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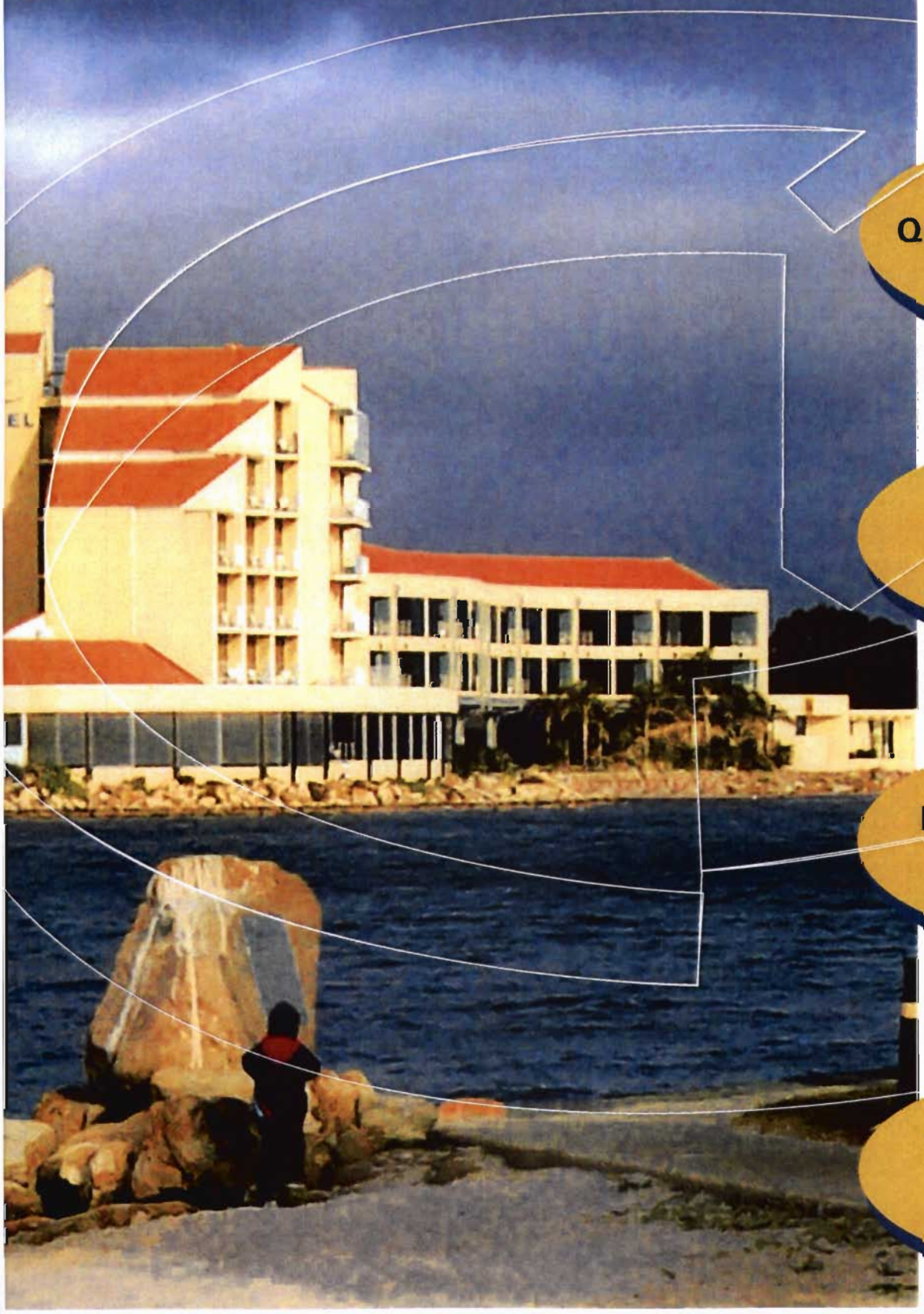

THE AUSTRALIAN METROLOGIST

From the Editor

In this issue we continue our two popular series - Jeff Tapping's *Quantification* and Ron Cook's - *Riverbank Reflections*.

In addition there is a reprint from *New Scientist* of an historical article on time by Stephen Battersby.

Adrian Caster's paper on Metrology and Globalisation from the last MSA conference has been included.

Les Felix has provided information and a Call for Papers for the MSA Conference 2007 to be held in Adelaide at the Lakes Resort, West Lakes.

A photo-spread shows the venue of Conference 2007 - see page 3.

- Maurie Hooper

Cover: Venue for MSA Conference 2007 - Lakes Resort, West Lakes, Adelaide, South Australia.

The Australian Metrologist

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Editor: Maurie Hooper

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Conference Venue - MSA 2007

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Quantification - Number 8

Jeffrey Tapping

Here we go again with some answers to the questions posed in the last issue.

What is the origin of the term *hundred* and how does it relate to the *wapentake* and the *virgate*?

The term *hundred* appears in old Australian maps and on title deeds from colonial times, and was inherited from Britain to denote an area of land. Originally it was an area of agricultural land sufficient to support 100 families, but as early as 1000 years ago it had become a term for a subdivision of an English county. It was also an area required to have its own local court. In the areas settled by immigrants from Denmark the area was known as a *wapentake*, the name apparently originating from the obligation of the residents to "take weapons", that is, to appear at community gatherings bearing arms to swear allegiance to the local Lord and to demonstrate their defensive capacity. Another story is that the people clashed their weapons together to express consent, a forerunner perhaps of clapping by a crowd to express approval. The name wapentake gradually became applied just to the local court, and then only to the local court officer (the bailiff). The bailiff's mace is probably a vestige of the weapons born to the court.

A *virgate* was also a land area, but much smaller than a *hundred*. One *virgate* was a quarter of a *hide*, and 100 *hides* made one *hundred*. It is tempting to think that that last equivalence was the origin of the term *hundred*, but I have found no source saying that it was. Because of the fuzzy definitions, all of these areas were ill-defined in magnitude, but a *hundred* was usually in the range 10,000 to 12,000 acres (4,000 to 4850 hectares).

You are up to scratch with the *bath* and the *pond*. How about the *tub*, the *tank* and the *shower unit*?

The tub is a volumetric unit that will appeal to our more dissolute readers. It was used by smugglers bringing in alcoholic liquors into the U.S.A. ands the volume was approximately 4 U.S. gallons (15.14 litres). The origin probably comes from the containers used rather than the volume.

The *tank* on the other hand has a more sober origin. It was a small unit of weight equal to 4.4 grams used in the Bombay (now Mumbai) region of India, and just in case anyone should ask you, 72 tanks made one Bombay *seer*. But you would have to be sure it was a Bombay *seer*, because the *seer* was defined as the weight of grain in a specified container, and because the specification could vary over India the value of a *seer* could be anything from 270 grams to a kilogram, depending where you were.

The shower unit is a horse of an entirely different colour. It is a unit of absorption of cosmic rays in a material, and is the distance for the energy of a cosmic ray shower (hence the name of course), to be reduced to one half. For air at sea level this is about 230 metres, and the for human body (and presumably also our coloured horse), 300 mm. It is a curious concept actually, because on one hand it is dimensionless being a ratio, but is expressed as length, but the length can be any units.

What sort of measuring instrument is a *clepsydra*?

It is a water clock, or more precisely, a device that indicates time intervals using a constant flow of liquid. Various forms have been used by different cultures, and for a very long time. Egyptian examples have been dated back to the 14th century BC, but the Babylonians probably used them even earlier. These devices depend on the fact that the rate of flow of a liquid through a small orifice is nearly independent of the pressure difference across it, and usually consisted of a tank with a hole in the bottom, with the time indicated by the water level in the tank. The Romans used a water clock to time speeches, and it occurred to me that this could be the origin of the expression "Your time has run out!". Native North Americans used a clock which was a boat with a hole in it, and the time expired when the boat sank. The liquid has been almost always water, but occasionally other liquids, and Galileo used a mercury clock when he timed falling objects to demonstrate that the acceleration rate due to gravity is independent of the mass of the falling object. In Athens there still stands a structure called the Horologium, erected in around

75 BC which had a sundial for measuring time during the day, and a water clock for measuring at night and other times at which the sun was not visible. This structure was also known as the Tower of the Winds, because it had reliefs depicting the winds on its faces.

What is the *denier* system of measurement?

This is the spot for a bit of history. When my father was a little boy, stockings for ordinary women were knitted thread, usually either cotton or wool, while the rich wore stockings made from fine silk. But a transformation took place when nylon thread became available: suddenly an appearance formerly open only to the affluent was affordable. Women took to these new sheer (that is, transparently thin), stockings with passion. And the thinner the material the more desirable they were. So now we come to the question. When I was a lad nylon stockings were given a denier rating, with ordinary ones being *20 denier* and thinner and more expensive ones being *15 denier*. Schoolgirls would wear *30 denier* stockings. None of us really knew what the numbers meant, we only knew that a lower number represented thinner stockings. I now find that it is in fact a measure of the weight per unit length of any fine thread used in textiles, specifically the weight in grams of 9,000 metres. So each metre of thread used for the *15 denier* material was just 1.6 milligrams! The name derives from the small Roman coin, the *denarius*.

What unit is the *typp*?

This unit was new to me, but is in fact the Imperial counterpart of the *denier* rating. In this case it is the weight in pounds of 1000 yards of thread. There were a couple of other similar units used: the *drex* which was the weight in grams of 10,000 metres of yarn, and the *tex* which was the weight in grams of 1,000 metres. The odd length used in the *denier* system comes about because the unit is a metric adaption of an earlier system based on the weight in drams of 1,000 yards of thread. And still the story goes on, with different systems used for different materials in different places. For example in the U.S.A. there is a system based on the number of hanks of thread to make up one pound, with a hank of 840 yards for cotton and spun silk, 300 yards (a lea) for linen, 256 yards for woollen yarns (made by twisting threads together, as in knitting wool), and 560 yards for worsted yarns (those in which the threads are twisted tightly, as in cotton thread). Now there is a bundle of tangled units.

We know that atmospheric pressure changes, so what exactly is a pressure of one *atmosphere*?

The answer is that it depends who you ask. These days it generally means a pressure of 101.325 kPa, which is equal to 14.696 lb/ in^2 in Imperial units. So where does this odd number come from? A little fiddling with my calculator showed that it happens to be exactly 760mm for a mercury barometer, so that seems clear. That was the pressure used for STP (standard temperature and pressure), when I was doing chemistry. My old Oxford English Dictionary defines one *atmosphere* as 15 lb/ in^2 (103.42 kPa), which is probably the old Imperial standard. But there is also a thing called the Technical Atmosphere, which is 1000 kPa or 14.504 lb/in^2. As another example of how careful you have to be in blindly accepting figures from books, one of my references (The Dent Dictionary of Measurement), gives one atmosphere as 101.325 kPa (correct) or 14.72 lb/in^2 (instead of 14.696 lb/in^2). It looks as if someone's fingers slipped on the calculator keys.

The Dent Dictionary also says that the highest recorded atmospheric pressure was 32.01 inches, (108.40 kPa) in Siberia, and the lowest was 25.90 inches, (87.7 kPa) in a Pacific typhoon. You can make your own judgement of how much to trust these numbers.

What was a *Tower Pound*?

The *Tower pound*, was an early mass standard in U.K., so called because the reference standard was kept in the Royal Mint in the Tower of London. It was used particularly for precious metals and drugs and contained 5,400 grains, or 349.9g. At the same time the *mercantile pound* used for ordinary goods was 6,750 grains, or 437.4g. The *troy pound* of 5,760 grains or 373.2g, believed to have originated in Troyes, France, superseded the *Tower pound* in 1527 as the gold and silver standard, and increased trade with France led also to the adoption of the 16 ounce avoirdupois *pound* (453.6g) in the 16th century to replace the *mercantile pound*.

What quantity is referred to as *ullage*? And how does it relate to the *tret* allowance?

Ullage is the amount that the contents of a container of goods such as alcoholic drinks, grain or flour. is less than the full capacity, due to losses such as leakage, evaporation and spillage. This was a particular problem in days gone by with casks on long sea voyages. Suppliers would then make some allowance for this loss, and the term derives from the French word for eye, and referred to the practice of filling a cask to the eye (that is, the bung hole), either literally or figuratively.

The *tret allowance* was also a concession or discount, in this case on the weight of the contents of a container, after the weight of the container was subtracted from the total. The allowance was used in tenth and eleventh century England and France, and was equal to one twenty-sixth of the contents. But the tret allowance had one vital difference from ullage, and that was the rationale for it. It seems that it was believed that somehow the weight of container plus contents was not the sum of the individual weights, but slightly more. I can find no reason why this was believed to be so, but perhaps it could also have arisen from leakage, spillage and so on.

What is the essential difference between an *acre* and a *jugerum*?

The similarity between these two terms is that both were used to measure areas of agricultural land. And the similarity goes further than that. *Acre* was first used in about 1300 for the area of a field that one yoke of oxen could plough in one day, and the term *jugerum* derives from the Latin for "yoke area". So the *jugerum* could be considered to be the Roman acre. The difference is that the *jugerum* was a strip of land of fixed dimensions rather than an area of any shape, while acre is just an area of any shape. The jugerum got that way because it was originally two *actus quadraticus*, which were square areas 120 Roman feet on each side, so a *jugerum* was 120 feet by 240 feet.

The Roman system of land area measurement seems to have been built up, at least in part, using this idea of adding squares. The full system was as follows.

1 jugerum = 288 scrupula

= 2 actus quadrati

= an area120 Roman feet by 240 Roman feet

= 0.626 Imperial acres, 0.254 hectares

1 heredium = 2 jugera

= an area 120 Roman feet by 480 Roman feet

1 centurium = 200 jugera

1 saltus = 4 centuria, 800 jugera

You may notice that 1 scrupulum is equal to 100 square Roman feet. I have not been able to determine whether it was a shape 10 feet by 10 feet, but this would be consistent with a system of adding squares, so it may well have been.

What is the difference between a French *arpent* and a Canadian *arpent*?

First I should tell you that *arpent* is a unit of land area. The word was derived from the Celtic for "land measure", but its earliest traceable history is of its adoption in France around the 16th to 18th centuries with a value borrowed from the Imperial system, and equal to 100 square perches (see Quantification 2). So far this seems simple enough, but things were actually very messy. And I must confess that the question I posed was a bit dishonest, because what I really wanted to tell you about is the amazingly complex tale that surrounds this unit. First, the term was also used for a linear measure which was the size of the side of a square with an area of one *arpent*. Sometimes the term *arpent de surface* was used to distinguish it from the *arpent* as a linear unit. Second, there were different *perches* used in France and consequently different *arpents*. The main ones were the *arpent de Paris*, the *arpent commune* and *arpent d'onnance*.

The *arpent de Paris* was based upon the *perche de Paris* (approximately 5.847 meters), with each *perch de Paris* equal to 18 *pied du roi*. (The *pied du roi* or Royal foot, was discussed in Quantification 5, and was equal to 324.8 mm). This is the most commonly encountered *arpent*. It was also known as the *arpent des eaux et forets*, the *grand arpent*, and the *arpent de roi*.

The *arpent commune* was used in the rich agricultural provinces south of Paris before the 19th century, and was equal to 100 square *perches du commun*, about 4221 square metres. The *perche du commun* was 20 *pied de roi*.

The *arpent d'onnance* was used mostly for wooded land, and was 100 square *perche d'ordonnance*, approximately 1.26 acres. The *perche d'ordonnance* was *22 pied du roi*.

In Canada the *perche de Paris* and the *arpent de Paris* were imported with the French settlers in Quebec where it continued to be used after the British takeover, and in fact right up to the 1970's. The Canadian Weights and Measures Act of 1879 incorporated the *perche de Paris* definition of the linear *arpent* as follows: "The arpent, when used as a measure of length, shall be one hundred and eighty French feet; and when used as a measure of superficies, shall contain thirty-two thousand four hundred square French feet.". In 1919 the *pied* (or French foot), was legally equated to the Imperial system as 12.789 inches (325mm), making the linear *arpent* = 191.835 feet (58.47m). Note that this is a tiny bit different to the original *pied du roi*.

Would you believe that this curious story does not end there? The units were also imported to Louisiana as they were to Canada, but they ended up with two slightly different magnitudes. In the towns the units were identical to those in Canada, but in the rural areas they were just a bit different. The rural linear *arpent* was 191.944 feet (90.682m) instead of 191.835 feet. The reason, it seems, is that land was originally allocated in terms of linear *arpents*, but the region fell under Spanish control. When the province was in Spanish hands, the Capitán-Generál authorized land modules 6 to 8 *arpent*s wide by 40 *arpents* deep. In practice, the dimensions of the grants were often stated in *lieue*, and a number of different *lieue* were in use during this period (I have a list of nine different values in use in 1751). French and Spanish surveyors in Louisiana interpreted the lieue as 2500 toise de Paris, = 83 1/3 arpent de Paris instead of 84. Later when the region came under U.S. control they did the sums backwards, and came up with the rural value quoted above.

And a final interesting anecdote. The name *arpent* has entered into French-Canadian literary history as a result of the book by prominent French-Canadian author Philippe Panneton. The book is titled "Trente Arpents", which translates as "Thirty Acres", and deals with the plight of the small French-Canadian farmers forced by the economic and social upheavals of the late 19th and early 20th centuries into migration to the city.

That Pond

I extend my thanks to Max Purss for solving the *pond* puzzle from Quantification 7. He has told me that some of the old TESA brand force measuring instruments at NML were calibrated in *ponds* as well as *newtons*. The *pond* was a cgs unit for a gram-force, that is, the gravitational force exerted by a mass of one gram in standard gravity. So of course a *kilopond* was an alternative name for a kilogram-force. That still leaves the question of whether there was confusion in Holland between that definition and theirs of 500 grams weight.

More Questions to Ponder On

What is the connection between *pond* as a unit and pondering as an action?

We have addressed the *Arpent* question, now how about the *Arshin*? A clue: it is definitely not a Chinese soup.

How long is a league? Anyone who says something like "four quarters of 25 minutes", or "too long" is in the wrong business.

What is the difference between an Imperial mile and a Statute mile?

In the ships bell system of time marking there is no "five bells". Why not?

What sort of unit is a litre-atmosphere?

What are zoll and zak? Another clue: they are not cartoon characters.

What is measured using a tonometer?

What unit is described as a traffic factor?

What is unusual about the shaku as a unit?

■

Riverbank Reflections 5

Ron Cook

In the last Riverside Reflections I made passing reference to a recipe for carp. It seems to me that the recipe isn't everything, not just in cooking but in many other activities.

Some years ago I was given some help by a technical officer who had spent most of her life working on calibration of gauge blocks. I need help calibrating some standard inductors, quite a different process. The gauge block work involved careful preparation and wringing together of the blocks and observing dim interference fringes in an interferometer. The inductors were measured using a double balance 1 kHz bridge and observing dial readings on ratio transformers and a null indicator, all in a well lit environment. I gave the lady a brief training session and then let her try a calibration by herself. I looked at her results and compared them with previous calibrations. The results were very good so I asked her to repeat the measurement. The results were in excellent agreement with her earlier test so I asked her to continue with the batch.

By the time she had finished I realized had acquired a gem. Her results were better than I had seen by any previous workers, many with extensive electrical testing experience. Did she do anything different to them? No, she just did it better. Now exactly what did she do better? That's a hard question. She followed the "recipe" but achieved better reproducibility, and was doing the work quite quickly. It was that little undefinable extra skill or touch that some people have. As in cooking, the recipe isn't everything.

Management courses often provide "recipes" for the attendees to help them produce budgets, deal with difficult people, manage projects, and introduce change and so on. You only have to look at the same group of people six months later to realize that it requires more than a set of "recipes" to make a good manager. The way in which any management activity is done is as important as what is done. Some people have succeeded very well by making an art form out of doing nothing, others make huge contributions just being themselves and enabling others to reach their potential. People like this trouble many managers who were initially technical persons and are used to data collection, analysis and reaching a conclusion – a form of recipe.

Following a recipe is the only way for many people to operate. Not that there is anything intrinsically wrong with this, but attitude and personality do make a difference. Are there other examples where this applies to measurement?

I recently came across a case where a calibration report for a thermometer gave two corrections for a reading of 0 °C. The owner of the thermometer

decided to use only one of the corrections. Also there were five corrections of less than 0.1 °C and one of 0.55 °C. So maybe the recipe was incomplete in regard to what to do when two corrections are given, but what conclusions do you draw from this story?

Well, wouldn't you query the calibrating laboratory as to why they gave two corrections for the same scale point? I would. The other option would be to take the average of the two values as the certificate gave no indication as to whether one should carry more weight than the other.

The larger correction at the sixth point would have had me scurrying for the last certificate to see if that had been obtained last time. Plotting the corrections suggested to me that the correction should have been 0.05 °C, not 0.55 °C. A call to the calibration laboratory would have ensued if previous certificates did not show a similar correction. If there was no prior certificate then a scan of the manufacturer's data would also be in order.

This is more to do with attitude than the recipe. It reminds me of the US and the Japanese automobile manufacturer's story. The US car makers were concerned that the Japanese cars were of higher quality than the good old US of A version. A trip to Japan revealed that the Japanese were following all the recipes given to them by the US manufacturers. At this time the US manufacturers admitted to having gone through a process of introducing short cuts in the quality control. As the first short cut did not create any apparent problem the managers decided that it would be OK to implement many of these, as by themselves did not cause much of a problem. Sometimes the effect of many tiny things is greater than their apparent sum. The attitude was that the US makers could ignore the decades of experience they had built up and run a "mean and lean" quality system. It's a failing of humanity to think the current generation smarter that previous ones.

So it is sometimes with measurement. Of course there is nothing wrong with innovation or improving efficiency in measurement. However an opinion that some things are unimportant and can be ignored is often going to result in poor quality measurements if that opinion is based on gut feeling and not real evidence.

One advantage of uncertainty analysis is that it shows where the major sources of uncertainty come from. Another recent case involved a laboratory that spent a lot of money on a calibrated pressure transducer, but assumed that the digital voltmeter used as a readout device did not contribute to the uncertainty. Strain gauge pressure transducers are known to have non-linearaties, drift and hysterisis, but digital voltmeters are often thought of as being as good as the resolution. Sadly that is not true.

Again a state of mind or attitude that was more important than the test procedure in determining the quality of measurement.

Do you or your staff have the right attitude or are you recipe followers?

I wonder if with the right attitude would make carp more palatable.

■

Obituary - Trebor Parry Jones

On the fourth of April Trebor passed away after a long battle with Parkinson's Disease, just short of 76 years. For the whole of his career he worked in the Temperature section of the National Measurement Laboratory, most of that time as a Group Leader or Section Leader.

In the second half of the twentieth century Australian National Standards researchers made contributions to the international measurement standards effort far in excess of our size and wealth. Our Government and people wanted results the country could be proud of, and Trebor was one of those who delivered what they wanted.

Trebor inherited responsibility for high temperature standards at the tender age of thirty when his superior Jack Middlehurst transferred to Food Research, and he took up the reins with enthusiasm. Jack was an extrovert who loved to develop novel equipment, and with these traits he did two significant things: he constructed a photoelectric pyrometer (which had the capacity to decrease the uncertainty of high temperature measurements by a factor of about 50), and introduced temperature measurement short courses for those in science and industry who took temperature measurements. Trebor was a different man: he wanted his equipment to do useful measurements and he wanted the laboratory to make meaningful and personal contact with the people who used the standards we produced.

He put the pyrometer to work to produce the improved standards. This proved to be more difficult than anticipated because of the instabilities in the lamps used to store the radiance scales, and the job needed Trebor's dogged approach to problem solving. As the difficulties with the old pyrometer unfolded, Trebor planned and then built a super-pyrometer which was installed at the then new NML at Lindfield. The significance of this pyrometer is that it subsequently produced results that were a vital part of the International Temperature Scale of 1990, the version which is still current. This country contributed perhaps half of the data used for the scale from 660 °C upwards, and much of that using the NML pyrometer. I must add that Trebor himself did not do all of the work, and much of its value resulted from coordination with the resistance thermometry work that was done concurrently, but it was his vision and personality that enabled the complete package to be produced.

Although he was in some ways quite conservative in his research, in others he was bold. He was the first at NML to use serious electronic computing power for calibration apparatus, and for some years a mini-computer of a sort that was not common in laboratories at the time, controlled simultaneously the pyrometer and the thermocouple calibration apparatus.

Special mention must be made of Trebor's work with the NML Temperature Measurement Courses. Jack Middlehurst presented these courses alone. Trebor had every scientist in the Temperature Group present some part of it, so that participants and scientists met and gained an understanding of the work of each other. First-name relationships were formed so that interaction became easy and any perceived class distinction between industry and science was dissipated. Probably about a thousand people participated in the courses during Trebor's reign. It should be remembered that for most of this time promotions were based almost entirely on published papers produced, so this work was done not out of self-interest, but because it was right to do it.

Trebor was also the inaugural Coordinator of the Asia Pacific Metrology Program, which was formed to improve measurement standards in our region, particularly in "developing countries". His friendly nature served the Program well, and it has been reported by old NML staff that if they visited a standards laboratory anywhere in our region, they would be greeted with "And how is our friend TP going?".

Trebor deserves our recognition for two particular reasons. First he was representative of a band of hard-working metrologists who raised the status of Australia in the measurement standards community from the coat-tails of Britain to a world leader. Secondly because he was exceptional in that band, in promoting good measurement at the grass roots level of industry. If the Metrology Society had existed in his time, he would have been recognised as a major contributor to some of MSA's aims. But for me personally, I will remember him most for just being a good man who cared about people as well as his job.

- *Jeffrey Tapping.*

History - The lady who sold time

Stephen Battersby

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If you wanted to know the time in 1930s London, you could listen for the pips on the radio, subscribe to a telegraphic time service - or arrange a weekly visit from an octogenarian spinster called Ruth Belville. For almost 50 years, Miss Belville had carried Greenwich Mean Time from its home at the Royal Observatory to a few dozen clients around the city, using a watch even older than she was. Members of the Belville family had been running this service with the same silver-cased chronometer for more than a century, and despite the arrival of new technologies, their business flourished. But as newly discovered documents show, at the start of the 20th century one of the most powerful people in the time industry did his best to put Ruth out of business....

In early 19th-century London, time was in high demand but short supply. Good clocks and chronometers were becoming more widespread, but a good clock is little use unless it is set to the same time as everyone else's — a standard time.

Most people who owned a dock had to set it by sundial, which was accurate to two minutes at best. And if you wanted to do better than that? By far the most accurate time was kept by astronomers, who needed it for their own observations and who also supplied it to mariners for the calculation of longitude. "So if someone wanted more accurate time, they could come and knock on the door of the observatory and ask the Astronomer Royal, 'Can I have a look at your clock please?'," says David Rooney, curator of horology at the Royal Observatory in Greenwich.

And people did. Chronometer makers in particular needed to know the time accurately during the manufacturing process and to set their finished chronometers. John Pond, the Astronomer Royal, grew sick of being asked the time, and the chronometer makers tired of having to ask: eventually they sent Pond a petition asking for a more convenient service.

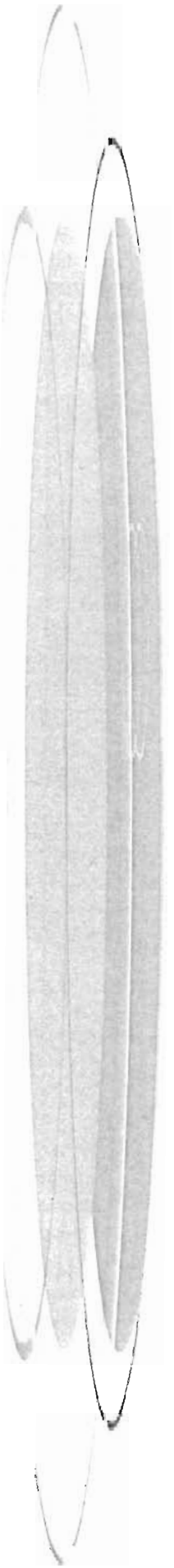
Pond gave the job to his assistant John Henry Belville, or Mr John Henry as he called himself to disguise his French origins during a time of widespread anti-French feelings. Henry needed a suitable timepiece to carry Greenwich time from the observatory to the city, so Pond gave him a chronometer by the greatest makers of the day, John Arnold & Son. The chronometer had been made for the Duke of Sussex, George IV's clock-mad younger brother. But it was too large for the duke's taste: he sent it back, complaining that it was "like a warming-pan". Henry was more bothered by its gold case, which he had replaced by a silver one because, according to a later newspaper report, "his curious profession takes him occasionally to the less desirable quarters of the town".

Henry started his rounds as the world's first time distribution service in June 1836, travelling to the city on the new London to Greenwich Railway. He had about 200 clients, not just chronometer makers and watch and clock repairers, but also banks and city firms, which were becoming increasingly aware that it was important to know the precise time of a financial transaction. Along the way he stopped off at some private households, for whom having the genuine Greenwich time -accurate to a few tenths of second - must have been something of a status symbol.

When Henry died in 1856 the job passed to his widow, about whom we know almost nothing. She retired in 1892, leaving the time delivery service to her daughter Ruth. For the next 16 years Ruth quietly carried on the business. Every Monday morning, she left her cottage near the town of Maidenhead in Berkshire and travelled to Greenwich. There she checked her chronometer against the observatory clock, obtained a certificate showing how much Arnold - as she called the watch- differed from GMT, and then set off on her rounds. But in 1908 Ruth's routine was about to be rudely interrupted: the forces of big business were planning an attack.

"Genuine Greenwich time must have been a great status symbol"

This rather shabby episode came to light only last year during preparations for the new Time Galleries at the Royal Observatory, Greenwich. In the observatory's Cambridge archives, Rooney discovered a file of letters and press clippings. With that file, and fragments of information from



other archives, he has reconstructed the story.

It starts on 4 March 1908, when a Mr St John Wynne addressed a group of city councillors and aldermen at London's United Wards Club. Titled "A plea for uniformity", its theme was the need to synchronise clocks across the land. Wynne argued that a modern, efficient society needed to be well ordered in time. Although GMT had become the legal time in Britain in 1880, Wynne felt that too many people and businesses were sloppy about setting their clocks.

There was no need for such sloppiness, he declared. After all there was a perfectly good time distribution service - by electric telegraph. Time by telegraph had been around since 1852, yet inexplicably there were still those who clung to old and inefficient ways. There were even some who relied on the services of a woman who wandered about with a chronometer.

As The Times reported three days later, Wynne had been scathing about Ruth's business. "It might be amusing to the present company to learn how GMT was distributed to the watch and clock trade before the present arrangements came into vogue," he began. "A woman possessed of a chronometer obtained permission from the Astronomer Royal at the time (perhaps no mere man could have been successful) to call at the Observatory and have it corrected as often as she pleased... The business is carried on to this day by her successor, still a female I think."

It seems that Wynne wasn't just rubbishing Ruth's service but her character, hinting that she may have used her womanly charms to gain access to the observatory. Without such special treatment, how could she stay in business?

Who was this man? Wynne, it turns out, was a director of the Standard Time Company - the largest private supplier of telegraphic time signals in Britain. His audience may have known, but The Times failed to mention it. Rooney also found that the worst of Wynne's insinuations are missing from the official version of the speech, published in a pamphlet. "It may have been sanitised, which suggests to me that the lecture itself was more critical than the published account. How many other lectures did Wynne give that weren't published or picked up in the press? My feeling is this was a drip-feed assault on a rival business," he says.

Wynne's motive is clear: he wanted an even bigger slice of the time industry. While the Greenwich observatory's own telegraphic time signals went mainly to the railways and the post office, the Standard Time Company established its own telegraph network, carrying signals from its own regulator clock (checked against GMT by a direct telegraph line from Greenwich) to private homes and businesses. With Ruth gone, STC might sign up her clients.

The first Ruth knew of all this was when a reporter from The Times turned up on her doorstep, waving a copy of his article. Soon she was inundated with reporters eager to find out more about the "Greenwich time lady". She was mortified and feared for her livelihood: the observatory could so easily end what had never been more than an informal arrangement. She wrote a series of apologetic letters to the then Astronomer Royal William Christie. "I deeply regret that the Observatory should think I had anything to do with starting this controversy." Christie was evidently unperturbed.

In the event, Wynne's efforts backfired. "I think the Standard Time Co. will not attack me again in public," Ruth wrote in a notebook a few years later. "All the result he obtained" was "to advertise the chronometer at the Company's expense". She continued her rounds for another 30 years.

Rooney believes that even in its later years, Ruth's business was not the anachronism most people thought. The telegraph had its own drawbacks. You had to rent your own telegraph line, which was expensive, and when wires and relays failed - as they often did - the service came to a halt. Ruth, on the other hand, only missed a day if ill. After 1924 the time pips were broadcast by radio, but early wireless sets were costly and required a licence and a large aerial.

Eventually radios did become commonplace, and from 1936 anyone with access to a telephone could get their GMT by calling the speaking clock. Yet when Ruth finally gave up her rounds, probably in 1939 at the age of 86, she still had some 50 subscribers. She died four years later leaving no heir, and so remains London's last time carrier.

■

MSA 7th Biennial Conference

The Metrology Society of Australia will stage its 7th Biennial Conference in South Australia in July 2007. The Conference will focus on issues of international measurement uniformity, including measurement techniques, education and its application in practice.

We will hear from an industry that finds international measurement uniformity absolutely essential - the Australian Submarine Corporation - and why it is so important that for example, parts made in Germany fit with parts made in Australia, be it electrical or dimensional.

The Conference will start on the evening of the 25th July 2007, with registration and the famous "NATA Starter" cocktail party with entertainment by the equally famous "The Five Degrees of Freedom"

The venue has been chosen for its stunning outlook, accommodation quality and proximity to the "visits" set for Thursday afternoon. The activities anticipated are a visit to a submarine (subject to availability& with limited numbers), the State forensic laboratories, Torrens Island power station and "Wine Education" by wine microbiologist Andrew Yap.

The venue is The Lakes Resort Hotel, West Lakes, 10 kilometres North West of Adelaide and the banquet dinner on Thursday night will be overlooking the Lake and feature entertainment by Linda McCarthy and guest comedian Kel Watkins.

For those who wish to value add by extending their stay, a wine tour will be organised for the Saturday 28th July. If you intend to enrol and will join a Saturday wine tour, please email the Conference organisers indicating your interest to *lesfelix@chariot.net.au* . If sufficient interest is shown, a formal invitation and fee value will be posted.

Look for information such as enrolment forms, call for papers, paper template and paper referee information from the MSA web site. A hard copy lift out of the enrolment form will be sent in the Christmas edition of TAM. All questions you have of the Conference Committee can be sent via the email address above.

Thank you

The Conference Chairman

Les Felix

CALL FOR PAPERS

The Metrology Society of Australia will stage its 7th Biennial Conference in South Australia in July 2007. The Conference will focus on issues of international measurement uniformity, including measurement techniques, education and its application in practice. Papers submitted are not limited to this subject as outlined in the scope of the conference, but will be subjected to the guidelines listed on page two. The paper template must be followed to avoid printing issues. The template will be available upon request.
Further information can be gathered by contacting the Conference Chairman (details below).

SCOPE OF THE CONFERENCE
The conference will welcome contributions from all areas of metrology. The topics include but are not limited to:

- *Metrology in industry*
- *Education and training*
- *Dimensional metrology*
- *Optics and Radiometry*
- *Pattern approval*
- *Metrology in medicine*
- *Measurement uncertainty*
- *Metrology and globalisation*
- *Chemical metrology*
- *Measurement of Heat and Temperature*
- *Electrical metrology*
- *Trade measurement*
- *Environmental metrology*

CONFERENCE TIMELINE

o 31 January 2007	*Submission of short abstracts by authors*
o 15 February 2007	*Notification sent to successful authors*
o 31 March 2007	*Submission of full papers to conference convenor*
o 15 April 2007	*Discount Registration Deadline*
o 25-27 July 2007	*7th Biennial Conference of the MSA*

SUMBMISSION GUIDELINES
Authors are required to submit abstracts (maximum of half a page) before **31 January 2007**.

The abstract should clearly describe the work and also indicate the preferred from of presentation (oral paper, poster paper or workshop). Submissions will be reviewed on the basis of their relevance to the theme and aims of the conference and to the development of metrology skills. Successful applicants will be notified, by **15 February 2007**, at which time they will receive guidelines on the preparation of the full papers to be published in the conference proceedings.
Submit the abstract, either electronically or in hard copy to the Conference Chairman.

Additional information can also be obtained by contacting the Conference Chairman by any of the following media.

Post
Mr Leslie Felix
Conference Chairman
42 Light Terrace,
Thebarton
SA 5031

Email
les.felix@abstec-calibrations.com.au

Phone/Fax
Phone 61 8 8354 1355
Fax 61 8 8354 1377

Up-to-date information appears on the MSA website at www.metrology.asn.au

Metrology and Globalisation – Benefits, Problems and Risks

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Reprinted from the MSA 2005 Conference "Smart Measurements - Metrologists Advancing Industry"

Abstract

The paper discusses the benefits and liabilities of Mutual Recognition Agreements as they relate to pattern or type approval. In the rush by manufacturers to introduce new products and technologies into the market place the pressure on regulators is increasing. In the paper we explore the advantages of a global approach and at the same time attempt to identify the problems that will have an impact around the world. It is difficult for regulators to keep abreast of the rapid changes in technology which tends to leave the standards producers in catch up mode. This has the effect of placing testing laboratories in a position of individually developing test procedures to meet the demand of their clients. There are obvious benefits in reducing the amount of testing that is carried out but this must not be at the expense of the performance and accuracy of the measuring instruments.

1. Purpose

The purpose of this paper is to review the trend towards greater globalization through the use of Mutual Recognition Agreements (MRA) and to identify the benefits, problems and risks associated with this trend.

This paper will focus on these issues particularly as it relates to the testing and approval of instruments that are to be used for trade in Australia.

2. Background

The National Measurement Institute has the responsibility under the National Measurement Act to examine and approve instruments that are to be used for trade. The definition of in "use for trade" as found in the National Measurement Act is "in relation to a measuring instrument means use of the measuring instrument for either or both of the following purposes:-

(a) determining the consideration in respect of a transaction;

(b) determining the amount of tax.

Simply put if money changes hands during a transaction on the basis of a measured quantity using a measuring instrument then the measuring instruments is considered to be in use for trade.

The normal process that had prevailed for many years was that instruments that were intended for trade use in Australia were subjected to the full range of tests in accordance with the OIML international standards that applied to the type of instrument. This process was costly and time consuming which led to manufacturers carefully assessing the market potential in Australia before committing to the pattern approval process.

This situation was common throughout the developed world where attempts at of the OIML standards but no reduction in the requirement for each country to conduct a full suite of tests before granting approval.

There are certainly benefits for instrument suppliers in reducing the time to market for measuring instruments; however it is hard to believe that haste to meet such commercial imperatives should outweigh the need for careful and thorough consideration of metrological implications.

The pressure on regulators and manufacturers to meet the demands of technological improvements in a shrinking world with more unified markets has led to the use of Mutual Recognition Agreements as a way of reducing the time and cost imposed on manufacturers in order to have their equipment approved for use in as many markets globally as possible.

A number of unilateral Mutual Recognition Agreements have been entered into with guidelines intended to ensure confidence that the testing carried out in each laboratory is of a similar standard. These guidelines have taken a number of forms: - firstly there has been the reliance on Third Party Accreditation to an International Standard (usually ISO 17025) with the accreditation being carried out by an organization that is a signatory to the ILAC agreement – secondly there has been some acceptance of peer assessment as the basis for a Mutual Recognition Agreement.

As the pressure increases for more Mutual Recognition Agreements and the proposed OIML Mutual Acceptance Arrangement (MAA) it is time to review the benefits, problems and risks associated with Mutual Recognition Agreements as they affect the global market.

3. The Benefits of Mutual Recognition Agreements

There are many factors involved with the use of

Mutual Recognition Agreements some of which provide considerable benefits to instrument manufacturers in their push for rapid introduction of new technology into the market place.

These benefits are:-

- The reduction in time and cost with testing being carried out by a single laboratory. This provides the benefit of obtaining approvals that will be accepted in many countries around the world without the need for repetitious testing by each authority prior to granting approval.
- The advantage of being able to work closely with one authority building relationships and reaching a consensus on interpretations of the relevant design recommendations.
- Consistency of interpretation of design recommendations. This is particularly important as many of the recommendations can be interpreted in line with the national requirements of the country of the testing authority, unfortunately these interpretations are not always the same in all countries.
- Geographical position assists with keeping transportation costs to a minimum avoiding the need to ship expensive equipment around the world with no certainty of achieving approval.
- The trend towards issuing authorities accepting test results carried out by the manufacturer without any third party assessment. This trend offers enormous advantages to the manufacturer as it avoids costly retests if failure occurs during testing in an issuing authority's laboratory.

4. The Problem with Mutual Recognition Agreements

When we talk about Mutual Recognition Agreements the question arises Mutual Recognition of what?

Many years ago the world moved towards the international standardization of the design recommendations for a wide range of different instruments through the OIML. Unfortunately technology is changing at a rapid rate which has meant that the OIML recommendations have been unable to keep pace therefore leaving critical decisions on the impact of new technology to individual issuing authorities.

This has led to the involvement of many different decision making bodies in determining the suitability or otherwise of a feature or function of a new instrument.

Participants in Mutual Recognition Agreements are confronted with instruments that comply with a range of different acceptable conditions. Certificates of approval issued refer to a range of different approval criteria such as "tested to OIML, complies with WELMEC, meets EC Directives, etc." This situation has created difficulties for manufacturers who are competing for sales internationally where the purchaser requires a statement of compliance for the instrument that is being sold. Two different issuing authorities can provide the same statement even though there are substantial differences in the construction and operation of the instrument which can create a significant commercial imbalance.

Each issuing authority conducts the required tests in accordance with the procedures specified in the relevant OIML document. Although these procedures are well specified for some aspects, there are gaps in others, and variations in test facilities contribute to variations in the applications of these tests. This sometimes causes variations in the end results. Several inter-comparisons have been carried out in the area of type or pattern approval amongst a number of issuing authorities with varied results. Most inter-comparisons in the area of type approval do not achieve much in the way of benefits due to the failure to investigate the causes of variations between participating laboratories.

It is perhaps worthwhile indicating here one of the difficulties that exists between EU arrangements and those in a country such as Australia.

The NMI in Australia has long had a commitment to adoption and implementation of OIML recommendations, and has tried to maintain participation in development and revision of these recommendations through OIML processes (with the spread of OIML work into new areas this is becoming increasingly difficult with our limited resources).

However there has increasingly been regional development (particularly the work of WELMEC in developing the WELMEC Guides) of interpretations / more specific requirements / extensions. We recognise that there is a lot of value in this work, but it is a process in which Australia has had no significant input, and consequently Australia has no commitment to adoption of these requirements and procedures.

As a result manufacturers run risks if they assume that equipment designed to meet European requirements will necessarily meet requirements in other countries.

No doubt there will be pressures for WELMEC Guides to be adopted into OIML Recommendations, and once this has occurred Australia will feel an obligation to accept and implement these procedures. It is difficult to escape the feeling that this is not a desirable process, and provides an unfair degree of influence to the EU countries (with the number of EU countries effectively presenting OIML with a fait accompli). We believe that it is important for OIML that all member nations feel that there is a reasonable possibility for their input to influence the outcome in recommendations – and therefore feel that preparation of new procedures should be carried out through the OIML processes in the first instance.

5. The Risks Associated with Mutual Recognition Agreements

Mutual Recognition Agreements are seen by manufacturers as a means of avoiding repetitious time consuming testing therefore allowing their products to reach the market place in many countries almost simultaneously.

Mutual Recognition Agreements are seen by issuing authorities as a means of allowing new technology into their respective countries with an acceptable level of confidence that the instruments conform with the relevant requirements.

Although both manufacturers and issuing authorities see benefits in Mutual Recognition Agreements there are also some associated risks.

Mutual Recognition places total dependence on one issuing authorities ability to test, correctly assess and fully understand an instrument. The risk is that the issuing authority will only apply the requirements that are considered of importance by that issuing authority. This may mean that some aspects of an instrument will not be assessed in a similar way to other issuing authorities thus causing other issuing authorities time and energy in determining any variations in assessment that may exist.

With Mutual Recognition Agreements only one instrument is fully tested and on the basis of one successful test the manufacturer is free to sell as many instruments as they wish.

6. Mutual Recognition - Acceptance induces competition between laboratories and approval authorities

Mutual Recognition Agreements have changed the way that issuing authorities operate. They have introduced the element of competition into the area where each authority competes with each other for the testing work that is available. Manufacturers have the ability to shop for the best price and the shortest testing time.

Advantages

- Speed
- Responsiveness
- Cost Minimisation

Disadvantages

- Haste
- Short-cuts
- Lack of thoroughness
- Placing commercial demands above metrological aspects
- Favoritism for 'Crucial' clients
- Reluctance to reject
- Tendency to lowest cost
- Lowest common denominator testing

7. One World, One Standard, One Test

The serious danger in this is that one incorrect test, incorrect interpretation or failure to detect non-conformance with a standard can rapidly be perpetrated around the world. At present mechanisms to detect and correct failure to comply appear to be slow and cumbersome, or lacking altogether.

What harm is involved in this?

- An 'uneven playing field' can develop, where manufacturers that stick closely to strict interpretations of a standard, and place a strong emphasis on compliance and quality become disadvantaged relative to those that place less emphasis on compliance and quality or that seek out a lenient interpretation (competition and differences between approval authorities means there is a good chance that one may be found).
- As a consequence of the above the tendency could be toward developing an attitude of 'what can we get away with' rather than 'what is required by the standard and good measurement practice'.
- The resulting reduction in standards has the potential to reduce the confidence in the approval processes, reduce the quality of measurement.

8. Ways of Addressing Identified Risks

The aim should be to identify the risks, and in cooperation with other international test laboratories agree on common solutions and interpretations. In this way it may be possible to achieve international acceptance of test results based on a common standard, common interpretation and

uniformity in the application of that standard. Inter-comparisons between the participating laboratories is a way of achieving confidence in the uniformity of the final result.

9. Mutual Acceptance of Test Reports vs Mutual Recognition Agreements

Currently NMI has agreements for Mutual Acceptance of Test Reports (in the areas of Non-Automatic Weighing Instruments, NAWI Indicators Load Cells and Driveway Flowmeters) with NMi (Netherlands), NWML (UK) and the Trade Measurement Service in New Zealand.

It is perhaps worth mentioning here what is meant by Mutual Acceptance of Test Reports – it does not present an automatic acceptance of an instrument tested/approved by one of our MRA partners. NMI does still require an instrument and documentation for examination and carries out some functional tests, particularly in areas where we have found differences in interpretation. The Mutual Recognition Agreements do however generally mean that the results of testing carried out by our MRA partners will be accepted without repeating them although we reserve the right to carry out additional tests if we wish. It is still necessary for NMI to prepare and issue approval certificates that are legally acceptable in Australia.

One of the most difficult areas is that relating to which and how many instruments in a family of instruments should be tested. Except in the case of load cells the OIML recommendations do not address this. Our impression is that the practice in Europe has been to approve a much wider range of instruments based on the testing of a smaller selection of instruments than would previously have been the case in Australia.

Consequently NMI has in some cases only approved a limited number of the instruments granted approval in Europe. NMI has also been tending to reduce the number of instruments in a family that it will test which again is an example of the pressures that exist towards 'Lowest Common Denominator' testing.

10. Modifications

Mutual Recognition Agreements also have implications where a manufacturer implements changes to the design of an instrument.

The manufacturer may then advise the original testing authority and either have additional testing carried out or obtain agreement to implement the changes without additional testing.

The decision regarding whether or not additional testing is necessary is a difficult technical and administrative decision for which there is little guidance in OIML recommendations. Consequently there is substantial potential for different conclusions to be reached by different authorities.

Mutual Recognition Agreements need to consider whether the decision by the original approval authority will be automatically accepted, or not.

The NMI Mutual Acceptance Agreements require the manufacturers to provide advice regarding any changes to both the original testing authority and the NMI in order to allow independent consideration of the need or otherwise of additional testing.

If automatic acceptance of such decisions is provided this certainly is a simpler and clearer process for the manufacturer, but provides another pressure for adoption of a 'lenient' decision. This means that manufacturers may tend to gravitate toward a test / approval authority that is more inclined to accept such changes without retesting.

11. Self Declaration

One of the avenues to approval and market acceptance in Europe is through self declaration. Given our concerns relating to Mutual Recognition Agreements, and the pressures toward reductions in testing / examination thoroughness, we feel that self declaration leaves too much potential for type approval decisions to be improperly influenced by commercial pressures within the company.

In the last couple of years there have been a number of instances in the business world of major problems occurring due to inadequate surveillance (e.g. lack of true independence of auditors). We believe that the lessons from this should be heeded.

It may be that in the future the OIML requirements become sufficiently well defined that moves toward self declaration could be justified – at this stage we believe that they are not.

12. Conclusion

The benefits of Mutual Recognition Agreements can be easily seen but it is important to recognize the risks that are associated with these agreements. We must be vigilant in ensuring that the short term benefits do not destroy the unstated level of consumer confidence that currently exists.

We must also be vigilant, as issuing authorities start to accept test results from accredited manufacturers, that we do not abrogate our responsibility to consumers and place total reliance on the "Third Party Accreditation" process without some form of checking to ensure compliance with the metrological requirements.

Confidence in the system and in Mutual Recognition Agreements can be maintained by a greater understanding of all issuing authorities of the effects that variations in standards, government requirements and local market conditions can have on the considerations that are made when an issuing authority approves an instrument "in accordance with the design recommendations".

Metrology is in a constant state of change and the implementation of mutual recognition agreements is certainly that. However unless carefully controlled, mutual recognition agreements may tend to drag testing and approval procedures to a lower, less reliable, level – in this respect they have the potential to be a liability. ■

Important Note from the Treasurer

2006 Membership Fees

We are progressing this year with a new system for the management of fees collection which tightens up on previous arrangements. Members who haven't paid in February have been reminded in April and again in June. There are still some who haven't replied and they will be marked as retired in August. To ensure you continue to receive TAM and e-Newsletters please make sure your payment is in. If you're unsure as to the status of your membership please contact either myself at randall@auspressurelab.com.au or Maria at maria.mochnik@nmi.gov.au and we will email a reply or forward an invoice copy.

Randall Anderson - Treasurer