THE AUSTRALIAN

METROLOGIST

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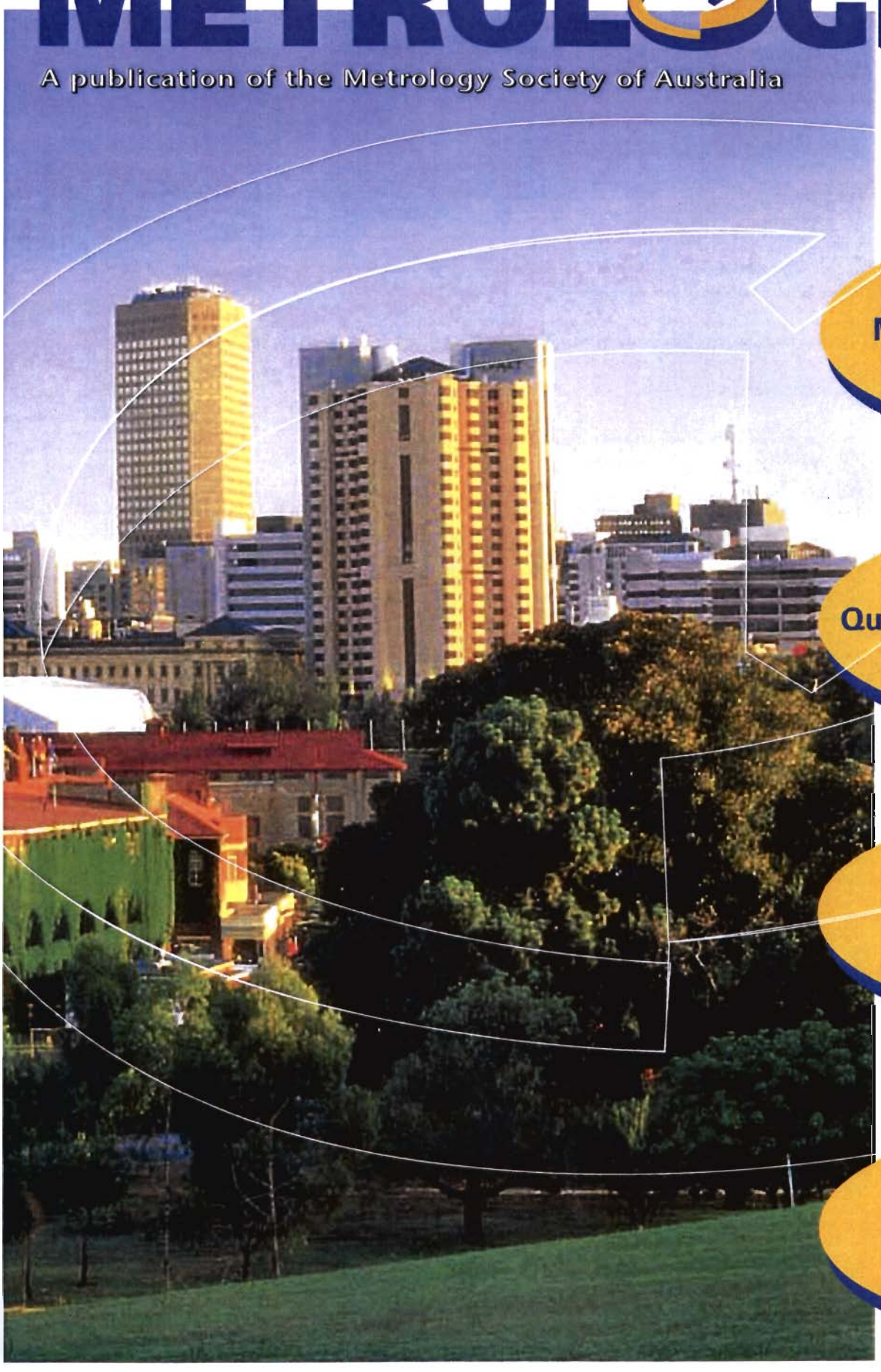

Force Measurements at NMI

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THE AUSTRALIAN METROLOGIST

From the Editor

As noted last issue, our regular contributors in Jeff Tapping and Ron Cook continue their enlightened and entertaining discourses on measurement related issues. Jeff sheds light on doubloons to earthquakes, with the odd glug and pik included to keep you guessing, whilst Ron gives up the dry river bank to cast his baited hook towards the speeding traffic on the nation's highways! No doubt some might find both these columns a little controversial at times, and the editor always invites comment from our trusty readers.

The South Australian group had a successful "demonstration" evening recently, and some photos are provided to help fill this issue out.

In addition there is a reprint from the MSA 2005 Conference Proceedings of the paper on Force Measurements at NMI by John Man.

The next issue will be mainly concerned with the coming conference and AGM in Adelaide.

- Maurie Hooper

Cover photo - a view of Adelaide - courtesy Ross Felix

The Australian Metrologist

The Australian Metrologist is published four times per year by the Metrology Society of Australia Inc., an Association representing the interests of metrologists of all disciplines throughout Australia. Membership is available to all appropriately qualified and experienced individuals. Associate membership is also available.

Contributions

Articles, news, papers and letters, either via e-mail, disk or hard copy, should be sent to:

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If you have a position vacant, write or e-mail the Editor with the details. A charge of $20 for up to 10 lines applies. (The circulation may be small but it is well targeted.)

The deadline for positions wanted/vacant is as above.

Letters to the Editor

Letters should normally be limited to about 300 words. Writers will be contacted if significant editorial changes are considered necessary.

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President's Report - April 2007

Is Time the thief of Quality?

Our illustrious editor Maurie as usual has had to chase me and others for the content of this magazine you are now reading. How do I know this? Because every issue, he has to chase me or others for content.

Is this because we are not interested? I don't think so.

Is this because we are all lazy? Maybe, but I doubt it!

Is this because the spirit is willing but the flesh is weak? In my case probably, but that is not the underlying cause.

I think it is because we all have thieves in our life. I know that this word from you president has been in the back of my mind for months, but there is always another deadline another task that places the article on tomorrow's to do list.

In project management jargon they say that of the magic triangle "Cost, Time and Quality", you can only ever have two. It is interesting that more often than not, the one that gets the cuts is quality. In this context I am talking about quality in the sense of fit for purpose. If quality is "fit for purpose" then aren't we sacrificing the whole purpose of our activity; the generation of activity without outcome. This may seem an extreme question, but it is one that I think is worth letting challenge us. Achieving a "fit for purpose" outcome is often criticised by the accusation of perfectionism. I have a growing concern that as individuals and organisations we are allowing the need for output and to meet deadlines to overwhelm our desire and need to deliver valuable outcomes. In other words we are letting time or money thieve our outcomes!

How does this relate to metrology I hear you ask? Metrology is the science of determining Value. As a society and as individuals we are cutting corners to meet deadlines or cost, we are not doing that important test, we are not taking the time to really think through what is needed and how to get there. It is a false economy, it reminds me of the carpenter's adage, measure three times and cut once! Let us stop measuring once, cutting three times!

Where am I going with this? Straight to the MSA conference. I implore you to make time and money to attend the conference. Take the time to hone your skills and knowledge, to think through and talk through your problems. Don't let time be the thief of your quality or outcomes!

- Jane Warne

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Quantification - Number 11

Jeffrey Tapping

Poncelet

The metric system of measurement has had many proposals for secondary units over the years, and this is one that has fallen by the wayside. It is a unit of power equal to the work done over a distance of one metre by the force which accelerates 100 kg by 1 ms^{-2}. As far as I can tell there was no name proposed for this force, so you are free to make up your own. The power unit was named for a remarkable man, Jean-Victor Poncelet who lived from 1788 to1867. He was a military engineer in Napoleon's attack on Russia in 1812, and was left as dead on the battlefield at Krasnoy. But he survived, was imprisoned by the Russians, and spent his incarceration writing a mathematical treatise on projective geometry. If you are mathematically minded, his life is worth looking into because he did some pretty good stuff.

Glug

This is another proposed unit that did not make it to the top. It is a unit of mass in the cgs system and is equal to the mass which is accelerated at 1 cms^{-2} by force of 1 gram-weight. The value is then 80.65 grams.

Pud and funte

These are both obsolete units of weight used in Russia, with one pud equal to 40 funt. One pud was equal to 16.381 kg. The name probably came from a Scandinavian version of the pound, the pund, but as we find so often the value was changed quite a bit. In Sweden the pund was equal to 425.1 g = 0.937 lb. In Norway and Denmark the name has been used for a metric approximation to the pound, and there 1 pund = 500 g, which is the same as the Dutch Pond mentioned in a previous issue.

Dollars, pesos and pieces of eight

This time I am talking about the *dollars* we are more familiar with, the currency kind. The story of how we came to use *dolla*r as the name of our money unit begins in the 16th century in the town of Joachimsthal near Prague where coins were minted from silver mined locally. The coins were abbreviated to *sthaler* which became *dollar*. Then the name *dollar* was used for the Spanish *peso* coin, which was used extensively in South America, and to some extent in North America. The name was then appropriated by the United States for the name of its currency after independence, and it was at this time the that the familiar $ sign was introduced. Since then many countries, including our own, have used the name.

The name *peso* came from the fact that the original coin was a specific weight of silver, and is a corruption of the Spanish *pesa* which means weight. The original U.S. silver dollar was the same weight as the peso, which explains why the peso was used interchangeably in North America. In Spain the *peso* was replaced by the *peseta*, but the name *peso* was retained by some of its former colonies.

I threw in *pieces of eight* as a bit of nostalgia, generated by the pirate fiction I read as a child, and I will now add *doubloons* for the same reason. First, *pieces of eight* was an alternative name for the *peso*, and came about because one *peso* was equal to eight *reales*. Similarly, the *doubloon* was named because it was equal to two *pistoles*. The whole colonial Spanish currency set was a nice binary series:

1 doubloon = 2 pistole = 8 pesos = 64 reales

Tear factor

This is the resistance of paper to resist tearing. It is equal to the lateral tearing strength of the paper divided by its thickness expressed as gsm (grams per square metre). My source does not make clear what "lateral tearing strength" is, but it sounds like the force needed to initiate a tear.

Richter scale

This topic should have been described as the trick question, because it certainly tricked me. I thought the answer would be quite straightfor-

ward, because it's a measurement that occurs on the news so frequently that I assumed the information I had in front of me would be reliable. But when I did a bit of cross-checking I found a variety of vague explanations that seemed in some ways to be contradictory, variously describing the scale as magnitude, energy, strength and amplitude. Finding out exactly what the numbers represent in a manner suitable for a metrologist proved more difficult than I imagined. But then inspiration struck, or at least, a memory rose to the surface. I recalled that one of my close friends from days of old actually did his PhD on seismology. So, much of the following explanation is by courtesy of Dr Lindsay Thomas, of University of Melbourne Geology Department.

First some background. In the nineteenth century there were earthquake scales based on what people observed, which was local damage. Early in the twentieth century a more theoretical interest in earthquakes arose, and it was realised that local damage gave little information about the actual size of the geological event because the damage depended on proximity to the quake. Events that occurred near populated areas gained wide publicity compared to those from unpopulated regions, and people confused publicity level with magnitude. This had one serious consequence, because it was thought that if a large event had occurred then stress was relieved, so the likelihood of another event was low, so precautions were unnecessary. Richter came up with a sort of triangulation technique, in which the strength and arrival time of a quake signal was registered at a number of locations, and from this information he worked out a scale which eventually became the Richter Scale in use today.

The first scale was based on the use of a particular type of seismograph called the Wood-Anderson type, and it was a logarithmic scale which means that it actually indicated ratios like the dB sound scale does. And like the dB scale it was necessary to choose an arbitrary zero. The zero chosen was the smallest signal that could be detected by the Wood-Anderson seismograph, and each increase of one unit represented a ten-fold increase in amplitude.

Now we come to the question of the confusion in popular media of what the scale represents. In the words of my friend Lindsay, "The log scaling does the magic - given energy is more or less amplitude squared, log energy is more or less 2x log amplitude, and magnitude is more or less log amplitude, so there will be a linearish relationship between magnitude and log energy. My long-taught rule-of-thumb is that each unit increase in Richter magnitude corresponds to 30x increase in source energy; for a bunch of reasons there isn't much point in looking closer."

And later in relating some of the history, "It was only (much) later that folk could demonstrate that there was some firm relationship between the Richter magnitude and energy release - from memory, there were attempts to integrate down the seismic record from an earthquake, then across the wavefront surface of which the record is a sample (except that it isn't - it is a superposition of lots of wavefronts). Even now I don't know if anyone has a really good handle on the energy release in a m = 5 event, because of the partitioning into various outcomes ranging from surface (guided) waves to latent heat of melting to change of phase of mineral forms, all of which and more can be involved. So, remember the confidence intervals (even where the authors don't)."

Lindsay added an interesting comment to this last paragraph: "One of the intriguing things to remember is that weapons testers have worked out how to disguise nuclear blasts so that the true yield of the weapon is not readily developed from Richter-style measurements; if we can do that, it is likely that natural events will also have a few degrees of freedom to smear the results." Which shows you once again that a measured result is not necessarily reality.

Gnathic index

This is a measure used in comparative anatomy for how much the upper jaw protrudes past the lower. There is a long definition of exactly what measurements are taken to calculate the index, but I will refrain from jarring your brain with it. (I was tempted to describe it as a jaw-breaker, but this is National Resist Temptation Week so I won't). The name derives from the old Greek word for jaw.

Last

Long-time readers will recall that this series began

with me finding measurement units that were also English words. I thought I had run out of new ones but they keep popping up. When Maurie Hooper was a little boy a *last* was a metal thing shaped like a foot on a stalk, and you used it to repair shoes. But *last* as a unit of measurement began as an old German unit of weight, which became the weight of goods at a specified volume, and later also that specified volume. From there things got messier as different groups adapted the measure in different ways. Here is a few of the versions of the *last*.

In Britain, as a measure of grain and malt: 80 Bushels, 2910 litres

as a measure of cod or herring: 12 barrels, 1387 litres

In U.S.A., as a weight: about 2000 ponds, 1.8 tonnes

weight of wool in sacks: 12 sacks of 364 pounds, 1.98 tonnes

The name comes from an old German word for "load", which survives in the word "ballast".

How long is a pik?

I have given you numerous examples of units that changed with time and place, but this one is perhaps the strangest of all. As a former unit of length in Turkey, Greece, Cyprus and Egypt it could represent any value over a range. In Turkey the minimum value was the short pik of 457 mm, and the maximum value was the long pik of 714 mm. In Greece the range was less, with a short pik of 640 mm and a long pik of 670 mm. So how did this come about? Well, the name derives from the Greek word for fore-arm, so it was obviously used for those rough measurements made using the arm as a measure, and of course the lengths of individual arms varied. It is in fact essentially the same as the cubit, which has the same origin. In time it was assigned a fixed value in the range, before it was displaced by other units.

What is the Saros cycle, and why is it so named?

The saros cycle is a period of 223 lunar months (about 19 years), and is the time period between occasions on which the sun, moon and earth are in the same relative positions. It is therefore the period of eclipse patterns, which explains the interest in it. Because orbits gradually degrade the cycle changes slightly over time, but it takes about 50 cycles before a particular eclipse ceases to happen. The name is taken from the Babylonian magic number of 3600, which is approximately the number of days in a Saros cycle. This number was considered magic because it is the square of the number base of 60 used by the Babylonians.

Post Script on IQ

In the last issue I made some unflattering remarks about the validity of IQ tests as a reliable measurement tool, especially when comparing people from different backgrounds. So imagine my surprise when I found an article in the February edition of Scientific American with a serious discussion of the significance of differences in IQ scores of blacks and whites in the U.S. Doubts about my original view were cleared away by rereading an important source of my information, *The Mismeasure of Man* by Stephen Jay Gould. I will give you some quotes from this book that are relevant. The first is from Alfred Binet, the originator of the IQ test.

"The scale, properly speaking, does not permit the measure of intelligence, because intellectual qualities are not superposable, and therefore cannot be measured as linear surfaces are measured."

What Binet is saying is that his tests measured a wide range of different kinds of talent, and that combining them into a single number (even with a single group), gave a questionable result.

The second quotation is from C.C. Brigham who wrote in 1923 about results of testing of potential U.S. army recruits.

"These army data constitute the first really significant contribution to the study of race differences in mental traits. They give us a scientific basis for our conclusions."

By 1930, after much study of the topic Brigham recanted and admitted that his earlier work was not valid (a very courageous man indeed), and he wrote:

"For the purposes of comparing individuals or groups it is apparent that tests in the vernacular must be used only with individuals having equal opportunity to acquire the vernacular of the test."

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Riverbank Reflections 8

Ron Cook

Watching a stream flow slowly past is always conducive to musing and as the fish are lying low there's not much else to do.

A short time ago the local Branch of the MSA advertised a talk by Dr Richard Brittain of the NMI with the title "Caught in the Act". This I thought might be "X" rated and as it was free I just had to go. It was of course suitable for general exhibition, and was an excellent introduction to the National Measurement Act (known as "the Act") and its purposes. No doubt Richard chose the title carefully and although all the attendees were male, none were wearing gaberdine overcoats.

The National Measurement Act provides an umbrella under which trade and commercial measurements can be fairly made. It arises out of the fundamental and ancient need for a community to have some fair trading rules and regulations, and the units to be used for legal measurements are named and defined in the Act, but the details are mainly in the associated Regulations.

Amongst other things, these Regulations address certification of reference standards, standard instruments and measuring devices for trade and commerce. Type approval is one of the activities that arise out of the need to ensure fair trade.

There is a lot to commend in the Act, but never-the-less one aspect is, I think, controversial. It is the extension of the regulations to require type approval of devices that on the surface are not related to trade. Yes, there is some possibility of litigation over the measurements, but perhaps there are other ways of dealing with this. I refer to parking meters and in the near future, RADAR speed "guns".

Now I don't have a problem with ensuring that the measuring parts of these devices are sufficiently accurate for their purpose to have their indications accepted, but to have them under the "Fair Trading" umbrella requires a bit of hand waving.

If I buy 250 grams of cheese I expect it to be accurately weighed. If I buy 30 litres of petrol I expect it to have been accurately dispensed. If I buy a metre of cloth I expect the rule used to measure it to be accurate. These are the classic "fair trade" scenarios for which the National Standards Act was originally devised. The Act itself and the Regulations under the Act were also intended to cover other aspects of trade and commerce involving measurements and over time its scope has been extended.

But how can it apply to parking meters and RADAR "guns"? What are you buying from the parking meter, or its owner, the Local Council? Not principally time which the meter measures. I think you are hiring a space in a public area for a set period of time. So if the time "dispensed" is to be regulated under the National Measurement Act, why not also the amenity you are hiring, namely the parking space? Should I expect to pay more if the space is shaded or less if prone to the

droppings of various birds? Should parking places have a written formal standard that they must comply with?

There are other things we hire for time but they do not require the NMI to be looking at applying the National Measurement Act to the time measurement. For example, baggage storage facilities at bus terminals and airports (the latter may now be closed because of concern for terrorist activity), or a locker at the local swimming pool. You can hire an animal or an aircraft, a bicycle, a book, a car, a companion, a dredge, an electric drill, furniture, a generator, a hotel room, etc, on a time basis. Will the NMI insist that the clocks used to determine these rental periods are to be traceable and type approved? May I be so bold as to suggest it's not likely?

So why parking meters?

Does having the meter's clock covered by the National Measurement Act make sense? Except for having it measure legal units (SI seconds, with an uncertainty of say 1 in 1000), I'm doubtful that there needs to be any more. Type approval can provide a degree of certainty that the instrument is suitable for purpose. Integrity of the time measurement could be assured by other means such as regular calibrations in a NATA accredited laboratory.

Then there is the parking fine. While it might be right and proper to fine a "customer" for overstaying his rental period, is it right to see it as part of the "fair trade" responsibility of the NMI. The parking space is the object of the transaction and the accuracy of the time measurement, the uncertainty to which the SI second is measured, is perhaps a secondary matter. A sensible magistrate would throw out any case mounted on the possibility of a few seconds per hour error in a clock in a parking meter.

I'd like to now turn to RADAR based speed measuring instruments. Why have these covered by the National Standards Act?

What do you trade with the traffic policeman? Hopefully nothing. Indeed giving him money or goods might have dire consequences. If he believes he has evidence that you have broken a law, that is, you have been travelling above the speed limit, then he may use the RADAR instrument reading as evidence to prosecute you with, unless you fess up and pay the fine when it comes. Indeed, in spite of some claims to the contrary, the RADAR reading is the primary evidence of a misdemeanour. This is particularly so in the case of unmanned speed cameras.

In these cases the measurement is made with a view to deciding whether you are to be punished or not. You haven't engaged in trade so why apply the National Measurement Act. Surely it is a matter for the regional Department of Justice, not the NMI?

Some in the community have argued that speeding fines are more of a tax than a punishment. Given the large numbers of motorists who are fined there has to be an element of truth in that argument. Should the calibration of RADAR "guns" therefore be a matter for the Taxation Department? Ok, ok, that's not a good idea.

Obviously there is also a need for some degree of deterrent to maintain a modicum of good behaviour on the roads and a fine is an acceptable way of doing this.

It seems to me that when I exchange money, goods or services for other goods or services then I have engaged in trading. If a physical measurement is required of the goods or services then the National Measurement Act becomes relevant.

If I exceed the speed limit I have not been trading but I've possibly been derelict in my civic duty. So why have the National Measurement Act involved?

Is it a case of creeping bureaurocracy?

Most motorists would want both their in-car speedometers and the RADAR gun to have errors that did not exceed say 1 km/h. The use of type approved equipment and control of the calibration of these under an ISO 17025 regime might be a very a good idea. But that isn't about fair trade. It's about "a fair cop". That is, we need to be

confident the RADAR at least is sufficiently accurate for its purpose, even if our speedometer is a little in error. Regular calibration of the radar by a laboratory accredited with NATA to do this work should suffice.

It seems to me that it is a combination of lawyers being too smart for our good and a benevolent attitude in the NMI. By trying to argue that RADAR measurements weren't in conformance with the National Measurement Act, the lawyers forced policing organisations to ensure that they were to the extent that a traceable calibration chain has been set up for radars controlled by the police.

Also the NMI, I suggest, saw no reason why the principles of Fair Trade shouldn't be extended to fairness and correctness in all measurements in modern life. (Remember however that Big Brother in Orwell's book "1984" started out being benevolent). I do not want to suggest that the NMI has plans to "take over the country"; merely to point out that the journey to a nasty place can start out with a sheaf of good intentions. I also want to question where we are right now, where are we going and is this where we should go?

For the motorist it's not a matter of "Are we there yet?" but more a matter of "Where the hell are we?" followed by "Is this the best place to be?"

So should all RADAR "guns" including those in unmanned installations be calibrated? Clearly the answer is "Yes". How should their measurement and calibration integrity be assured? Well maybe it doesn't have to involve Australian type approval. By selecting instruments that have passed comprehensive environmental tests performed by the manufacturer and having the operating instruments regularly calibrated in a NATA accredited laboratory? Yes, that is certainly a practical approach.

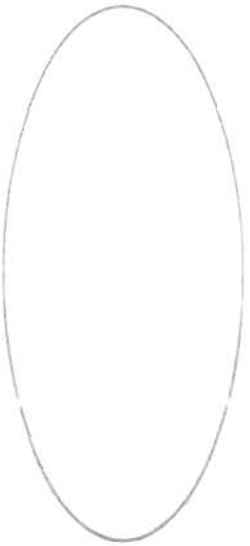
Apart from the philosophical question of the appropriateness of the application of the National Measurement Act, there is another reason why I question the need for type approval for speed limit enforcement instruments. The technology is not static. Speed measurement technology has changed at a far greater rate than the changes of technology applying to pan balances and load cell balances and volumetric containers. If the technology is changing rapidly then by the time an instrument is type approved, it may well be obsolete and the exercise pointless.

From a philosophical point of view I don't see the connection between a punishment and fair trade so I'm cynical about the "value added" by having RADARs (and their relatives) type approved under the Act.

As a parting thought I ask whether the whole legal measurement system could be replaced by an accredited measurement system. What do the readers think?

I could go on about other instances where charges are made on both measured quantities and deemed quantities which are I suggest in a grey area when it comes to fair trade, but the sun is getting low and if I want some fish to eat for the evening meal then I'd better find a fish shop pronto.

■



From the MSA 2007 Conference Chairman

By now most of you will have registered to attend the conference in Adelaide - if you have not booked yet, then "Where the bloody hell are you?" I am looking forward to seeing you here.

The banquet is shaping up to be a great night - in fact this is getting exciting. The timing of the sessions and the visits are being confirmed. There is however some sad news regarding the visit to the submarine. This was always the difficult one to arrange. The submarine scheduling has made it impossible to be sure of being available, so I have set this group to visit the turbine engine test cell at the Adelaide Airport.

The buses will be able to drop people off at the airport Friday evening to fit the departures that occur after 6.00 pm. Due to parking difficulties we ask that you make your own way here Wednesday. We have a bus to take the family groups out during the conference sessions, and we have such visits as "the chocolate factory," "the strawberry farm," " the toy factory," "shopping" or Adelaide hills tours in mind but are happy to tailor to the groups needs. A small fee of about $20 each to cover the driver's time and fuel would required; this can be reduced if we fill the bus. The Saturday wine trip is booked and will be a VIP tasting and lunch and then on to a fortified wine maker before returning for bags and Airport drop off. We expect the return will be before 5.00 pm in time for a 6.00 pm flight.

Just to recap, we need numbers for the day tours, wine trip and some indication of transfers to airport. Also, we need to get numbers for vegetarian meals and ascertain any special dietary requirements (diabetic or allergies etc).

- *Les Felix*

From page 6 - Quantification 11

He was referring here to recruits from different migrant groups, but of course the same applies to different cultural groups within a country. The matter is of more than academic interest. Those in the U.S. who believed that limited ability was innate in some deprived groups used it as an argument that there was therefore no point in trying to raise their status, and that they should remain in menial tasks. It also resulted in selective immigration laws that excluded millions of potential migrants who perished in the Nazi gas chambers and concentration camps. So you can see that measurement can have a serious social side.

I conclude with the words of philosopher John Stuart Mill, who cautioned against the error "to believe that whatever received a name must be an entity, having an independent existence of its own." The corollary of this is that a measured number does not necessarily represent a real quantity.

In the next issue we will talk about the following:
How long was a mile originally?
What is a dopping of sheldrake?
What are the following instruments used for?
Drosometer, ebulliometer, fluviometer, cryometer (a prize is offered for the most imaginative answers).
What is the similarity and difference between a barie and a barye? And between a ching and a ch'ing?
What is the origin of the term Jumbo for a large object?

■

Post Script on Mass Standards

The December 2006 edition of Scientific American carried a feature article on the search for an absolute fundamental standard of mass, following in the wake of the article on the same subject in TAM of the previous April. To be fair the Scientific American had some very fancy graphics lacking in TAM. It also had a nice little colour picture of Achim Leistner of the optical workshop at NML Australia, looking at a silicon sphere shaped under his direction, alas without identifying the person or place. The April 2007 edition of Scientific American had a letter in which the correspondent made the point that according to general relativity theory the mass of a packed atom of silicon would be slightly less than that of one in isolation due to the binding energy of the crystal. The author replied, most politely and patiently I thought, that the correction is much less than one part in a billion, which is considerably less than other corrections and uncertainties, but would be accounted for anyway if the new definition used the silicon sphere method. I wondered if this was an example of ignorance of uncertainties, or just someone trying to demonstrate in print how clever he is, and shooting himself in the foot in the process.

- *Jeffrey Tapping*

■

Australian Government
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2007 Conference Pack

Like to settle back with a good wine and cheese, followed by a coffee and chocolate or a bit of crumpet drizzled with jam or honey? Why not save some of the contents of the complimentary conference pack til you get home and treat yourself to a bit of indulgence.

Vittoria Coffee, Beerenberg and Spring Gully Foods have supplied some of their renowned produce for you to try and enjoy.

Saturday's winery tour is booked for Orlando and Grant Burgess so you can put some of the conference presentation content to work evaluating their products.

Vittoria Coffee

In 1958 after becoming frustrated by the lack of quality, fresh Espresso coffee, Orazio and Carmelo Cantarella (The founders of Cantarella Bros.) began roasting small amounts of coffee at their premises in Sydney's Haymarket, initially supplying the Sydney 'Italian' cafés. The 'Vittoria Coffee' brand was born.

Cantarella's leadership in the development of Australian coffee culture through Vittoria Coffee is well recognised. Initially making 'Italian Style coffee famous' through cafes and continental delicatessans, Cantarella CEO Les Schirato broadened the experience to mainstream Australia by introducing pure coffee to supermarkets - now a category worth nearly $90 million.

As well as a major importer of European food, (including Jarlesburg cheese) Cantarella Bros is the largest pure coffee company in Australia. Over one in every three cups of coffee enjoyed at home is a Cantarella Brand.

In 2004, Family Business Australia named Cantarella Bros Family Business of the Year - 2nd gen.

Cantarella Bros is headed by CEO Les Schirato. Les is responsible for taking the company from a $2.5m turnover in the early 80's to a budget of $135m in 2004.

A recipient of the coveted Australian Entrepreneur of the Year Award & the 2004 AMI Marketing Innovation national award, Les is known as Australia's 'Coffee King' and is a sought after speaker and contributor to business & marketing texts.

Vittoria is a socially responsible company that participates tirelessly in many charitable and community activities, through donations, sponsorship and participation with their coffee carts to raise funds for important community charities too numerous to mention here. Their wide commitment and support of Australian society is listed on their comprehensive website.

Beerenberg

Beerenberg is an Australian-owned company based at Hahndorf, 28km from Adelaide's CBD. All products are made from the company's farm, which has been in the German migrant Paech family since 1839, three years after the state of South Australia was proclaimed. Grant and Carol Paech, are the fifth successive generation of Paechs to work the farm.

Grant made the first batch of strawberry jam in 1971 from surplus crops, growing the range to 48 products and exporting since 1986 to 24 countries, major airlines and more than 300 hotels. Beerenberg pioneered the concept of portion serves, which was a major milestone for the company, allowing it to secure significant airline-supply contracts.

The freshest farm produce and traditional recipes are used to make home-style mouth-watering products with no added artificial flavours, colours or preservatives. Beerenberg's range includes jams, marmalades, chutneys, sauces and marinades, pickles, dressings, dessert toppings and olive oil. Low-joule preserves are also available and ideal for diabetics.

Purpose-designed, state-of-the-art equipment is used in the company's factory and recently a new packing line was constructed to meet the growing demand.

The company continues to win food, business, tourism and farm management awards, and its products have become Australian icons.

Spring Gully Foods

Spring Gully pickles was originally established in 1946 by Edward McKee at Spring Gully in the Adelaide suburb of Rostrevor. Orphaned at the age of three, Edward spent much of his early life living in a tent in his Aunt's backyard. Shortly after the 2nd World War, Edward brought an orange orchard at Spring Gully for 30 pounds. He added over 3,000 hens to provide manure for the orange trees and sold oranges and eggs to local corner stores. A Christmas present of his renowned home grown pickled onions to his customers proved so popular, that it demanded he produce more... Edward McKee was in the pickle business.

As the business expanded, Edward was joined by son in law Allan McMillan, stepson Eric Webb and close friend Malcolm Clyma. As supermarkets began to replace the corner store, Spring Gully's only option was to expand. Anew factory was built on site at Spring Gully and eventually broader distribution was gained through the "Tom the Cheap" supermarket chain in Western Australia and South Australia. Coles and Woolworths followed and Spring Gully Pickles were on their way to outright market leadership in these two states.

Allan McMillan's sons, Brian and Garry, along with Eric Webb's sons, Ross and Kevin, joined the company in the 1980s. Their initial goals were to make the Spring Gully brand truly national, to modernise the plant as well as to introduce "best practice" and the sophisticated quality control systems demanded by today's market.

In 1993 the company moved into their purpose built premises at Dry Creek in Cavan, South Australia. The facility has enabled

Spring Gully to meet their stringent quality control standards, plus provide room for continual expansion.

Over the past five years, the Spring Gully brand has established itself in the Eastern States of Australia and into New Zealand, as well as actively developing export markets in the Asia Pacific region.

Spring Gully Foods has acquired a number of leading companies in recent years and now has Leabrook Farms Honey, Gardener Pickles and new bottled water product called Nuqua under it's wing.

Orlando Wyndham

Owned by the French Pernod-Ricard group. The group currently holds about 2,000 hectares of vineyards and includes the following subsidiaries/ brands:

* Orlando
* Jacob's Creek
* Wyndham Estate
* Poet's Corner
* Carrington
* Coolabah
* Maison
* Steingarten
* Jacaranda Ridge
* Morris Wines
* Richmond Grove
* Gramps
* Montrose
* Craigmoor
* Wickham Hill

It is well known in export markets for the Jacob's Creek range.

In 1997 Orlando Wyndham embarked on a major expansion and international marketing program to virtually double exports of its top-selling Jacob's Creek. The initiative will result in global sales of Jacob's Creek increasing to more than four million cases by 2001. Jacob's Creek has been the UK's biggest selling wine since 1992.

Orlando Wyndham announced in 1997 it will spend more than $66 million over the next four years to upgrade and expand its winery and vineyard operations in South Australia and New South Wales, with significant investment planned at the company's two Barossa Valley wineries.

In 1998 Orlando launched a new bottling line, capable of filling and packaging 23,000 bottles an hour, as Orlando Wyndham prepares to export up to half a million cases a year of its Jacob's Creek label into North America. It is part of a worldwide push to double exports of Jacob's Creek to four million cases a year by 2001.

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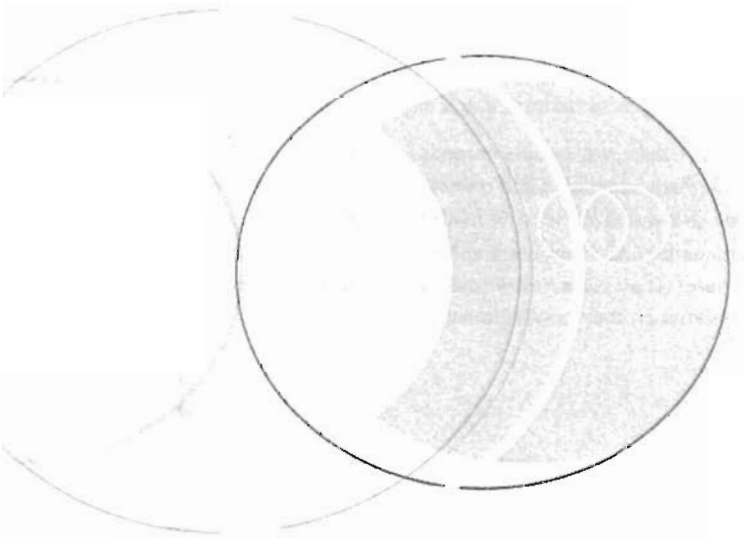

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FORCE MEASUREMENTS AT NMI

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Abstract

The revised Australian Standard AS 2193 for the calibration of force measuring systems has set specified uncertainty values of the applied forces as a criterion for calibrating these instruments. The force capability at the National Measurement Institute (NMI) has been upgraded by means of two force standards to cover forces up to 4.5 MN in compression with a level of accuracy to meet these changes and the needs of force measurement in Australia. The establishment of the two force standards based on build-up technique is described. The status of calibration capabilities at NMI and the development of a 3.5 MN force standard are presented.

Keywords: force; build-up systems; force standards

Introduction

A revised Australian Standard AS 2193 [1] for the calibration and classification of force measuring systems was issued in 2002. This version covers specific requirements for the classifications of force transducers and of testing machines. Assessment for class allocation of force transducers is primarily based on the uncertainty of the applied forces as shown in Table 1.

Table 1. Class allocation of force transducer

Uncertainty of applied force (%)	Class of force transducer
0.01	0
0.02	1
0.05	2
0.1	3

NMI has dead-weight force machines of 5.5 kN and 550 kN capacity. Both machines can be used for the calibration of force transducers in compression and tension. The uncertainty associated with the forces generated by these machines is 0.002%, that can assign class 0 to force transducers in accordance to AS 2193. For forces above 550 kN, NMI uses a 10 MN hydraulic force machine designed for use in compression only. The force is generated by applying hydraulic pressure to a piston and cylinder combination of known area. However, the applied force will be subject to additional uncertainties due to friction between the piston and cylinder. The uncertainty of the applied forces generated by the hydraulic machine is 0.06%, which means the capability of NMI for the calibration of force transducers of capacity above 550 kN is limited to class 3. A Class 3 force transducer can only be used for calibration of a class B testing machine as specified in the AS 2193. This level of accuracy of a testing machine is unable to fulfil the specifications required by other Standards for testing of metallic materials in Australia.

In 2002, NMI recognised the need to improve the uncertainties for higher capacity force measurements to meet these changes but setting up a new facility would involve considerable capital cost and interruption of the calibration service. NMI chose the build-up technique as the best way to expand these capabilities. This paper presents the build-up systems that have been established at NMI, and gives a brief account of work planned to expand the capability for force calibration in tension.

Build-up systems

In a build-up system, three force transducers are arranged in parallel, and their force indications are summed to provide an estimate of the total applied force. This configuration allows the use of the three force transducers to calibrate a force transducer up to three times their individual capacity. The first build-up system of 1.5 MN was established and reported in 2004 [2]. A schematic diagram of this system is shown in figure 1. It consists of three 500 kN force transducers, each of which has been calibrated in the 550 kN dead-weight force machine maintained at NMI.

This system was used to calibrate three force transducers of 1.5 MN each individually by installing it in series with the test transducer in the 10 MN hydraulic force machine. These force transducers are assembled similar to the arrangement shown in figure 1 to form the second build-up system of 4.5 MN capacity. Calibration results of the force transducers have been reported in [3].

Figure 1. Schematic view of the 1.5 MN assembly

Both of the 1.5 MN and 4.5 MN systems have been designed to promote even distribution of the applied force to the transducers by arranging them symmetrically about the centre of the system and by closely matching the transducers in height. As shown in Figure 1, the force axes of the force transducers are fixed at the apexes of an equilateral triangle, concentric with the base plate. The heights of the force transducers are matched and the surfaces made parallel to within 0.05 mm. A 300 mm diameter hardened steel platen with a thickness of 150 mm is used to distribute the applied force evenly over the three transducers. Details of the mechanical components shown in Fig.1 are described in [2].

A test was carried out to examine the force distribution by placing the 1.5 MN build-up assembly in series with a self-aligning ball and socket joint in the 550 kN dead-weight force machine. A series of three nominal forces ranging from 460 kN to 547 kN was applied to the build-up system through the ball and socket joint. This was repeated four times. The maximum deviation in the force distribution among the three transducers was found to be less than 0.2% of the applied forces.

Two tests for the 1.5 MN system were carried out to check the coherence between this build-up system and the dead-weight force machine using a 500 kN force transducer as a transfer standard. The transfer standard was first calibrated in the dead-weight force machine and then placed in series with the build-up system in the 10 MN hydraulic force machine. In both tests, measurements of two forces with nominal values of 450 kN and 500 kN were carried out three times at each rotational orientation (0°, 120° and 240°) of the 500 kN transfer standard. The first test was carried out in 2003; and after the re-calibration of the individual force transducer of the 1.5 MN build-up system the second test was carried out in 2004. The average value of these differences is calculated to be 0.002%, with a standard deviation of 0.001% for the 2003 data and 0.002% with a standard deviation of 0.005% for the 2004 data. These results show that the measurements made by the two systems are in good agreement. A further comparison of forces over the entire range of the build-up system is required to check its performance. To this end, the NMI is to take part in the coming APMP regional key comparison for forces up to 2 MN.

A 2 MN force transfer standard was used to carry out a comparison between the hydraulic force machine with the 1.5 MN build-up system and the 4.5 MN build-up system. In this test, measurements of forces with nominal values of 1.5 MN were carried out three times at each rotational orientation (0°, 120° and 240°) of the transfer standard. The deviations in the 1.5 MN data relative to the 4.5 MN data for the force step at 1.5 MN are within 0.02%. The average value of these relative deviations is found to be 0.0008% with a standard deviation of 0.015%.

Uncertainties of the forces measured by the two build-up systems have been evaluated and reported [3]. Their values are summarised as follows:

0.02% for the 1.5 MN system;
0.03% for the 4.5 MN system for increasing forces only, and
0.04% for increasing and deceasing forces.

Current force capability

NMI maintains three dead-weight force machines covering a range from 1 N to 550 kN for force transducers in compression and tension. With the new build-up systems, this force range has been expanded to 4.5 MN. Table 2 shows the current force capability that can meet the requirements of the AS 2193 for classification of force transducers.

From Table 2, it is seen that NMI's capability is adequate for assigning class 2 status to force transducers up to 4.5 MN in compression, which covers the vast majority of calibration requirements in Australia. However, there remains a need for NMI to improve its capability above 550 kN in tension such that it can assign class 2 status. A class 2 transducer can be used to calibrate class A testing machines. That are required by other standards such as AS1391 [4] for tensile testing of metals. NMI has initiated work to upgrade its force facility in tension. This is described in the next section.

Table 2. Current NMI capability

Force machine	Class of force transducer that can be assigned	Testing that can be calibrated with that force transducer
Compression		
1 N to 550 kN	0	AA
Above 550 kN to 1.5 MN	1	AA
Above 1.5 MN to 4.5 MN	2	A
Above 4.5 MN to 10 MN	3	B
Tension		
1 N to 550 kN	0	AA
Above 550 kN to 3.5 MN	3	B

Upgrade of tension force facility above 550 kN

The 10 MN hydraulic force machine consists of a base casting, supporting four vertical columns which in turn support an upper adjustable cross head with a spherically seated platen. The base casting also incorporates an up-stroke hydraulic ram which drives a spherically seated support and a lower compression platen. A tension force transducer can be calibrated in the hydraulic force machine using the arrangement shown in figure 2.

The intention of the arrangement is to load the test instrument in tension in series with a reference force transducer in compression, thus calibrating the test instrument in terms of the reference force transducer. The reference force transducer is of 3.5 MN capacity and has a bore in the middle for the tension rod to pass through. The test instrument along with its adaptors and tension rods is placed between the outer frame and the inner frame of a cross-over rig. The cross beam of the cross-over rig is placed against two of the threaded columns diagonally and butted against two nuts. A hardened cylindrical steel block is seated between the cross beam and the base of the inner frame. In operation, the up-stroke hydraulic ram moves the cross-over rig upward. This upward force is converted to

downward force pulling the test instrument in tension due to the reaction being taken by two of the machine threaded columns through the cross beam in the cross-over rig. The maximum capacity for tension is limited to 3.5 MN by the structural strength of the cross-over rig.

It is anticipated that calibration of the reference force transducer using the two build-up systems is to be made next month, and the facility for tension calibration above 550 kN will be in operation by the end of this year.

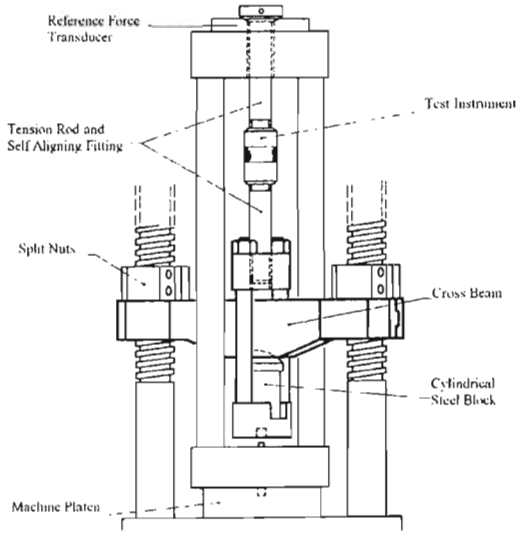


Figure 2. Calibration of force transducer in tension up to 3.5 MN

Conclusion

NMI has established two build-up systems covering forces up to 4.5 MN in compression. The uncertainties associated with the forces measured by these systems are evaluated to be within 0.05%, which enables NMI to assign class 2 level of accuracy to force transducers. Both these systems have been used in the calibration service for disseminating Australia's standard of force to industry. They are for material and structure testing for safety and quality of products. In tension calibration, NMI is undertaking developmental work to upgrade its facility above 550 kN to meet the requirements of AS 2193 and the needs of force measurement in Australia.

References

[1] AS 2193: Calibration and classification of force-measuring systems, 2002.

[2] J. Man, D. Tyrrell, "Development of a 1.5 MN build-up system force standard at NML," Proceedings of the 5th Biennial Conference, Metrology Society Of Australia, pp. 59-65, 2004.

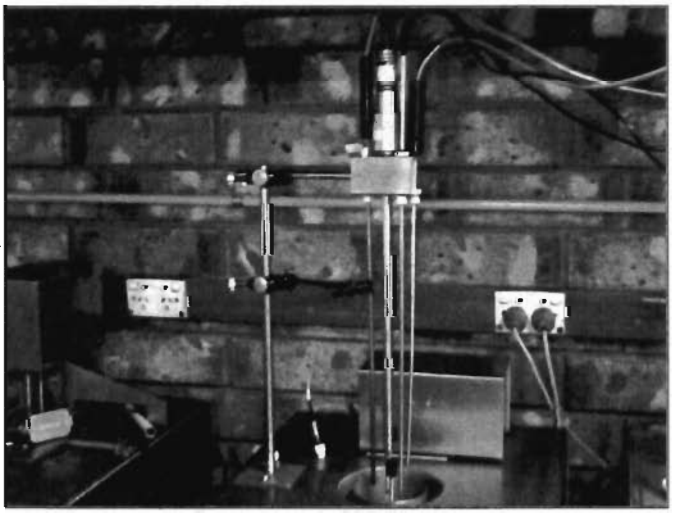
[3] J. Man, "Establishment of force standards up to 4.5 MN based on a build-up system at NMIA," Proceedings of the Asia-pacific Symposium on Mass, Force and Torque, (APMF 2005), Aug. 2005.

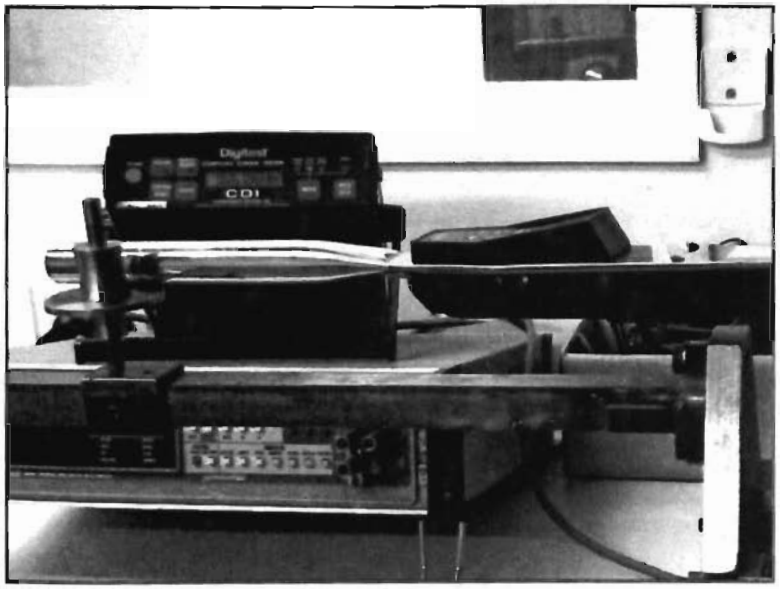
[4] AS 1391: Metallic materials – Tensile testing at ambient temperature, 2005.

■

SA Group Meeting Night

The group met on 28th March at Abstec Calibrations laboratory for a "demonstrations night", with guests from the Institute of Marine Engineering Science and Technology. Following a light meal and a chat, small groups were formed to move around the six demonstration areas organised by Abstec staff with help from Richard Duncan and Barry Downs.





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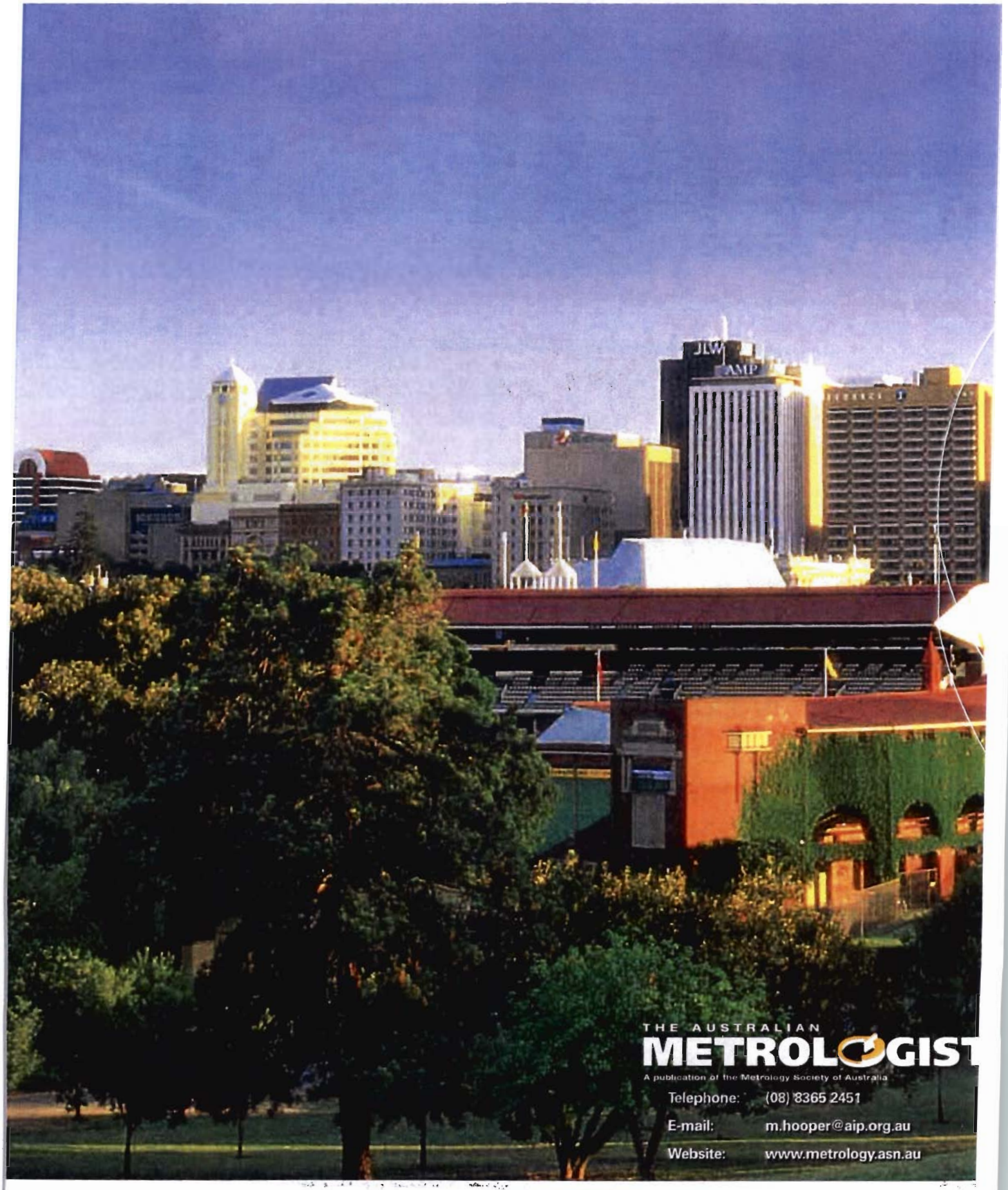

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