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FROM THE PRESIDENT

President's Report to the MSA AGM, September 22, 1999

This last year saw the national committee fully recovered after the transfer from Melbourne to Sydney, and able to concentrate on the operation of the Metrology Society as a national body. While members are most heavily concentrated in Victoria and NSW, groups in SA and Queensland have reached the stage of needing to be slightly more formal in their operations, due to growing numbers and the desire to see the workload more equitably shared. Fledgling contact is maintained with the other states. In common with many endeavours, a local champion is required for progress to continue. The operation of the website and editorship of TAM are two tasks that have been decoupled, at least in location, from the national committee. The society is fortunate in having editor Maurie Hooper and webmaster Mark Thomas settled in their roles and doing an excellent job in disseminating information to members.

The society extended its wings internationally during the year, with Honorary Fellow Bill Blevin representing us at the IMEKO committee meeting and conference, held in Japan. The last year has seen the Graduate Certificate in Metrology surface in earnest at Swinburne University. The Education Sub-committee of MSA assisted with the concept, structure and course outline for this undertaking. While MSA as an entity has no direct involvement in the course material development and presentation, its members will be contributing in an individual way. Another activity of the national committee was to survey the members on their needs and views for the society to progress. The responses are still being collated – the results will be discussed and acted upon by the incoming committee, and published in TAM. The committee also established guidelines for corporate sponsorship, particularly to cover those firms where a metrology responsibility and interest was maintained but staff might rotate through the role.

Funding was provided towards the re-binding of material presented by Capt. Henry Kater to the Royal Society of New South Wales in 1818, on his pendulum experiments. Members can view this book at the Macleay Museum in Sydney.

The committee recently approved a second Honorary Fellow for the MSA. This is to recognise John Birch, head of the National Standards Commission, for his contributions to metrology, especially his lead-role in legal metrology in the Asia-Pacific region. Congratulations, John. The intent was to present the award at this AGM, but unfortunately John is unable to attend the conference, being engaged in exactly the work that generated the recognition.

On behalf of you, the members, I'd like to thank the outgoing committee for their efforts during the year, and their employers for granting time to deal with what are generic interests in metrology. I'd particularly like to thank our treasurer Marian Haire and secretary Laurie Besley – their efforts beyond the regular operation of the society will make it easier to transfer operations in the future, all part of being a vibrant national organisation. Thanks also to Kerry Marston and her committee in producing MSA99, operating essentially independently of the national committee.

- Jim Gardner

FROM THE EDITOR

Another issue – and again the difficulty of deciding which articles to keep for the next issue! Because of the material available, some of the new innovations promised last issue have been held over until next year, together with some technical articles. I trust you will find something of interest in each issue. In fact I welcome input from our readership – please let your views be heard, especially if you are dissatisfied.

It is time to mention **computer viruses** – since I've received two in the last two months (in Word documents attached to e-mails). Luckily my anti-virus software detected both and I deleted the files before they could harm my system. (Anyone who sends me a virus is sure to get a curt reply for their troubles!) I feel we all have a duty to ensure we do not (even unwittingly) pass computer viruses on to others.

- Maurie Hooper

Mechanical Testing of Ophthalmic Lens Materials

Submitted by Trevor Bell who is on secondment to Ian Wark Research Institute, University of South Australia from NML,Lindfield NSW.

Introduction

The primary physical characteristics which must be considered when discussing lens materials are the optical properties. Depending upon the application, clarity, colour or refractive index may be the main selection criterion. However, from time to time other, non optical criteria may be of increased importance, for example heat resistance in microscope objectives used in high temperature work.

In ophthalmic optics these same considerations apply but additionally, the mechanical properties are a significant consideration since the lenses are exposed to a wide range of environments and subject to physical handling, in many cases, dozens of times per day.

Over the centuries many materials including various natural materials have been found to meet the above requirements to various degrees. For example, emerald is reported as giving the Emperor Nero a soothing green view of the games and later, certainly by the beginning of the 14th century quartz, or rock crystal was fabricated into eye glasses for the educated and affluent of Europe[1]. Modern crown and flint glasses are perhaps the most well known materials. However, what is less well known is that, primarily for comfort but also safety reasons, more than 90% of today's glasses are fitted with polymeric lenses.

The mechanical properties of ophthalmic lenses must be such that the minimum requirement is the maintenance of geometric integrity during use. Initially the material must be able to be fabricated into the appropriate shape by grinding and polishing or moulding. In the longer term the material must be reasonably tough and abrasion resistant.

Problems of scratch resistance in polymeric materials has had to be overcome and this has been addressed by the use of a wide range of multi-purpose coatings which enhance scratch resistance as well as imparting antireflection, tintability and other benefits[2]. However when something is improved there must be a test or tests which can demonstrate such improvement and quantify the result. Furthermore, as new materials are developed they require new test techniques and there is a need for refinement and increased understanding of existing test methods if they are to be appropriately applied and understood.

Mechanical Tests

Toughness

Most tests applied to spectacle lenses are a standardised version of the kind of failure which might be encountered during use. In the case of toughness the concern is that the lens will catastrophically shatter upon being struck and it is evaluated in terms of impact resistance by a standardised drop ball test. Increased impact resistance in glass lenses is obtained by differentially stressing the lens surfaces and interior. This may be achieved by annealing and subsequent quenching or by ion exchange reactions on or directly under the glass surface. Such chemical toughening may be applied to thinner lenses than thermal strengthening however to achieve high toughness in a glass lens usually requires increased thickness.

Polymeric lenses are inherently tough compared to glass. However, the overall toughness is reduced by the application of hard coatings and so most types of polymeric lenses are also subject to toughness specifications.

Apart from evaluation in terms of the height of ball drop that a lens will survive, this test is generally a pass/fail test.

Adhesion Testing

The Cross Hatch *adhesion test is applied to determine how well attached a coating is to its lens substrate. A pattern of cuts at right angles to each other is made into the coating through to the substrate. Adhesive tape is applied to the cross hatched area and upon removal the resultant cracking at the cut edges or peeling of segments between cuts is evaluated subjectively on a scale of 1 (poor) to 5 (good) by visual comparison with a standard pattern.*

Obviously, if tests are to be reliable and repeatable the tape, the pressure with which it is applied and the manner in which it is removed must all be specified. These factors, in combination with the subjective evaluation of the resultant surface damage make this test very dependent upon the expertise of the examiner.

Abrasion Testing

Abrasion may be defined as general damage to the lens surface caused by attrition or erosion either from impact or friction. This type of damage can be measured quantitatively with a haze meter which measures the scattering of a light beam as it passes through a lens.

Haze measurements are not necessarily directly related to surface damage and certainly don't reveal anything about damage mechanisms, a knowledge of which is necessary for a research program directed at understanding failure mechanisms and developing materials which will improve surface performance.

Like mechanical tests in most fields those used in the ophthalmic industry whilst aiming to measure intrinsic materials behaviour usually actually evaluate the materials in accordance with the standardised rules of the test. They do allow materials to be scaled but may not necessarily reflect performance in service situations.

The Taber Test was originally used for testing the durability and abrasion resistance of paint by measuring the weight of paint removed during the test. In 1982 the test was modified and approved for use in testing "the resistance of transparent plastics to one kind of surface abrasion by measurement of its optical effects"[3].

The test consists of rotating the lens under a rubberised abrasive wheel rotating in the opposite direction and results in an annular abraded area on the lens surface which is the width of the wheel. The wheel must be conditioned to the shape of the curve of the lens and the test is controlled by testing standard lenses before and after a specified number of test lenses.

The Bayer Test was created to determine the durability of automotive paint. The test was later modified to test abrasion resistance of plastics used as transparent windows and was subsequently incorporated into the ophthalmic field.

It consists of oscillating the test lens under a bed of abrasive media for a set number and frequency of back and forth oscillations. The abrasive medium consists alundum, a form of aluminium oxide, or silica sand which is defined in terms of grain size and weight of material used.

The Steel Wool Test is probably the most popular test in the optical industry as it is easily demonstrated, at least in a very simple way, on the shop floor. The standardised test was developed in the 3M Company in 1975 and was focused on the amount of force that was required to reach the threshold of penetration of the surface on an abrasion resistant coating before scratching occurred. Unlike the above tests, this test was created specifically for the optical lens market.

This test is more subjective in assessment and more difficult to quantify than other methods. However, because the test was developed to simulate the coating and substrate failure under load bearing conditions, it is of immediate relevance to the industry. Steel wool tests vary, however, all involve a given force, a standard grade of steel wool and a controlled number of oscillatory strokes.

When the lenses are severely scratched the damage can be evaluated by measuring haze.

The Young Tumble Test was created in 1973 at American Optical to simulate the equivalent of one year of typical wear conditions and field samples from various wearer and market tests were used to validate the technique. It approximates long term low level wear such as cleaning and placing the lenses in a storage case. As the name implies the test lenses are placed in a rotating drum with the test media which consists of a combination of abrasive materials like 3M Scotch Pads, polyurethane foam, coarse saw dust, abrasive sand and whole bran wheat in a rotating drum with the test lenses. Specific amounts of each material are used to create the test medium. The test time and speed of the tumbling drum are controlled and the test results are evaluated by haze measurements.

A more quantitative approach

Whilst each of the above discussed test procedures and and quite a few more enjoy acceptance in the ophthalmic industry as a means of ranking lens materials and coatings, they are by no means universal in application [4]. As such it is difficult to reconcile anomalies which can arise, for example, by a material performing well in a steel wool test but comparatively poorly in a Bayer test. Such anomalies are certainly due to differences in the failure mechanisms to which various materials are susceptible and differences in the types of abrasion caused by the tests.

To more quantitatively evaluate new coating materials SOLA International Research Centre at Lonsdale, SA, in collaboration with the Ian Wark Research Institute at the University of South Australia are using the CSIRO developed Ultra Micro Indentation System (UMIS)[5]. Using very small test loads (less than a few mN) this instrument performs nano hardness and scratch tests sensitive enough to determine the mechanical properties of the surface without undue influence from the substrate material.

This work will lead to a better understanding of the abrasive processes involved in the above discussed tests, but of more importance, the aim is to quantitatively determine surface deformation processes of coating/substrate systems and correlate these with observed product performance.

Surface hardness, elastic modulus and coating/substrate adhesive data obtained in indentation and scratch testing, in conjunction with finite element modelling, will be used to design materials systems which optimise those mechanical properties which lead to improved performance of spectacle lenses. ❑

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The Australian Museum Eureka Prize for Industry

The MSA invites members to contact the Society if they would like the MSA to nominate their company for the 2000 Eureka Prizes. his prize is awarded annually to a business, company or corporation which "through innovation or outstanding commitment to research, development or training, has sought to elevate corporate responsibility for scientific endeavour to a level consistent with our national capacity and needs."

The MSA feels that it would be great for metrology in Australia if a measurement initiative were to take out such a prize. Therefore the Society is eager to have a role in nominating a company with which one of our members is associated, or in providing the required referee's comments on the nomination entered by the company itself.

Nominations for the Eureka Prize must be received by the Australian Museum by February 11, 2000. Further details may be obtained from the MSA Secretary, Laurie Besley. The entry/nomination form may be viewed on the Australian Museum's website at www.austmus.gov.au/eureka, or Laurie Besley can send you a printed copy.

The winner of the Prize will be announced at a high-profile ceremony during National Science Week in May, 2000. It could be you walking up to receive it.

MSA Award 1999

.... The envelope please.

This award is made every 2 years during the MSA conference.

Two criteria apply – the recipient must be a member of the society and have performed work deemed excellence in metrology.

The award at MSA 99 went to Len Kerwood, of the Gawler Instrument Company. It recognises the inventive step and development of a new method to measure the alignment of lift rails, replacing a slow manual technique. A rail survey unit rides the rail in concert with the lift, recording alignment and steps, weighting the results according to effects on the passengers. The device and method are the subject of patents and have resulted in export sales. Congratulations to Len and Gawler Instruments on a well-deserved award.

The judges thank all who submitted entries for the award.

METROLOGY SOCIETY OF AUSTRALIA

Conference: 22 – 24 September 1999, Sydney, NSW

MEASUREMENT FOR A SUSTAINABLE FUTURE

Address by Peter Roberts

Peter Roberts is a leading business and financial journalist, best known to readers of The Australian Financial Review for his regular column, Best Practice.

For the past 13 years Best Practice has investigated and profiled thousands of local and international companies, with special emphasis on their underlying strategies, technology base and management policies.

In 25 years in journalism Peter has built up a detailed understanding of Australian science, technology and technology-related business, and its position in the global economy.

He is a regular commentator on Australian industry policy and is a regular public speaker on the subject.

For the past six months Peter has been on leave of absence from The AFR, founding his own Internet based buying service for small and medium sized businesses. He is returning to the newspaper next month and is also taking up a new role as columnist for BRW magazine.

Peter addressed MSA 99 at a get-together function hosted by NATA. His chosen topic was "Industry Policy for the New Millennium."

INDUSTRY POLICY FOR THE NEW MILLENNIUM

\- Peter Roberts

John Button used to tell the story about the three politicians from Canberra who turned up one day at the Pearly Gates. The first one said to St Peter, 'Listen Pete, when am I going to be recognised as the world's greatest Prime Minister', to which St Peter replied 'not in your lifetime, Bob.' The second said 'Listen scumbag, when am I going to be recognised as the world's greatest Treasurer', to which Peter replied 'Not in your lifetime, Paul.' Then the third bloke, a little guy, a Geelong supporter, said 'When is Australia going to get a decent industry policy." Peter thought for a moment and replied 'Not in **MY** lifetime John.'

John Button was even more correct than he thought. As Australia prepares to enter the new millennium we do not have a national industry policy worthy of the name. We have bits and pieces of a policy, but I don't think I would have too much argument from this audience if I said that it does not add up to a coherent whole. We don't even have a national consensus that we need an industry development policy. So perhaps I should start with a little justification of why I think Australia's leaders should be more actively attempting to influence the direction of industry development.

Let's start with what is currently my favourite prediction. It comes from Professor Ashley Goldsworthy and his 1997 report on the information economy. If things continue as they are, Australia faces a balance of trade deficit in information technology of $46 billion by 2005. Now, I might be missing something and I hope I am. I'll give you some figures to justify this in a minute, but I just don't see how we are going to be able to pay for this. No matter how many tonnes of coal or bushels of wheat we sell, no matter how many Japanese tourists we entice to our shores, I just don't think we are going to be able to bridge this yawning gap.

Remember, Information Technology is our biggest industry, and it is the world's fastest growing industry. It is the key enabling technology and industry of the 21st century. Our information technology industries broadly defined turn over more than $51 billion a year.

It is a truly massive industry.

Our problem is that we are IT junkies, eagerly consuming other people's IT. We are great at using other people's technology, we are great at adapting other people's technology, but we produce little of global relevance of our own. I've made this statement before. We don't have an indigenous computer hardware industry, or large telecommunications companies, or even a single world scale maker of silicon chips. But invariably the response comes back - what about the promise of Australian software companies.

Well, the sad fact is that fewer than 50 local IT companies have annual revenues over $5 million, and less than a dozen have revenues over $100 million. Local IT companies tend to be in consulting, contracting out, and in customising other people's products.

Our IT companies are rarely in the business of developing globally relevant new product. But where they are developing their own intellectual property, companies are exposed today to intense takeover pressure from overseas. Two things contribute to this. The low value of the Australian dollar makes Australian assets very cheap internationally. And the lack of venture capital and the lack of support on the stockmarket for high technology stocks means Australian listed companies are far cheaper to buy than a similar company listed in the United States. Australian technology stocks typically trade at 10 to 12 times earnings, compared to multiples of 30 typical in the United States.

Only recently JNA Data Communications was trading on the Australian stockmarket for around 90 cents a share. The US company, Lucent Technologies took over the company, offering $3.75 a share. How can we keep any significant technology under local control when our stockmarket so undervalues them? In the end JNA was taken over, following the likes of Datacraft, Eracom, AWA, Stanilite, Exicom, Dataplex and Netcomm which have been bought out or failed in recent times. Computer Power Group, once the world's largest trainer of computer professionals is the latest to be in line for foreign takeover.

Virtually every one of the Australian IT companies I have written about at the Australian Financial Review that were created before the 1987 crash, have now themselves crashed, been taken over or are clearly in line to be taken over. A whole generation of promising technology, or promising businesses is gone or going. There is some dynamism out there, especially in the Internet. But as yet, there is not a new generation of young, fast-growing listed companies waiting to take their places.

We have seen a few, recent successful Internet listings it is true. But whether the few turn into a flood, or whether we continue as we have don't o adapt US models to Australia rather than developing genuinely new local businesses, remains to be seen. One would have to say that business in Australia is a year or two behind the United States in exploiting the Internet, certainly behind Canada, and possibly behind Israel. We have potential to be sure, but we are not world leaders.

The upshot of all this is that we are at a point of virtual irrelevance in the world's most important industry. We got there because successive generations of Australians failed to participate in those industries in their infancy. We built the world's third electronic computer, CSIRAC, but we preferred to import computers from overseas. We were in on the ground floor of long distance telecommunications, but we bought our technology from Europe and the United States and helped establish their companies as global concerns. We had the world's third largest space industry centred in Woomera with all its implications for communications, but we gave that up too because we thought we couldn't compete.

Back then, when we should have developed a national vision to take us into new areas of business, we retreated into our shell. We didn't bother with fast growing, high value, knowledge intensive industries to any degree. We left the clever industries to others just as we have always done. Britain used to look after the technology and we supplied the raw materials. Then we looked to the Americans, then the Japanese and today, we again look to the United States in the revolution that is the Internet.

Well, this particular national tactic, policy if you like, hasn't been working. We continue to slide down tables comparing national income. Australia as a nation is getting poorer relative to the rest of the world. Why is this? Aren't we the guys who brought the world the stump jump plough, the black box flight recorder, the bionic ear hearing implant? True we did all that. But today, our record shows us as great inventors and innovators, but we are hopeless as a nation at turning our innovations into great knowledge-intensive and innovation intensive companies, and our great companies into great industries.

Ladies and gentlemen, I have been known for my optimistic views, but today I find it harder and harder to maintain my optimism. In IT and in so many knowledge-based industries of the future, Australia is being squeezed to the periphery of the real game.

We are attracting little of the footloose international capital searching for a home. Of more than $60 billion earmarked for investment in the Asia/ Pacific silicon chip industry, virtually nothing is earmarked for Australia, notwithstanding some good efforts by the Victorian State Government. Government, generally, is fond of telling Australian business that it needs to be world competitive. But apparently the need for competitiveness stops at government policy.

Today Australia Inc is an investment product on a global shelf. Trans-nationals can shop comparatively, weighing up skill levels, market size and investment policies of the different investment options. The trouble is the trans-nationals are putting other nations in their investment shopping trolleys ahead of Australia. Australia's business and taxation regimes are simply not competitive internationally. We are not getting our share of trans-national investment. I'll talk more about the latest developments in taxation in a moment.

Even worse, we have few local enterprises capable of making it on the world stage in key high value industries. Just compare a few Australian companies with my favourite high performing, adaptive, innovative company, Hewlett Packard.

Hewlett Packard is an innovation machine. HP makes 50 per cent of its revenues from products that are less than 15 months old. It pumps out new and upgraded products at such a rapid rate that they never are allowed to go stale. The reward has been that in the past five years revenues have grown at 24 per cent a year and profits at 30 per cent a year.

Then compare that with what used to be known as the big Australian, BHP. Today it might better be described as the downsizing Australian. Average revenue growth for BHP over the past five years has been seven per cent, and profit growth eight per cent, a third of the level of Hewlett Packard. Or how about Amcor with a revenue growth rate of seven per cent ,and profit growth of only two per cent. Or Southcorp with revenue growth of five per cent and profit growth of four.

Our companies are slow growers and poor performers. I'd like to briefly compare the top 20 companies by stock market capitalisation in the United States and the top 20 in Australia. The US top 20 has nine pharmaceutical or electronics companies, all highly innovation-intensive, all globalised, all producing products and technology that is exportable. By contrast, nine of our top 20 companies are banks or financial institutions. They don't export, they are not global though some have international operations. They are still cutting job levels rather than growing.

Australia does have high performing companies, but they tend to be domestically focussed services organisations such as Telstra or Woolworths. Nothing wrong with this, but recall my favourite statistic about Australia's looming IT trade gap. Australia desperately needs to generate new industries that are competitive internationally, that bring revenues and profits back onshore, that employ Australians at the highest level, and that we can retain in Australian ownership, or at least in Australian management control.

Just consider Australia's export profile as we approach the year 2000. Our exports split up roughly forty per cent mineral commodities, 20 per cent agricultural commodities, 20 per cent manufactures and 20 per cent services. Ladies and gentlemen, this is the export profile of a partly developed country. It is not the export profile of a country making its future on the basis of advanced skills and knowledge. There are some who believe that to continue to pay our way, all we need to do is encourage services and excellence in IT, and export more and more raw materials. Well, we have been doing that, we have been boosting export volumes, but we have not been boosting the value of our exports at anything like the same rate.

Since 1960 the proportion of our economy devoted to exports has more than doubled, from 11 per cent of GDP to 25 per cent in 1997. The income we received, on the other hand, has risen by only five percentage points, from 15 per cent to 20 per cent. Since 1960 we have traded off 14 per cent of our GDP for a five per cent increase in national income. This is a losing formula. There is no future for Australia just doing more of the same.

This is where industry policy comes in. Australia actually has been a test bed for industry policy, and we have achieved considerable success over the years.

It is not well known, but the building blocks for large scale manufacturing were set in place by successive national governments between World War 1 and World War 2. Basic infrastructure and skill gaps were filled by establishing such things as a national measurement laboratory. I hardly need mention in this company how vital such things as measurement are to industry development. Once these skills were in place local and foreign companies were enticed into strategically important industries. Basic manufacturing competence was achieved in defence department factories and then technology was transferred to the private sector. We were an agricultural nation in 1918, incapable of repetitious mass production. But by 1939 we were able to mass produce tanks and guns, and even relatively high technology products such as gun sights and other optical devices. This was the first great period of industry policy.

After World War 2 protectionism aimed at replacing imports with local goods substituted for industry policy. Protectionism seemed to go well for a time. But because we took it to far and didn't know when to force the new industries to stand on their own two feet, we cut ourselves off from global competitive pressures, and we became lazy. We are left with the risk- averse, inward-looking, and un-innovative managers and financial community we still have today. We are having to unlearn our way of operating and learn the new ways of surviving in a far more competitive and dynamic environment.

The next great phase of industry policy came in the 1980s under Labor and the then industry minister John Button. Crucially, Labour began to open the economy to competition and, under John Button, used policy to breathe life into moribund industries such as steel, motor vehicles and pharmaceuticals. I should point out that these are low and medium technology industries, other than pharmaceuticals. The payback came when exports of elaborately transformed manufactures (ETMs) surged 14.5 per cent a year from 1985, and indeed, manufactures are increasing their share of national exports.

But while Button was able to resuscitate old industries, he was generally not able to create the environment to nurture the new industries. There were tremendous successes. The 150 per cent tax deduction for research and development was behind a trebling of R&D performed by Australian business in he decade to 1994.

In the 1980s our business sector spent roughly the equivalent of business in Iceland and Turkey on research, an absolutely pathetic performance. Today business spending on research is approaching that in medium-level research nations such as Canada and Italy, but it is still 50% below the OECD average. With the Federal Government cutting the research tax concession to 125 per cent, R&D is now falling for the first time since the mid-1970s. Industry estimates suggest research fell 10 per cent in 1998/99. The Federal Government's business tax reforms announced yesterday leave the concession at 125 per cent, a major disappointment, We need to treble business R&D again though to reach the level of those innovation powerhouses of the US and Japan.

So Senator Button showed the power of industry policy to influence industry behaviour and national economic outcomes, but his greatest failure, in my view, was his failure to develop a venture and development capital sector. WE are starting to get one and the capital gains tax concessions for foreign superannuation funds announced yesterday will bring a flow of overseas venture capital into the country. But we don't yet have a significant venture sector and hence we don't have the massive formation and growth of new companies in technology that is driving the US economy.

The countervailing and dominant view to that of industry policy is embodied in a singularity of opinion in Treasury, the government's finance departments, and among academic and financial markets economists. Treasury's view is that all a national government needs to do is get the macro-economic settings right, and to reduce the cost of doing business through micro-economic reform, encourage competition, and the free market will guide Australia to a new, optimal industry structure.

What was that old saying? I think it was John Keynes who said that economists are particularly economical with ideas - they make the ones they learn in school last the rest of their life.

Surely this is true in Australia today. I am reminded of the story of Industry Commission economist who visited a factory in Melbourne. The place was singing along, with product loaded straight from the production line onto trucks and out to the airport to be exported. The economist couldn't work out what was going on, weren't manufacturers meant to be inefficient. So he turned to the factory manager and said, 'I can see it works in **practice**, but does it work in **theory?**

This theoretical view of the world, and a generous dollop of political opportunism underlie the government's business tax reform package. The headline company tax rate of 30 per cent sounds great, but it was allowed to become a Holy Grail. But it is not just the headline level that is important, it is the combination of other carrots and sticks in the tax system that combine to drive business towards innovation, globalisation and dynamism.

I have already mentioned that we continue to spend too little on research. Nothing in yesterday's package will change that. I have said that the reforms to venture capital will encourage overseas investment, but they also encourage our continuing preoccupation with investment in areas such as property. The capital gains tax reforms will help redress the bias that dividend imputation gave to our tax system towards low growth, dividend producing businesses. But again there is no focus. The same benefits go to a high tech exporter as a real estate investment company. Yet the two investments have vastly different potentials. The removal of accelerated depreciation will hit capital intensive industry and infrastructure investment.

The package relies heavily on the lower company tax rate to boost business. This will have some effect, but its benefits to the nation will be dissipated by spreading it across all sectors of the economy. Investment in a milk bar is treated by this package as if it were equally desirable as investment in a silicon chip plant. There may be special concessions for big high technology projects, but bureaucrats will decide who gets them. Overall, the package is political device to win the hearts of small investors in property and the sharemarket. Its effects may be positive, but it could have been a whole lot better if we better understood industry policy.

Unfortunately industry policy has been turned from a desirable phrase into an expletive. But today's industry policies are completely different to protectionism.

Industry policy in Australia in the protectionist era of the 1960s was aimed at developing import-replacing industries. Today's industry policies aim to develop globally competitive companies.

1960s policies revolved around tariff and other barrier protection. Today we don't have many barriers to inward trade, we are one of the most open developed markets on Earth. Protection in other than motor cars and textiles, clothing and footwear are five per cent or heading for five per cent. We don't have the quota restrictions on imports in cars and textiles that, say, that bastion of free trade, the US retains to this day. So don't let anyone tell you we need to remove protection in Australia, we have already done it.

Today's industry policies do not involve long term cost imposts to the community nor open-ended subsidies for individual firms. They do involve planning for the future as we did after World War 1, and they do involve spending money to hasten the pace of change in the private sector, as we did with the 150 per cent tax deduction for research.

hey are a deliberate and calculated trade-off between short- term costs and long-term benefits. They can be measured, monitored and policed.

No one today is asking for government to subsidise us out of slow- growing commodity industries and into fast- growing new industries. It can't. But what we do need as step one in the process of rebuilding our industry structure is national vision and leadership. Without the leadership shown by governments such as Singapore and Israel in taking their countries into new fields, we just don't stand a chance.

So actually understanding as a nation that we have a problem is the first step, and developing a vision to do something about it is the second. And we need a national consensus here. We can't have, as we have since the Button era, one arm of government attempting to guide industry towards higher value activities, and another section er iploying spoiling tactics to oppose it.

Such a national vision requires Australia to consciously move up the value-adding scale in the industries here we are already competitive. The other half of this vision comes in selecting a few areas of new industry opportunity where we can be truly globally competitive.

The task then is to marshal our national resources to create competitive advantages for the country and for our companies in these selected areas. The federal government's action agendas and the previous government's industry plans are on the right track, even though they are small and underfunded. They look for impediments to growth and do something about it. They look at the requirements for growth such as skilled people and do something about it. They help companies prepare themselves for competition by networking and improving internal processes. Such initiatives are not expensive, but they do require conscious work.

Obviously we must select from those industries that are based on skills and knowledge. For knowledge is the new competitive edge in business. In the past land, labour, technology and finance were the drivers for economic growth. Today knowledge has usurped their position as the key generator of wealth.

In the 21st century it will be those companies and those countries that harness their knowledge, that manage their knowledge and that exploit their knowledge that are going to get ahead. Anyone can buy raw materials, anyone can access finance and technology, anyone that is that has the knowledge to exploit them.

So far I have painted a role for national government in setting a vision for the country, in repairing the taxation system, in encouraging innovation and in joining with industry sectors to examine the specific reforms needed for accelerated growth.

Business is obviously the group that will actually deliver the benefits to the nation. I have already mentioned that Australian management is undergoing a painful unlearning of the bad habits learned during the protectionist era. I don't subscribe to the myth that Australians are bad managers. That is rubbish. What we are is inexperienced in meeting some of the key challenges of the moment.

In the US they have been funding start up ventures in IT and biotechnology for 30 years and the whole financial community is attuned to it. We used to have a financial community attuned to taking risks on mining ventures. All we need is time to learn the skills to apply that dynamism to the new and important industry sectors. This is a learning experience and we are learning. Unfortunately, others are learning more quickly than we are.

But only when investors reward companies for their ability to compete internationally and for their ability to innovate, will we see a rapid improvement in Australian management. Unfortunately we are far from that today. The market follows and rewards big established companies even long after their business models have been shown to be deficient. The market shuns small technology businesses and in fact, it doesn't bother to understand technology. It is amazing that Australian investors will happily take a punt on a risky mining stock. But when it comes to technology investments, investors are generally not interested.

Ladies and gentlemen, I think today I have given you more reasons why we need a new type of industry policy, than actual details of that policy. That is because I believe we already know the sorts of things we need to do. Asia rose from poverty in our lifetimes because of national industry policies. The venture capital driven dynamism we seem in the US today grew from subsidised venture capital initiatives in the 1950s, and from the stimulating effects of defence spending on technology.

In the past Australia has been unafraid to use industry policy and has enjoyed some success. Our real challenge is building a national momentum to accept such a change.

Thank you. ❑

Measurement in Sport Competition

The recent Metrology conference included a display of posters developed by students across Australia. Schools using Measurement in Sport were invited to submit posters outlining their students work. More than 15 posters were displayed. They showed how students had tackled the problem of achieving a variety of temperatures for different types of sporting balls. Basketballs, table tennis balls and golf balls were all used to determine how temperature effected the elasticity of a ball. It was obvious that this simple activity made the students think about scientific method and they also became aware of how hard it is to measure the temperature of a ball.

First place went to Kobad Bhavnagri and Paul Hampshire from Mullauna College who experimented with golf balls. They received $200 for their efforts and $200 for their school.

The **National Standards Commission** sponsored this competition.

News from the NSW Branch

The NSW Coordinators Committee was formed in 1994 with a primary task to organise the first national conference of the MSA which was successfully held in 1995. Since then, the Committee has been focusing on trying to make belonging to the Society worthwhile and thus attract new members. The NSW Committee presently comprises Ilya Budovsky, Marian Haire, Brian Pritchard, Mary Ryan and Bob Kelly.

Each year the NSW branch arranges 1-2 technical seminars or workshops and around 6 technical visits/ social nights. Many of the NSW and interstate members attended and enjoyed the Uncertainty Debate of 1997 and Seminar and Discussion "Calibration Intervals - do they make a difference?" in 1998 (for information and copies of the presentations see www.metrology.asn.au/education.htm).

The technical visits have been just as successful. Although often having measurement flavour, those visits are not always associated with metrology. Over the years, NSW members have had an opportunity to get as close as possible to crashing a jet at the QANTAS Jet Base flight simulator, to controlling air traffic at the Mascot Airport Control Tower, flying an Optus satellite and booking drivers for speeding with the use of the latest lidars. Other highlights included visits to RTA Crushlab, Biosensor Research Facility at Chatswood and Astronomy Centre of the University of Western Sydney just to name a few. It was pleasing to see that most of the technical visits at the recent Third Biennial Conference of the MSA followed those arranged by the NSW Branch. Several years ago, in recognition of the efforts expended by our hosts, a decision was made by the Committee to extend invitations to the hosts to attend all state events for a period of one year. This created some wonderful opportunities for further interaction and even gave the Society some new and valuable members.

NORTH HEAD SEWERAGE TREATMENT PLANT

Thursday 22 July 1999

The plant was founded in 1965 and takes on average 300 million litres of sewage daily which is 1/3 of its capacity. However, on rainy days the flow becomes critical. To overcome the problem a giant storage tunnel is being constructed, which was witnessed by the visitors. The tour involved all aspects of sewage treatment including the underground facility 60 m below the ground level. An informative and entertaining talk presented by Jim Fairly, Community Liaison Officer at the Plant, and a video presentation gave the audience a comprehensive picture of the scale of the Plant's operation and its efforts to improve the water quality of Sydney beaches. More than 20 people attended the visit. At the end of the tour everyone was presented with a bottle of pure water from Sydney's Warragamba Dam.

SKY 'N' SPACE NIGHT

Tuesday 14 September 1999

University of New South Wales Kensington Campus, Anzac Parade, Kensington, NSW.

This was the third in the series of astronomy events that are ever so popular among the NSW members. Similarly to the previous two nights, the Committee arranged for perfectly clear skies that allowed everyone to enjoy the sights of the moon, alpha-centauri and several other objects. The stargazing was preceded by a fascinating talk in the planetarium tailored to the likes of the varied audience which included several kids.

(*Editor's Note:* Photos taken at both of these visits may be viewed on the MSA website – lighting conditions made them difficult to reproduce satisfactorily in TAM.)

The invitations to upcoming events are posted to NSW members on a regular basis. I addition, email notification has been recently introduced. Current information is also available at the Society's new web site www.metrology.asn.au. If you would like a specific venue to be included in the future visits or have other suggestions, please do not hesitate to contact any of the NSW Coordinators.

- Ilya Budovsky

VALE TONY ADAMS

27-1-1945 – 16-10-1998

The committee was saddened to hear of the death late last year of Tony Adams, a member from South Australia. We reproduce here the eulogy delivered by Nigel Currie.

Eulogy for Anthony Simon Adams - simply Tony to his workmates.

I have known Tony as a friend and fellow worker for the last 8 years, with some 5.5 years as his supervisor. Tony was a quiet, unassuming, humble man. Not a showy, life of the party type, but a sincere, unpretentious man with a very dry sense of humour. In fact, so dry, that, at times, it was difficult to know whether he was serious or not. Sometimes he found his circumstances trying, but he never lost his sense of humour.

Some might remember him for his classic 'yes but no' statements which epitomised his balanced outlook on life. I said he was quiet, but give him your ear and he could talk the leg off a chair (as the saying goes). He seemed to have an opinion on almost anything and was only too willing to share it. On occasions he seemed to out-think the speed at which he could speak and appeared to talk in riddles - yet it was all perfectly clear to Tony.

Tony was an avid motorcycle rider. About a year before his death he joined the Ulysses Motorcycle Club, but never quite made that last club ride that he kept planning but kept postponing. A faithful, loyal friend to many. A quiet, unassuming, humble man.

Tony began his working life as an apprentice fitter and turner in 1962. After completing his apprenticeship he served two years of National Service duty. He then spent the remaining 30 years of his working life with the Defence Science and Technology Organisation in its various forms and names at Salisbury. There Tony progressed from fitter and turner to toolmaker, to toolmaker checker and on to become a technical officer in the field of metrology. He also worked as a 'weekend warrior' and engine fitter for the RAAF reserve.

He was a skilful, practical and competent man. I am sure that Tony would like to be remembered as a (physical) metrologist - one who measures things to determine how long, how wide, how high and how straight they are. Not as a meteorologist - one who forecasts the weather. His standing joke when anyone rang him ignorantly to inquire about the weather was to report the conditions of his air-conditioned laboratory: 20°C and fine. Afterwards he'd say, "Can't people spell?" One day I remember a lady inquiring whether we could forecast the weather months in advance in Queensland. We had a good laugh after she left.

I remember Tony as a quiet achiever. In 1990 he took control of the metrology laboratory at Salisbury which was one of the top metrology laboratories in Australia. Under a demanding workload he competently managed the laboratory providing high quality metrology services to very appreciative Defence and private industry customers. He rapidly gained the respect of his metrology peers throughout Australia and became a foundation member of the Metrology Society of Australia. As a worker he was knowledgeable, meticulous, diligent, honest, innovative and self motivated. He simply went about his work faithfully with a spirit of excellence and pride even when the workplace went through times of turmoil. The diagnosis of his illness came as a shock to his work mates. I know Tony was encouraged by the concern, practical help and prayers of his work mates.

I saw Tony in the hospice the evening before he died and briefly chatted with him and his family members. Two impressions remain with me from that time. Firstly, the frailty of life. Oxygen was being administered to assist his breathing. Secondly was the affirmation of him as the quiet achiever. As Tony had quietly gone about his work with little recognition, quietly endured the turmoil in his workplace, even so to the end, he quietly endured as he could the physical trials. I give thanks for Tony the quiet achiever, the diligent worker, the unassuming, humble man.

Software for metrology

Modern measuring instruments are increasingly dependent on embedded code. Serena Holley reports (IEEE Review July 1999) *on an important initiative designed to ensure that metrology software is always up to the mark.*

The Hubble Space Telescope and a breathalyser - spot the connection. The first is one of the most unfortunate measurement disasters this century and the second a personal measurement disaster for anyone mixing drinking and driving. One of the prime motivations behind the Department of Trade and Industry's Software Support for Metrology (SSfM) programme is to ensure that software used in making measurements does not succumb to any of the pitfalls that so nearly compromised the scientific value of the Hubble programme. The initial images from Hubble were seriously blurred – the result of a failure to verify the accuracy of the reflective surface of the telescope's primary mirror. The root cause of the problem that so nearly destroyed the Hubble telescope programme - unexpected complexity obscuring a basic error - is a particular danger in software construction, characterised by products which combine a high level of complexity with no concrete physical form.

The breathalyser, or breath alcohol analyser as it is more properly called, is just one example from a wide range of measurement instruments that use metrology software. A new generation of breathalysers (see panel) is to be introduced in the UK this year, incorporating new and sophisticated software. However, while there are no doubts about the efficacy of software in breathalysers, there are concerns that the growing variety and volume of metrology software is putting the accuracy of measurements at risk. Generally, there are few formal standards, which means that the quality of the software can be variable. Yet the implications of the incorrect use of metrology software are serious and far-reaching. Errors lead to invalidated measurements that, if not held in check, could ultimately threaten confidence in the National Measurement System and affect British industry's ability to compete.

Ground breaking

SSfM, which comes under the umbrella of the National Measurement System programme, is set to break new ground in the quality and the reliability of software in metrology applications. Launched in 1998 and due to be completed in 2001, SSfM will improve control over the design, use and testing of metrology software in all non-safety-critical applications. It includes work in metrology, mathematics, software and theoretical physics, with strong links between the disciplines. It focuses on four themes: modelling techniques, validation and testing, development techniques, and support for measurement and calibration processes.

The National Physical Laboratory's Centre for Information Systems Engineering is working on SSfM with several other organisations, including Logica, the independent consultancy, systems integration and software company, who are partnered by Sira Test & Certification Ltd.

Validation and testing

In an industry survey for SSfM last year, the NPL found that validation and testing were the two most significant causes of concern. Those organisations questioned were extremely worried about the numerical correctness of software, which, when used for processing measurement data, can deliver insufficiently accurate results or even fail to deliver results at all.

The NPL's Dr Brian Wichmann, a pioneer in methods for evaluating the correctness of software, is playing a major role in the validation and testing theme. In Dr Wichmann's view it is all too easy to unwittingly introduce errors into software. He quotes the example of an LCD-display weighing machine which, although measuring small and large weights accurately, to everyone's horror, displayed total gibberish when the weight was exactly 10□000 units. The result, reports Dr Wichmann, 'of just one incorrect, rarely executed software instruction.'

Verification standards do exist. For instance, ISO 9000 requires verification but it is solely concerned with management as part of a development life cycle. It does not dictate actual techniques. There is also a big gap between the disciplines traditionally applied to metrology and those presently applied to conventional software development. Metrology software is more rigorously verified where applications come up against legal or safety requirements, for example, in the approval stipulations for petrol pumps. The software in petrol pumps falls into the category of legal metrology that must be certified by the National Weights and Measures Laboratory (NWML).

As the NPL pointed out in its report for SSfM, many users currently have no means of validating software or firmware embedded in measuring instruments and have to take in on trust that suppliers have performed sufficient testing.

Spreadsheet woes

Spreadsheets as metrology tools are notoriously error prone. The facilities they provide are usually taken on trust and without validation. Those organisations consulted in the NPL survey were horrified to discover how vulnerable they could be to errors in spreadsheets. The NPL has found that common spreadsheet packages contain mathematical functions that can provide unreliable results because they use unstable methods. Another major difficulty in validating spreadsheets is that there is often no specification of the computational task, as would be the case in other metrology-software functions.

As part of the SSfM, NPL will promote the issues to be considered in the preparation and use of such specifications. It will provide guidelines on spreadsheet model design and on how to check the correctness of the numerical values calculated by the spreadsheet cells. It will also draw up a best practice guide on testing spreadsheet models against user-provided specifications and checking data entry. NPL will also provide reference data sets for a range of the commonest metrology computations and help to develop a support mechanism for UK users.

Development techniques

The metrology community as a whole feels that current practice guides on software development are not meeting its needs. In a survey by Logica of regulators, purchasers, developers, users and professional bodies, most felt that further guidance would be welcome. As part of the survey they were asked to identify issues to be addressed in the provision of greater guidance.

Users of metrology software, including Glaxo Wellcome, said they were very concerned that the metrology community might be unable to identify best practice in software development for metrology systems. Validation, configuration management and audit trails were among the issues highlighted by the survey.

The use of metrology software within the pharmaceutical industry has increased dramatically over the last couple of years. Ineffective software could effect the quality of drug products. Pharmaceutical regulators inspect the validation and use of software and if they deem it not fit for purpose then they can stop it being used. If there is no alternative system, then this could affect production.

Dr Guy Wingate, Glaxo Wellcome's Computer Compliance Manager, is a member of the steering committee for the Good Automated Manufacturing Practice Forum, the pharmaceutical industry's body responsible for developing software guidelines known as the GAMP Guide. The GAMP Forum is particularly interested in software suppliers formally qualifying their development and documentation practices.

Dr Wingate also wants to see an agreed approach to the use of spreadsheets and databases based on an appropriate balance between the degree of criticality associated with the task for which the software is used, and the effort devoted to development and testing. There is a particular need to ensure that the security and control system works effectively, which includes a need for standard test data to verify the correct functioning of the spreadsheet at the time of use.

In response to such concerns, a software development guide is currently being devised by Logica and Sira as part of SSfM. The guide, due to be released early next year, is intended to improve design, construction and testing, and bring together the metrology and software disciplines. It will provide a development method in the form of a comprehensive checklist supported by text. The project team's intention is to provide a development method that closely fits the requirements of the metrology sector to the extent that its benefits will be self-evident.

'A guide to development is an important first stage in improving metrology software because it has a knock-on effect,' argues Glaxo's Dr Wingate. 'If you develop it properly then testing will be much easier which will, in its turn, reduce support and operational costs.'

The special requirements of software development in the metrology environment are highlighted in comments from Logica's David Brinkley, the Guidance on Developing Software for Metrology, (GDSM) Project Manager: 'One of Logica's survey findings was that current development life cycles fall short of the ideal for mixed-technology projects. Quality management systems sometimes mandate a life-cycle that is insensitive to the needs of development projects. These methods tend to be monolithic and bring all the technologies together at the end rather than allowing for small, technology proving, projects and intermediate deliverables. This means that validation cannot be done on small parts along the way and the risk is that the project team ends up with a lot of sub-systems containing unidentified errors.'

In order to create a flexible development process, the Logica-Sira team is working to identify the critical processes necessary to the successful creation of metrology applications. Predefined processes are easier to apply to small projects than to large ones and the team is examining the importance of the right choice of project scope to achieving successful metrology software applications.

David Brinkley believes that there is a basic disparity between conventional approaches to software development and the distinctive requirements of metrology software. 'One of the challenges facing us,' he argues, 'is that existing best practice on software system development is principally concerned with developing a system according to an agreed specification without much regard to hardware issues. For instance, hardware control is performed implicitly by the host system and data recovery and processing is performed by the host system according to user domain instructions.'

The trouble with this approach, Logica believes is that it usually neglects the methods needed for verifying measurement channels containing combinations of unverified hardware controlled by unverified software. To overcome this deficiency, and to make the software development guide as easy as possible to apply for systems of all sizes, the team is structuring the guidance on the basis of complexity.

Adding value

British industry has already come a long way in terms of the quality of its metrology. Reliable and high quality metrology software is vital if it is to build on this success. The SSfM-GDSM project will work hard to gain industry's support by emphasising recommendations that result in real added value.

To probe further

For further information, or to participate in the project, please contact David Brinkley (tel +44 (0)171 4461477; brinkley@logica.com). Alternatively, visit the GDSM page on the SSfM web site: http://www.npl.co.uk/ssfm/.

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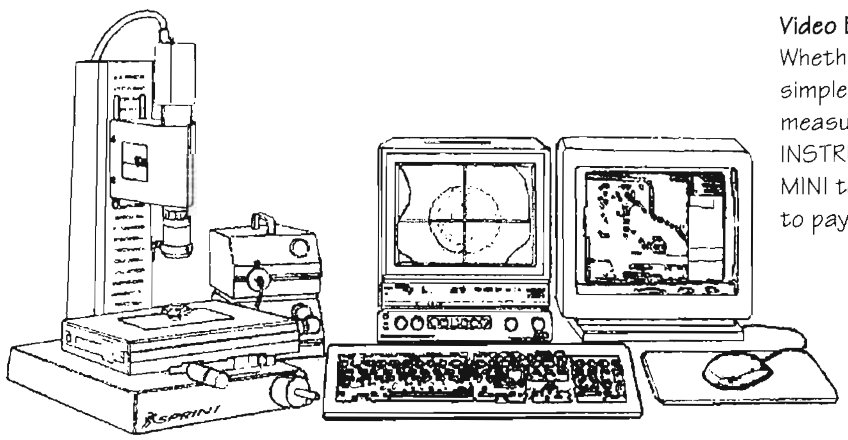

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