

THE AUSTRALIAN METROLOGIST

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PRE-CONFERENCE ISSUE

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FROM THE PRESIDENT

Planning for MSA 99 is at the detail level, with the conference committee actively involved in scheduling, reviewing etc. This is a difficult stage for any conference planning, where the budget was guesstimated some time ago based on previous experience and the true costs and likely income vary on a daily basis as registrations trickle in. The program has something of interest to all metrologists, either in the papers or in the activities planned. You can help the committee by registering early. The AGM of the society will be held during this period – see the separate notification elsewhere in this issue.

One of the successes of the MSA has been the establishment of the Graduate Course in Metrology being offered at Swinburne University. This was an initiative of Helmi Salem, chairman of the Education Sub-committee, and championed by Brian Costello at Swinburne. Now that the course is actually up and running, the MSA remains involved through a committee of experts from various metrology fields who oversee the course content, with course providers most likely drawn from the ranks of MSA membership but as private individuals or firms. Here's to a successful and continuing course to fill this long-felt need in metrology.

Let me turn now to the image of metrology in general. In this modern, fast-changing world there seems to be a general perception that metrology in its various forms is a staid old practice where nothing ever changes. What we do is considered part of the infrastructure that has always been there. Benefits are hard to quantify without hand waving arguments on the flow-on effects of measurement and so the purse-strings are loosened grudgingly to do what is seen as the same old work, such as measuring length, resistance, force, temperature, time etc. What may not be recognised is that the technology of measurement is constantly changing, and so part of the budget has to be spent in keeping abreast of new measurement techniques, tools and applications which not only require calibration but may offer more efficient ways of providing downstream calibrations once those new tools have been characterised. This effort of course generates no immediate income, so its cost is an overhead on current methods. Ignoring this overhead puts future viability and relevance at risk.

At the same time, there are users who rely on the old methods. An example is time measurement. In the last TAM there was notification that Radio VNG was likely to be curtailed – largely because key users have moved to using systems based on those accurate clocks constantly circling the earth at high altitude to provide GPS positioning. Yet our legal system requires that stop-watches still be calibrated to be valid if used to measure excess vehicle speed. A number of industries still use mercury-in-glass thermometers, requiring traceable calibration if they have a quality system and temperature is an influence factor for the quality of the product (eg weather bureau long-term records, or the petroleum industry). Someone, usually the user, has to carry an accredited support system for these calibrations, even though the bulk of temperature measurements in the range would now be made with thermocouples or platinum-resistance thermometers. The last TAM contained another example in an advertisement for a video CMM system. Once calibrated, and once studied to understand the achievable accuracies with different types of objects, such a device is likely to be a significant time-, hence cost-saver, for some dimensional measurements. The hard part is finding the time to make an assessment of any new device against the manufacturers' claims while keeping the books balanced and food on the table. As one of our previous leaders was oft quoted to have said, life wasn't meant to be easy.

- Jim Gardner

FROM THE EDITOR

Even though this issue is only five weeks or so after TAM17 (to comply with AGM requirements) I have been embarrassed by the abundance of material! The excellent *Metrology in Retrospect* is longer than usual, but will be absent in the November TAM.

Some new ideas will be tried in the next issue, and I will print much of the carry over material that I have on hand. Your committee is working towards making TAM something you look forward to reading every three months.

- Maurie Hooper

Metrology Society of Australia

Annual General Meeting

University of NSW

Wednesday September 20, 1999 at 4.30 pm

Agenda

1. Apologies
2. Minutes of the previous AGM and subsequent special General Meeting
3. President's Report
4. Treasurer's Report
5. Recommendation of fees
6. Election of Office bearers

Please Note:

The terms of all members of the executive expire, thus requiring election or re-election of members to fill these positions.

Nomination and Proxy forms appear on the following page. You may photocopy these forms rather than mutilate TAM.

QUESTIONNAIRES

If you have not returned your questionnaire yet,
you are not alone! Mary Ryan would love to see
more returned - do it today!

METROLOGY SOCIETY OF AUSTRALIA

APPOINTMENT OF PROXY

I..... of.....
being a member of the Metrology Society of Australia Incorporated
hereby appoint of.....
being a member of that Incorporated Association, as my proxy to vote for me on my behalf at the
Annual General Meeting of the Association to be held on the 20th day of September 1999 and at
any adjournment of that meeting.

Signed

Date

Note: This Proxy form must reach the Secretary 24 hours before the AGM.

METROLOGY SOCIETY OF AUSTRALIA

**Nomination for Officers or Ordinary Members
of the Committee of Management**

We..... and
being members of the Metrology Society of Australia Incorporated hereby nominate
..... for the position of President / Vice President / Secretary
/ Treasurer / Ordinary Member (circle the position for which the candidate is nominated.)

Signed Date..... Member Number

Signed Date..... Member Number

I.....being a member of the Metrology Society of Australia
Incorporated accept nomination to the Committee of Management of the Metrology Society of
Australia Incorporated.

Signed Date..... Member Number

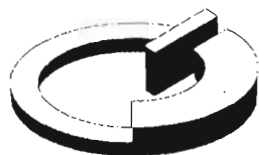
**Note: This Nomination form must reach the Secretary no less than 7 days before the
AGM.**

**Send to the MSA Secretary, Laurie Besley, CSIRO, NML, PO Box 218, Lindfield 2070,
or Fax (02) 9413 7202.**

**It is recommended that you photocopy the above forms rather than mutilate the maga-
zine. Also, the forms and notices are available on the MSA website.**

METROLOGY SOCIETY OF AUSTRALIA

AWARD 1999



The Metrology Society of Australia Award recognises achievement and excellence in Australian metrology and the contribution metrologists make to the Australian community. Metrology is the science of measurement. Membership of the MSA includes scientists, engineers and technicians working in government and industry from all fields of measurement in Australia and overseas.

The MSA Award is presented biennially at the MSA conference dinner. In 1999 this will take place in Sydney, NSW, 23rd September.

Nominations are now invited for this award. Only members of the Metrology Society of Australia are eligible. Members may self nominate or nominate another member.

The award is for work completed, or that has gained scientific or industrial recognition, in the past five years and which has contributed to the Australian economy. The work must fall into one or more of the following categories:

Basic research: Original research directed towards the significant improvement of fundamental measurements, the accuracy of derived units or fundamental constants. Solutions to difficult measurement problems, work that has fundamental importance to the development of measurement, the application of new or existing science and mathematics to new measurement applications, including the development of new instruments, techniques or methods for reducing uncertainty.

Development: The development of new instruments, measuring techniques or systems for Australian industry, including the design of prototypes, testing, characterisation and product manufacturing. For example, the development of a new thermometer or an in-line automatic inspection system.

Application to industry: The use of new or improved measurement science and technology in Australian industry to increase quality, productivity and competitiveness. For example, the use of new sensors to control production processes or the application of statistics for scheduling recalibration systems.

Selection Process

The Award judges will be a sub-committee of the MSA National Management Committee. The judges will use criteria such as; degree of innovation, significance of the work, potential or real cost savings, stage of development, potential for application in other fields or industries; quality of the supporting material and testimonial evidence supplied.

The Award judges are bound by confidentiality agreements, ensuring complete confidentiality of submitted material.

The Metrology Society of Australia Award 1999

To nominate, please fill in the entry form below and send it and the submission to:

Dr. L. Besley, Secretary
Metrology Society of Australia
PO Box 218
Lindfield NSW 2070

The closing date for entries is **15th September 1999**

Name of Nomination:

Address:

Telephone:

Fax:

Email:

Concise description of work on which the nomination is based:

.....

.....

.....

.....

Nominated by:

If not self nomination, please provide contact information below.

.....

.....

Signed:

Date:

Do you wish the submitted material to remain confidential?

Y/N

Register now for MSA 99 – Metrology for a sustainable future

Highlights of the third biennial conference include:

Industry Policy for the New Millennium

Hear Peter Roberts on this topic at the Opening Cocktails, Wednesday 22 September. Peter Roberts is a widely respected and well-informed journalist and commentator. His columns in the Australian Financial Review have encompassed contemporary issues in areas such as research and development, industrial innovation, quality, industry policy and best practice.

Special Issue – The profitable Laboratory

What makes a profitable laboratory? Does the conflict between customer requirements and process really exist or is it a myth? A discussion panel of prominent metrologists has been carefully selected to present the many different points of view that seem to concern this issue. This hot topic will be explored on Friday, 24 September.

Workshops

It is planned to run a number of workshops throughout the conference. to date the topics are as follows:

1. Implementing ISO 17025 in the laboratory.

Explore the management and technical requirements to implement ISO 17025.

2. Introduction to Uncertainty

Basic concepts relating to compliance, uncertainty and its estimation, and reporting uncertainties; will include sources of and quantifying errors in measurement, the nature of their distributions and the fundamental steps involved in calculating an uncertainty estimate using ISO methodology.

3. Preparing an uncertainty budget

Develop a simple uncertainty budget using ISO methodology; approach will be non-statistical; examples used will, as far as practicable, avoid the use of uncommon discipline specific technical elements, this will depend to some extent on the general mix of participants.

4. Uncertainty – advanced calculations

For those who have mastered the basic ISO GUM method and need to deal with complex models and noisy data; demonstrating a computer program developed for commercial risk found to suitable for uncertainty estimation and particularly useful when the model is large and complex; treatment of curve fitting of noisy data also presented. Participants will be encouraged to join in the discussion.

5. Internet applications and services in the metrology laboratory

Use the internet for centralised data storage and viewing; remote monitoring of equipment; benefits of internet solutions against more traditional methods.

6. Verification of Non-automatic Weighing Instruments.

Become familiar the new test requirements for the verification/certification and inspection of non-automatic weighing instruments in use for trade.

7. Traceability of Torque Measurements in Australia

Providing a forum for interested parties to discuss the issue of traceability of torque measurements in Australia; and to explore the current status and practice of torque measurements.

Demonstrations of the latest equipment and applications by Fluke and Datron

Don't miss out on a very interesting range of papers that cover a broad spectrum of metrology and its applications in our modern technologically advanced society

Further information, program and registration details contact Kerry Marston or Richard Brittain on (02) 8999 3922 or visit our Website www.metsoc.aust.com/~confmsa.

METROLOGY IN RETROSPECT

Contributed by Julian Holland,
Macleay Museum, University of Sydney

Australian Exploration and the Introduction of the Aneroid Barometer

Introduction

'Take care of my Barometer, and as you observe its gentle rise and fall, so imagine your friend's spirits rising or ebbing down during the daily progress of his enterprize.'¹ So wrote the German scientist and explorer Ludwig Leichhardt to the Rev. W.B. Clarke on 4 December 1847. That evening Leichhardt set out from Sydney on an expedition intended to traverse the continent reaching Swan River in Western Australia early in 1850. The last news of the party arrived the following April. They never reached Swan River settlement and their remains have never been found. The Australian interior was a hazardous place for explorers then and remains so for ill-prepared travellers today.

Leichhardt had no use for his barometer on the expedition. After the deficiencies of the barometer on his first expedition he had relied on a boiling-point apparatus (hypsometer). As Clarke later commented, 'Leichhardt, to remedy the inconvenience felt on his first journey, went out upon his present expedition, supplied by a friend with an apparatus for measuring heights by means of boiling water'.² The friend was Clarke himself. He had lent it for Leichhardt's previous venture in 1846-47 and the explorer was glad of it. 'Mr Clarke's boiling apparatus is very handy indeed and I hope to make an interesting series of observations with

it', Leichhardt had noted in November 1846.³ Eight months later, at the conclusion of the expedition, Leichhardt expressed his satisfaction: 'The Boiling Apparatus has been of great service to me and I have determined the approximate elevation of the most interesting parts of my route'.⁴

Having left Clarke to watch the 'gentle rise and fall' of his mercurial barometer in Sydney, Leichhardt set off with Clarke's boiling-point apparatus on his fatal expedition. On his way north he stopped at Capt. P.P. King's property, Tahlee, where he made 'comparative observations on the elevation of several hills, which Capt. King had measured with the Barometer. My Boiling Apparatus gives in all these observations very satisfactory results, not more out than 30-40 feet'.⁵

In exploring Australia, the supply, transport, maintenance and repair of scientific instruments posed many difficulties. No instrument was more at hazard than the mercurial barometer. A metre-long glass tube filled with mercury, even when encased in a metal outer tube, was very vulnerable on long inland journeys. Even getting instruments to Australia safely was not always possible.

The Surveyor General of New South Wales, John Oxley, encountered some of these problems. When he received a consignment of instruments from the London firm of Watkins & Hill in 1815 he found that an artificial horizon was 'damaged by being improperly packed'. Watkins & Hill made a replacement.⁶ Oxley conducted two expeditions into the distant interior of New South Wales, made possible by the first successful crossing of the Blue Mountains in 1813. Oxley left Sydney on his first journey in April 1817 equipped with several instru-

¹ Ludwig Leichhardt to Rev. W.B. Clarke, 4 December 1847, in M. Aourousseau (ed.), *The Letters of F.W. Ludwig Leichhardt* (Cambridge, 1968), vol. III, p. 977

² W.B.C., 'Aneroid Barometer', *Sydney Morning Herald* (SMH), 28 July 1849, p. 4

³ Leichhardt to Capt. P.P. King, 28 November 1846, in Aourousseau (note 1), p. 920. Leichhardt had made 'several interesting observations' with the apparatus a few weeks earlier: *ibid.*, p. 912

⁴ Leichhardt to King, 2 August 1847, in *ibid.*, p. 937

⁵ Leichhardt to John Mackay, 19 December 1847, in *ibid.*, p. 979

⁶ Colonial Office, 201/81. Alison Morrison-Low kindly brought this reference to my attention

ments, including mountain barometers (and an artificial horizon, perhaps the replacement for the broken one):⁷

I have to lament that our mountain barometers were broken at an early stage of the expedition The conveyance of such delicate instruments is always attended with great risk, and in our case peculiarly so, our means being only those of horseback. I am afraid that a method of constructing those instruments, so as to place them beyond the reach of injury by carriage, will always remain among the desiderata of science.

Sydney in the early nineteenth century did not have craftsmen who could repair the damage. When Oxley set off again in 1818, he had to make do without barometers. Altitudes had to be taken by estimation alone.⁸

Accidental damage to barometers was a recurring problem for explorers. 'It is to such accidents that we owe the blanks in the journals of Strzelecki, Sturt, and Kennedy, respecting the elevations of the different points of the countries traversed by them', Clarke observed in 1849. 'Had they or Leichhardt had the advantage of carrying an instrument capable of detecting differences in elevation, without unwieldiness or difficulty of management, we might now have acquired some sufficient information respecting the actual condition of the interior of this continent, beyond what we now possess.'⁹ It was the arrival of just such an instrument in Sydney which prompted Clarke into print - the aneroid barometer.

Instead of relying on a column of mercury to balance atmospheric pressure the aneroid barometer uses the expansion or contraction of a sealed metal bellows. The idea for such a de-

vice dates back to about 1700 but it was Lucien Vidie who developed a practical instrument in the 1840s. A prototype was tested with satisfactory results in an ascent of St. Paul's Cathedral in London in 1843. The invention was patented in England and France the following year. France was unresponsive to Vidie's invention and it was through the London chronometer maker Edward Dent that aneroid barometers began to find a market. The instrument was being mentioned in various journals by 1848 and in 1849 was clearly attracting a market with three booklets on its use published in London.¹⁰

Australian Reception

The first indication that aneroid barometers were soon to be available to customers in Sydney came on Saturday 23 June 1849. The indication was very oblique: 'J. Flavelle respectfully informs his friends and patrons that his brother has just arrived from Europe, with a splendid and varied assortment of useful, ornamental, and scientific articles, selected personally in Paris and London, all of the newest and choicest designs, among which are some new instruments now for the first time introduced to the Australian public.'¹¹

John Flavelle, born in Dublin about 1816, had come to Australia about 1842 and worked as assistant to a Daguerreotype photographer, G.B. Goodman. In 1846 he established an opticians and watchmakers business in Sydney in partnership with Samuel Brush.¹² This firm did well in the growing mercantile opportunities of Sydney in the 1840s and gave rise to two new firms. In announcing the dissolution of the partnership 'by mutual consent' in February 1849 the two tradesmen assured their public - 'The business will be carried on in the same

⁷ John Oxley, *Journals of Two Expeditions into the Interior of New South Wales* (London, 1820; facsimile repr. 1964), p. xiv

⁸ 'The accident which had befallen our barometer during the former expedition not being repaired, we are of course deprived of means to make any observations on the height of the country above the sea, otherwise than by the several falls or rapids.' The party was following the course of the Macquarie River. *Ibid.*, p. 214

⁹ Clarke (note 2)

¹⁰ W.E. Knowles Middleton, *The History of the Barometer* (Baltimore, 1964; repr. Trowbridge, 1994), pp. 398-409; Anita McConnell, 'The Aneroid Barometer comes to London', *Bulletin of the Scientific Instrument Society*, No. 38 (1993), pp. 20-22

¹¹ *SMH*, 23 June 1849, p. 1

¹² For an account of the firm and its successors see Julian Holland, 'Useful, Ornamental and Scientific: An Irish Contribution to Australian Retail History', *The Australian Antique Collector*, 51st Edition, April-October 1996, pp. 184-87

premises [488 George Street] by Samuel Brush, and at 478, George-street, by John Flavelle and Brother.¹³ John Flavelle was joined by his brother Henry, and Samuel Brush soon entered into a partnership with his brother-in-law William MacDonnell. Both Flavelle Brothers and Brush & MacDonnell were significant retailers of scientific instruments in Sydney for several decades.

Flavelle opened his new premises in March and awaited the arrival of his brother accompanied by the 'splendid and varied assortment' of goods.¹⁴ The *Chartley Castle*, bearing 'Mr. and Mrs. Flavelle and child' had sailed from London, leaving the Downs on 8 February and finally arrived in Sydney on 18 June 1849. Among its cargo were '16 packages merchandise' belonging to Henry Flavelle.¹⁵ Sixteen packages may be taken to indicate a considerable quantity of goods, sufficient to stock the Flavells' new shop. Soon afterwards an advertisement offered 'The new ANEROID BAROMETER, £4 each'.¹⁶

It was perhaps from the Flavells' new stock that Dr Kenworthy brought the first aneroid barometer to Tasmania where it came to the attention of Lieutenant Kay at the Royal Observatory, Hobart (Rossbank Observatory). 'It may fairly be considered a matter of congratulation to find that one has so soon reached these shores', thought Kay, who understood it had only come to public notice at the British Association meeting in Swansea the previous year. Kenworthy lent the aneroid to Kay who made a series of 120 comparisons with the Observatory's standard mercurial barometer. The needle of the aneroid followed the movements of the mercurial barometer closely but with readings averaging 0.22 inch lower.¹⁷

Kay put the aneroid to another test in ascending Mount Wellington near Hobart. On reaching a point on the mountain known as the Springs, Kay paused a while and observed 'a remarkable instance of [the aneroid's] accuracy in *relative changes*'. A slight fall in the reading there was found later to have been matched by the mercurial barometer at the Observatory. However, as Kay continued to ascend he reached a point where the aneroid indicated 25.87 inches and changed no further as he approached the summit some 500 feet higher. On descending to the same point, the needle once more began to move.

Kay presented his findings to a meeting of the Royal Society of Van Diemen's Land on 11 July 1849. He recommended

the Aneroid as a useful instrument for all the ordinary purposes to which a barometer is applied, or where scientific results are not required. As a convenient and portable weather-glass it is valuable, as it may alike lay on the drawing-room table, or be carried in the coat-pocket without risk of injury.

Kay had maintained a rigorous series of precision measurements at the Observatory over a period of many years. He was therefore very cautious about the instrument's potential for scientific work. There was a difficulty in adjusting the aneroid and this could only be done accurately in comparison with a reliable mercurial barometer. 'Here it is that I conceive the principal of the instrument to be objectionable, and particularly so when employed in the mensuration of heights.'

About this time another series of tests was being carried out in Sydney. W.B. Clarke had already read accounts of Vidie's invention in the *Nautical Magazine*, *Literary Gazette* and *Athenaeum*. Clarke, 'having learned that Messrs. Flavelle, of George-street, Sydney, had imported several of these instruments, obtained their permission to test them'.¹⁸

¹³ Notice dated 24 February, *SMH*, 27 February 1849, p. 1

¹⁴ *SMH*, 8 March 1849, p. 1 (premises)

¹⁵ *SMH*, 19 June 1849, p. 2

¹⁶ *SMH*, 2 August 1849, p. 1

¹⁷ Lieut. Kay, 'On the Aneroid Barometer', *Papers and Proceedings of the Royal Society of Van Diemen's Land*, Vol. I, Part II (1850), pp. 83-87 and graph

¹⁸ Clarke (note 2); Clarke's report is dated 23 July 1849

William Branwhite Clarke (1798-1878) was an Anglican minister with broad scientific interests. He had studied at Cambridge where he came under the influence of the geologist Adam Sedgwick and mineralogist J.S. Henslow. It was geology to which Clarke was particularly drawn and he was elected a fellow of the Geological Society of London in 1826. Following his emigration to New South Wales in 1839 he was an active member of the small scientific community in Sydney, being long associated with the Australian Museum and the Royal Society of New South Wales. As already noted Clarke had a hypsometer. He also had a number of other instruments, mainly associated with geology and mineralogy.¹⁹

Clarke borrowed four aneroids which he tested in 'a series of measurements of an extensive character'. He published a table of 14 comparisons of 'heights in feet of certain localities above the level of high water in Port Jackson' (Sydney Harbour). These comparisons were variously made by lineal measurement, by levelling and with a mercurial barometer. 'And it is nothing but justice to the importers, as well as to the inventor, to say, that so far as a close examination of four of these instruments has gone, there is no cause to consider (so far as these four are concerned) that there has been any exaggeration whatever in the statements made respecting the Aneroid Barometer.'

The possibilities of the instrument filled Clarke with enthusiasm. Supposing 'that it does no more than measure heights as well as any other instrument, the saving of time, the portableness of the article, and the absence of risk of injury, are advantages which will readily outweigh many inconveniences to which other modes of measuring elevations are exposed.' He could see the great advantages for the navigator and 'the mere registrar of atmospheric changes' of an instrument without fluid and therefore unaffected by the roll and pitch of a ship, 'and as it indicates the atmospheric changes in all positions, however it may happen to be placed, face upwards or bottom upwards, or on its side,

horizontally or vertically, it is the safest instrument of the kind ever invented'.

Clarke thought it probable that 'English ingenuity will produce an Aneroid, that will be no bigger than a watch, and will be as easily carried; and it is not a too fanciful notion to imagine a young lady of the next ten years with her barometer about her neck, or in her reticule, measuring as she walks the undulations of her garden'. As far as the former claim was concerned, Clarke's optimism was borne out. The London firm of Negretti & Zambra had produced an aneroid the size of a pocket watch by 1861.²⁰

The tests had been carried out in winter. Clarke compared the four aneroids with three mountain barometers, 'sufficiently often, and under a range of nearly an inch of pressure during the period of the experiments' that he felt the aneroids indicated the changes of the atmosphere 'with as much precision' as the mountain barometers. He was aware that the effect of the high temperatures of an Australian summer had yet to be determined.

Unlike Hobart, Sydney does not have a mountain conveniently close by which Clarke could have employed to test the aneroids more extensively. The maximum height above high water given in his table is less than 400 feet. He was therefore unable to find the limit of action as Kay had done.

Who the customers for Flavelle Brothers' first aneroids were is unknown but one might surmise that Clarke was among them.²¹ In the

¹⁹ Some of these instruments, including a Dent's dipteroscope, are held in the Macleay Museum, University of Sydney

²⁰ Negretti & Zambra, *A Treatise on Meteorological Instruments* (London, 1864; facsimile repr. 1995), pp. 54-55. The second prediction is not a unique example of the view that the use of scientific instruments by middle-class women represents the zenith of domestication of those instruments. An anonymous reviewer of a book on the adulteration of food in 1857 did 'not despair of seeing the time when it shall be deemed a necessary accomplishment of every good housewife to be enabled to test the quality of all articles of food by the aid of the microscope'; *Quarterly Journal of Microscopical Science*, 5 (1857), p. 229

²¹ Unfortunately there is no aneroid barometer among Clarke's instruments held in the Macleay Museum

months following his initial account of the new instrument Clarke undertook further observations so that by December he could report that he had 'tested it in about a thousand sets of observations at all elevations up to 2000 feet'. He could see how various improvements could make the aneroid very useful.²²

'Having myself used extensively various Barometers of the Aneuroid construction, in taking elevations in Australia, I wish here to point out, that, if a proper correction could be devised for the effects of temperature, and the instrument could be made equally portable as now with sufficient expansion of the interior vacuum box to allow of measurements up to 6000 or 7000 feet, and the addition of a vernier to enable accurate divisions of the inch into thousandths, to be read off, the Aneuroid Barometer would be an invaluable assistance to surveyors in general and to explorers in particular. Some most remarkable coincidences between altitudes ascertained by levelling and by the Aneuroid prove to me, that, in certain conditions of the atmosphere, this instrument, even now, used carefully, is perfect. But, for an extensive journey, over broken ground, in this variable climate, it is not always to be relied on.

Conclusion

In practice, the aneroid barometer was not a substitute for other methods where accurate measurements were required. As Middleton comments on the aneroid barometer, as it had become standardised by the mid 1860s:²³

It was excellent as a domestic "weather-glass," and highly useful as a marine barometer under the conditions prevailing at the time. As a scientific instrument of

precision, especially for the measurement of heights, it had a long way to go.

While not quite so accurate as the mercurial barometer, the boiling-point apparatus remained preferable to the aneroid for altitude determination for explorers, surveyors and geologists.²⁴ Nevertheless there must have been a ready market for aneroids for marine and domestic use. In 1852, Flavelle Brothers offered the 'new aneroid barometers, with metallic plates and attached thermometers'.²⁵ These were among a large assortment of instruments directed to 'Gentlemen engaged in, or having a taste for, scientific pursuits'. Again Flavelle Brothers advertised aneroid barometers and also 'Bourdon's metallic ditto' in 1854.²⁶ In succeeding years the aneroid barometer underwent many improvements and modifications, including being mounted in wooden frames in the style of mercury wheel barometers. They became standard items for retailers of scientific apparatus. In 1872, for example, W. MacDonnell & Co. (successor to Brush & MacDonnell) offered full-size aneroid barometers from £3 and 'Pocket Aneroid Barometers, best, with latest improvements, for ascertaining with ease and certainty the depths of mines, or heights of mountains; marked up to 8000 feet, £5 5s'.²⁷

If in the second half of the nineteenth century the aneroid barometer did not prove to be a complete substitute for mercurial barometers for precision scientific purposes, there were by then established retailers of scientific instruments in Australia who could undertake repairs or replace instruments they were unable to repair. □

Reprinted from the *Bulletin of the Scientific Instrument Society*, No. 61 (June 1999), pp. 24-26.

²² W.B. Clarke, ms introduction to Edmund Kennedy's 1847 journal, printed in Edgar Beale, *Kennedy: the Barcoo and beyond, 1847* (Hobart, 1983), pp. 261-62. Clarke commented on the etymology of the word 'aneroid' in his article of July 1849 (note 2): 'The word "Aneroid" being a French mode of writing Aneuroid'.

²³ Middleton (note 10), p. 408

²⁴ Thomas Walker Fowler, 'The Determination of Heights by Barometric Methods', in A. Liversidge (ed.), *Report of the Seventh Meeting of the Australasian Association for the Advancement of Science* (Sydney, 1898), pp. 702-08

²⁵ *SMH*, 13 January 1852, p. 3

²⁶ *SMH*, 2 November 1854, p. 6

²⁷ *Sydney Mail*, 13 April 1872, p. 476

NATIONAL STANDARDS COMMISSION NEWS

MSA visits NSC

In response to a number of requests from members of the Metrology Society of Australia – NSW Branch organised a tour of the National Standards Commission's laboratory facilities in North Ryde. The tour, which was attended by 20 enthusiastic metrologists, provided an insight into the extensive nature of pattern approval testing and the challenges involved in testing the many new and innovative measuring devices being produced for the Australian marketplace. After the tour of the laboratory John Birch explained how the National Measurement System works and the role pattern approval plays in protecting consumers from fraud. Mr Birch also explained the Commission's work in developing mutual recognition agreements and their importance to the Australian economy. There seemed to be considerable interest in the topic and participants left with a selection of information leaflets which provided more detail on a wide range of subjects related to measurement. Information leaflets are available in subjects ranging from daylight savings and calendars to chemical metrology. All information leaflets are available either directly from the Commission or on our web site at www.nsc.gov.au.

Update on National Measurement Act

The regulations supporting the National Measurement Act are now complete. The new regulations will look different; they will be clearer and easier to use. The mole, maximum permissible errors and the ability to combine units have been included. Guidelines are currently being developed to facilitate the use of these regulations. When complete the Act, regulations and guidelines will be a complete package. These regulations will come into effect when the Act is proclaimed. This will happen before October 1, 1999.

Legal metrology

Legal metrology provides a sound evidential basis for measurements. It gives confidence and traceability to the measurements. The system needs to be able to guarantee the integrity of measurements. When a measurement forms the basis of a prosecution the defence may be

entitled to challenge the validity of the measurement if they have additional evidence that casts doubt on the measurement. The aim of the Act is to provide confidence and metrological integrity and so keep out of the courts. Legal traceability requires that the measurement is traceable to a standard. Section 10 of the National Measurement Act says 'Measurements to be ascertained in accordance with appropriate standards of measurement, certified reference materials or certified measuring instruments'. Legal traceability only applies to physical quantities where legal units have been specified. Standards of measurement are needed to realise units of measurement associated with physical quantities. Here is an example of a physical quantity, its unit of measurement and the standard.

Physical Quantity	Unit of measurement	Standard
Length	m	Distance light travels through a vacuum in 1/299792458 of a second

There are a number of ways you can show traceability. The simplest way is usually to have a Regulation 80 certificate as this avoids having to provide an expert witness to verify traceability at each reference point. The Regulation 80 certificate ensures traceability back to the standard. With the rearrangement and elaboration of existing provisions to enhance their clarity a Regulation 80 certificate will become a Regulation 13 certificate.

New Training Package

A train the trainer course has been developed for the verification of non-automatic weighing instruments. This is an initiative of the Asia Pacific Legal Metrology Forum (APLMF) funded through the Australian government. It has been developed in consultation with all the States and Territories trade measurement authorities and the cooperation of the Trade Measurement Advisory Board (TMAC). It contains new test procedures, which will be adopted on September 1, 1999 and trialed for one year. The course will be delivered in Sydney for the first time in August. There are further plans to develop similar courses in other areas of trade measurement. This training will assist with the harmoni-

sation of trade measurement practice within the region.

LOAD CELL TESTING FACILITIES

Load cells are tested over a temperature range from -10 to $+40^{\circ}\text{C}$. The tests are computer controlled so that test sequences remain constant throughout the ranges of load cells tested.

Most load cells are tested for pattern approval purposes, however standard test sequences may be altered to suit individual performance testing of load cells.

Load cells are also tested to determine the effects of barometric pressure and humidity on their performance at no load

Load Cells Less than 50 kg

Load cells of less than 50 kg maximum capacity are tested manually.

Load Cells from 50 to 500 kg

The small load cell test facility has a capacity range of 50 to 500 kg. It incorporates a lever with selectable lever ratios of 1:1, 2:1 or 5:1.

Load Cells from 600 kg to 50 000 kg

The large load cell facility has capacity ranges of:

600 to 5 000 kg by dead load; and
5 000 to 50 000 kg via a 10:1 lever. □

MSA Web Site Update

- Mark Thomas mthomas@netspace.net.au

<http://www.ozemail.com.au/~ausmet>

The MSA web site has had various changes over the last year that I hope has improved its appeal and ease of use. I see the web site as an MSA member's resource and I hope that you are finding it of use.

I have set a number of aims that I am trying to achieve with the web site. As it is your resource I welcome any feedback or suggestions about it.

My main aims are to provide:

- ♦ A current source of MSA membership information for members that includes documentation related to the MSA such as membership requirements, membership levels, application forms, etc.

- ♦ An up-to-date source of information about local and international events including both MSA organised events and events of interest to the MSA membership.
- ♦ A technical information resource that will be of interest to all members. Currently there is a link to notes presented in a forum on calibration intervals held in Sydney last year.

There is also a member's list, photos, links to other sites of interest, and summaries of previous issues of TAM. Pictures of members attending different events are on the web page. Have you looked to see if you or anyone you know is on the web page? I would like to have more pictures and information supplied from states other than Victoria, so next time there is a gathering of members in your area click off a couple of shots and sent them to me.

New items now available on the site include:

- Links to the MSA99 Conference web site, only two months to go.
- AGM Announcement page with downloadable proxy and nomination forms.
- MSA Award page with downloadable nomination forms for the 1999 MSA Award.
- I have started including 'Web Sights' of interest that are changed regularly and provide a link to sites that are different but related to metrology. Currently there is a link to the Queensland University Physics Department Museum. There are many pictures and descriptions of various pieces of old and historic equipment that were used to make measurements.

The usage of the MSA web site is increasing. The weekly usage figures show that there are over 1000 hits per week. The web site is now listed with all the major search engines and is regularly accessed from places all around the globe.

The web page is updated regularly with minor updates every couple of weeks or as I am informed of new items to be included or changes to existing items. Major updates are about every four weeks. You can receive e-mail notification of when these major updates occur by completing the notification box on the main page or e-mailing me to have your e-mail address added to the mailing list.

Drop me a line if you have any ideas or links that you think other members might be interested in. Many thanks to those that have given me feedback about the web site in the past. It has been good way to let me know if I am on track. □

IMEKO – XV World Congress, Osaka, Japan, 13-18 June 1999

A short report to the Metrology Society of Australia by W R Blevin

1. Overview

Technical sessions were held from Monday 14 June to Thursday 17 June in the modern Asia and Pacific Trade Center in the Osaka Bay area. Typically there was a plenary lecture each morning, followed by eight parallel sessions of technical lectures for the rest of the day. Also in parallel was the business meeting of the IMEKO General Council which, apart from the plenary lectures, occupied all-day Tuesday plus the Wednesday morning. Personally, I was able to attend the General Council meeting, the four plenary lectures, a special session on 'Measurement for Quality Systems' at which Dr B D Inglis was one of five speakers, and just a sprinkling of the other technical lectures. I had to leave the Congress at mid-day on the Thursday to participate in a meeting in Tsukuba of the executive of the International Committee of Weights and Measures (CIPM), this being the main purpose of my trip to Japan.

Some 650 persons participated in the IMEKO Congress, about 360 from Japan and 290 from abroad. Of the latter, Eastern European countries continued to be strong participants, but only Germany and Italy were strongly represented from Western Europe and America. The Australian participants were Dr Inglis, Dr L Reznik from Victoria University of Technology who was presenting two papers, and myself. I did not meet Dr Reznik. The registration fee was rather high at 80,000 Yen (about \$1,000).

Some 264 papers were presented in oral sessions and 88 in poster sessions. The proceedings are published both on a CD-ROM, of which I have a copy for MSA, and in hard copy (Volumes I-XI). I have a copy for MSA of Volume I, which includes the plenary papers in full and abstracts of the other papers.

2. The meeting of General Council

Almost 50 delegates attended the meeting. Discussion was for the most part dominated by the office-bearers of IMEKO and the chairmen of its various boards and committees. The only woman present was Karolina Havrilla from the IMEKO central office in Budapest.

Some of the points of most interest to Australia were as follows.

- Financially IMEKO is now 'in the black' although apparently it was 'in the red' for a period in recent years.
- Lists of membership contributions received in 1998 and in 1999 up to 1 June showed no contribution from Australia in either year. Since I was not aware of MSA policy on this, I did not comment.
- It was agreed that the IMEKO budgetary and other financial statements are too informal and should in future comply with basic standards of accounting. Apparently Dr Ugur of Turkey had been pressing for this for several years.
- Albania and Kenya were admitted as new members of IMEKO although in each case, contrary to the constitution, the entity joining is a government organisation rather than an independent society. It was pointed out that some existing members, eg Italy and Turkey, were similarly in breach of the constitution, and it was agreed to recommend to the next meeting of General Council that the constitution be amended to reflect the real situation.
- It was decided to establish two new Technical Committees.

TC 19: Measurements relating to the environment

TC 20: Measurement techniques for the construction industry.

- It was acknowledged that USA participation in IMEKO is disappointingly low, and as one measure to overcome this it was agreed to associate IMEKO with a conference being organised for the year 2001 by the Instrument Society of America.
- The next World Congress, IMEKO-XVI, is to be held in Vienna on 25-28 September 2000, and the next General Council meet-

ing will be held during that week. After that, World Congresses will be held at intervals of three years.

- The following recommendation from IMEKO's Advisory Board (AB) will be considered at the Vienna meeting of General Council (GC).

NEW SYSTEM FOR THE DETERMINATION OF MEMBERSHIP DUES

The AB recommends to the GC a change of the paragraph 10.7 of the Constitution as follows:

Member Organisations of IMEKO shall pay annual dues to cover the operating expenses of IMEKO on a basis (called a Unit of Contribution UC) fixed by the GC for a three-year period. For this purpose the Member Organisations shall choose to set their dues in one of the following categories, based on the size and resources of the Organisation and as proposed by the Treasurer:

- a) One UC for non-industrialised countries or very small industrialised countries*
- b) Two UCs for medium sized industrialised countries*
- c) Four UCs for big industrialised countries.*

If accepted this recommendation might well bring pressure on MSA to pay two Ucs instead of one as at present. I pointed out to the Council that the recommendation confuses the resources of Member Organisations with the Gross National Products of their countries, but this only led to a com-

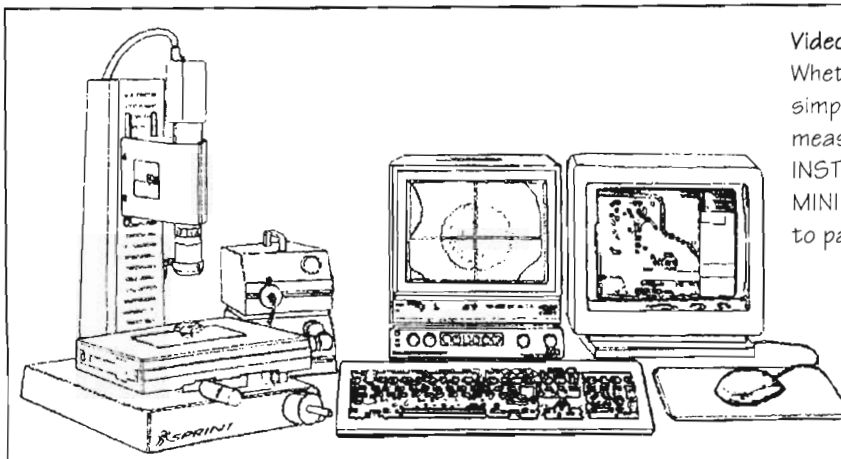
ment by the Treasurer that Australia is an affluent country for which the dues should be trifling!

3. Some general impressions

The four plenary lectures at the Congress were all of a high standard and the special session on measurement and quality was a useful exercise. I was less impressed, however, by most of the other technical presentations that I heard. It seems to me that IMEKO is trying to cover too many areas of measurement where other international organisations are already attracting the cream of the researchers; in such cases IMEKO tends to be attracting only contributions at the margins. IMEKO is doing better in fields such as flow, hardness and force measurement where it is meeting a need for technical communication that is not adequately catered for elsewhere. The President, Dr K Iizuka, expressed to me disappointment that, although IMEKO was established to cater especially for measurement in industry, the centre of gravity of those participating is swinging more and more to people in universities and governmental research institutes.

I believe that MSA will get real value from its membership of IMEKO only if it can succeed in getting reasonable attendances by Australians at IMEKO's general and more specialised technical conferences. It should therefore advertise the conferences well in advance.

I thank the Metrology Society of Australia for the opportunity to represent it at the Osaka congress. □



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c/o CSIRO National Measurement Laboratory
PO Box 218
LINDFIELD NSW 2070

The MSA website (www.ozemail.com.au/~ausmet) is worth visiting.

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