear what the actual final results will be, the predictions are no longer "hot news" and the media loose interest in the predictions. The interest then turns to the analyses of a more political nature, such as the question: which parties lost or gained support from which other parties. The CSIR also contributes to these analyses, as it has developed sophisticated trend analyses tools [Ref. 3]. However, in the 2009 elections the interest in the predictions prolonged much longer than normal, as the question whether the ANC would get a two thirds majority at this late stage depended crucially on the small differences between the CSIR predictions, the predictions by political analysts and the actual results. By Friday it was still not clear whether the ANC would achieve this majority, although at some stage it had more than 67% of the votes declared. The CSIR model consistently predicted that the ANC would not achieve the two thirds majority, and in the end the model prediction turned out to be correct, beating most of the political analysts!

During election night there are many political analysts present at the election headquarters. They regularly interact with the CSIR team to get the latest updates on our predictions and use this information in their own analyses. A number of them have been involved in the past and the interactions with the CSIR team members have already led to joint papers. The media exposure in 2009 was on various national radio stations, on the TV stations SABC2 and SABC3, as well as on the BBC, where they featured a short interview. The exposure started on the Tuesday night before the election, while the final news item involving the CSIR was on Friday night on SABC3 during the seven o'clock news bulletin. There were many newspaper reports quoting our predictions and the comments by our spokes persons.

CONCLUSIONS

For all the CSIR team members this is possibly one of the most interesting projects they have been involved in and at the same time possibly the most exciting. There is an incredible vibe at the election centre, lots of media activity while at the same time we as modellers rub shoulders with politicians from all political parties, political analysts and media personalities. It happens every few years and is an intense few days. Given all the problems the team had this time round we are still happy that our predictions were fairly close to what the final results were. We look forward to the next elections which will be the municipal elections in 2011.

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Winter School on Biomathematic

Courses and Tutorials, February 15th -19th 2010

SUBMISSION OF ABSTRACTS AND PAPERS

Prior to the Operations Research conference in Havana (see p. 19) a Winter School on Biomathematic will be held. Those interested in presenting their results in the conference must submit an abstract in English of about 250 words, which will appear in the Abstract Booklet. An extended abstract of a maximum of 4 pages should be also sent for evaluating the contents of the contribution. Both documents must include: title, author names, institution and electronic mail of the speaker.

The papers should follow the following style: Title Black Arial 12", rest of the text Arial 10" in a version of Words. Submitted papers will be reviewed by (double-blind) by two reviewers, non-blind, and participative peer review. These three kinds of review will support the selection process of those that will be accepted for their presentation at the conference.

Authors of the papers presented at the conference will be invited to adapt the contributions for their publication in the Journal Investigación Operacional with no additional cost.

SPECIAL SESSIONS

We invite those interested in organizing a session to propose it to the Chair of the Program or Organizing Committee.

DEADLINES:

1. November 30, 2009: Registration and reception of Abstracts
2. January 3, 2010: Information about the acceptance of the papers
3. June 30, 2010: Full version of the paper for the Proceedings

CONFERENCE FEES

Foreign participants	140 CUC (around 164USD)
Cuban participants	140 CP
Cuban Students	60 CP
Foreign Students	60 CUC (around 60USD)

The fees, to be paid upon registration, include the Welcome Party, Volume of Abstracts and Conference Dinner.

Students shall prove their condition upon arrival. Members of the Sociedad Cubana de Matemática y Computación, ASEPUMA and ASEPELT will pay a reduced rate.

ACCOMMODATION

Travel Agencies can organize your trip to Havana for a stay for 8 days / 7 nights.

Additional information can be obtained from the organizers. ■



IFORS Distinguished Lecture at EURO XXIII Bonn

Prof Christos Papadimitriou with the
IFORS President, Elise del Rosario.



The latest IFORS distinguished lecturer is Prof Christos Papadimitriou of the University of California at Berkeley in the USA. He gave a plenary session presentation at the recent EURO XXIII conference that was held in Bonn, Germany. Some brief background to this lecture. IFORS is grouped into 4 regions of which EURO is one of them. During regional conferences such as the EURO conference, IFORS sponsors the Distinguished Lectures to support the regional conferences. The IFORS Distinguished Lecture also aims to recognize the accomplishments of outstanding individuals in our field. The title of Prof Papadimitriou's presentation is given here as well as the abstract. In introducing the IFORS distinguished lecturer at the plenary session in Bonn, the IFORS President, Elise del Rosario, gave a bit of background to this remarkable and interesting individual.

Title of presentation: Computing equilibria

Abstract: The existence theorems establishing that certain equilibria, such as the mixed Nash equilibrium and price equilibria, are guaranteed to exist under very general conditions, are some of the most reassuring results in Economics. Developing efficient algorithms for computing these equilibria—that is, rendering these existence theorems constructive—has been over the past decades an important research front, which however has met with very limited success. In recent years, a new kind of complexity theory has been developed and applied to establish that certain of these computational problems are intractable, thus explaining the lack of progress in the development of efficient algorithms for them. These complexity results raise important new questions related to efficient algorithm for computing approximate equilibria, not unlike the way in which the theory of NP-completeness for combinatorial optimization problems in the 1970s led researchers to the exploration of approximation algorithms. In this talk I shall survey these complexity results, as well as a few recent algorithmic advances.

Elise del Rosario's introductory words to the plenary session:

Today, we are lucky to have with us one such outstanding person who has been recognized as an international expert on the theory of algorithms and complexity, and its applications to databases, optimization, artificial intelligence, economics, the Internet, biosystems and computational biology. He has written 5 textbooks, which include the familiar Computational Complexity as well as the Elements of the Theory of Computation. He is currently the C. Lester Hogan Professor of Electrical Engineering and Computer Science at the University of California at Berkeley,

Before joining Berkeley in 1996, he taught at Harvard, MIT, Athens Polytechnic, Stanford, and UCSD. He holds a PhD from Princeton, and honorary doctorates from ETH (Zurich), the University of Macedonia (Thessaloniki) and the University of Athens. He is a member of the American Academy of Arts and Sciences and of the National Academy of Engineering. He is also a fellow at the Association for Computing Machinery.

It is worthwhile noting that his passion has expressed itself in non-traditional ways. He has written a love story, actually a novel about computation entitled "Turing" which was published by MIT. He also produced a graphic novel about the history of mathematical logic, Logicomix. He speaks several languages, and plays the keyboard in the band named Lady X and the Positive Eigenvalues, a professor-graduate student band in Berkeley. He is also a serious backgammon player. His involvements could better be understood as we listen to what he tells his students, and I quote: *I encourage my students to go completely wild in their curriculum, to go out and learn not only that which they think they should learn in order to be good computer scientists—usually mathematics and programming and engineering and so on—but learn about everything else, about psychology, economics, about business, about biology, about the humanities. I think the future belongs to programmers who are well-rounded people who have diverse interests, who are flexible, who understand deeply other fields and are ready to transform them.*

Ladies and gentlemen, it is my great pleasure to present a person who has and is continuing to transform other fields, the IFORS Distinguished Lecturer, Professor Christos Papadimitriou. ■





ARNE JENSEN

- the second operational researcher in Denmark

(This article appeared in the newsletter of the Danish Operations Research Society, Orbit number 14, 2009 and is published with permission from the editor)

Arne Jensen passed away on 11 November 2008 at the age of 88. Arne was born on 16 February 1920 in Vordingborg, South of Zealand, Denmark. He became a Master in Insurance Science and Statistics in 1944 at the University of Copenhagen. In 1954, he obtained his Doctor degree in Economics from the same University, the title of his thesis was: A Distribution Model Applicable to Economics.

In 1955, he introduced this new discipline called Operational Research (OR for short) at the Faculty of Economics, University of Copenhagen, in his different teaching activities. For this purpose he wrote a textbook in Danish entitled: Lecture notes on OR (p. 250). This was the first systematic education of this subject in Denmark. In the period 1955-1956 he gave talks and wrote articles in Danish about the applicability of OR.

DORS – The Danish OR Society was established in 1962 and Arne Jensen was the first president. Later in 1963 Arne became professor in mathematical statistics and OR at the Technical University of Denmark. This was the birth of IMSOR – The Institute of Mathematical Statistics and Operational Research, the first research centre in Europe focusing on both statistics and OR. Under his leadership IMSOR became an international centre for research and education.

Arne Jensen was a highly creative researcher. He got involved in a wide variety of activities. He confronted the challenges in his own way. Finally, he solved the problem in a new way. He was an innovator in his field. He was able to combine “hard” and “soft” approaches in a unique way. Arne’s professional life can be characterized as a long chain of challenges which he has met using systemic thinking, interdisciplinary approaches and interaction with the decision makers.

In Jensen (1980), it is possible to see in details the wide variety of projects he got involved in. From an OR perspective I will enhance the following areas:

- The use of economic models and principles for design of technical and transportation systems.
- Planning Approaches for public roads and future planning under uncertainty
- Approaches for risk analysis
- Applied decision analysis in public planning.

Arne Jensen was a true cosmopolitan. He visited all continents, from the ruins of Machu Picchu, Cuzco, Peru to The Chinese Wall. He was open-minded and was fascinated by other cultures and value systems. He was very concerned about the problems in the underdeveloped countries. His scientific work is better known and admired in the Third World than in Denmark. He enjoyed having at IMSOR students from different parts of the World: Turkey, India, Chile, Peru, France, USA, Poland, Island, China, etc. His international engagement was reflected in the period 1971-1973 when he was president of IFORS – The International Federation of Operational Research Societies.

Now I will present some of my personal experiences with Arne to enhance his personality. I came to IMSOR invited by Arne Jensen in 1968, from Belgium. The first two years I had a scholarship from the Ministry of Foreign Affairs. During this period I wrote my PhD thesis under his guidance, and then he offer me a position as an associate professor.

Arne Jensen was a highly creative researcher. He got involved in a wide variety of activities. He confronted the challenges in his own way. Finally, he solved the problem in a new way.

It is not an easy task for a poor foreigner from Peru to make a successful professional life in Denmark. The Jante Law was (is) everywhere, but Arne was aware of my scientific potentialities from the very beginning. He did not only open the doors of IMSOR but he also opened his home for me so I got to know his family. Without any doubt I can say that my work in Denmark could not have been such a rich experience both professional and personal without his support. He supported my professional development by giving me challenges, just learning by doing.

Already after finishing my PhD thesis, he appointed me as a leader of a large-scale project related to the optimal design and location of plants for the asphalt industry. Here I was able to learn how to do consulting work in practice and on the potentialities and limitations of mathematical modelling.

The next challenge was my teaching duty; it was to give a fundamental course on optimization theory. His only remark in handing me several books was: “To lecture is the best way to get to know a subject – and this subject

you are going to need in the future.” What a wise professor, I became totally devoted to optimization, discovered new principles, published many papers and books, and finally my Doctoral dissertation was entitled: Engineering Optimization.

The Ministry of Foreign Affairs wanted a report about how OR can support the development of the underdeveloped countries. He said to me: “Victor, you are coming from Peru, you should write such a report. You get one year free from other duties to write THE BOOK.” Again learning by doing and criticizing what others have done. I learn about my lack of knowledge of social sciences. Thereafter, with the support of Arne, I studied cultural sociology at the University of Copenhagen. He introduced me to his two friends Stanford Beer and Russ Ackoff, who had a lot of influence in my work with “soft” OR. As Arne commented: “If I had your age I will do the same. You are creating the future.” The last years of my professional life has been devoted to the development and use of the so-called soft OR approaches. I

published the first book about soft methods in Danish language.

In 2005, I wrote in this magazine an article about Ole Rømer (ORBIT, no. 10, 2005) where I show that Rømer was the first operational researcher in Denmark. Without any doubt Arne Jensen was the second Danish operational researcher. Although living at different times, there are some similarities: they were problem solvers in real life using their mathematical and scientific background to deal with actual problems in society. The main difference was that Arne knew that he was making history, without any doubt he was the greatest Danish operational researcher of the last millennium.

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Victor Vidal

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TRIBUTE TO JONATHAN ROSENHEAD AT 70

Jonathan Rosenhead, a name known to virtually everyone in the world of O.R., was born in England in 1938, and educated at the University of Cambridge and University College London in Mathematics and Statistics respectively. Jonathan has been a fervent supporter of the OR Society for many years and a driving force behind many of its initiatives.

Jonathan Rosenhead ►



Jonathan Rosenhead has been on the staff of the London School of Economics (LSE) since 1967 and Professor of Operational Research from 1987. He is now officially retired, but still teaches and researches there. He was a Labour Party candidate for Parliament in 1966 and was heavily involved in the British Society for Social Responsibility in Science for more than 20 years.

He is unique in many ways, not least because his involvement in O.R. spans some five decades, but also because he has been the recipient of a prodigious number of OR Society awards and medals. He was also President of the OR Society during the period 1986 / 1987 and has the distinction of being a young President by today's standards and also one of the few presidents in recent years that has had to compete for the title. (He fought off competition from two others, Martin Beale and Frank Lyness.)

I recently attended a conference held in his honour; it was entitled "A Tribute to Jonathan Rosenhead @ 70", and took place at the LSE on 16th and 17th April. This well attended event was populated by the 'great and good of O.R.', who together lent an air of 'history' to Jonathan's tribute.

I only attended day one of this conference but I am pleased to report that I came away with a notebook full of anecdotes with which to furnish this series of articles, and a camera full of photographs with which to illustrate them. Part 1 of this article concerns the introduction to Jonathan's conference, and the contribution made to it by Ailsa Land concerning Jonathan's early career and work at the LSE and the contribution from our society's President Sue Merchant, concerning Jonathan's prodigious number of honours received from the society.

Attendees at this conference were welcomed by Mike Cushman, LSE and Alberto Franco, Warwick University, there then followed an introductory session which consisted of tributes from Ailsa Land and Sue Merchant (OR Society President).

Ailsa Land was the first to speak here; she said that Jonathan Rosenhead was a "man of many parts". Given the time afforded in this introductory session though, she chose to focus on just one of those parts, Jonathan's relationship to the LSE.

Ailsa said she didn't know Jonathan at all until his first appearance on a one-year appointment to cover O.R. teaching normally done by Gordon Foster, who was visiting Trinity College Dublin for a year in 1967.

Before 1967 she had taken on the teaching role herself using Gordon Foster's lecture notes, but in 1967 she was 'heartily relieved' that Jonathan had been hired to take the teaching role on when Gordon was going to be away.

Ailsa said that Jonathan's career up to 1967 qualified him excellently for the task - a degree in mathematics at Cambridge in 1959 and an MSc in Statistics at University College London in 1961. Subsequently he had worked as an O.R. scientist, first at United Steel in Sheffield and then in the consultancy firm SIGMA in London until 1963. He then spent a year at the Wharton School Management Science Centre working with, amongst others, Russ Ackoff. During this time Jonathan had also published papers on forecasting, simulation and statistics.

Then Jonathan spent his first year at the LSE 'wrestling' with Gordon Foster's lecture notes, and this resulted in the publication jointly with Gordon Foster and V. Siskind in the JRSS of a paper elucidating some aspects of the effects of demand distribution on stock holding models.

Gordon Foster then decided to spend a second year at Trinity College, and Jonathan was offered another one year appointment. Eventually Gordon Foster decided to stay permanently in Ireland, and this led to Jonathan taking on full time LSE lectureship.

As the years passed the LSE's O.R. group grew and flourished, and developed an undergraduate course in Management Sciences. A one year graduate O.R. course

was created and when other LSE departments started one-year MSc courses, the O.R. course also became an MSc.

As interest in O.R. grew and more O.R. tutors joined the department, Jonathan recognised an opportunity to move away from the more purely technical bookwork O.R. topics and develop an interest in the appropriate approach to the difficult problems encountered in the application of Operational Research to the real world, so-called Soft O.R..

Ailsa Land then said Jonathan's contribution to Soft O.R. was well illustrated by his publications and conference contributions over the years, but from the LSE point of view, the important thing, in her opinion, was his development of a course in Problem Structuring as a main component of the MSc course.

She also spoke of the time that Jonathan became a Senior Lecturer, and then, when she decided to take early retirement from her personal Chair rather than take on additional administrative chores, of how Jonathan became the first to hold the title of Professor of O.R. at the LSE in 1987.

Ailsa Land also said that Jonathan's first dramatic administrative achievement was when he became head (Convenor) of the Statistics Department and was largely responsible for the break up of that unwieldy department into its constituent parts. In the years since then she said she had watched in admiration, at how Jonathan had taken on LSE administrative tasks and committees, and still found time for research and writing.

Following on from Ailsa Land's tribute, Sue Merchant, President, OR Society UK, spoke about her understanding of Jonathan's remarkable career, and the fact that he had been the recipient of an extraordinary number of awards and medals from the OR Society.

She said that, in 1979 Jonathan received the OR Society's 'President's Medal', which is awarded for the best account of successful O.R.

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Mike Cushman ▲



Alberto Franco ▲



Ailsa Land ▲



Sue Merchant ▲



Saul Gass ▲

practice presented at the society's conference. Jonathan's paper was 'An education in robustness', it looked at the choice of exam subjects for a 14 year old, and indicated how O.R. could be used effectively in decision areas which do not command large resources. It was notable for its 'refreshingly direct style'.

In 1992 Jonathan was the first recipient of the 'Beale medal' (awarded in memory of Martin Beale) for his "sustained and significant contribution through the literature, to the philosophy, theory and practice of O.R.. In 2005 Jonathan was awarded the 'Companionship of O.R.', an honour awarded to those individuals who have demonstrated a sustained support and encouragement for the development of O.R.. The citation for his companionship touched on three themes with which Jonathan had been involved. His substantial contribution to Community O.R., his influence in drawing together the 'different threads' of 'soft O.R.' to create a coherent field of study in problem structuring methods, and last but not least, his contribution to O.R. in developing countries. Particularly his co chairing of the 1st and 5th ICORD conferences (International conferences on O.R. development)

One of the guests and speakers at this event was the distinguished professor Saul Gass, professor emeritus at the Robert H. Smith School of Business, University of Maryland. His contribution to Jonathan's event noted that 1938 had been an auspicious year. In addition to it being the year of Jonathan's birth, it was also, in the opinion of many OR historians, the year when OR began. Commenting on that year, Saul said. "From an astronomical point of view we can only conclude that all the planets were in proper alignment"

Saul then went on to say that the theme of his talk was "the evolution of Operational Research" and some of the areas he would touch upon included OR's early development as a scientific field during and after World War 2, OR's post World War 2 movement into industry and business.

He said that over the past six or so years he had been writing and working on historical aspects of OR – part of this work involved the co-editing of a book in which the work of over 40 OR pioneers would be detailed. He then said that he would like to acknowledge the contributions to this book by Jonathan Rosenhead, Graham Rand, and Maurice Kirby. "Their contributions form the background of my discussion today."

He said he had been trying to understand how OR originated and arrived at its current form, he said that post World War 2, there was only little recognition of the role of OR, but there were no private or government groups calling for the application of OR away from the battlefields, so it was all the more remarkable that OR established itself within a twenty year period of its inception.

He also said he was aware that today's view of OR was viewed in a variety of ways amongst commentators, the scientific and the academic community, but he felt that OR's evolution and growth was due to the training and insight of three war time OR scientists. Patrick Blackett, Charles Goodeve and Philip Morse –who were the propelling force in classical scientific training and defining a clear view of how OR as a science could make a difference in the real world of human decision making.

One of these scientists Patrick Blackett (later Baron Blackett of Chelsea) was responsible for developing new tactics in the use of anti aircraft guns and destroying German U-boats. Blackett was one of the first scientists to define the essential elements of Operational Research. In October 1941 he wrote a Report on Operational Research which is considered by many to be the original 'definition of Operational Research'. Of the use of scientists at the operational level.

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

In 1947 Kittel described OR thus: 'Operations Research is a scientific method for providing executive departments with a quantitative basis for decisions.' In 1948, Sir Charles Goodeve, a Canadian chemist (founder chairman of the OR Club), summed it up as 'quantitative common-sense'.

Goodeve had served in the Royal Canadian Naval Volunteer Reserve. In England he joined the Royal Naval Volunteer Reserve. In 1936

he was promoted to the rank of Lieutenant Commander. In 1939, he began work at HMS Vernon, specializing in ways to counter the threat of mines. He developed the "Double L" technique for minesweeping magnetic mines. Later he developed the degaussing method for reducing the magnetic field around ships which triggered mines.

In 1940, Goodeve implemented the British production of the Swiss-designed Oerlikon 20 mm cannon, which was needed to provide antiaircraft protection for naval and merchant ships. His group, renamed the Directorate of Miscellaneous Weapons Development (D.M.W.D.), then worked on antisubmarine warfare developing the hedgehog, an array of spigot mortars which threw small, contact-fused bombs ahead of a ship. At one point, to protect the project from internecine warfare inside the Royal Navy. At the end of the war, Goodeve was knighted, and awarded the U.S. Medal of Freedom.

The third OR Scientist Saul spoke about was Philip McCord Morse, he was an American physicist, pioneering OR in World War II. He is considered to be the father of OR in the United States.

Morse made many contributions to the development of OR. Early in 1942 he organised the Anti-Submarine Warfare Operations Research Group (ASWORG), later ORG, for the U.S. Navy, after the US had entered World War II and was faced with the problem of Nazi German U-boat attacks on transatlantic shipping.

Morse co-authored *Methods of Operations Research*, the first OR textbook in the U.S., with George E. Kimball based on the Navy work. His further writings include the influential books *Queues, Inventories, and Maintenance* and *Library Effectiveness*. He received ORSA's Lanchester Prize in 1968 for the latter book.

Morse gave the opening address at the 1957 organizing meeting of the International Federation of Operational Research Societies (IFORS). In 1959 he chaired the first NATO advisory panel on OR.

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(This article is largely based on two articles that appeared in OR Inside, newsletter of the OR Society of the UK and is published with permission) ■



Euro Summer Institute 2009

- IFORS Fellowship Report

Introduction

The Euro Summer Institute 2009 (ESI) was held at Lleida (first week) and Solsona (second week) in Spain and the theme was Agriculture and Forest Management. Other natural resources topics, like water management and fishery, were also addressed at this meeting.

The meeting included presentations from students who submitted original papers for the meeting and presentations of invited talks by OR researchers related to the theme of the meeting.

The main objectives of ESI are:

- exchanging ideas among young OR researchers; and
- interaction between young OR researchers and invited speakers from different branches of OR related to the main research topics.

The young researchers who participated in this meeting were mostly PhD students and young professors. Some more experienced researchers also participated in this meeting. They were from many different countries including Austria, Belgium, Brazil, Czech Republic, Chile, Finland, Greece, Israel, Kenya, Portugal, Poland, Spain and United Kingdom. During the two weeks, some social activities were planned for all the participants and were very well received.

OR in Agriculture and Forest Management

The research topics addressed during this Institute included OR in agriculture, forest management and natural resources. The invited talks and contributions in the first week of ESI were mostly related to agricultural topics and other natural resources, whereas the second week focused mostly on forest management. The program was well balanced and the invited talks covered the different topics and interests. The topics covered in the invited talks were:

- Markov Decision Processes;
- Design Of Experiments;
- Simulation;
- Supply Chain Management;
- Spatial forest planning;
- Multiple Criteria Decision;
- Forest fire management.; and
- Decision graphs.

These topics were addressed by different researchers and they are discussed in the next section.

Invited talks

The invited talks enabled the young researchers to learn more about the different research topics related to the meeting theme. These were of great importance, since they covered different topics, and were well organized and prepared. During the talks, the students had the opportunity to raise questions and exchange ideas. At the social events and intervals, the students also had access to the professors, who were fully accessible for further discussions. A summary of the invited talks and some personal comments are presented next..

1. *Markov decision processes for sequential decision problems in agriculture and forestry - Anders R. Kristensen and Lars R. Nielsen*

This talk focused on dynamic programming and its application to agriculture and forestry. The professors offered a detailed illustration of the method with examples from agriculture. In a computer lab class setting, the students were also asked to do some exercises related to the talk.

Both professors were very open to discussions and questions and presented their talk very efficiently. The talk was very interesting and allowed those who were not familiar with Markov decision



▲ *Mariá Cristina Vasconcelos Nascimento*

processes to familiarize themselves with a new methodology. The interaction between the students and the professors were also good.

2. *Design Of Experiments: Overview - Jack P.C. Kleijnen*

The presentation given by the Professor Jack P. C. Kleijnen involved different types of design of experiments for real life systems. His main focus was sensitivity analysis and optimization. The professor succeeded in achieving the objectives of his presentation. Moreover, in my case and the majority of the group, who were not familiar with the theme, this presentation was very introductory and it enabled us to see how we could use it in our own research.

3. *Optimization under uncertainty and catch quotas in fisheries management - Victor Alborno*

This talk presented some optimization models related to total allowable catch quota for fishery management. Deterministic and stochastic programming was used for these models.

I found this presentation very interesting. It was held in the computer lab and we were exposed to AMPL software. The development of the models was well explained, and the professor presented it very well. In particular, I learned interesting concepts of stochastic programming from this talk.

4. *Framework for multi-criteria decision management in watershed restoration - Angel Udias*

This talk was about a watershed model for sustainable management of water. The professor proposed a multi-objective genetic algorithm to optimize economical and ecologically the water restoration to be implemented in the Catalan region. This talk was interesting mainly because of the content and because of the importance of water management. The professor presented interesting tools and discussed them in an effective way.

5. *Supply Chain design: models and methods - Stefan Nickel*

Some practical examples of location problems in supply chain management of the forestry industry were presented. Professor Stefan Nickel presented a great talk, answered our questions and discussed many interesting variations of the supply chain problem. I interacted with him around the problems he discussed, and he was very attentive.

6. *Incorporation of environmental issues and fire protection in spatial forest planning - Andres Weintraub*

Professor Andres first talked about the theme: "Forty Years of OR in Forestry" and presented a variety of problems and methods involving forestry. Then, he covered the topic spatial forest management, focusing on, the adjacency problem and many formulations and solutions methods to solve it.

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The talk of Professor Andres was great since he discussed the real issues regarding forestry and gave his views on the evolution of OR in forestry.

7. *Multiple Criteria Decision Making in Forestry - Carlos Romero*

Different multi-criteria topics involving weighted goal programming and min-max goal programming for the decision making in forestry was presented. In addition, different methodologies of multi-criteria decision making, like constraint method and compromise programming were also presented.

This talk was very theoretical and of great value for me since it enriched my knowledge about multi-criteria decision making. The professor has a good way of presenting and was available to answer questions during the presentation as well as during the intervals.

8. *OR applications in forest fire management - David Martell*

Some OR models which applied to forest fire management were presented and discussed. Issues concerning fire management and the type of treatments after the forest fires; if it should be re-planted after a fire or not (salvaged), and the study of the probability of fire in some regions were mentioned.

This topic was new for me. Basic concepts of forest fire management were presented, as well as some models to formulate it. Moreover, the presenter was a good speaker and was also available for questions.

9. *Optimising forest management at the stand and forest levels - Timo Pukkala*

The professor discussed the planning of a forest through stand level optimization. The interest of this practice is mainly economical since it focuses on the forestry practice. Some optimization methods such as dynamic programming, non-linear programming and population-based methods were introduced in this context.

The topic was closed to many of the students present and in that sense very useful.

10. *Decision graphs: representation languages and solution algorithms - Thomas D. Nielsen*

The presentation was on decision graphs, focusing on Bayesian networks, which is a probability model, while some solution algorithms and available tools were mentioned.

This was a new concept for most of the students; they enjoyed the presentation, especially me, who works with graphs. Prof. Nielsen handled all the questions very effectively.

Participation as an IFORS delegate and personal enrichment

As a non-specialist in agriculture or forest management, I was very well received by the group. I learned a lot during the two weeks and created a good network. Collaboration possibilities do exist. Moreover, I made many friends who I can partner in future research work.

General Conclusions

I usually do not participate in conferences, however this meeting was great. It was very well organized and well prepared. We had a full schedule, and it was worth it. Presentations of this Summer School will be submitted to the journal, *Annals of Operations Research*.

The interaction between the participants was very good, the organizer, Prof. Luis Pla, is very competent and a great person. The organizers were also very participative and helpful. I made friends with the young researchers, with the professors as well as the supporting organization. A good environment was created and that contributed to the success of this meeting. The quality of the presentations was of a very high level especially those of the students, I learnt a lot about a range of topics.

Mariá Cristina Vasconcelos Nascimento ■

ELAVIO 2009

FIRST REPORT

From 9 to 14 August 2009 I attended the XIV Escuela Latinoamericana de Verano de Investigación de Operaciones held at El Fuerte, México, as a Scholar sponsored by IFORS.

I was the presenter of the first session of talks related to Evolutionary Algorithms. There were speakers from Argentina, Mexico and Brazil. I presented my talk An Integer Programming Approach for the Single Source Minimum Cost Unsplittable Flow Problem in Session 11 dedicated to Integer Programming. I received valuable comments from the audience. Also, I attended the tutorials on Metaheuristics For Multi-objective Optimization presented by Carlos Coello Coello, Cinvestav, Mexico; Recent Advances in Monte Carlo Evaluation of Static Network Reliability Measures presented by Héctor Cancela, Universidad de la República, Uruguay; and Location problems: Models and algorithms presented by Justo Puerto Albandoz, Universidad de Sevilla, España.

During the ELAVIO 2009 I met several young researchers from different countries. Based on their research work and experiences an open spirit of collaboration with some of them has been established as well as good friendships. There were also some social activities which have enriched my culture. Now that ELAVIO 2009 has ended, I can state clearly that my goals were absolutely satisfied both professional and personally. I would like to thank IFORS again for covering part of my travel expenses.

Maria Fernanda Salazar Montenegro
Escuela Politécnica Nacional, Quito, Ecuador

SECOND REPORT

Before I start my report on the XIV Latin-American Summer School on Operations Research (ELAVIO) let me tell you why I applied. The School was intended to be a place in which practitioners of the discipline would meet and interact closely. Moreover, the internationally recognized quality of delegates ensured the potential of success of this meeting. Both aspects made me eager to attend.

The XIV ELAVIO was held during the week 9 - 14 August 2009, in El Fuerte, at the estate of Sinaloa, in northwestern Mexico. The setting was the Escuela Normal Experimental "Prof. Miguel Castillo Cruz", 10 miles from downtown El Fuerte, on a side of the water dam "Josefa Ortiz de Domínguez", a place known as "El Sabino". El Fuerte is a beautiful place, full of history and culture. The people and the surroundings were quite nice, and I have to thank the School for being able to get acquainted to them.

The organization of the event was excellent, mainly thanks to Prof. Juan Carlos Leyva López (President of the Organizing Committee of the XIV ELAVIO). Since my arrival, the hosting was warm and efficient. My classmates came from disparate places: Argentina, Brasil, Chile, Colombia, Costa Rica, Cuba, Ecuador, España, México, Perú and Venezuela. With most of them I shared a budding friendship that we now pursue via email. The courses and tutorials were taught by highly qualified professors. The ones I particularly liked were those of Professors Sira Allende Alonso ("Mathematics of Economics"), Eduardo Fernández González ("Multi-Criteria Decision Analysis: Fundamental Paradigms"), Jorge Navarro Castillo ("Uncertainty in Multi-Criteria Decision-Making"), >>



ELAVIO 2009 ... CONTINUES >>

Justo Puerto Albandoz ("Location Problems: Models and Algorithms"), Héctor Cancela ("Recent Advances in Monte Carlo Evaluation of Static Network Reliability Measures"), Carlos Coello Coello ("Meta-Heuristics For Multi-Objective Optimization") and Roger Ríos Mercado ("Modeling and Solving Territorial Planning Problems"). The topics were clearly and precisely developed. In addition, the presentation of the students' research results and the ensuing discussions complemented the material presented in the courses and tutorials.

Upon my return to Argentina I am further pursuing some of the topics which I now see in a new light after the courses and presentations. Many exciting exchanges with professors and students provided a lot of food for thought and enriched my research work. Thanks to this, I gained a wider and deeper perspective on the goals I want to achieve in my doctoral thesis.

As a final word, let me thank the organizers of ELAVIO and the authorities of ALIO (Latin-Iberian-American Association of Operations Research) for granting me the opportunity to participate in the School. I would also like to thank the support of IFORS (International Federation of Operations Research Societies) without which I could not have attended this prestigious event.

Mg. Mariano Frutos

Department of Engineering - Universidad Nacional del Sur, Bahía Blanca, Argentina.



▲ Mg. Mariano Frutos

New Survey of OR Practice Around the World

IFORS have commissioned a survey of OR practice in member countries, updating an earlier one carried out in 1996. The aim is to enable a better understanding of the usage of quantitative tools, techniques and approaches and their impact on decision-making in organisations, as well as the background of the OR analysts involved. It is expected that the results will enable IFORS to improve their support to and promotion of OR in member countries.

The survey will be led by Dr John Ranyard, Senior Research Fellow, Management Science Department at Lancaster University (and previously an OR manager in British Coal). He will be supported by two Lancaster colleagues, Prof Robert Fildes, who specialises in forecasting and marketing analysis and Dr Alastair Robertson, a research associate specialising in marketing research, who has much experience of technology surveys using online questionnaires. John and Robert carried out a comprehensive study of OR practitioner groups in the UK for the OR Society in the mid-1990s, which was widely published.

All IFORS member countries will be included, with the main point of contact being the IFORS Representative. The principal instrument will be a comprehensive online questionnaire, aimed at OR practitioners in non-academic organisations. It is appreciated that the usage of OR varies considerably across member countries and so some Societies in countries with well-developed OR practice communities (eg USA and UK) will be encouraged to aim at a higher response rate and will be contacted directly. The timescale is from September 2009 to October 2010 to collect, collate and analyse the comprehensive data involved. Subsequently a paper will be written for publication in ITORS.

President Elise del Rosario comments:

"I believe that this survey will provide IFORS with a better understanding of how and to what extent OR is being applied to solve practical problems in member countries, including the methodologies and techniques being used, the context of OR work in organisations, the background of practitioners as well as country-specific uses and developments. This will enable IFORS, in conjunction with member Societies, to improve support for the development and use of OR in member countries in several ways, for example:

For academics

- by identifying training/educational needs and collaborative research possibilities.
- For practitioners
- by identifying the different types of OR work being carried out and how OR work is organised
- by benchmarking current practice across countries

IFORS looks at this survey as potentially one step towards a more positive and fruitful collaboration between academics and practitioners"

John Ranyard and Robert Fildes

jranyard@cix.co.uk and r.fildes@lancaster.ac.uk



▲ John Ranyard



▲ Robert Fildes



Analytic Support for Maritime Domain Awareness and Counter-Piracy

Since the disaster of September 11, 2001, greater emphasis has been placed on understanding the “new” maritime environment ... an environment in which terrorists are capable of exploiting access to open societies and economies, and the vast commercial systems of the world’s nations to bring about damaging effects. Since then, ensuring a safe and secure maritime environment is critical to national security and economic well-being.

The security environment of today, therefore, includes a wide range of “targets” that the United States and Canada must track: potential terrorists, pirates, smugglers, paramilitary naval forces, etc., both on the domestic and international fronts. Dealing with this security environment requires an awareness of the maritime domain; often referred to as Maritime Domain Awareness (MDA). Generically, MDA can be defined as:

The effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of a nation.

The challenge of achieving MDA is of a particular concern to the US Department of Defense and to the Canadian Department of National Defence. Consequently, there is a real need for the military operational research and analysis (OR&A) community to provide the necessary analytic support to ensure that MDA generation efforts mature in support of our national objectives.

Compounding the problem is that no nation, let alone a single agency, has the capability or capacity to achieve MDA unilaterally. MDA requires broad collaboration among many partners, each with a potentially vital contribution to effective understanding of the maritime domain. Since 2002 government agencies within the United States and Canada have promulgated strategies for homeland security from a maritime perspective.

As early as January 2002, President George W. Bush stated that, “The heart of the Maritime Domain Awareness program is accurate information, intelligence, surveillance, and reconnaissance of all vessels, cargo, and people extending well beyond our traditional maritime boundaries.” Twelve months later the US Coast Guard published its *Maritime Strategy for Homeland Security*, establishing key objectives and means to achieve them to mitigate risks associated with threats to US maritime security and to prevent terrorist attacks. On 2 April 2004, Admiral Thomas H. Collins, 22nd Commandant of the US Coast Guard went further by establishing the Maritime Domain Awareness Steering Committee and the Maritime domain Awareness Directorate. That same year, the US government established policy guidelines to enhance national and homeland security by protecting US maritime interests – National

Security Presidential Directive 41 / Homeland Security Presidential Directive 13 (NSPD-41/ HSPD-13).

October 2005 saw the publication of the National Plan to Achieve Maritime Domain Awareness which stated, “Maritime domain Awareness is the effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of the United States.” Also, in 2006 a maritime warning mission was added to the North American Aerospace Defense Command (NORAD) mission set under the NORAD Agreement Renewal. This was done to capitalize on the existing information sharing processes in place at NORAD and allows multiple government agencies in both Canada and the United States to determine their response based on a greater information set. At the same time, the Bi-National Planning Group (BPG), which was formed in response to the events of September 11, 2001, was concluding four years of work (2002-2006) with a report that recommended that the governments of Canada and the United States establish agreements that would facilitate better information and collaboration, including within the maritime domain.

Canada, with the world’s longest coastline bordering on three oceans, is investing heavily in improving its ability to deliver relevant domestic maritime surveillance to identify and act on activities which impact upon its national interests. After 9/11, and in light of other challenges to Canadian sovereignty that have occurred in recent years, the types of threats that Canada is focused on are multi-dimensional and include economic, environmental and criminal activity, as well as terrorist attacks and military activity. In addition, Canada has equally important roles in the defence of North America and in contributing to global security which now includes counter-piracy operations as a priority. These roles have been reaffirmed as recently as May 2008 with the publication of the *Canada First Defence Strategy*. To help fulfill these roles, Canada is upgrading its capabilities to develop and maintain MDA both for North American security as well as for Canadian assets engaged in deployed operations. Investments in MDA include improvements in gathering, analysis, integration, use, dissemination and sharing of decision quality information gained from a combination of maritime, land, air and space surveillance systems as well as the integration

of intelligence and information available from major stakeholders in maritime security such as other government departments, allies and the commercial sector as well as a host of other non-governmental agencies and stakeholders.

In line with this year’s MORS theme, *Leveraging Operations Research for Global Security Operations*, MORS and DRDC/CORA (with NORAD-USNORTHCOM J-84 Analysis Division as proponent) are teaming to hold the first-ever MORS special meeting outside of the United States. This special meeting, *Analytic Support for Maritime Domain Awareness and Counter-Piracy*, will explore and identify ways in which OR&A supports the activities related to the generation of MDA. Critical to the success of this workshop will be the participation of the operational and policy communities. In an attempt to maximize international participation, **the meeting will be unclassified.**

Goals, Objectives, and Workshop Organization

The meeting will bring together analysts specializing in a variety of OR applications capable of providing insight and direction to the MDA process. Primarily, this workshop will be of interest to the MDA communities within North America. Given that many other nations have valuable experience in this area, international experts will also be invited to participate. Keynote speakers, panelists and attendees will be invited from the agencies such as the Departments of Defense and Homeland Security, and the Canadian Department of National Defence.

There are three desired outputs from this workshop:

1. Identification of the analysis requirements that are required to answer the operational questions regarding MDA. **What are the questions that need to be answered by the analysis community?**
2. Identification of current and new analytic tools (models, techniques, etc) that can be used to help answer the operational questions. As an example, measuring the “awareness” in MDA and understanding the key elements of situational awareness as they apply to Fourth Generation Warfare at sea. **What types of analysis and what tools/models are required to**

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help the operational community answer the operational questions, and do they currently exist?

3. Build an analysis community for MDA. Efforts made towards establishing and maintaining an adequate level of MDA require a multi-disciplinary and interagency effort. Currently international organizations, navies, and law enforcement are only a few of the groups struggling to establish a global MDA capability. Just as diverse will be the analytic resources needed to support this effort and there exists the need to build a community of interest (COI) in MDA-related analysis. This multi-disciplinary group will come from a variety of backgrounds with disparate analytic skills that need to be integrated in their support of MDA. **What skill sets, agency representation, etc. should be part of an MDA analysis community? What type of forum is suitable to ensure that proposed initiatives do not fail?**

Five working groups have been set up as follows:

WORKING GROUP ONE: MDA Policy and Laws: This working group will review policies peculiar to the US and Canada as well as those common to both countries. International participation will broaden the discussion to include the spectrum of MDA challenges. It is hoped that products of this working group will be:

- Identification of policies and laws that enable MDA and promote the goal of domestic maritime security.
- Recommendations to improve policy and cooperation between Canada and the US as well as within the international community; and
- Identification of national and international policy and legal gaps in the development of

MDA and the execution of marine security operations.

WORKING GROUP TWO: Blue Water MDA: This working group will examine the problem of developing MDA and conducting operations on the open ocean.

WORKING GROUP THREE: MDA in the International Littoral: This working group will examine the problem peculiar to developing MDA and conducting operations in the littoral outside of North America.

WORKING GROUP FOUR: MDA in National Waters: This working group will examine the problem of developing MDA and conducting operations within the territorial waters of the US and Canada and other nations.

Possible subjects of discussion for working groups 2 through 4 are:

- The development of MDA requirements;
- The identification, tasking, scheduling and coordination of available surveillance assets;
- The processing, analysis and exploitation of available sensor, information and intelligence;
- The exploitation of information to develop and disseminate decision quality MDA;
- The sharing of information across domestic and international organizations;
- The identification of training/career profiles for MDA analysts of the future;
- The identification of systems-level solutions to MDA; and
- The execution of marine security operations enabled by MDA in these three domains.

WORKING GROUP FIVE: Counter-Piracy: This working group will examine the requirements for MDA to combat piracy on both a large and small scale, to include a review of costs

(damages, insurances, broader economic impacts, prevention, dissuasion, mitigation, recovery, hostages, etc.), measures (prevention, dissuasion, mitigation, recovery, hostages, intelligence, targeting, countermeasures, etc.), and relationships to other criminal activities (insurgencies, combating WMD, drugs, immigration flows, smuggling, etc.).

The workshop itself is to be conducted at the Chateau Cartier (www.chateaucartier.com), located in Gatineau, Ottawa, Canada, just ten miles from the city of Ottawa. MORS and DRDC/CORA are working to acquire a block of rooms for attendees. The dates for the meeting are 26-29 October 2009.

The organizing committee is already assembling a great set of plenary speakers from across Canada and the US. If you would like to help the planning committee, contribute technically, know of someone who should be invited to attend and/or present, please contact the authors of this article. Stay tuned to the MORS website (www.mors.org) for additional details. For information on the sites and attractions of Ottawa, as well as seasonal information, please visit the Ottawa Tourism link www.ottawatourism.ca.

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Transportation and Logistics Workshop

The Millennium Institute Complex Engineering Systems, would like to invite you to a workshop on Transportation and Logistics to be held during the second week of December 2009 at a seaside resort in Chile.

The focus of the workshop spans the classic problems in transportation and logistics, including network design problems, planning and control strategies, fleet management, routing, timetabling and vehicle scheduling, crew scheduling, real-time optimization of operational schemes, etc. We are particularly interested in research on the operation of public transportation services, from the design of such systems to the logistic issues behind their efficient operation, with emphasis in methodologies and optimization tools coming from operation research developments. Transportation problems can be formulated as mixed integer programs, considering deterministic and stochastic models that can be solved through sophisticated exact methods (for example branch and price for column generation schemes, branch and cut, etc.) and illustrated heuristics (such as evolutionary

algorithms, GRASP methods, among others).

We plan to have plenary presentations of well known researchers and few parallel tracks. This light presentation load is meant to facilitate discussion, analysis and networking among the invited speakers, attendees and students.

The organizing committee includes Cristián E. Cortés (Chair), Fernando Ordóñez (Co-Chair), Andrés Weintraub and Vladimir Marianov. The International Program Committee will be appointed shortly. The following invited speakers have already confirmed their assistance: Jonathan Bard, Michel Gendreau, Martin Savelsbergh, Maria Grazia Speranza, Paolo Toth.

The workshop is part of a larger effort to build an international collaboration network oriented

to innovative formulations, methodologies and solution methods to solve public transportation problems from an operations research standpoint. Such a research effort is essential to address real operational problems in mass transit systems of many mayor cities in Latin America, for example the Transmilenio and Transantiago systems in Colombia and Chile. We invite you to be part of this research network, which will include not only researchers but also professionals from the public and private sectors and from operators of the involved countries. We would like to ask for your help in securing funds to set up this research network by writing us a letter of support for this effort, highlighting your intention to participate in the workshop, which would be a perfect time to kick off this collaboration initiative.

If you are interested in presenting a paper, or knowing more about this Workshop, visit www.sistemasdeingenieria.cl or contact Karla Jaramillo, k.jaramillo@sistemasdeingenieria.cl



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We invite members of ALIO, INFORMS and the worldwide OR/MS community to join us in Buenos Aires in June 2010 for the ALIO-INFORMS International Meeting. This joint conference consists of the INFORMS International Conference and XV CLAIO, the biannual conference organized by ALIO.

Since their inception, Operations Research/Management Science tools have helped solve problems in many industries, yet OR/MS has much more to offer society in its efforts to sustain economic growth while using resources efficiently. There are always new challenges for using OR/MS techniques in non-traditional domains.

At ALIO-INFORMS 2010, attendees will exchange ideas on topics such as services, logistics and transportation, manufacturing, supply chain management, environment, natural resources, biotechnology, and healthcare. The meeting intends also to emphasize the importance of the relationship between basic research and the practice of OR/MS.

The academic program will consist of plenary talks, tutorials, and parallel sessions, covering many aspects of OR/MS and it will offer a forum for intellectual exchange between participants of all the countries of Latin and North America, as well as from other regions around the world.

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IMPORTANT DATES

- August 15, 2009 Abstract Submission Opens
- February 1, 2010 Abstract Submission Deadline
- April 26, 2010 Author's Deadline for Final Abstract Changes
- May 7, 2010 Registration Deadline

VENUE

The conference will be held at the Law School of Buenos Aires University (Facultad de Derecho de la Universidad de Buenos Aires).

More information about ALIO/INFORMS is and will be available at <http://meetings.informs.org/BuenosAires2010/meetings@informs.org>



9TH INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH

February 22nd to February 26th - 2010 - Colegio San Jerónimo de La Habana, Havana

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TOPICS

- **Optimization:** Linear, nonlinear, discrete, parametric, stochastic and global optimization.
- **Probability and Statistics:** Biostatistics, multivariate analysis, neural techniques for data mining, probability and stochastic processes, sampling, statistical inference, reliability.
- **Mathematical Economics:** Financial modeling, games theory; mathematical models for economic problems; microeconomic theory, portfolio problem.
- **Numerical Analysis and Algorithms:** Geometric computation, graph theory, meta-heuristics, neural networks, numerical linear algebra, numerical solution of differential and differential-algebraic equations.
- **Multicriteria Decision Making:** Decision support systems; multi-objective optimization, preference modeling.
- **Systems and Control:** Dynamical systems, optimal control; stability.
- **Management Sciences:** Banking and financing, logistics (routing, scheduling, inventory), marketing, operations research for development.
- **Partial differential equations:** Homogenization, Fluid Mechanics and Coastal Dynamics, Simulation and computer science, Mean Field Games, Coalitional equations, Control and inverse problems, Applications to Biology and Medicine.

SCOPE

Although preferences have traditionally been in the listed main fields the organizers of the conference have found significant interest in promoting a broadened scope of preference handling with a series of multidisciplinary streams of sessions, for exchanging experiences between researchers facing similar questions, but coming from different fields. Therefore the scope of the conference is intentionally broad and addresses all aspects of understanding, modeling, computational handling, and applications on the listed topics. In particular, we welcome original contributions to these areas and contributions that provide cross-fertilization between these topics and interesting applications.



Registration Form

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February 22nd -26th , 2010

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