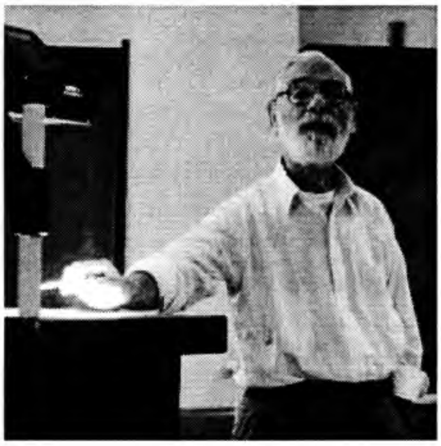
OR NEWSLETTER

Operational Research Society of New Zealand (Inc.), PO Box 904, Wellington, New Zealand **July 1995**

GUEST EDITORIAL

RALPH L DISNEY, Texas A and M University and 1995 University of Canterbury Erskine Fellow



I have views contrary to many of those appearing in Brian Easton's *Guest Editorial* in the January *Newsletter.* While I would like to rise to all of his bait in this space, I can only comment on his distress with the publication process and its output.

I have been actively involved in professional publications for 40 years where I have seen the publication process from top to bottom. I have served as Editor, Area Editor, Editorial Board Member, author of papers, books, chapters, tutorials, and signed book and paper reviews.

There are four items to which this editorial addresses. They are:

- What is the publication process?
- Publish or perish?
- Abstruse mathematics!
- OR/MS is not science!

The Publication Process

Editors, upon receipt of the manuscript, choose up to five reviewers to study the paper in detail and provide a critique, including a recommendation for publication, revision, or rejection of the paper. These reviewers are almost never paid and, except for being listed perhaps once a year, receive no other acknowledgement. Yet such reviewing is essential. It is the glue that holds together the field.

Immediate publication is a rare recommendation. The journals I have worked with have a rejection rate from 50% to 80%.

The whole process can take from a few weeks to years, even after acceptance. How long a paper sits after acceptance, depends on the journal's backlog. The American Mathematics Society (AMS) regularly publishes this delay time for many of the world's leading journals, including *Operations Research.* I cannot think of any publication of mine that has not gone through this

Contents

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process, except signed book reviews written for journals and signed reviews of papers appearing in *Mathematics Reviews.*

Papers presented at meetings seldom go through this extensive reviewing process. In fact, at one time ORSA had a by-law requiring that any member be allowed to present a paper at a national meeting. I think that is a good idea so as to guard against cliques forming to freeze out new ideas. But this opens the door to papers of high variability at these meetings.

How good is the paper reviewing process? Poor papers are an embarrassment to the journal, the reviewer, and the author. No one of good sense tries to publish such papers. However, since the entire process is driven by humans, such things do happen. When they do, the responsibility resides with the author, not the reviewer. Easton is quite right to bemoan the publication of such a paper. He is quite wrong to blame the reviewer for it.

But the process can also protect the author of a good paper. I and other editors have asked for additional reviews of papers which authors felt to be improperly rejected. These additional reviews can overturn previous recommendations, but they seldom do.

For many years I have heard complaints of the peer reviewing process, often from rejected authors. It is not a perfect process, but I know of none better.

Publish or Perish

Statistics that I have seen suggest that the vast majority of professional scientists and engineers never publish anything. Of those that do publish, the vast majority publish one paper in their career, usually a paper from a master's thesis or a dissertation. The probability function of the number of papers published by individuals seems to be Poisson distributed with a very large ë.

Anyone who has never published should. It is an arduous task. The review, rewrite, re-review, and perhaps re-write again is just as trying as standing before any tribunal judging your work. So why do people do it? Why did Hans Daellenbach just publish (1994) another book of nearly 550 pages? Why did Don McNickle contribute two chapters to that book? Because they seek fame and international recognition? Hardly. Hans Daellenbach and Don McNickle have international recognition.

There are probably as many reasons why people publish as there are people publishing. Surely, fame and international recognition may be one. But among those publishing people I know, the driving force seems to be an urge to communicate. They are bright, enthusiastic people who have something to say and have a need to say it. They get comments from readers and so get cross fertilisation of ideas. The history of science and technology is built on such exposures of ideas.

One of the sad stories with which I have been directly involved concerns a young assistant professor who seemed to have taken the "publish or perish" as an imperative. He published 40 papers in three years — a prodigious publication rate. I was asked as an outsider to review him for promotion. In all honesty, I could not recommend him. The 40 papers simply were not very good, but one can always get a paper published. Some journals have no reviewing process. In this young man's case, it was not publish or perish, but publish and perish. He gained fame and international reputation — ill fame and a bad reputation.

Abstruse Mathematics

A good mathematician would laugh at this charge. Little of OR mathematics is "abstruse", nor even, in the eyes of the mathematics community, is it mathematics. Abstruse, it seems to me, is in the eyes of the beholder not in the mathematics.

G. H. Hardy, the eminent British mathematician, was reported to have been delighted because he had researched a field that had no earthly use. Yet today his mathematics is used in areas of computation. Kolmogorov put together measure theory and set theory to provide a mathematical theory of probability. Today, 65 years later, there is not a field of science (hard or soft) that does not use this "abstruse" theory. To fault Newton because his abstruse mathematics did not the next day put a man on the moon would be at best disingenuous. The criticism of abstruse OR mathematics is equally disingenuous.

But mathematics is a two-edged sword. It is a begetter of applications (non-Euclidean geometry led to the special theory of relativity which led to the Hubble telescope). But it is also the begotten of applications (Fourier's theory of heat revolutionised the mathematical field called analysis). The entire history of science and technology is one of a continual interplay of mathematics and application. The argument that "abstruse" mathematics has no place in the O.R. literature is to deny the future of the field.

OR/MS is not Science

Since none of the foregoing is, in the least, controversial, it appears that now is the time to become so, if ever. Ready? OR/MS is neither a science, nor a profession, and likely never will be! Why?

It seems to me that a crucial feedback loop is missing. This loop feeds back information to theorists in which their theories are evaluated against a "real" world, perhaps the real world in a test tube, perhaps the real world of a cyclotron, perhaps the real world of a DNA molecule. This feedback is missing from OR/MS, and consequently the field never can get beyond a few techniques, which are applied to the same problem in different disguises, over and over. There is no accumulation of knowledge other than an accumulation of tools and techniques.

The literature of the field does not expose unsolved problems, data for model building and evaluation, aberrations and anomalies in data or mathematics, information on which to base our thinking and archive it, so that later generations do not have to rediscover the wheel.

The argument seems to run that the academics should do something about this, but it is not an academic problem. It is a professional problem. The profession, including consultants (even those faculty members who moonlight as consultants), government workers (even those who have found their niche outside the university), industry workers, etc., need to stop throwing stones at each other and get to the job of building a knowledge base. Every science and profession I can think of has such a base, not OR/MS.

Here is a short story. Several years ago when I was editor of a journal, I had been hit on the head so many times by the argument that our journals were too theoretical (is the reference to 'applied mathematics of little or no relevance for practical problem solving' on page 2 of the January 1995 *ORSNZ Newsletter* referring to this?), I decided to concentrate on soliciting "real" life applications. A friend had contacts with people in industry who had recently completed what I would call an OR study. I wrote to 75 of them and offered my services to help them in any way possible to publish their work, no strings attached. I now know 75 excuses for the practitioner not publishing.

But OR/MS is not science, nor is it a profession in the sense of the great professions of medicine and law. It is a collection of tools and techniques looking for a home. It reminds me of the consultants at the cocktail-hour complaining about queueing theory while standing in line for their drinks.

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THE FUTURE OF NEURAL NETWORKS IN FORECASTING

WILLIAM REMUS, University of Hawaii and 1995 University of Canterbury Erskine Fellow

Over the last few decades there has been much research directed at understanding and predicting the future. This research has given us many methods for forecasting. Most of these methods rely on statistical techniques. Currently, there is a new challenger to traditional statistical models, namely neural networks. See Wasserman (1989) for a good introduction to neural networks and White (1992) for extensive mathematical proofs about neural networks.

Why, in general, might neural networks perform better than traditional models? The literature suggests several advantages neural networks have over traditional statistical methods.

Neural networks are mathematically shown to be universal approximators of functions and their derivatives. Additionally, neural networks are capable of approximating ordinary least squares and non-linear least squares regression, non-parametric regression, and Fourier series analysis (White, 1992). This means that neural networks can approximate whatever functional form best characterises the time series. White (1992, p. 79) states in summary, 'neural networks are capable, in principle, of providing good approximations to just about anything one would like.'

While this property gives little value if the functional form is simple, e.g., linear, it allows neural networks to extract more signal from forecasting data with complex underlying functional forms, such as those associated with currency trading. Furthermore, neural networks can at least partially transform the input data if needed.

Neural networks also are inherently non-linear (Wasserman, 1989). That means not only do they estimate non-linear functions well (White, 1992), but they can also extract any residual non-linear elements after linear terms have been removed. If the underlying model is non-linear then not only will the non-linear neural networks make better forecasts than linear models, but this improvement will be increasingly apparent as the forecast horizon lengthened, since the predictions of the non-linear model will increasingly depart from those of the linear model.

Neural networks can partition the sample space and build different functions in different portions of that space. The neural network model for the Boolean exclusive OR function is a good example of such a model (Wasserman, 1989, pp. 30-33). This suggests neural networks might be particularly effective when used for modelling discontinuous functions.

Comparing Traditional and Neural Network Models

Prior to the our work (Hill, O'Connor, and Remus., 1995), comparisons between neural networks and traditional models were often limited in scope. The current work compares neural networks to other models in the famous Makridakis forecasting competition. In that competition (Makridakis *et al.*, 1982), various groups of expert forecasters were given all but the most recent data points in each of the series. Each group was free to use any of the techniques in their domain of expertise to forecast the many time series. The time series came from many and varied real world sources. The forecast groups had no knowledge of the source or nature of each time series. We conducted our work as if we were part of the competition and forecasted the same time series. As in the competition, holdout data was used to compare the models..

In the forecasting literature, great stress is put on the impact of the data and task characteristics on forecasting model selection. DeLurgio and Bhame (1991, pp. 206-221) provide an extended discussion of these selection characteristics summarised below:

Data period used (eg., annual, monthly or quarterly)
Demand pattern capability (eg., non-linearity)
Accuracy at each horizon
Number of observations required
Cost of application
Frequency of forecast revision
Type of application
Uses external or subjective data
Automation potential

In our study we compared the overall accuracy of the neural networks with six traditional models (including exponential smoothing, Box-Jenkins, Holt's, and a judgment-based method) and also tested the accuracy of neural networks and traditional models across four of the model selection criteria discussed above (data period used, demand pattern capability, accuracy at each horizon, and number of observations required). Note that the literature described above makes some specific predictions on the latter.

In the study, we found neural networks outperform the traditional models in forecasting monthly and quarterly data series. However, the neural networks are not superior to traditional models with annual series. We examined how the functional form of the time series affects the comparative accuracy of the neural networks. Although overall, neural networks perform well for all monthly series, they seem to perform best for discontinuous series as would be predicted by theory. We also compared our neural network models with the traditional models across a 18 month forecast horizon. The neural network models generally perform better than traditional models in the later periods of the forecast horizon. The number of historical data points has only a minor influence the comparative advantage of the neural network model. Neural networks, however, require more data points in general than the simpler forecasting models.

It is important to note that the variance of the neural network model forecast errors is almost always smaller than those of the traditional models. Although most emphasis is usually placed on forecasting accuracy *per se*, a reduction in the likelihood of extreme errors is to be prized, since managers can place more faith in the accuracy of such forecasts.

When to Use Neural Networks

The time series forecasts based on neural networks are superior to forecasts from traditional statistical time series methods when forecasting quarterly and monthly data, but not for annual data. Theory would suggest that this might result from the more complex series forms apparent in monthly and quarterly data. Thus, the future of neural networks is in forecasting times series with complex patterns.

One crucial reason that the neural networks perform better is the neural network's ability to handle discontinuities. Thus, it is important to know the functional form of the series in order to predict whether neural networks will be superior to traditional statistical models. We note that in product and inventory forecasting, the incidence of non-linearity and discontinuity is rather high. Thus, future applications of neural network models to similar problem domains might be highly desirable.

Also with traditional models, forecasters often select different models for a long term forecasting horizon than for a short term horizon. For example, regression often is recommended for the former and exponential smoothing for the latter. We found neural networks perform comparatively better for long term forecasting. This also suggests an important area for future neural network applications.

One interesting aspect of our work is that we did not fit each of the individual neural network models. Instead, we developed a procedure (described in our paper) which generated the models without our intervention. This is an important advantage since it facilitates the automation of time series forecasting. Ease of automation is yet another reason for selecting a forecasting model.

The cost of developing neural networks, however, can be quite high (particularly if automation is desired). In our case many hours were spent adjusting the software parameters and developing the necessary procedures to make the forecasts. Model estimation also consumed substantial computer resources.

The above costs will decrease in the future for the following reason. The current generation of neural network software converts the inherently parallel neural networks to serial form to estimate the model. In the future, parallel processing hardware will become available and should reduce the model development time (both in terms of elapsed time and CPU time). This, in turn, should reduce the cost of building neural network models.

References

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Hill, T., M. O'Connor, and W. Remus, "Neural Network Models for Time Series Forecasts," Working Paper: University of Hawaii, 1995.

Makridakis, S., A. Anderson, R. Carbone, R. Fildes, M. Hibon, R. Lewandowski, J. Newton, E. Parzen, and R. Winkler, "The Accuracy of Extrapolation (Time Series) Methods: Results of a Forecasting Competition," *Journal of Forecasting*, 1982, 1, 111-153.

Wasserman, P.D., *Neural Computing: Theory and Practice*, New York: Van Nostrand Reinhold, 1989.

White, H., *Artificial Neural Networks: Approximations and Learning Theory*, Oxford, UK: Blackwell, 1992.

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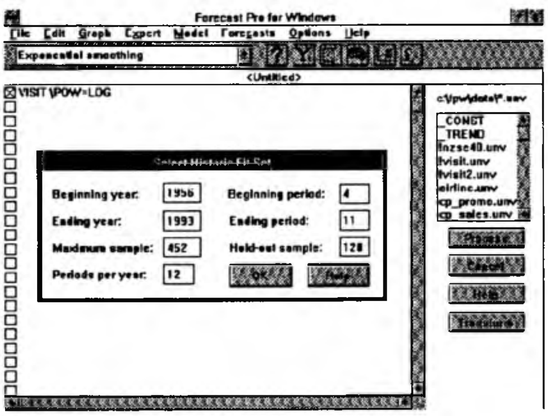
FORECAST PRO

DON MCNICKLE, Dept. of Management, University of Canterbury, Christchurch

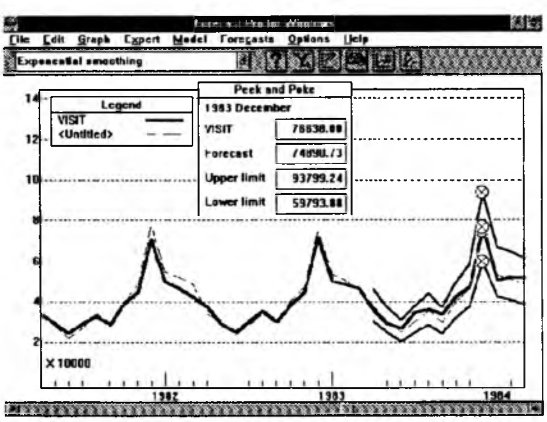
Spreadsheets seem to be getting bigger and bigger these days, with more and more features. EXCEL can do multiple regression, calculate Bessel functions, and solve LP problems reasonably well. One curious deficiency it has is in the area of extrapolative forecasting — things like exponential smoothing, dealing with seasonal patterns in data, and so on. All it has is a mediocre version of simple exponential smoothing and trend fitting by polynomials — probably one of the more dangerous forecasting techniques! I have always been puzzled by this, since I would have thought that many business spreadsheets are actually developed for some kind of forecasting role.



Anyway Forecast Pro is one of the products that fills the gap. It is an easy to use, Windows forecasting package. As well as all the usual extrapolative models, it has what it calls Dynamic Regression to allow models with dependent regressors to be fitted. There is an XE version that adds in X-11 decomposition, intervention analysis, and multiple-level exponential smoothing.

When you start it, the basic data screen appears: the icons at the top of the screen refer to the kinds of windows it has. The 'question mark' is *help*, 'Y_t' is the *data screen* (showing), the 'notepad' is the *audit trail*, where the program records any calculations or fitting it does, the 'brain' is the *expert system* that automatically selects the method (basically choosing between smoothing and ARIMA models), and fits it, the 'graph' is the Graph window, and the 'hatted Y_t' is the *model selection and fitting window*.

From here, all I have to do is to click on the button marked *process*, then the 'brain' to get a completely automatic model selection (based on the BIC criterion) and forecasts. Alternatively, the *model selection* button allows me as much control as I want over the model selection and fitting process. So I can do all the usual ARIMA diagnostics if I want. The automation appears to work well. It detects the presence or absence of seasonality, and for series which have an accepted ARIMA model it usually does find that model. Sometimes it fits more terms than the traditional Box-Jenkins approach would have suggested. All the numerical calculations go into the *audit trail* which can be saved as an ASCII file and printed out later.



In the Graph Window a very useful feature is *peek and poke*, that allows you to get the numerical value of any point, or modify values by dragging them. (Obviously this has to be done with some caution, but it allows clearly incorrect historical values to be easily modified.)

Data input is carried out through its own univariate or multivariate ASCII file structure, or it can read straightforward .WK1 or .XLS spreadsheets. There is DDE as well, not that I ever seem to be able to make that work properly on any product!

Received wisdom in forecasting says that on the average these simple techniques work as well as anything — certainly as well as fancier models and better than wild gue . . . (whoops — expert judgement). Yet people out in the real world still will not use them. The usual reason they give is that they are still too difficult. Well, with Forecast Pro, once you have got the data in, a forecast takes exactly four mouse clicks to produce. If you want to know more about what it is doing, the manual includes a good tutorial as well. Forecast Pro is a well written program that does a limited range of analyses about as simply and efficiently as I can imagine.

You can get it from **Hoare Research Software, P.O. Box 4153, Hamilton East, or BFS Inc., 68 Leonard St, Belmont, MA 02178, USA**. There is a demo disk of the XE version that can do everything except store your own data, so you can have an exhaustive try before you buy.

e-mail: d.mcnickle@mang.canterbury.ac.nz

NETSPEAK: A FIRST STEP TOWARD A 'REAL' NETWORK MODELLING LANGUAGE

BRUCE W. LAMAR, Dept. of Management, University of Canterbury, Christchurch

A while back, I was having an interesting conversation with Bruce Benseman of Industrial Research Ltd. regarding the use of minimum cost network flow (MCNF) models in practice. Part of our conversation went something like this:

Bruce B. 'Do you know what I've observed Bruce?'
Bruce L. 'What's that, Bruce?'
Bruce B. 'Well, Bruce, I've found that many of the network applications I have dealt with are close to being a [minimum cost flow] network, "but not quite".'

In the midst of this conversation with Bruce, I realised two key points. First, it was going to be awfully hard to keep track of which Bruce was which; and second, Bruce (in this case, the other Bruce) was absolutely right.

On the one hand, network-related applications are ubiquitous. They occur in a whole host of problem domains (including personnel scheduling, cash flow management, physical distribution, telecommunication, and reservoir management to name but a few). Moreover, there are numerous OR success stories involving the use of MCNF models for these applications. The acceptance of MCNF models in these various disciplines is due in large part to

(a) the ability to represent network models visually (as opposed to algebraically) via a flow diagram; and

(b) the impressive computational efficiency of current MCNF algorithms (a network with hundreds of nodes and thousands of arcs can be solved in literally seconds on today's personal computers).

But, on the other hand, there are many more 'almost'-success stories involving MCNF models (this is the '...but not quite' part of Bruce B.'s quote). Many network-related applications would fit neatly into the mould of a MCNF model if only some messy complications could be assumed away — complications either in the constraints or in the objective function. Unfortunately, by ignoring these complicating bits, the results (and therefore the usefulness) of an MCNF model can be profoundly affected.

Keep on truckin'

To illustrate this point, consider a trucking company transporting small parcels across the country. This is clearly a network-related application — with the network being the physical road network in this case. Moreover, the company is interested in minimising total transportation and handling costs while, at the same time, providing a high level of service (namely, by meeting demand). So, at first glance, this situation would seem to fit exactly into the framework of a MCNF problem. But, as usual, reality has thrown a monkey wrench into the works.

The shape of the cost function associated with an arc in this carrier's network depends on the average daily volume of freight (i.e., flow) carried on that arc (see Figure 1). If the flow is zero, the arc is not used and so naturally the cost is zero. If the flow is small, the carrier will send a prespecified number of trucks per day over that arc even though the trucks will be only partly full. This is done in order to maintain a satisfactory level of service. In Figure 1, this minimum frequency is set at two truckloads per day. Alternatively, if the arc flow is above the minimum frequency, then the carrier will implement a 'go when full' truck-dispatching policy and the arc cost will be roughly proportional to the number of truckloads of freight carried over that arc.

In short, the cost functions for this problem are highly nonlinear (they are discontinuous and neither convex nor concave) making them difficult to solve analytically. Moreover, a linear approximation of the function depicted in Figure 1 grossly misrepresents the actual cost function (see Figure 2). Compared to actual cost function, a linear cost function will favour relatively small flows over a large number of arcs. But it is in this region that the linear function makes the poorest approximation to the true function. So, not only will the total cost estimated by a MCNF model using a linear cost function be inaccurate, but the entire set of 'optimal' flows determined by a (linear) MCNF problem will be erroneous.

Clearly, a more accurate representation of the cost function in Figure 1 is needed. One approach would be to use a mixed integer programming (MIP) formulation of the problem wherein discrete decision variables are used to represent different segments of the cost function given in Figure 1 and side constraints are added to enforce logical relationships between the discrete and the continuous decision variables. As an in-between step, a 'fixed-plus-convex' cost function (see Figure 3) could be used to reduce the number of discrete variables needed in an MIP formulation in order to strike a balance between a realistic representation of the problem and a mathematical form that is more tractable analytically. But, in either case, the desirable properties (a) and (b) characteristic of MCNF problems highlighted above will have been lost. If only there were another way!

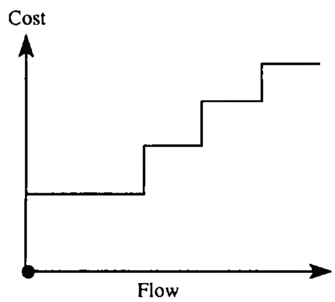


Figure 1 Actual arc cost function

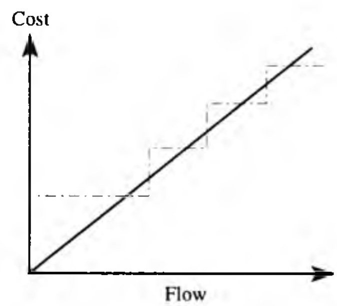


Figure 2 Linear arc cost function makes poor approximation

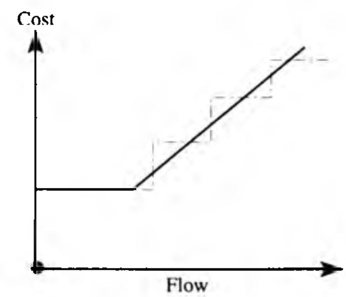


Figure 3 "Fixed-plus-convex" arc cost function makes closer approximation

Pitch for NETSPEAK

Well, it just so happens that that is exactly what I have been working on. I am in the midst of implementing a network modelling language called NETSPEAK that is designed to facilitate the formulation, solution, and analysis of nonlinear MCNF problems of the type typified by the trucking example given above.

In a nutshell, I designed the syntax of NETSPEAK with three underlying characteristics in mind. First, NETSPEAK is designed to be able to specify a wide variety of network flow problems ranging from a simple shortest path problem to a complex multi-stage, multi-model problem. Second, it incorporates a number of structures inherent in modern mathematical modelling languages (including flexible input/output, robust program control, and intuitive commands). Finally, probably the most unique aspect of NETSPEAK is its ability of solve optimally MCNF problems with nonconvex objective functions (such as the ones exemplified in Figures 1 and 3). It can also handle concave quadratic, logarithmic, square-root, and piecewise-linear objective functions. Naturally, it handles linear objective functions too (as in Figure2).

The purpose of this brief article has been to provide a broad-brush picture of the environment in which the network modelling language NETSPEAK is intended; and, if you are interested in this area, to 'whet your appetite'. If you would like more information, I would be glad to hear from you. You can contact me via e-mail, snail-mail, voice-mail, or by any other known medium as follows:

Bruce W. Lamar, Department of Management, University of Canterbury, Private Bag 4800, Christchurch. Phone: (03)364-2941; fax: (03)364-2020
e-mail: b.lamar@mang.canterbury.ac.nz

IFORS 96 VANCOUVER MEETING

NZ National Contribution Paper

IFORS invites each national member society to nominate one paper as its national contribution. Any member of ORSNZ who is interested in having a paper considered for the NZ national contribution is requested to send a copy of the full-length paper to

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by the **1st of August 1995**. All submissions will be evaluated by two senior members of our society and one will be selected as the NZ national contribution, to be presented in person by the author or one of the authors. ORSNZ will make a small contribution towards the conference cost of the presenter. Note that the above deadline is absolute, since we are already somewhat behind schedule.

OR Practice Papers

John Charles Ranyard is organising a stream of practice papers reviewing of OR practice in specific countries. He has heard rumours that OR is alive and healthy in NZ and hopes that one will be forthcoming from us. If anybody intending to go to IFORS 96 is interested in contributing towards such a paper, please contact me (H. G. Daellenbach) as quickly as possible. I have already been promised a generous contribution by the Energy Modelling Group at Canterbury. It would be nice to here from Auckland about their work with Air NZ and NZ Steel, as well as the latest exploits of the two prominent OR consulting groups, CORE and IRL. Unless I hear from some volunteer, I will assemble the paper, and if need be also present it, since I will be at the conference. But I will be happy to let anybody else have a go at it. The names of all contributors will appear on the paper. Do not delay! Can anybody in Auckland hear me?

MEETINGS CALENDAR

31st Annual Conference of ORSNZ
31 August - 1 September 1995
Victoria University of Wellington

A.C. Aitken Centenary Conference - 3rd Pacific Statistical Congress
Annual Meeting of the N.Z. Statistical Association
1995 N.Z. Mathematics Colloguium
28 August - 1 Sept. 1995
University of Otago, Dunedin
A.C.Aitken Conference Administrator, Dep. of Math. and Stats, University of Otago, P.O.Box 56, Dunedin, N.Z., FAX 64-3-4798427
e-mail: casm@maths.otago.ac.nz

International Symposium on OR with Applications in Engineering, Technology, and Management (ISORA)
28-31 August 1995
Beijing; sponsored by The Asian-Pacific OR Centre within APORS and CAS
Topics: theoretical, computational, and application aspects of optimization in the widest sense, including LP, NLP, stochastic, combinatorial, multiobjective techniques.
Information: Dr Ding-Zhu Du, Computer Science Department, University of Minnesota, Minneapolis, MN 55455, USA, FAX 1-612-6250572
e-mail: dzd@cs.umn.edu

OR 37 Annual Conference of the O.R. Society (U.K.)
12-14 September 1995
University of Kent, Canterbury
Conference theme: Adding value in a changing world
Information: Chris Barrett, Conf. organiser, ORS, Seymour House, 12 Edward Street, Birmingham B1 2RX, U.K., FAX (44) 121 233 0321

INFORMS National Meeting
29 Oct. - 1 Nov. 1995
New Orleans: Sheraton
Information: Amiya Chakravarty, Tulane University, New Orleans, LA 70118-5669
FAX: 001 504 865 6751

INFORMS National Meeting
5 - 8 May 1996
Washington D.C.: Washington Hilton and Towers
Information: T. R. Gulledge Jr., George Mason University, Fairfax VA 22030-4444
FAX 001 703 764 4692
e-mail: gulledge@gmuvax.bitnet

1996 IFORS Conference in Vancouver, B.C.
8 - 12 July 1996
Venue: Hyatt Regency, Vancouver
Conference theme: OR bridging the theory and practice of decision making
Deadline for abstracts: 31 October 1995
Format: submit three copies, single space, paper title, 50 word abstract limit, author's name(s), full mailing address, presenter. Include abstract fee of CAD$100, payable to IFORS 96, by cheque, VISA, or Mastercard.
To: Conference Secretariat, IFORS 96, Venue West Conference Services Ltd., 645 - 375 Water Street, Vancouver, BC, Canada V6B 5C6, FAX (604) 681 2503
Chairman program Committee: Prof. Theo Stewart
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See also NZ National Contribution to IFORS 96

APORS' 97 - 4th Conference - PRELIMINARY ANNOUNCEMENT
30 Nov. 1997 - 4 Dec. 1997
Melbourne, Australia
Invitation to be added to mailing list, contact:
APORS' 97, c/o ASOR Melbourne Chapter
GPO Box 1048H, Melbourne, Australia 3001
e-mail: P.Lochert@sci.monash.edu.au
FAX (61) 3 903 2227

SEEN ELSEWHERE

The March-April 1995 issue of *Operations Research* features a paper by Robert M. O'Keefe, entitled 'MS/OR Enabling System Design', contrasting the traditional view of OR as analysis aimed at supporting improvements in existing systems with OR's role in redesigning completely new systems. He claims that the perceived 'image problem' of OR stems in part from seeing MS/OR as an analysis method, effecting marginal and continuous improvements of existing systems, whereas the management culture of the 80s and 90s calls for design of often radically new ways of doing things. He cites business process engineering as a manifestation of this new trend. The paper then looks at the consequences of OR taking this new focus, in terms of the need of OR workers to be conversant with more than just techniques, but also information systems analysis and design, the need for design-oriented data collection and generation, the trend of multiple model approaches that are fully integrated into a tightly coupled system, a change of role for the OR workers from analysts with a strictly limited commitment to a change agents with a more encompassing and continuing involvement starting with the initial inception of such project to well past the implementation phase, and the implication of all this on MS/OR education. To quote (p. 204):

'From this discussion, the following guidelines stand out as fundamentally important (*for any OR worker to do*):

1. focus across existing boundaries;
2. expect to build a system;
3. understand the data;
4. be able to develop hybrid systems;
5. aim for system integration;
6. proceed with evolutionary implementation;
7. determine a measurable benefit.

Sounds encouraging!

Summarized by H. G. Daellenbach; e-mail: h.daellenbach@mang.canterbury.ac.nz

WHAT IS OPERATIONAL RESEARCH?

Operational Research is the scientific approach to solving management problems. Using observation, data and analysis, the OR practitioner builds up quantitative relationships, called models. Models that take an overall system view help management make informed decisions.

The Secretary
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