THE AUSTRALIAN METROLOGIST

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FROM THE PRESIDENT

"In the National Interest!"

A major conclusion of the recently published Kean Report (reviewed in this issue) is that there is an urgent and growing need for improved coherence and strategic direction in the standards and conformance infrastructure to protect and further "the national interest".

The Kean Report's solution is to restructure Australia's measurement system, with closure of the NSC and the transfer of coordination to the National Measurement Laboratory and policy making to DIST. While the MSA does not agree with this proposal, it must be acknowledged that there is a problem. Several examples serve to illustrate this.

Firstly, one main reason for the inquiry was the conflict between NATA and SAQAS over the provision of laboratory accreditation. The Kean Report recommended what was obvious to everyone working in metrology, namely that "in the national interest", laboratory accreditation should continue to be provided by only one agency, and that the agency should be NATA.

It remains to be seen whether the recommendations concerning NATA and SAQAS will be accepted. But why was an inquiry required in the first place? If opening laboratory accreditation to competition is not "in the national interest", why wasn't the conflict resolved either by the organisations themselves or by the government?

Secondly, opportunities for training in measurement and calibration skills are seriously lacking in Australia. In response to this situation, the NSC in cooperation with industry and TAFE developed 30 metrology training modules for use in TAFE colleges. However, these modules will only be offered in TAFE colleges with sufficient student demand as well as suitable teaching staff and teaching resources. Predictably, the NSC is struggling to have these modules introduced into the TAFE system, although everyone agrees it would be "in the national interest".

Finally, the need to establish traceability of chemical measurements is growing in Australia and internationally. Regional leadership in this field will go to the first to build a national reference laboratory and provide a system for the dissemination of reference standards. Unfortunately, attempts made so far to coordinate the various elements of Australia's measurement system and establish a chemical metrology infrastructure have failed.

Why are we having these problems? Australia's measurement system involves a complex web of interactions and linkages between the Commonwealth, NML, NATA, NSC and SA. In the past, these organisations cooperated "in the national interest". Cross representation of the organisations on each other's committees and councils provided for informal coordination. Conflicts and problems such as those mentioned above were resolved quietly and without fuss.

The Kean Report attributes the problems to the considerable strains placed on the infrastructure by the rapid expansion in demand for quality management systems (QMS), causing intense competition between SA and NATA. To me, this is a symptom rather than a cause. SA and NATA were already looking to diversify their operations and generate extra revenue. QMS certification was simply a lucrative source of cash that fell within the scope of both organisations.

The Kean Report provides a clue to what I believe is the reason for our current problems in coordinating Australia's measurement system. Under "Funding to Non Government Agencies", it is reported that both SA and NATA have received Commonwealth funding since their inception, with NATA being fully funded until 1956. Since then, funding has steadily reduced to 13% for SA and 9% for NATA. Funding was originally provided to both SA and NATA through CSIRO. In the late 1970's, funding responsibility passed to the Department of Science and Technology, and later to DIST in 1985. Elsewhere it is reported that there has been a significant decline in the funding of NML over the last twenty years.

This steady decrease in government funding for infrastructure organisations has been accompanied by the embrace of economic rationalism within government circles. Educational institutions have been similarly affected, (continued Page 3)

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Letters should be limited to 200 words. Authors will be contacted should editorial changes be considered necessary.

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IN THIS ISSUE

FROM THE PRESIDENT (continued)

with performance being assessed in terms of economic success as much as educational value. This has led, not surprisingly, to organisations whose loyalty is primarily to themselves, rather than to "the national interest".

The government cannot, therefore, expect organisations like SA and NATA and educational institutions like TAFE to act "in the national interest" when the government has economically washed its hands of them. This also applies, to a lesser extent, to the government funded NML and NSC, where cost recovery and commercial return often dominate. The game has become growth and survival, rather than acting for the common good.

I am not an economist or a political analyst. I do not know whether economic rationalism was necessary for survival in a depressed world economy or whether it was a political ideology foisted on us by gray people in economic think tanks. I do know that we can never go back. The informal methods used to coordinate the system are no longer appropriate or effective. They are relics of the past. It is unnecessary, however, for the major restructuring of the measurement system suggested by the Kean report.

What is required is for the Commonwealth government to formally define and allocate roles, responsibilities and powers for the various organisations within our measurement system. This must be done with the understanding that the aims, structures and motivations of Australia's standards and conformance infrastructure organisations have changed irrevocably.

John Miles

LETTERS TO THE EDITOR

Start Them Early!

I was about to leave home for an MSA organised tour of a professional laboratory when stopped by my 14 year old with "Could I come. That sounds interesting."

My immediate reaction was a hesitant "no", but maybe we, as a professional group, should consider the developing career aspirations of our youth. Could the Committee and Members consider whether limited invitations to non-members of the MSA (mainly family) could be considered for future tours?

Neville Owen

Ed: The Management Committee has no problem with this suggestion in principle. Do members have a view?

Run that by me again

It was pleasing to receive recently the number 4 issue of *The Australian Metrologist*; but more so, to find also the Membership Certificate which will be treasured with satisfaction and pride.

Firstly, may I congratulate those Committee volunteers whose time and thought culminated in the production.

Secondly, however, when my grandson visits for a student's tea, there is a high probability that his observation will prompt the question, "Grandpa, what is the interpretation of the significant figure at the top of your Certificate?"

Being one involved in true values, I would wish to respond with 99% confidence of a precise answer that has no uncertainty and is traceable to a National reference. As the limit of my lateral thinking is somewhat rounded at the sides and my imagination may be random and askew, your reprint of the derivation and colour selection of the logo would be much appreciated.

I predict that others of the population would appreciate your printed response.

Roy Hood

Ed: You will find a write-up on the logo on page 7.

Nasal Metrology

One thing the MSA has achieved is to broaden my understanding of what metrology embraces. As a toolmaker, I thought that metrology was all the measurements associated with high precision engineering. "What would a chemist or someone from the weather bureau know about metrology?"

Well, I admit to being slow, but I want to learn and I am trying. So this really is an appeal for help.

Having climbed Cathedral Range (Victorian Central Highlands) after a drought breaking rain, I was struck by the wonderfully unmistakable smell of freshly liberated eucalyptus.

Maybe the vapour affected my brain. The questions which provided stimulation to write this letter were:

* could a chemist skilled in metrology measure such small concentrations of eucalyptus?
* however could this measurement be made?
* how many parts per million could I smell?

Among our non-engineering metrologists, I hope someone can provide me with just a little more knowledge of our wonderful planet.

Alex Smart

THE KEAN REPORT

The Report of the Committee of Inquiry into Australia's Standards and Conformance Infrastructure (the Kean Report) was published in March 1995. The MSA had made several submissions to this inquiry.

Following publication of the Kean Report, the Committee of Management held a special meeting in May to draft a response. Several members contributed to this process by providing written submissions. **[This is what gives an organisation life.]** A formal MSA response was subsequently drafted and forwarded to the Government. The following is based on that response.

The Kean Report is a significant document containing sixty recommendations on measurement, standards, conformance and quality. It is well written and comprehensive, providing excellent and useful information on Australia's measurement system and guidance for its future.

The Report recognises something MSA members have known for a long time, namely that:

> *".. a readily identifiable, strongly scientifically based and comprehensive measurement system is the foundation of a high quality standards and conformance infrastructure".*

Additionally, the infrastructure is:

> *".. a crucial element of the commercial and scientific fabric of a modern community".*

The need to address the impact of standards on industry competitiveness and the dissatisfaction of many users with the standards and conformance infrastructure prompted the Kean Report. These concerns were mainly over the effectiveness of the standards writing process and the conflict between some providers of infrastructure services, particularly laboratory accreditation. So what did the Kean Report say?

Laboratory Accreditation
Members of the MSA having some association with laboratory accreditation are probably most concerned by the competition between NATA and SAQAS.

Our submission to the Inquiry highlighted the potential problems associated with a multiplicity of laboratory accreditation agencies operating in Australia. These problems include inconsistency in applying accreditation requirements and the loss of a single national focus for laboratory accreditation. We suggested that the quality of laboratory accreditation would drop due to a dilution of the limited technical resources available in Australia. Submissions from NML and NSC put similar views, namely that competition would lower standards and erode the high regard in which Australia's system is held internationally.

The MSA recommended that the role of NATA as the national accreditation agency be confirmed by Government in accordance with the terms of the existing Memorandum of Understanding (MOU) between NATA and the Commonwealth.

The Kean Report supported this view by finding that laboratory accreditation should continue to be provided by only one agency.

It suggested that the Government review its MOU with NATA emphasising its unique status. It recommended that JAS ANZ remove laboratory accreditation from its charter and that the Government should make the necessary efforts to discourage other agencies from offering laboratory accreditation services.

Standards
The Kean Report found that Standards Australia (SA) was held in high regard by the general community. Paradoxically, there were many who were very dissatisfied with aspects of SA's operation.

The Report is quite critical of the policies, management and structure of Standards Australia and made several recommendations designed to make it more responsive to the needs of its users and the national interest. It recommended that SA take steps to divest 51 per cent of SAQAS to maintain the national interest of ensuring that Australia's peak standards writing body retain standards writing as its core activity. It also considered that SA needed a more modern and accountable system of corporate governance. Stringent procedures were recommended for appraising the need for an Australian standard, for estimating the true cost of a standard and for actually writing the standard.

Quality Management Systems
Another issue often raised by members is QMS certification. The Kean Report found that there is widespread confusion about what QMS certification does and does not do. It said that the peak quality bodies and the QMS industry have a responsibility to better inform clients about ISO 9000 and its costs, benefits and limitations. It is important to recognise that ISO 9000 only aims to give customers confidence that suppliers have in place management processes that deliver **consistency**. It does not assure product **quality** contrary to the way it is often marketed.

Many submissions to the Inquiry identified variability in the quality of QMS auditors, inconsistency in the approaches taken by certification bodies and a lack of

sufficient knowledge by auditors of the specific industry involved as serious problems.

JASANZ was correctly named as the appropriate body to resolve this problem, as JASANZ is responsible for accrediting QMS certifiers. The Kean Report recommended that the government require JASANZ to assure that criteria are applied more consistently in the accreditation of QMS certifiers, that standards for QMS certification are applied consistently by certification bodies, and that high priority be given to the accreditation program for auditor training.

A point not stressed enough by the Kean Report is that an understanding of measurement is fundamental for QMS auditors (and suppliers). Sadly, this is frequently lacking. How often have we heard about QMS audits that have stumbled over misunderstandings concerning traceability, uncertainty, the interpretation of calibration reports and the identification of critical measurements. Metrology should be one of the first disciplines included in QMS auditor training.

Uniform Trade Legislation

A most important recommendation in the Kean Report is that the Government assume full responsibility for trade measurement by amending the National Measurement Act to incorporate the principal elements of the Uniform Trade Measurement Legislation.

The MSA strongly supports this proposal. We can no longer afford to suffer an inefficient State based trade measurement system. Ominously, a report in 1891 proposed the same thing! The Constitution actually gave the Commonwealth the power to make laws in relation to weights and measures. It has never accepted this responsibility, choosing to share it with the States. This is despite many reports and reviews commenting on the problems caused by lack of uniformity of administration of trade measurement across Australia.

Measurement

The Kean Report makes several proposals concerning the structure of Australia's measurement system. The recommendations involving the National Measurement Laboratory (NML) are widely supported by the metrology community. They are that the NML be declared a National Facility with a separate line item in the Commonwealth budget and that the NML budget should be at least maintained and preferably increased over time. These recommendations have the aim of securing NML's funding base and strengthening its role.

The MSA strongly supports this proposal. NML funding and resources have declined significantly over the last twenty years. The capacity of NML's to maintain, develop and disseminate Australia's primary standards of measurement is now under threat.

The Kean Report recognises that measurement is the foundation of the Standards and Conformance Infrastructure and that NML is the core of Australia's measurement system. It is vital that funding for NML be supported and strengthened.

The Kean Report also proposes to transfer the coordination of Australia's measurement system from NSC to NML, close the NSC, and transfer responsibility for measurement policy to DIST. This is not supported by the MSA.

The MSA believes that the Kean Report fails to give compelling reasons or provide evidence of greater effectiveness and cost saving to justify such major structural changes. Indeed, the proposed transfer of the national coordination function from NSC to NML would require significant increases in resources and funding for NML. This is at a time when NML is being increasingly denied funding to simply carry out its present function.

The MSA agrees that there is *"an urgent and growing need for improved coherence and strategic direction for the infrastructure to protect and further the national interest"*. The current obstacles to coordination are, however, not structural. Rather, they arise from the lack of a clear definition of "coordination of the measurement function" and a clear assignation of this role to the NSC.

The National Measurement Act 1960 gives the NSC the responsibility: *"to coordinate the operation of the national measurement system"*. In practise this has been interpreted as: *"to promote and coordinate the use in Australia of a uniform system of units and standards of measurement"*, a much narrower and more constrained view. The absence of a clear statement of the powers of the NSC in coordinating the national measurement system and a lack of the resources have seriously hindered the NSC in carrying out functions such as introducing a national metrology training program, establishing a national infrastructure for chemical metrology, resolving issues concerning competition in laboratory accreditation, etc.

The MSA therefore favours retaining the present structure. The current problems should be addressed by formally defining and assigning the role of the national coordination of the measurement system to the NSC, recognising the importance of this responsibility and allocating the NSC sufficient resources to accomplish this task.

Training and Professional Development

The MSA submission to the Inquiry included several recommendations concerning the training and professional development of Australian metrologists. It is therefore disappointing that the Kean Report did not identify education and training as an issue or make any recommendations concerning education and training in measurement skills.

The efficiency and effectiveness of Australia's measurement system are primarily dependant on the skills and training of the people involved. A sound skills base in metrology is vital to underpin the technical infrastructure. The current lack of opportunity in Australia for training and professional development in measurement skills is a major issue not addressed by the Kean Report.

The Kean Report may be obtained from the Australian Government Publishing Service for $25. A copy of the MSA response may be obtained from the Secretary, Colin Wagg.

John Miles

LABORATORY COMPUTING

AUTOMATIC DATA ACQUISITION

The metrologists life is not a simple one. (Sounds like the opening line from a song doesn't it.) Technology is moving very fast around us and things are not the same as they were even a few years ago. There is a significant number of technologies that rely on a skilled operator and a "feel" for the work. The sad fact is that these technologies are very labour intensive, very expensive and may not always be "what the customer wants".

One solution to this expensive labour problem is to automate the technology and use computers, data loggers and transducers to do the hard slog for you. In one fell swoop you have made your life blissfully simple. All the black art of measurement is lost (or hidden), and anyone can do it. Right!

Enter the sceptic. A NATA assessor (or some other friend, or an auditor) may ask a silly question like: "What sort of testing have you done to prove that this system gives reliable, repeatable results?" You, of course, produce reams of paper that support your case and everyone is happy.

But how confident do you really feel? Lets look at what you have lost by choosing this wonderful tool.

First the data logger. The specs' may say it has a 12 bit DVM. This means a voltage signal will be converted with a resolution of 2^{12} or 4096 parts of full scale or 0.025%. This may sound good but if you are using only part of the full scale range then your resolution will be poor and may compromise the resolution of your transducer. Also remember that resolution is only the first small step towards uncertainty.

Next the transducer. When taking a reading from an indicating instrument you tend to observe the reading for some time before accepting a value. A data logger on the other hand will take a single snap shot when you tell it to. No averaging, no smoothing, no estimating, just one number. While a data logger can be told to take a set of measurements and average them, this is not automatic. Depending on the data logger, this snap shot can be taken in less than 100 microseconds or as long as about a second. The consequences of this can be quite significant depending on the measurement environment.

We would like to think that all measurements are taken at steady state but this is far from the truth when fast data loggers are used. Modern transducers have a bad habit of being "intelligent". The manufacturer provides the ability to communicate with the transducer by sending code along the measurement lines at high frequency in short bursts. This communication may be present when a snap shot reading is taken giving a misleading result. There is also a chance of electrical interference, power line disturbance, mechanical vibration, air conditioning draft, doors being opened or "Murphy". These are all transient but, if captured by a data logger, they suddenly become real data.

Last the measurement algorithm. Automatic data acquisition will only produce reliable results if the data collection algorithm you implement has some form of data validation. This is the process that you, as a metrologist, go through as you take a reading. If you need to implement automatic data acquisition in your work place you must find a way to emulate the validation process. It is never easy but to not do so will compromise your present standards.

This can be achieved by averaging a number of results and rejecting averages that produce too large a scatter or standard deviation. You may prefer to read in large quantities of data and then use a spread sheet to reject data manually. When monitoring a moving signal, you may need to use some form of moving arithmetic average. Methods of averaging and data smoothing are very much beyond this brief comment.

This finally leads to the moral. You can certainly take more readings faster using a data logger to save time, but you may get less information.

Neville Owen

MEASUREMENT STANDARDS

IN SEARCH OF THE PERFECT SPHERE

Perfection, like beauty, is a relative thing - (but only up to a point!). Starting from a (nearly) perfect single crystal of Silicon about the size of a loaf of bread, the CSIRO Division of Applied Physics is producing balls of (nearly) perfect smoothness and (nearly) perfect sphericity.

In this case, near perfection means that the maximum radial departure from a hypothetical true sphere is less than about 30 nanometres, measured with an uncertainty of around 3 nanometres, and the roughness of the surface is measured in Angstroms. Furthermore, this extraordinary quality of geometry and surface smoothness must be achieved with a final diameter specified to within +15 to -0 μm of 96.3 mm, resulting in a mass which is within a few tens of milligrams of 1 kg. Plato, had he been alive to see one of these wondrous objects, might have felt a twinge of satisfaction, in silent contemplation of his own reflection in this most universal of Platonic solids' mirrored convexity.

The extent to which a perfect sphere can be made, and the extent to which its mass and volume can be accurately measured is precisely the extent to which a standard of density can be realised (d=m/v). But also, if such a sphere is made from one single (nearly) perfect crystal of Silicon, then by accurate measurement of the microscopic (crystal lattice spacing and atomic mass), and the macroscopic (mass in terms of the kg and volume) parameters - we are able to relate mass at the two scales accurately together via the Avogadro constant N_A. If this can be achieved with sufficient accuracy (say a few parts in 10^9) then we can think about replacing the last of the SI units defined in terms of an artefact (the Paris kilogram) in terms of fundamental atomic constants (ie the mass of atoms).

Australian spheres of this quality are being used for both purposes by national standards institutes around the world, amongst them, those of Germany, Italy and Japan. Production of the spheres requires a close integration of the science, art and skills of fabrication and metrology at state-of-the-art levels, and in this instance between the Divisions' Sydney and Melbourne laboratories.

Under the direction of *Achim Leistner* at NML-Sydney, a sphere starts out life as a boule of single crystal silicon, and is initially roughly shaped using diamond tools and coarse loose silicon carbide abrasives. Fine grinding follows, using progressively finer grades of aluminium oxide powder. Multiple rotating cones hold and work the sphere by the combined action of machine and hand manipulation. The shape of the error surface at the end of this process is critical in determining the final geometric quality of the ball.

High accuracy roundness and sphericity measurements performed at NML's Melbourne Branch are used to establish that the primary symmetry of the residual error surface is due only to the inherent orientation of the crystal lattice itself, and not components of the fabrication process. The final phase of super-polishing is achieved by carefully controlled optical fabrication methods involving aspects of mechanical, physical and chemical processes, supported at each critical stage by high level qualitative and quantitative metrology to accurately monitor the evolution of the surface geometry.

Sphericity measurements are generated using a Talyrond 73 roundness machine, specially modified to collect and process multiple profile signals using a desktop PC, to characterise and correct for errors introduced by eccentricity offsets and systematic error of the high precision spindle. Systematic coverage of the sphere by equatorial and multiple longitudinal 2D roundness measurements, and subsequent integration of the data by imposing internal consistency constraints using an iterative least squares fitting procedure, results in high magnification images revealing the radial error surface of the sphere with an uncertainty of a few nanometres.

Walter Giardini

MSA LOGO

Since the membership certificates have been posted out, some Members have requested information on the MSA logo and the colour scheme selected.

Logos such as the Wool Mark and that of CSIRO were used as something of a benchmark as both have visual impact and have become easily identifiable with their organisation.

Many proposals were received from the membership but the one which formed the basis of our logo was John Newnam's suggestion of a circular indicating dial with a stylised pointer at about one o'clock. This seemed to have a fairly universal application to all disciplines. Our graphic artist, Neil Moorhouse, then produced some variants including the three dimensional one we finally adopted.

As for the colour scheme, the basis for the selection of blue and gold was that they were conservative colours reflecting the approach of the profession and, rather undramatically, they looked good together.

CONFERENCES AND COURSES

INAUGURAL MSA CONFERENCE

Following the call for papers for our first MSA Conference, forty abstracts and expressions of interest to prepare papers have been received. Indeed, the response has been so promising that the program has had to be extended to three days even with streaming of the topics.

Technical Program
The program will include three sessions of technical papers each day followed by either a panel discussion or technical visit. Trade displays will provide an opportunity for participants to have a "wander" between the more formal activities.

The disciplines in which papers will presented include electrical, dimensional, mechanical (physical) and chemical metrology. There will also be sessions devoted to trade measurement.

Technical Visits
Currently there is a choice of three technical visits to:
- Australian Government Analytical Laboratory
- National Measurement Laboratory
- National Standards Commission

Sponsorship
Another very pleasing response has been the number of organisations providing sponsorship. So far, contributions or pledges have been received from:
- Bellinger Instruments
- Australian Government Analytical Laboratory
- CSIRO National Measurement Laboratory
- Gawler Instruments
- Glaxo Pty Ltd
- NATA
- National Standards Commission

To all these organisations we offer our sincerest thanks. These contributions will reduce considerably the cost of attending and will also make possible some of the things which would otherwise have only been on the "wish-list".

If your company would like to provide sponsorship, it's not too late. Contact the organising committee now.

Conference Dinner
The conference dinner on the second night will be aboard the Matilda II while cruising Sydney Harbour. It will include pre-dinner drinks and nibblies, main course (with wine), desert, a fruit and cheese platter and coffee. A bar service will also be available.

Concluding BBQ
The conference will conclude with a barbecue and drinks so that everyone can relax and mull over the proceedings before setting off home.

This is YOUR conference and will only be successful with the support of as many Members as possible. Please come and make sure that it is the first of many.

Dates:	**29 November to 1 December**	
Venue:	**National Measurement Laboratory**	
	Bradfield Road	
	LINDFIELD NSW 2070	
Cost:	**Members**	**$200**
	Non-members	**$235**
	Students	**$110**
	Any single day	**$125**
Contacts:	**Kerry Marston**	**(02) 888 3922**
	Glenda Sandars	**(02) 413 7087**

The Management Committee would like to thank the conference organising committee, Kerry Marston, Glenda Sandars, Barry Sutcliffe, Bob Kelly and Ilya Budovsky, for the terrific job they have done.

UNCERTAINTY OF MEASUREMENT COURSE ON THE ISO GUIDE

A three day course on the ISO TAG WG4 *Guide to the Expression of Uncertainty of Measurement* will be conducted by the CSIRO's Division of Applied Physics in the following cities on the indicated dates.

Sydney:	6th - 8th September
Brisbane:	20th - 22nd September
Adelaide:	4th - 6th October
Melbourne:	18th - 20th October
Perth:	8th - 10th November

This course is intended for calibration laboratory staff who are required to make formal estimates of their measurement uncertainties. It is expected that attendees will be able to perform calculations involving algebra and partial derivatives. To enable better interaction between the presenters and the attendees, numbers will be strictly limited to 20.

Fee: $680 all inclusive
Contact: Mrs R Crawford
CSIRO Division of Applied Physics
Phone: (03) 542 2965 Fax: (03) 544 1128

TECHNICAL GROUPS

INAUGURAL MEETING OF THE PRESSURE GROUP

The first meeting of the Pressure Technical Group was held at Clayton on the 20th of April. Ten participants attended with a further dozen or so apologies received and post-meeting expressions of interest (half from interstate) bringing the current size of the group to around 20. Following a brief overview of the MSA by President John Miles and subsequent discussion of the Guidelines for Operation, group members voted unanimously to be formally constituted as the first Technical Group of the MSA and were formally welcomed by John.

The meeting then went on to discuss a number of matters of immediate relevance. As well as the obvious "support" functions of initiating liaison and communication activities with appropriate organisations and forums, members of the group put four items on the immediate agenda.

1. The identification of appropriate ranges and instruments which would be suitable for proficiency testing in the low pressure range;
2. Recalibration intervals for pressure balances (Working Group 1);
3. Low pressure range - identification of specific needs (Working Group 2);
4. The Australian Standard for bourdon tube pressure gauges AS1349 (Working Group 3).

The function of each working group, which is restricted to several people for practicality, is to organise discussion and input, collate, analyse, distribute and report data and information. All members of the Pressure Group have the opportunity to make an input and, beyond that, input is sought from all relevant and appropriate sources, be they individuals or organisations which have a genuine contribution to make. If anyone is interested in obtaining a full copy of the minutes and papers from the meeting, please contact me at the address below and I will send you the information.

The enthusiasm of group members was evidenced by everyone's ready willingness to participate in the working groups and was certainly a great start to our activities. Discussions of pressure and other related matters continued after the meeting over light snacks and drinks and all group members now look forward to getting on with the job. Below (in alphabetical order) is the provisional list of current group members which includes those who were at the meeting, or who have otherwise expressed interest in the group's activities. Members of specific working groups (WG's) are indicated.

Randall Anderson(WG-1)
Dale Atkinson
R. (Bob) Britton (WG-3, chair)
Graham Brown(WG-3)
Graham Gentles
Walter Giardini (WG-1, chair)
Don Groeneveld
Les Jarosz (WG-1)
Craig Lester
Neville Owen (WG-2)
Peter Rees
Clem Rowe
Noel Samaan
A. (Tony) Tossel (WG-2,WG-3)
Colin Wagg (WG-3)
Allan Ward (WG-1)
Jane Warne (WG-2, chair)
Steve White
Ken Wrighton (WG-2,WG-3)

Pressure Group convenor:
Walter Giardini
CSIRO - Division of Applied Physics
Private Bag 33, Rosebank MDC
Clayton, Vic. 3169
Ph: 03 9542 2963 or Fax: 03 9544 1128.

QUICK TIP - CALCULATORS

Does your calculator cope with standard deviations? Ron Cook of CSIRO pointed out a flaw in many calculators which was highlighted during one of his uncertainty courses. If you have a calculator with statistical functions and you use it for determining standard deviations, you should check that it gives the answers that it should.

Most people are aware that they need to ensure that the standard deviation button calculates the sample rather than the population statistic. What can present problems for the unwary is where you are dealing with numbers having several significant figures. Many calculators introduce significant rounding and truncation errors. Try the following exercise if you are unsure.

Select the statistics mode on your calculator and enter the numbers 1 to 5. The sample standard deviation should be 1.581.

Now repeat the same steps with the numbers 1 000 001 to 1 000 005. Some calculators will give the standard deviation as 0. Mind you, this will make your measurement uncertainty figures look much better!

NML NEWS

CPEM '2000

The National Measurement Laboratory (NML) has succeeded in its bid to host the prestigious Conference on Precision Electromagnetic Measurements (CPEM) in the year 2000. The CPEM is one of the foremost International metrology conferences and is held biennially, with sponsors including the International Bureau of Weights and Measures (BIPM), IEEE Instrumentation and Measurement Society (USA), National Institute of Standards and Technology (USA), Union Radio Scientifique Internationale (URSI) and the National Research Council of Canada. The NML bid was successful against competition from Denmark, Italy, the Netherlands and the United Kingdom. *CPEM '2000* will be the first CPEM to be held in the southern hemisphere and only the second held outside Europe and North America. Dr Barry Inglis, Chief Standards Scientist at NML, will be the Conference Chairman.

BIPM/NML VOLTAGE INTERCOMPARISON

In April 1995 Mr Bob Frenkel of NML and Dr Thomas Witt and Dr Dominique Reymann of the BIPM compared the NML voltage standard with the travelling BIPM Josephson volt standard. The difference was determined to be 0.10 nV in 1 volt, with a Type A standard uncertainty of 0.11 nV. The Type B uncertainty is not expected to exceed 0.2 nV. This outstanding result places NML well within the spread of a select group of about 15 national laboratories around the world.

INTERNATIONAL COMPARISON OF SPECTRAL RESPONSIVITY OF SILICON PHOTODIODES

The BIPM in Paris has recently concluded an international comparison of the spectral responsivity of silicon photodiodes. Including NML, 18 laboratories participated. Each laboratory measured three photodiodes, with before and after measurements made at the BIPM as the coordinating laboratory. The BIPM fully characterised the photodiodes for uniformity, linearity, temperature sensitivity, shunt resistance, and stability. In the process, information on the ageing of photodiodes was deduced, particularly on exposure to ultraviolet light.

Agreement between laboratories in the region 400 to 700 nm was around the 1% level, with a core of laboratories showing about .2% agreement. CSIRO results were within this core grouping around 500 nm, but drifted away near 800 nm. Results in the ultraviolet region showed stronger disagreement between the laboratories, up to 4% variation. CSIRO results were within 1% of the core laboratories in this spectral region, where systematic errors tend to be larger as measurements are more difficult.

As a result of the intercomparison, CSIRO re-evaluated its procedures; systematic errors were found due to the use of photodiodes with thick oxide layers, where small angular offsets produce larger errors than for photodiodes with thin oxide layers. Improved methods for detecting and removing noise in individual spectral runs were also devised. The CSIRO scale in this spectral region was revised and agreement with the BIPM result is now within 0.2% in the range 400 to 1000 nm. Changes are less than the uncertainty quoted in typical reports.

This intercomparison was unusual in radiometry and photometry in that, for the first time in this field, the demonstrated stability of the comparison artefacts was sufficient to show real differences between the national laboratories, related to the means by which each laboratory derives its scales.

INDONESIA-AUSTRALIA COOPERATION

NML is involved with the Indonesian national measurement laboratory, Puslitbank KIM-LIPI, in a project to gain international recognition of Indonesia's national standards of measurement. Initial work has concentrated on the fields of length, force and electrical resistance, but other quantities will be addressed over the next four years.

To have full confidence in the measurement chain in Indonesia, it is necessary to also gain international recognition for the second-level calibration laboratories, those which are part of the Indonesian national calibration network. This is the aim of a second project proposed by NML and NATA and their counterpart Indonesian organisations. If funding bids are successful, the project will commence in the 1995/1996 financial year.

THE ASIA-PACIFIC METROLOGY PROGRAM (APMP)

Of the 16 international intercomparisons being coordinated by APMP members over 1995/1996, four are currently seeking participants - hardness (Vietnam), vibration accelerometry (Taiwan), spectral responsivity (Korea) and RF Power (Hong Kong). Current developments and news from member laboratories have been published in the April 1995 issue (No. 9) of the APMP Newsletter, while an overview of the history, operations and activities of the Program will be available shortly in the form of the APMP information booklet, *the Asia Pacific Metrology Program - Accessing World Markets*. For details of any APMP

activities or publications, please contact the APMP Secretariat Ph: [02] 413 7788; Fax: [02] 413 7383.

THE ASIA-PACIFIC ECONOMIC COOPERATION (APEC)

The Asia-Pacific Laboratory Accreditation Cooperation (APLAC) and the Asia-Pacific Metrology Program (APMP) Secretariats met in late March to draw up recommendations for collaboration between Asia-Pacific Specialist Regional Bodies in Standards and Conformance. This document was circulated among members of both bodies for comment as well as being tabled at the APEC Specialist Regional Bodies meeting, held at NML on April 10, 1995. The Regional Bodies meeting was convened by Mr Graham Boxall of the New Zealand Ministry of Commerce and was attended by representatives from APLAC, APMP, the Pacific Accreditation Cooperation (PAC) and the Pacific Area Standards Congress (PASC). A report on work programs of the Regional Bodies and potential areas for collaboration is being prepared by all bodies for submission to the next APEC Standards and Conformance Sub-Committee meeting in Sapporo, Japan, in June 1995.

EMPLOYMENT SURVEY

In the next issue of *The Australian Metrologist*, we will be conducting an employment survey of our members. The information collected will then be collated and presented in the December issue.

Metrologists are a rather diverse lot, not only in the disciplines in which they work but also in their qualifications, training and the path taken to enter the field of measurement.

We will be looking to build a profile of salaries and conditions with respect to qualifications and experience, position, industry sector, discipline and any other information which might be useful.

To the best of our knowledge, this will be the first such survey of the metrology community in Australia. It is hoped that the information collected will be useful to the members in considering their career path and to employers in providing guidance on appropriate salaries and conditions. It might also be used to provide an accurate picture of prospects for people contemplating a career in metrology.

If you have any suggestions for additional information we might seek from the membership, please contact the Editor or your State coordinators as soon as you can as the survey will be designed over the coming weeks.

MEMBERSHIP NEWS

NEW MEMBERS

We are pleased to announce that the following metrologists have been granted membership since the March issue. Welcome to the MSA.

ACT

Mr David Robinson	Dimensional

New South Wales

Mr Peter Willows	Electrical
Mr Bruce Hardiman	Electrical
Mr Maxell Cuthbertson	Physical/Temperature
Mr Henry Rodrigues	Electrical
Mr Brian Pritchard	Electrical
Mr David Adkins	Electrical
Mr Kerry Fernandez	Multi-disciplinary
Ms Kimberlee Brown	Electrical

Queensland

Mr Philip Gold	Electrical
Mr Geoffrey Barnier	Electrical

South Australia

Mr Kevin Kakoschke	Dimensional
Mr Ross Wiley	Dimensional

Tasmania

Mr Andrew Muthy	Dimensional

Victoria

Mr Tony Pilli	Dimensional
Mr Raja Athanasius	Multi-disciplinary

NEW APPLICATION FORM

Recent applicants and those who have been recruiting will have noticed that the application form which has been used for the past few months is dated 1994!

We now have the new form available which can be obtained from the Secretary or your Sate Coordinators. Apart from looking a little more official, the new form has been designed for both applications for membership and for regrading to a higher category.

FELLOWSHIP

When we launched the MSA, it was agreed that the membership category for Fellow would not be available for at least the first two years.

The two years is now almost up and the Committee has been re-examining the issue. At the risk of sounding too democratic, what do you think?

STATE EVENTS

QUEENSLAND

SEQEB's Measurement Engineer, Mr Doug Quinn, acted as host and presenter for the May Technical Meeting which was attended by an eager group of over twenty members and visitors.

Following a short discussion of MSA business, Doug introduced his topic by referring to the added pressure on Supply Authorities following the reorganisation of the electrical supply industry in Queensland with its division into the generating corporation, AUSTA ELECTRIC, the Queensland Electricity Transmission Corporation and the seven regional distribution corporations.

SEQEB's Technical Services Division includes Tests and Investigations as a vital component and the latter has a firm base in the NATA accredited Standards Laboratory which has held registration for over 42 years. These calibration services are utilised totally throughout the Queensland supply network and the reference standards allow a least uncertainty of measurement for the various quantities equal to the best in the country outside of the National Measurement Laboratory.

Precision energy metering is becoming especially significant at the bulk supply points with the introduction of half-hour load profiles and with State and National Grid Codes enabling the larger "contestable customers" to purchase their electrical energy on a "free market".

John Lansley of the Meter Development Section presented a lucid description of the historical development of energy metering right up to the modern solid-state metering units and PLC systems.

Two groups were formed to permit additional material to be presented by Gary Rush in the Approvals Laboratory, Ray Evans in the Standards Laboratory, John Lansley in the Meter Laboratory and Phil Gould in the High Voltage and Investigations Laboratory.

All of these areas hold NATA accreditation for the work performed and were found to be of particular interest to the Members with respect to the high standard of presentation and precision. Special interest was taken in learning of the in-house automated and special equipment developed within the various areas.

Roy Bruce expressed appreciation to Doug and his staff for the educational evening and for the hospitality extended.

The Queensland co-ordinators, in conjunction with Gerry Samual, have been deliberating and consolidating their efforts to facilitate the conduct of metrology modules within the Queensland region.

Correspondence and local meetings have been convened with the National Standards Commission and the Engineering, Manufacturing and Services Consortium of TAFE Queensland. Valuable assistance has been received from Kerry Marston and Derek Merrin on behalf of the NSC and TAFE respectively.

The Coordinators were able to examine the Module Descriptors for the metrology modules and were advised of the Assessment Criteria now being in its final format.

Preparing a further full scale survey of calibration officers within the State and their associated training needs is the next task. There may then be a submission to the Vocational Education, Employment and Training Commission seeking a monetary allocation for a "Profile Set" within the industry training.

It would be of great assistance if any readers in Queensland who have not signified their intention to participate in this calibration training, or who know of other persons in this aspect of industry, could respond either to the Queensland Coordinators or to Ms Kerry Marston of the National Standards Commission, Box 282, North Ryde, NSW, 2113.

Roy Hood

Next Meeting

Date: 25 July 1995
Time: 7.00pm
Venue: ADI Calibration Laboratory, Amberley
Topic: Measurement Services for the RAAF

SOUTH AUSTRALIA

The South Australian Chapter of the Metrology Society met on 7 June at the measurement laboratory of Duncan Tool and gauge.

Our host for the evening and well known metrologist was of course Richard Duncan. With the help of three of his extremely capable staff, Richard gave the dozen or so members quite a comprehensive run through of his company's capabilities with respect to the measurement sciences.

It was indeed encouraging to see a smaller private company taking dimensional metrology so seriously. Richard's philosophy is that "if you can't measure it, you can't make it".

Richard has developed a number of unique methods of measuring various things over the years and I am sure that something was learned by all who attended.

Duncan Tool and Gauge has conducted a successful trade open day immediately prior to our meeting. This was well attended which would indicate they general interest in dimensional metrology is alive and well in Adelaide.

The South Australian metrologists thank Richard and his staff, Dana Cope, Matthew Wajcik and Stven Wigzell, for an interesting and informative evening.

We are open to suggestions for meeting venues for later in the year. Please contact Jeffrey or Brenton with your ideas.

The next event will be a dinner to held in late July/early August.

Brenton Watkins

VICTORIA

Thirty members of the Victorian Branch of the MSA (and Max Purss from Sydney) visited the Bureau of Meteorology on the evening of the 9th May. The visit was organised by Jane Warne, Senior Physicist in charge of the Physics Laboratory at the Bureau and a member of the national committee. Jane also acted as a guide, along with David Kupsch, a senior forecaster and well known for his weather forcasts in the media.

The evening started in the Bureau's main display room featuring a miniture cyclone generated using a powerful fan and a smoke generator. The display also included old meteorological measuring instruments and computer simulations and forecasts of both local and worldwide weather.

We were then taken upstairs to the main forecasting room where meteorological information collected from all over the world is gathered, sifted and analysed. This data is fed to a number of very large and powerful computers which forecast the development of weather patterns for up to five days. Three dimensional radar images of the moisture content of the air are also used to locate rain and thunderstorms.

The next stop was the physics laboratory where measurements of temperature, pressure, humidity and rainfall dominate. The metrology of meteorology is fascinating. Indeed, the true task of the Bureau is not to forecast but to collect meterological data and monitor trends. Because no two measuring instruments have exactly the same metrological properties, the replacement of existing instruments with new instrumentation to measure such basic quantities as rainfall and temperature must be considered very carefully if proper long term comparisons are to be made. The Bureau cannot, therefore, simply replace all of its field instruments without a detailed analysis of the performance of the new instruments.

It was also interesting to learn that a radio transmitter and instruments for measuring temperature, pressure and humidity are routinely strapped to albatrosses to collect data far out to sea.

The tour concluded with a supper and discussions of things metrological. We thank Jane and Ron McBain, the Victorian Coordinator, for organising a great night and the Bureau for hosting the visit. These visits are a particularly good way of meeting other metrologists and they illustrate the wonderful diversity of careers found in our membership.

Next Meeting - Annual Dinner

Date: 27 July
Time: 7.00
Venue: Armarentto Restaurant
205 Victoria Parade, Fitzroy

SUCCESSFUL MEASUREMENT SEMINAR LIFTS MSA PROFILE

The MSA and the Advanced Engineering Centre at the University of Melbourne and RMIT recently presented a one-day seminar entitled "The Quality of Measurement - The Measurement of Quality".

The seminar, held on 20 June at the Bundoora Campus of RMIT was designed to inform and involve people from industry in the science of precision measurement and its practical usage. The measurement implications of the ISO 9000 quality management systems also featured, along with practical solutions to measurement problems and selection of equipment.

MSA members were well represented on the list of speakers and their talks were all well received. The President of the MSA, John Miles, was a member of the seminar organising committee and gave the keynote address on Australia's measurement system. Randall Anderson from the Australian Pressure Laboratory and a member of the MSA Pressure Technical Group, gave a talk on the metrology of pressure gauges. Horst and Carol Sieker from ACM Laboratory gave a joint presentation on running a small metrology laboratory.

The seminar was well attended and very successful. Activities such as these are consistent with the MSA's aim to promote metrology and to provide training opportunities for Members and the wider community.

MEMBER PROFILES

Member Profiles will be a regular page in each issue as a means of introducing individuals to the wider membership. Please don't be too shy if at some time you get a call from the Editor asking for a few lines about youself.

Brian Philips
Brian's company, Survey and Optical Instruments Limited, is one of the few laboratories in Australia offering a calibration service for optical instrumentation such as theodolites, optical plumb lines and optical levels. This is not the limit of Brian's talents, however, as he also performs calibrations on laboratory balances and industrial weighing appliances.

Located at Sumner Park, a leafy suburb some 15 km South-West of Brisbane, the laboratory has held NATA registration since 1982.

Brian started his career in the fitting and turning trade but went on to become an Instrument Maker. Over the years, he has worked for some very well known instrument companies including National Instrument Company and Watson Victor Limited and has received training in a very diverse range of optical and related instrumentation and balances.

Despite this wealth of experience, Brian has not stopped developing additional expertise. His most recent interest is in the field of optical fibres.

Brenton Watkins
Brenton is our South Australian Coordinator who, aided and abetted by Jeffrey Tapping (we'll fill you in on Jeffrey another time), has been working hard to ensure the prosperity of the MSA in that State. As you might note from the activities so far reported, Brenton and Jeffrey are doing a great job.

When he is not working for the benefit of the MSA, Brenton, an Electrical Engineer, manages the testing laboratory at Pope Electric Motors. His laboratory is NATA registered for the testing of three-phase induction motors in the range 0.37 to 500 kW. While primarily being a valuable resource to the company, the laboratory is also available for some outside work. [This is as close to an advertisement as I intend to get. Ed]

Measuring the performance of electric motors is probably not the first thing which comes rushing to ones mind at the mention of the word metrology. There are, however, many aspects of electric machine performance which must be determined. These include temperature rise, losses and efficiency, starting performance, insulation quality and both structure-borne and air-borne vibrations and their determination involves a wide variety of measurements.
While the measurement of the temperature rise of a motor winding is traditionally carried out by measuring its change in resistance, one of the more interesting temperature rise measurements is that of the surface temperature of the rotor of a motor under full load, steady state operation. Thermocouple wire becomes a little twisted when the rotor is spinning at hundreds or thousands of rpm and mercury-in-glass thermometers have their problems too. This measurement is currently being done using temperature sensitive tapes which contain chemicals which change colour at specified temperatures. It may sound simple but "calibration" and traceability are interesting.

The accuracy of most of the quantities measured by Brenton is not in the part per million category but reliable, traceable and repeatable measurements are just as important here as they are in the calibration laboratory.

Peter Crawshaw
Peter has been a metrologist in three countries and is one of those rare people who hold a tertiary qualification with a major in measurement. Peter completed a Bachelor of Technical Science at the University of Manchester having specialised in electrical measurement.

After having worked with Ferranti Limited where he was involved in the design and development of energy metering, Peter moved to South Africa where he worked with the Electricity Supply Commission (ESCOM). After holding various Engineering positions, Peter achieved the level of Head of Measurements and Standards which involved the management of teams engaged in many measurement tasks including dealing with 400kV systems.

Whilst he was working for ESCOM, the South African CSIR established the National Calibration Service, an accreditation scheme for calibration laboratories. Peter served on many of the Working Groups formed to set up the system.

1987 saw Peter move to South Australia to take up a position with ETSA in their NATA registered standards laboratory. In the time since, the laboratory has improved its measurement capabilities significantly and has also developed a capability in the area of temperature calibration.

If you are in Adelaide, Peter's laboratory is worth a look. Better still though is his model railway layout which is fantastic!

MSA DIARY - 1995

Management Committee Meetings and Planning Days

Members wishing to contribute agenda items or attend any of the Management Committee Meetings shown in the diary should contact the President, John Miles on (03) 542 2964 or by fax (03) 544 1128.

July

19 Half-day planning meeting - NATA Melbourne

27 Annual Dinner (National), Melbourne

July

25 Queensland Technical Meeting - ADI Calibration Laboratories, Amberley RAAF Base, Ipswich at 7.00pm.

August

9 Management Committee Meeting - Melbourne

10 *The Australian Metrologist* deadline for the August/September issue.

September

14 Victorian Technical Meeting - Topic to be confirmed.

October

2 The MSA Bulletin published.

10 Management Committee Meeting - Melbourne

October/November

TBA Queensland Technical Meeting - Photometry at QUT, Gardens Point, Brisbane (tentative).

November

10 *The Australian Metrologist* deadline for the November/December issue.

29 Management Committee Meeting - NML, Sydney.
Annual General Meeting - NML Sydney

November/December

29-1 The Metrology Society of Australia Conference, NML, Sydney.

December

12 Planning day for 1996

STATE CONTACTS

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		Kerry Marston	888 3033
		Ilya Budovsky	413 7201
	Postal C/O	Mr Barry Sutcliffe NATA 7 Leeds Street Rhodes NSW 2138	
Queensland		Roy Hood	274 7750
		Erwin Schilling	864 2248
		Ian Cowling	864 2592
	Postal C/O	Mr R Hood GEC Alsthom Australia Ltd GPO Box 406 Brisbane Qld 4001	
South Australia		Brenton Watkins	268 6077
		Jeffrey Tapping	362 1240
	Postal C/O	Mr R Duncan Duncan Tool & Gauge 10 Allan Street Melrose Park SA 5039	
Western Australia		Denis Baylis	333 8832
		Paul Edwards	451 0883
	Postal C/O	Mr P Edwards NATA Suite 5, Technology Centre 2 Brodie-Hall Drive Bentley WA 6102	

All of these people have joined the Metrology Society of Australia

Anthony Adaman
Tony Adams
David Adkins
Terrence Albury
Bernard Anderson
Leslie Anderson
Randall Anderson
Jeffrey Andrews
Eduardo Apoderado
Richard Ashley
Ian Asmussen
Raja Athanasius
Errol Atkinson
Andrew Baghurst
Derek Ball
Kenneth Barnett
Geoffrey Barnier
Kenneth Bassett
Maxwell Baxter
Denis Bayliss
Peter Beggs
Laurie Besley
Andrew Bilyj
Eugenio Bini
John Birch
William Blevin
Thomas Boon
Geoffrey Boulton
Brian Brannelly
Lyndon Branscomb
Ronald Breen
Graham Britton
Kimberlee Brown
Nicholas Brown
Roy Bruce
Stephen Buckman
Ilya Budovsky
Douglas Burgess
Patrick Casey
Alan Catt
William Cerutty
Stephan Chakalakis
William Chappell
Jung Chen
Philip Ciddor
Christopher Cockett
Anthony Collings
Robert Collins
Andrew Connell
John Connolly
Peter Coogan
Michael Cook
Ronald Cook
Dennis Cooper
Ian Cowling
Darren Crampton
Peter Crawshaw
Greg Cunningham
Maxwell Cuthbertson
Mark Daniels
John Darling
Valery Davydov
Max Dawkins
Barry Deeth
Jack Deller
William Deusien
Brendon Dickins
Thomas Doney
Barry Downs
Jack Duce

Mark Duce
Peter Duncan
Richard Duncan
John Dundas
Kevin Durney
Anthony Dyke
Gary Dykes
Wayne Eames
John Ebsary
Paul Edwards
Hernando Esquivel
Bruce Farr
Kerry Fernandez
Stuart Findley
Patrick Fogwill
Bruce Forgan
Robert Frenkel
Lewis Fricker
Ronald Fronda
Peter Gardener
Walter Giardini
MichaelGibbes
Philip Gold
James Gordon
David Gowdie
Ashley Gracias
Stephen Grady
Robert Graham
David Gray
Peter Gray
Kent Gregory
Bruce Grigson
Donald Groeneveld
Ronald Guest
Michael Hadley
Bruce Hardiman
Grahame Harvey
Raymond Harvey
Glen Hay
Gregory Hayes
Gary Heffernan
Philip Heskett
Gregory Hicks
Mark Histed
Brenton Hodgson
Peter Hodgson
Ian Hoerlein
Patrick Hogbin
Roy Hood
Maurice Hooper
Blair Howell
John Hunter
Barry Inglis
Walter Iwanicki
Andrew Jackson
Anthony Jackson
Ian Jackson
Stephen Jenkins
David Johnston
William Johnstone
Kevin Kakoschke
Keith Kaulfuss
Robert Kelly
Ian Kendall
Matthew Kennedy
Tim Kennon
Leonard Kerwood
Rhys Kimber
Michael King
Andrew Kirby

Orla Kjaersgaard
Eugenia Kleftouris
Chris Knuckey
Bojan Kocet
Doan Lam
Nigel Lane
Richard Lange
Peter Langley
Victor Lawrence
Dennis Leaney
Bernard Lebenbaum
John Leinster
Helen Liddy
Andrew Little
David Little
Tegan Lord
Graham Lucas
Noel MacGregor
Donald MacQueen
Antal Mark
Tina Marmo
Kerry Marston
David Martin
Ian Martin
Paul Martinus
Peter Mayo
Ronald McBain
James McCartan
Stuart McDonald
Patrick McErlain
Mark McEwen
Colin McLachlan
Bruce Meldrum
John Meriton
John Miles
John Mitchell
Angelo Monteleone
Bruce Morrison
Danny Morrison
Andrew Muthy
Warwick Neil
Barry Neville
John Newman
Werner Nickel
Philip Noon
Wolfgang Norkowski
George Occhipinti
Ian Ogilvie
Bonifacio Olaver
Damian Ousley
Neville Owen
David Pack
Mario Padalini
Anthony Palmi
Ian Paterson
John Pearce
Ronald Petto
Brian Phillips
Mark Pilkington
Anthony Pilli
Emanuel Pinczower
Raimondo Pippia
Cameron Platt
Gordon Povey
Gary Price
Brian Pritchard
Nick Provenzano
Maxwell Purss
Rodney Pyke
Douglas Quinn

Graeme Rattew
Ian Richards
Graeme Richardson
Brian Ricketts
David Roberts
David Robinson
Henry Rodrigues
Bruce Rossi
Clement Rowe
Juris Rungis
Gerald Samuel
Glenda Sandars
Philip Sanders
Lutgardo Santos
Wilfredo Satorre
Graeme Savige
Erwin Schilling
Denis Sexton
Mark Shortis
Carol Sieker
Horst Sieker
Johannes Sieker
Benedykt Simankowicz
Douglas Simpson
Roy Singh
Michele Skamp
Gordon Slimmon
Greig Small
Alex Smart
Graeme Smith
Kevin Smith
Neil Smith
Michael Snell
Carl Sona
Mozart Sovierzoski
Mark Spillane
Paul Standaert
Harold Stasinowsky
Richard Strickland
Barry Sutcliffe
George Tanos
Jeffrey Tapping
Stephen Theuma
Mark Thomas
Eric Thwaite
Alfred Tiedemann
Peter Underwood
Colin Wagg
David Wallace
Christopher Walsh
John Walsh
Gary Want
Allan Ward
Jane Warne
Brenton Watkins
Terry Wayman
Robert Weatherson
John Weir
Ian White
Steve White
John Wild
Philip Wilde
Ross Wiley
Stephen Williams
Peter Willows
Robert Woo
Alan Worroll
Howard Wright
Alec Yeo
Paul Zechovsky

Have you?