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JABIRU AIRCRAFT

PLASTIC ELECTRONICS

IN THIS ISSUE

From the Chair

Welcome to the January 2011 edition of the *News Bulletin*. This will be my last Chairman's message, as the next edition will be published in May 2011, when you will have a new Branch Chairman.

Since the September issue, several events have occurred. On 18 September, the Branch held an executive committee meeting in Melbourne. Several issues arose from this meeting, the more important being:

- engineering heritage award applications to be submitted to HQ for a 1785 Boulton and Watt beam engine and an 1855 steam locomotive, both located in the Sydney Powerhouse Museum (more details below)
- the registration of an online business service with our bank
- the pending establishment of a Victorian Young Members Section
- a member recruitment and retention toolkit, since issued to the Australian Branch and circulated to Panels.

On 9 November, I took part in another International Strategy Board teleconference with various Regional members from around the world. Highlights of this teleconference were:

- the proposal of a two-year pilot plan for expanding the IMechE into China, centred in the Pearl River delta
- the design of a new Near You website, scheduled to be released for testing from March 2011; it is proposed that the new site will be operational in the summer of 2011
- the online availability of affiliate applications.

At the time of writing, Speak Out for Engineering competitions in NSW, Victoria and South Australia have either been completed or are in progress. The winners of these competitions, together with the Queensland winner, will compete in the Australian championship in Perth on 26 February 2011. The Australian champion will then have the chance to compete against other regional winners in New Delhi in April 2011.

As mentioned above, engineering heritage award applications are being prepared for submission to London. Full details are available from www.imeche.org/eha. For those interested in engineering history, I recommend opening up the EHA booklet, which goes through all the current pieces of mainly mechanical engineering awards, complete with sound effects when the pages are turned!

The B and W steam engine was made by Matthew Boulton and James Watt in Birmingham in 1785 to power Whitbread's London brewery and is the world's oldest existing rotative engine. For further information, refer to the Sydney Powerhouse Museum website, www.powerhousemuseum.com. It should be noted that the late 19th century image of this engine is to appear on Britain's new fifty-pound bank note (apparently much to the dismay of the Science Museum!).

The 1855 locomotive (No. 1) was built in 1855 by Robert Stephenson & Co. in Newcastle-on-Tyne. Designed by J. E. McConnell of the London and North-Western Railway, it is a very rare survivor of a McConnell goods express locomotive of the 1850s. It is believed to be the only known example of its type in the world. Although now purely a static exhibit, on 28 May 1855, this locomotive hauled the first passenger train, a special service, from Sydney to open Long Cove viaduct (near the present site of Lewisham). Again, full details are available at www.powerhousemuseum.com.

Hopefully, by the time you read this, I shall have submitted applications to HQ for both the above engines.

There is a further application for an engineering heritage award in progress by a South Australian member, for the Humphrey Pump at Cobdogla in South Australia.

Finally, I should like to express my thanks to all Branch Committee and non-Committee members, for all the assistance you have given me during my term as Chairman of this Branch. I have thoroughly enjoyed my tenure and I wish the incoming Chairman and his committee all the very best of luck in the ensuing two years.

Clive Waters

Jabiru Aircraft

The final South Australian Joint Technical program event for 2010 was an interesting talk presented by Jabiru Aircraft Pty Ltd's Managing Director, Rodney Stiff, OAM, on 9 November. The talk was presented in the Sir Robert Chapman Theatre, Engineers Australia South Australian HQ. The audience of 90 was made up of many young engineers and aviation enthusiasts; several of the latter had flown the Jabiru. The company takes its name from the large white stork.

In 1988, at 49, Rodney Stiff abandoned a successful career in design, development and marketing cane harvesters to join Phil Ainsworth in forming Jabiru Aircraft. Their plan: to develop a highly efficient and affordable Light Sports Aircraft.

Rodney had dabbled with light aircraft development earlier and described his attempts to build a machine having a wingspan of 2.5 metres, powered by a chainsaw engine. After failing to get the aircraft to rotate, he suggested to his daughter (then 20kg lighter) that she become his test pilot. She succeeded in taking off and landed after a short flight, vowing never to fly one of his aeroplanes again!

Rodney explained that his background in cane harvesters – their high speeds over undulating ground necessitated some fairly complex structures – had stood him in good stead when he turned his attention to aviation. Phil was a human resources professional with limited engineering skills, so Rodney bore the brunt of the early development work. He had to learn from scratch to work with composites. He added wryly that if a cane harvester component broke, one simply doubled its thickness – but no such avenue existed in airframe development. The beauty of working with fibreglass is that one can introduce local strength where needed. A target all-up weight for the early aircraft was increased to 450kg, allowing a four-cylinder four-stroke engine to be specified.

The aircraft was designed for manufacture right from the start, but all Rodney used were

Jabiru Aircraft

the very basic workshop tools he owned – a bandsaw, drill press, hammer and bench vice! In the overall scheme of things, the two partners envisaged a 12-month period to obtain the necessary aviation approvals to commence production. In the event, it took four years and this delay added considerable stress to the fledgling enterprise.

On top of this setback, the Italian company supplying the engines decided to discontinue manufacturing. Thinking that all the hard yards had been completed with the airframe development, the partners were confronted with the somewhat herculean task of designing and building a lightweight 1600cc engine from scratch. Local casting, forging and machining companies were used, and after 10 months, the new Jabiru engine was ready for testing. Following a bench test, the engine was stripped and found to have a crack in the crankshaft. The crankshaft was strengthened and retested, but again exhibited some cracks. By this time, the production run had commenced and there were 14 aircraft waiting for engines.

Next, 600 hours of flight testing began, at the rate of 50 hours per week. Rodney found the long hours at the controls quite draining, and on one occasion, as a diversion, he landed on an idyllic but remote Queensland beach to break the monotony. However, the sand proved too soft for takeoff and some sand found its way into the carburettor. After several fruitless hours trying to call for help on over 700 channels, he was finally rescued by a yachtsman.

In March 1993, the Jabiru engine was approved by Australian CAA. Rodney explained that although the urge to make changes to the design as development proceeded was very strong, he had to ask: can we afford the risk? At the time of writing, the engine has a capacity of 2200cc and weighs a mere 60kg.

Today, the family-owned company's philosophy is to subcontract all components and subassemblies, necessitating robust quality control. The finished subassemblies are then delivered to Jabiru for final inspection, assembly and 4.5 hours of flight testing before being signed off. This approach has kept capital expenditure costs and overheads low, and softened the impact of any downturns in the market. Prior to 2008, the company was producing 20 aircraft and 70 engines per month, shipping to 31 countries. But demand has slackened due to the global economic downturn. (In 2009, there were 100 companies building LSAs in the United States, but they built a total of only 240 aircraft.)

Ongoing developments include injection-moulded propellers, although there has been some reluctance among test pilots to try them out! The company has established a succession plan, with Rodney's eldest daughter in line to take over. The engineering team comprises four qualified engineers, including Rodney. Three of the engineering team members use AutoCad Inventor and FEA software; Rodney professes to prefer working with paper and pencil!

Following a question and answer session at the end of the talk, EA's Philip Campbell proposed a vote of thanks to Rodney, who had travelled from Bundaberg with his wife for the presentation, and wished the Jabiru Aircraft Company all the best for the future.

Stan Gafney

State News

State News VIC

The Panel's technical meeting on the subject of 'Fluid-induced Vibrations', held in conjunction with Engineers Australia – Mechanical Branch, was well attended. Some of us became aware that well-known NSW Panel member Geoff Stone was giving a presentation entitled 'Pumps Without VF Drives' for the Associates Group of Engineers Australia, and those of us who attended found the material covered very interesting.

The Victorian Panel Speak Out for Engineering was planned for November, however we were unsuccessful in attracting sufficient entries so had to cancel. The conclusion was that the timing was unfortunate, being close to examination time, and next year we will move the competition forward to mid-October.

A most successful site visit was organised to the HSV (Holden Special Vehicles) factory in Clayton. The visit began with refreshments and a presentation about the company by managing director and IMechE member Phil Harding, followed by a presentation regarding the technical features of the vehicles by the chief engineer. These were followed by a guided tour around the factory to view the work in progress. The visit was very popular and limited to 40 participants; as another 100 applicants were turned away, we propose to run the event again next year. It was noticeable that the average age of participants was roughly 20 years younger than at usual IMechE functions.

As a continuation of the celebration of the 50th Anniversary of the Australian Branch, an exhibition of some of the 13 000 engineering books in the State Library of Victoria collection was held in an open dedicated area at the west end of the Redmond Barry Reading Room. Selected books included those written by or about 30 of the last 150 Past Presidents of the Institution; those published by IMechE; and those about engineering developments in the UK and Australia since the Institution was founded in 1847. Of particular interest were the bound volumes of engineering magazines going back to the 1850s. Members and other interested parties were able to visit the display at any time suitable to them within the library's opening hours, and tables and chairs were provided so that the material could be examined in comfort.

Finally, the Panel Committee composition remains much the same as in past years with the exception of Matthew Springer, a young member who has joined us and is attempting to organise a Young Members Group in Victoria. I would be pleased to hear from any members who may consider joining the Panel Committee to help run activities here in Victoria.

J. W. Burt

Victorian Panel Chair

State News NSW

Speak Out for Engineering NSW – 2010

The NSW round of the Speak Out for Engineering competition was held at Chatswood on 21 October. Originally established by the IMechE in the UK in 1964 to challenge young engineers to prove that they could 'communicate effectively', the SOfE competition remains as relevant today as when it started and has broadened its scope to include engineers at all stages in

their career. The event involves local heats within countries, with winners going on to national finals and then, if successful, regional finals. The NSW 2010 state heat proved to be a lively and informative evening for all concerned.

Three members of the IMechE at early stages in their careers presented a paper on an engineering topic of their choice. The rules of the event allowed each competitor a maximum of 20 minutes to give their presentation, followed by a period for questions. The audience was treated to three very different but equally interesting topics.

Chris Hoskin was the first presenter. Using an interesting mix of his professional experiences and an explanation of some technical aspects, he described his career in railway engineering and, specifically, heritage railway work. He presented in a clear and engaging way, establishing a high standard for the following competitors.

Sarah McDonald was the second entry and presented a paper on the opportunities to apply an engineering approach to the monitoring and treatment of Parkinson's disease. She proposed that a variety of monitoring devices and data collection systems could be employed in everyday objects to better assess a patient's condition and improve the matching of medication levels to the severity of the symptoms at any given time. Sarah's was a professional and powerful presentation.

Duncan Lockard, the final competitor, gave a presentation on the theme of bio-mimicry, the adoption of design solutions found in nature in human engineering endeavors. Putting forward his arguments in a well-structured and thought-provoking manner, he left the audience with the idea that nature has evolved a multitude of engineering solutions and that engineers should take account of how natural designs deal with a particular problem to find inspirations in engineering.

At the end of the evening, the judging panel declared Chris Hoskins the winner by a small margin and Sarah McDonald the runner-up. All three speakers were congratulated for their accomplished presentations.

Chris receives a prize of £200 and goes on to represent NSW in the national SOfE finals to be held in Perth on 26 February 2011. Sarah receives a runner's up prize of £100.

The NSW committee wishes Chris Hoskin well in the national finals and looks forward to building on the continuing success of the SOfE events in 2011.

Monika Sud

New South Wales Panel Chair

State News QLD

On 6 October the Queensland panel hosted a student evening at the University of Queensland (UQ). The target audience was third- and fourth-year mechanical engineering students. It was a great opportunity for the students to meet IMechE members and to discuss their future prospects. It was also an excellent social gathering for university staff, students and our panel.

Our panel committee member, Joe Percy from GHD, was the speaker for the evening. Basing his talk on the topic, 'Consulting engineering: What is it? And how did I become one?', he presented his employment and engineering experience since graduation. During question time, the student body asked questions such as, 'Do you take resumes?', 'What does a consulting engineer do?', 'What sets them apart from other engineers?' and many more.

While giving the students a personal account of his path to consulting, Joe explained how he became a consultant via a range of experiences in the field of mechanical engineering as well as a series of chance encounters. Drawing examples from his career, he explained the importance of professional development and of IMechE membership. Panel members then mingled with students over food and drinks. It was an extremely successful recruitment event: at the end, 30 students signed up for affiliate membership. IMechE is grateful to Professor David Mee and his staff for UQ's continuous support.

Dayaratne Dharmasiri

Queensland Panel Chair

State News SA

Since the last edition of the *Bulletin*, life in South Australia has been quiet and relatively uneventful on the official front. The Joint Technical Program, which is held together with Engineers Australia, Institution of Engineering and Technology and Royal Aeronautical Society, has been in its last stages for 2010 and a report from the November lecture is covered separately in this issue of the *Bulletin*.

Preparations are coming to a close on next year's JTP events list, which will hopefully have been distributed by the time this issue arrives on your doorstep. Once again, the report includes a good mixture of interesting lectures and site visits.

One of the major events attended by a number of our members was the Final Year Project Exhibition by the School of Mechanical Engineering at the University of Adelaide. Over 60 project groups displayed their work and results from throughout the year. Projects ranged from 'Unmanned & Autonomous Areal Vehicles over a Cricket Bowling Machine' to a self-playing violin, with everything in between. The event was held over one evening and the following day. SA Hon Sec Stan Gafney represented the Institution as a member of the judging panel, which was responsible for awarding prizes to the best projects in various categories. We are already looking forward to next year's event, which is expected to be bigger again due to an influx of final-year students.

The Panel Committee is currently also in the final stages of preparing to host the SA Speak Out for Engineering competition; I will report on the outcome in the next issue.

Michael Riese

South Australian Panel Chair

Visit To Holden Special Vehicles (HSV) – Clayton, Victoria

HSV was established in 1988 and occupies the premises previously used by VW Australia. Some 32 engineers from IMechE and IE Aust had a most interesting visit to these facilities on 30 November 2010. Phil Harding, Managing Director of HSV, gave an expert and thorough account of this successful and profitable enterprise. (Interestingly, Phil had previously spent many years with Rolls-Royce in the UK). HSV's rationale is to produce and market higher performance Holden cars to the 10.7% of drivers it has identified as enthusiastic about such cars but unwilling to finance the near equivalent 'though much more expensive European versions.

The company has the full support of the parent company GMH, which provides three

directors. Its 'Brand Pillars' are performance (i.e. power and torque), handling, styling and superior technology. In principle, the basic car, with an imported 325 kW engine, is supplied from the GMH plant in Adelaide, and modified in Clayton by items including engine tune, suspension improvements, much larger disc brakes with six pistons, special alloy wheels, wider and lower profile tyres, a more elaborate exhaust system, restyled front and rear bodywork, additional instruments and electronics, and a comprehensive road test.

Production is around 30 cars per day (*editor's note: maximum production capacity*), with some being exported to Singapore, South Africa and the UK. In-house technical personnel numbers about 70. Further detailed data on the cars was presented by the engineering manager, Joel Stoddart. Particular reference was made to the vehicles' handling characteristics. As may be expected, many of the cars are used in a racing environment, (e.g. 5 seconds from start to 100 km/hr) so electronic stability control and related technologies receive much attention. There is also a liquid-propane fuel-injection development, which yields a 15 per cent reduction in carbon dioxide emissions.

The facilities at the plant were, naturally, of the greatest interest to us, and also noteworthy for the very high standard of housekeeping. There is no doubt about the build quality of the HSV product.

Patrick Russell-Young

QUOTATION

"Gravitation cannot be held responsible for people falling in love. How on earth can you explain in terms of chemistry and physics so important a biological phenomenon as first love? Put your hand on a stove for a minute and it seems like an hour. Sit with that special girl for an hour and it seems like a minute. That's relativity."

– Albert Einstein

Editorial

I'd like to use this issue's editorial to summarise the results of the recent survey on the Australia Branch *News Bulletin*. The editor received **104 responses** by the deadline (30 November 2010) and a summary of the results follows.

Q1: Would you prefer to receive the *News Bulletin* in hard copy or electronic format?

66% preferred hard copy while 34% preferred an electronic version.

Q2: What is your preferred electronic format?

Of those who preferred an electronic format, the majority (around 85%) preferred email while 8% preferred downloading from 'Near You'. There was one request to have the *Bulletin* in a downloadable format for an electronic reader.

Q3: Are you satisfied with the current layout?

91% are satisfied with the current layout. Some comments from those who thought there was room for improvement are:

- *Remove branch contacts from the back cover and make them available on the 'Near You' site.*
- *Layout can be modernised with more photos/images. Avoid pages with all text.*
- *Would prefer larger text on non-glossy paper.*
- *Would like more, shorter articles.*
- *Too stodgy.*

Q4: If the layout were to change, would you prefer a layout similar to . . .

63% preferred a layout similar to PE, 4% preferred a layout similar to the Royal Academy of Engineering's *Ingenia*, and the rest did not respond.

Q5: Please comment on the content of the *News Bulletin*

58% were happy with current content while 35% would like more technical content and 4% would like more social and interactive content.

Q6: Any other comments?

- Quite a few readers wished to see promotion of local (Australian) technology initiatives.
- Use the *Bulletin* to promote social side of membership and upcoming events.
- Would like to see interviews with influential/iconic engineers.
- Use of more pictures amongst technical articles, cover should be more catchy and bright, and the content requires more social content.
- Layout is perhaps less important, but articles of technical and people/interactive content are more important and effort should be focussed there to improve content.

- It's a very good newsletter, about time to go electronic!
- IMechE should facilitate loading of technical content to Near You – the *Bulletin* should have hyperlinks to these articles.
- Electronic format gives the opportunity to include checkable links to matters mentioned in the articles. Also, I would like links to technical talks (usually in Sydney) that I cannot attend.

Based on the responses, the editor will recommend a number of changes to the *News Bulletin* when the Australia Branch meets in Perth on 26 February 2011. Amongst these changes will be:

- Setting up an email distribution list for those who prefer to receive the *Bulletin* in an electronic (pdf) format.
- Improving the content by including more technical articles and a social interaction section.
- Including more graphics in the layout.
- Actively seeking interviews with influential engineers for interviews.
- Using back cover page for articles and moving the branch contact and membership information to the Near You website.

The editor would like to thank all those who responded to the survey and would like to gently remind our readers that your input is vital to make the *News Bulletin* and our membership vibrant. In this respect, the editor would love to hear from you, be it in the form of a technical paper, a letter, an interesting or amusing anecdote, a photo, or whatever you would like to contribute.

Interview with Professor John Pumwa

Professor John Pumwa is Head of Mechanical Engineering at PNG University of Technology and is IMechE's Representative for Papua New Guinea.

What lead you to choose mechanical engineering as a career?

I was born in a Baptist Mission Station where my father was working with the Australian Baptist Missionaries as an operator of saw-milling machines and a driver. I was very curious to know how these machines operated and to watch the various components moving. I observed the missionaries while they repaired the vehicles, tractors and other machinery. I wanted to know more about how these items were designed and made. The missionaries told me that in order to learn and fulfil my curiosity, I must attend school and do well in order to succeed. I took their advice seriously and it has paid off – I have achieved my dream of becoming an engineer.

Please explain a little about your career so far. For example, how did you begin your career and what made you decide to do a PhD and join a university?

I graduated from the Papua New Guinea University of Technology with a Bachelor's Degree in Mechanical Engineering in 1979. After graduation, I was employed as a production engineer by New Britain Palm Oil, where I was responsible for shift operations in West New Britain Province. It was always my desire to further my engineering education. However, this was difficult while I was working with a private company, so in 1985 I resigned from New Britain Palm Oil and joined the Mechanical Engineering Department at the Papua New Guinea University of Technology as an Assistant Lecturer.

After teaching for about three years, I was awarded an AusAID scholarship to do my Master's Degree in Mechanical Engineering at the University of Wollongong. I completed my degree, with Honours, in 1991. I am thankful to the faculty and staff at Wollongong. The atmosphere in the department was very pleasant and conducive to study, which made my stay very enjoyable and I still value it very much today. After completing my studies, I returned to the Papua New Guinea University of Technology, where I was appointed as a lecturer.

In 1993, I successfully secured a Graduate Research Assistantship with the Mechanical Engineering Department at the Texas A&M University in the United States, to enrol for my PhD studies. My research was entitled 'Experimentation and Modelling of Compound Impact Wear' and I had funding assistance from NASA. The research project was supervised by Dr Skip Fletcher, a Dietz Professor Emeritus and former President of ASME and ABET. I want to thank the faculty and staff at Texas A&M University for making my stay a very pleasant and enjoyable experience that I will never forget.

Professor John Pumwa

In 1997, after completing my PhD studies, I returned to the Papua New Guinea University of Technology. I was the first Papua New Guinean ever to earn a PhD in any engineering field. I was appointed as a Senior Lecturer and the Deputy Department Head in the Mechanical Engineering Department at the Papua New Guinea University of Technology. In 2006, I was appointed an Associate Professor and an Acting Department Head. In 2008, I became the first Papua New Guinean ever to become an engineering Professor and I became Head of Department at the Papua New Guinea University of Technology.

What are the highlights and difficulties associated with your job as head of mechanical engineering at the PNG University of Technology?

Being the Head of the Mechanical Engineering Department in the only Technology University in the nation is a challenge and comes with many responsibilities. In a state university, where funding is limited, you must be innovative in creating activities to support your academic, research and community service programs – otherwise you will not survive. The department has been active in offering our workshop and laboratory facilities to local industries and, in turn, generating necessary funds to assist the academic and research programs.

One of the difficulties encountered as the Head of Department is the recruitment of academic staff. The department is severely short of staff (every year) and it is very difficult to execute all our initiatives when we are short of staff to carry out responsibilities such as teaching, research and community services. The Department has initiated the process of accreditation of its academic program but it may be shelved until a later date due to the shortage of faculty. Our university simply cannot compete with industries and overseas universities and we struggle to attract candidates to join the department. We have made a number of offers without success.

How popular is mechanical engineering in PNG? Is it something children aspire to as a career? Are there any programs to promote mechanical engineering?

The mechanical engineering program is very popular as a result of the recent increase of industrial activities in Papua New Guinea and we have received a lot of applications from school leavers and those who have completed school. Unfortunately, our facilities are limited and we cannot afford to admit all qualified students. Moreover, this is the only institution in PNG with a mechanical engineering program, which means that all applicants from the whole country are sent to us for screening and selection. This reduces the efforts we can put towards promotion programs. However, the Department's admissions coordinator does visit various secondary schools and informs students about what is expected of a mechanical engineer and what he/she does.

How many students select to study mechanical engineering each year at your university and, of this number, what percentage completes the course?

Due to the limited academic facilities at the university, the admissions quota for the mechanical engineering program is 45 students (including both school leavers and those who have completed school). However, the total number of applications received every year is about 150–250. Of the 45 students who are admitted, at least 25–30 students graduate every year. In future years, it is highly likely that there will be an increase in the number of applications as a result of the increase in the number of secondary schools in the nation. If the facilities at the university do not improve, we'll end up with a bottleneck, which may increase the nation's social problems.

What opportunities are available in PNG for young graduate mechanical engineers?

Almost all graduates from the mechanical engineering program at the Papua New Guinea University of Technology are employed. In fact, at present there is a heavy demand for mechanical engineering graduates because of the increase of industrial activities in the country – in fact, we may not be able to meet the demand. It is high time for the university to increase the facilities to accommodate the high number of secondary school graduates wanting to study, and at the same time to graduate sufficient mechanical engineers to meet the local demand.

What do you like to do when you have some free time?

Being a Papua New Guinean, I like to watch rugby league games (national sport), both live and on TV. Also, as a committed Christian, I like to participate in church activities.

Plastic Electronics *(The writer of this article, Dr Scott Watkins, did a presentation on the topic at a Victorian Panel event)*

Most of us encounter plastics as inert materials that, if anything, are electrical insulators. Indeed, we rely on the insulating properties of many plastics as the covering material around power cords. However, there are certain classes of plastics that do conduct electricity and the use of these plastics in a variety of electronic devices is poised to change the way we live.

Imagine, for instance, fully flexible television screens that can roll up and be carried in your pocket. Imagine also lightweight, plastic solar cells that can be incorporated into clothing, curtains and roofing materials. All of these applications are being actively developed by research groups around the world and the prospects are looking good.

The discovery of conducting polymers was recognised by the award of the 2000 Nobel Prize for Chemistry to Alan Heeger, Alan MacDiarmid and Hideki Shirakawa. The new area of research spawned by their discovery has since led to the development of polymeric semiconductors that are the active material in a range of devices. Polymeric semiconductors are more like insulators than true semiconductors. However, they are generally capable of transporting charges over distances of up to several hundreds of nanometres. By comparison, a human hair is around 200 times thicker than a typical polymeric semiconducting layer in a device. It is the fact that these thin layers can function that enables devices based on them to be lightweight and flexible.

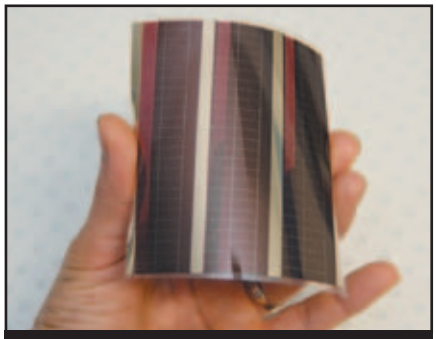

Figure 1: A prototype Flexible Solar Cell (Courtesy Dr Doojin Vak, University of Melbourne / CSIRO as part of VICOSC)

The materials used in devices based on plastic electronics are often also referred to as organic semiconductors. This broader definition includes polymers and small organic molecules (some resembling drug molecules or naturally occurring dyes) that are mainly based on elements such as carbon, hydrogen, nitrogen, sulphur and oxygen. Another key advantage of these organic semiconductors, as compared with inorganic semiconductors such as elemental silicon, is that the properties of the organic semiconductors can be easily modified by simple variations to their chemical structure. For example, silicon – a material commonly used in solar cells – has a fixed-band gap that defines the wavelengths of light that can be absorbed by a silicon wafer and therefore any device made from this material. The fixed band-gap also defines the apparent colour of silicon-based devices, the blue panels often seen on roofs. By contrast, organic or polymeric semiconductors can be chemically modified to alter the range of light that can be absorbed. Such chemical changes also impact on the efficiency with which these materials transport charges. It is therefore the chemical versatility that has driven the development of these materials and it provides an opportunity for chemical, rather than engineering, solutions to improve the performance of devices.

Figure 2: A prototype OLED. (Courtesy: Karl Weber, CSIRO)

Organic Light Emitting Diodes

The most developed technology that makes use of plastic electronics is the display technology known as Organic Light Emitting Diodes (OLEDs). In an OLED, one or more layers of polymeric or organic semiconductors are sandwiched between two electrodes. One of these electrodes is transparent (a common material is indium-doped tin oxide) and the other is a metal such as aluminium. When a voltage is applied between the two electrodes, charges migrate through the organic layers, leading to some of the molecules becoming energetically excited. These molecules, which are typically also luminescent, relax back to their ground state by emitting light. The colour of the light is determined by the chemical structure of the emitting material and can be tuned to give red, green, blue or white light. The OLED was first developed by researchers at Kodak using small organic molecules originally developed for photocopiers. Subsequent research in Cambridge in the 1990s demonstrated that OLEDs could also be made from polymers. The significance of this latter discovery was that the polymer films could be prepared from solution, using common coating or printing techniques. When compared with high-temperature vacuum deposition of inorganic semiconductors, the printability of plastic electronic materials established yet another important advantage.

The development of OLEDs has been pursued by most of the major display companies around the world. When compared with Liquid Crystal Displays (LCDs), OLEDs use a simpler device structure to emit light with higher power efficiencies, better contrast ratios and faster switching times. In combination, this makes OLEDs a superior display technology to LCDs and a number of small displays and mobile phones are now commercially available featuring OLEDs.

One of the key features of OLEDs is that the use of trace amounts of dopants based on metals such as iridium has enabled device power efficiencies to exceed all other light-emitting technologies. Indeed, white OLEDs now outperform fluorescent light bulbs in terms of power efficiency. This has opened the way for the expansion of OLEDs from a display into a lighting technology. The prospect of using thin films or panels as lights, rather than point sources, will change the way we use lighting and can realistically be achieved using less power than conventional lights.

Polymer Solar Cells

Polymer solar cells, commonly known as Organic Photovoltaics (OPVs) have a similar device structure to OLEDs. A layer (or layers) of organic semiconductors is sandwiched between two electrodes (one of which is transparent). When light is incident on the device, some of the molecules or polymers are energetically excited. These excited states can lead to separate positive and negative charges through charge separation at an interface between two materials with differing electron affinities. Charge transport through the materials leads to a flow of electrons from the device and a voltage difference is established between the two electrodes. When connected to an external circuit, the OPV produces charges that do work to power devices.

As with OLEDs, OPVs have the advantages that the organic semiconducting layer is very thin (less than 300nm), and can be printed. This enables solar cells to be made via inexpensive coating techniques and delivers a product that is flexible. The current best power conversion efficiencies (light to electrons) of OPVs is around 8%. This compares with thin film silicon solar cells that operate at about 9% or crystalline silicon cells (such as those commonly found on homes) that operate at about 15%. The challenges for researchers working on OPVs are to translate the lab-scale power-conversion efficiencies to production-scale modules and to continue to improve the power-conversion efficiencies of the devices by absorbing more light and transporting charges more efficiently.

Commercial Prospects and Device Lifetimes

As noted above, OLED displays are now finding their way into an increasing number

Plastic Electronics

of small-display devices. With all major display companies actively pursuing OLED development, it is only a matter of time before OLEDs begin to penetrate the large-size display and lighting markets. Notably, the development of the production processes to facilitate the manufacture of large-size OLEDs will also benefit OPVs. This raises the prospect that it could be large-display manufacturers and electronics companies, as opposed to traditional solar cell manufacturers, that drive the development of OPVs.

With regard to lifetimes, OLEDs on glass have now been shown to deliver extrapolated operating lifetimes of at least several decades. This demonstrates that these organic semiconductors are inherently stable to transporting electrical charges, a fact that also applies to OPVs. The major degradation mechanisms for both OLEDs and OPVs are closely linked to defects in the semiconductor-electrode interface and the encapsulating layers that protect the materials from oxygen and water degradation. Continued development of better barrier materials, particularly for flexible substrates, will greatly enhance the operating lifetime of all plastic electronic devices.

The Future

Plastic electronics is a disruptive technology that will change the way we make and use electronic devices. By enabling flexible displays, lights and power sources, new devices will serve to even further cement the ubiquitous presence of electronics in our lives. OPVs in particular have the potential to make solar power a realistic energy source on a large scale in the medium to long-term. That all of these devices can be made using low-entry barrier, established coating and printing techniques also means that the manufacturing prospects for Australia are good. Roll-up screens and flexible solar cells? The future is looking bright.

Dr Scott Watkins

Stream Leader – Organic Photovoltaics
CSIRO Materials Science and Engineering
CSIRO Future Manufacturing Flagship
scott.watkins@csiro.au

Knowledge Capital

As engineers, we all have learned knowledge, which is our capital for our earning. We underwent a stringent formal education to acquire our knowledge. While we all have knowledge, its level and discipline differ among us, and our knowledge is finite. Thus, in our work, we focus primarily on our core competency. Many of us have multi-disciplinary engineering experience, which creates more opportunities for employment (especially useful during an economic downturn). Some of us have gathered knowledge beyond the engineering field, in management, law, finance etc. and are enjoying various competitive advantages.

Inventions, innovations and discoveries contribute to global information growth. Lifelong learning is the best way to prevent income depletion. We are our own best teachers. Many individuals are adopting different techniques to continuously increase their knowledge through education, experience and thinking. But having knowledge does not produce skill, which is either inborn or acquired by practice.

Knowledge-based intangible assets are growing within corporations and are more valuable than tangible assets. Intangible assets include operating systems, know-how and social relations. Operating systems includes organisational structures, policies, procedures, methods and company cultures. Know-how includes licenses, the skills and knowledge of employees, competency and creative/innovative capabilities. Social relations include employee loyalty, customer patronage, supplier backing, competitors' cooperation for joint ventures, networks, reputations, trademarks, community supports and government encouragement.

The importance of a quality operating system was first realised with the release of the International Standard Organization (ISO) 9000 series in 1987. ISO 9000 facilitated the emergence of greater competition as companies began developing and/or formalising their operating systems. Since 1987, ISO has released many more standards covering environment, occupational health and safety, risk, business continuity, various aspects in information technology (IT), supply chain and more. Moreover, the Australian Standard (AS) 8000 series covers corporate governance. These standards present the industry with the knowledge to simplify and streamline tasks without individual companies having to experiment in order to find a workable system. We can expect more and more standards to be released, including those suitable for managing people skills in workplaces.

People skills depend primarily on emotional characteristics. This is the reason that Emotional Intelligence (EQ) has replaced the Intelligence Quotient (IQ) in the recruitment arena. Attitude has become a key element in recruiting staff. This is the rationale behind the ASK (Attitude, Skill and Knowledge) model of recruitment. Many employers believe that the additional skills and knowledge required for any new work can be easily acquired within the company provided that the employee's attitude is right. Determining individual attitudes and continuously nurturing positivity requires specific skills, which are the responsibility of the human resources group.

One of the key tasks for a company's management is to get the best out of its employees. In fact, these days, more of the budget is allocated to wages than to tangible resources. The way in which employees carry out their duties depends on their level of motivation. Company policies and practice, relationships with their superiors, the working environment and their inner desires all influence their motivation. Unfortunately, some supervisors spend their energy on eliminating capable subordinates who have the potential to replace them. This behaviour frustrates staff and decreases motivation. If senior managers don't pick up on the supervisors' behaviour and only measuring staff performance by results, the business ultimately dwindles. Managers need skills in conflict resolution in order to nip any unhealthy activities in the bud.

Since civilisation, land owners dominated the agrarian society as land and labour were employed in agricultural production. In those days, knowledge was very little and little skill was required to perform tasks. The interest of the rulers in agrarian society was mainly to collect revenue and to control the military. There was no specific administrative system at that time.

The invention of the steam engine initiated the Industrial Revolution, which kicked off the capital society. Economist Adam Smith's book *The Wealth of Nations* (1776) was a forerunner to our current economic system. Capital society depends on money, machines, materials and manpower for production. Since Smith's work, many more M's have been added, including method, mission, management and marketing.

After the Industrial Revolution, when workers realised they were being exploited, agitation increased and some socialist states were formed. Society was now divided into two camps: capitalist and socialist (Marxist). Management knowledge, competition, demands for higher productivity and scarcity of skills improved working conditions in capitalist society. Moreover, electronic applications and information technology accelerated the evolution of learned knowledge. The mode of production began shifting towards the application of knowledge with automation and machinery. Today, the world's leaders are predominantly from

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Notice of AGM

2011 Branch AGM and Speak Out for Engineering (SOfE) Australian Finals

The 2011 Branch AGM will be held on Saturday 26 February in Perth (5 pm tentative). The SOfE Australian finals will be held in the afternoon before the AGM on the same day. The AGM will be followed by a dinner. Members are invited to attend the SOfE finals, the AGM and the dinner.

The AGM and SOfE finals will be held at the Seasons of Perth Hotel, 37 Pier Street, Perth. Venue for the dinner is TBA. For more information please contact Ken Tushingham on 08-93390155 (H).

The following members are the sole nominees for office bearer positions for 2011/12. They will be declared elected unopposed at the AGM and will take up positions during the third week of May 2011.

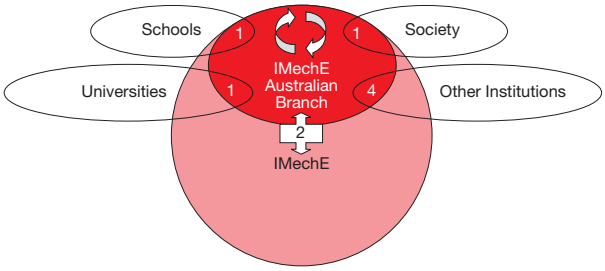
Chairman: Ian Mash *(centre in picture)*

I am a Chartered Mechanical Engineer and was elected a Fellow of the Institution in 2009. I hold Masters Degrees in Mechanical Engineering from the University of Cambridge, and an MBA in Engineering Management achieved through distance learning whilst in full-time employment with Bombardier Transportation in Europe. Employed in the transport (railway) industry since graduating in 1997, I have undertaken a range of roles, but have more recently specialised in leading the safety assurance and legislative compliance aspects of new rolling stock projects, including four fleets in the UK before I immigrated to Australia in 2005. Since then, I have supported several new train projects and, most recently, have been Project Manager – Safety Assurance for Downer EDI Rail in the execution of the $3.6B Public–Private Partnership project, delivering 626 new rail vehicles for New South Wales.

I have been active in the IMechE since 1998, having previously been a committee member of the North East Railway division in the UK, a past Chairman of the Railway Division Young Members, the Hon Sec for the NSW Panel since 2005, and have served as Hon Sec for the NSW Branch since 2009. I have undertaken numerous professional interviews, and continue to champion the Speak Out for Engineering competition in NSW.

My vision, should I become Chairman of the IMechE Australia, is to work towards:

1. Enabling engineering to progress from being a hidden success story in Australia by seeking to grow awareness of the sector – taking a positive, inspiring message into schools and universities, and into society beyond our membership.
2. Enabling a voice for our Australian membership to seek meaningful improvements in those issues most relevant to our members in Australia.
3. Ensuring best practices in gaining, retaining and serving our panels' memberships are shared across Australia to the benefit of all members.
4. Continuing to work with other relevant institutions to the benefit of our profession.



Hon Secretary: Dayaratne Dharmasiri

My education includes a Bachelor's Degree in Mechanical Engineering with Honours (1981) and a Master's Degree in Business Administration (1995).

I spent the first seven years of my career (1981–1988) as a mechanical engineer in the construction of irrigation and hydroelectric power projects, employed by Sir William Halcrow & Partners Group, Salzgitter Consult GmbH, and Central Engineering Consultancy Bureau. Since then, I've been working in the rail industry, employed by Queensland Rail.

I joined IMechE in April 1989. I am the current Queensland Panel Chairman (2007–present) and was the Panel Secretary for 2005–2006.

I have served the Engineers Australia Queensland Division Mechanical Branch as Chairman (1994–1995) and Secretary (1993–1994), and on the Member Affairs Committee, the National Engineering Week Committee and the Rockhampton Local Group Committee.

My vision is a truly global IMechE that mechanical engineers around the globe will strive to belong to. We can achieve this by understanding members and prospective members' needs and their perception of IMechE. With your support, I shall pursue the interests of IMechE and its members, shall work hard to promote IMechE amongst members and non-members, shall work in close co-operation with other professional bodies and educational/academic institutions, and shall make every effort to recruit younger members.

Hon Treasurer: Ken Tushingham

My education was all in the UK where I finished with an Honours Degree in Mechanical Engineering at what is now known as the University of Northumbria.

My career as a professional engineer is of over thirty years within the power-generation industry.

I joined the IMechE in 1975 and have been an active member of the Australian Branch and Western Australian Panel since 1985. My roles have included WA Panel Hon Secretary 1987–1995, Branch Hon Secretary 1993–1995, Branch Chairman 1995–1997, WA Panel Chairman 1995–2009 and Branch Hon Treasurer since 1999.

I aim to promote the IMechE through the smooth working of the Australian Branch. A foundation of this is a sound financial position, which I will work to maintain using my knowledge of business in general and the workings of IMechE in particular.

Notice of AGM

Assistant Hon Secretary/*News Bulletin* Editor: Matthew James Springer

I graduated with a MEng (Hons) Mechanical Engineering with Diploma in Management from the University of Aberdeen in 2009. I am currently working as a Project Engineer at miniFAB (Aus) Pty Ltd (Melbourne), managing small projects and developing prototypes for medical diagnostic equipment and other technology that requires micro-, nano- or bio-engineering design. My role within miniFAB also involves designing, fabricating and managing low-volume manufacturing.

I was project manager of the University of Aberdeen IMechE Formula Student Team and, at present, I am the Young Member Representative for the Victorian Panel.

My vision is to take on board the wishes of the *News Bulletin* readers and bring in a new format. I want the *Bulletin* to give readers up to date, informative, relevant and interesting articles. I hope to keep all current readers stimulated whilst engaging new members and readers of all age groups. I particularly want to make the *Bulletin* accessible to younger members who may otherwise not see the benefits of membership.

Piping System Surges – Is your company at risk?

Many national Codes and Standards have requirements to design piping systems to take account of the effects of occasional loads such as pressure transients. In these cases, contract documents and specifications list the many piping standards that require the contractor or designer to carry out surge analysis. Contractors do not necessarily understand this responsibility and do not always allow for the study, let alone the mitigation equipment to meet the design requirements. Rarely is a tender sufficiently detailed to enable a surge analysis to be undertaken and so the consequences are not allowed for by the contractor at tender stage. An informed tenderer, however, may allow a PC Sum to cover the need for any mitigation devices.

Surge events in pipelines concern not only positive pressures but also negative ones. Full vacuum can occur when there is column separation in a piping system. This commonly occurs when there is a loss of power or rapid closure of an upstream valve. Thin wall ferrous, and low stiffness GRP and thermoplastic pipe may be subjected to buckling due to vacuum. Buckling may be more likely if the pipe has become oval because of the installation techniques or support design.

Commonly, the use of the Joukowsky formula is advocated to determine the worst case of surge. Unfortunately it does not always indicate the highest transient pressure that will occur in a system. In practice, this equation is usually only directly applicable to quite simple piping systems and not when rapid collapse of vapour cavities occurs. In a complex system, the pressure transients bounce off boundaries and can combine to produce even greater surge pressures than for a simple valve closure. The Joukowsky formula makes no allowance for vacuum events that may result in buckling failure.

Pipelines have been known to fail catastrophically as a result of surge events. The failure may take the form of a pipe burst or a pipeline collapse from buckling. The consequences of a failure can be immediately catastrophic or, in the longer term, require increased expenditure in maintenance because of fatigue.

The Codes and Standards recognise the phenomenon of fatigue. To overcome the potential of fatigue failure in the pipe wall, increased thickness is required in the wall. Historically, S-N curves have been used to evaluate the fatigue resistance of pipe materials. Certainly for thermoplastic and GRP materials, the newer science of fracture mechanics with FEA is being used to determine the design life of materials. Pipeline accessories may also succumb to fatigue damage, resulting in leaking gaskets; valve body, seal or gasket failure; instrument failure or pipe support failure.

Equipment that may be damaged is specific to a particular pipeline or process facility. The consequences arising from such damage is also specific. Those involved in a project should undertake a risk review or HAZOPS (hazard and operability study), identify these matters and rank the consequences. If this is not done, damage to equipment may mean that a process is offline whilst replacement equipment is installed, and the on-costs can be many times the primary capital cost of the equipment alone.

The vibration resulting from a series of surge events can cause pipe supports to damage the external surface of the pipe material and result in corrosion or a leak. If a leak is in a difficult access position, the repairs become costly and time-consuming. Pipe supports secured to concrete or steel structures can fail at the fasteners as a result of fatigue. The repetitious loading can result in fasteners loosening or failing. Concentrated masses such as valves may be excited by surge events and cause damage to the piping material. Such items should be supported locally to prevent such occurrences.

Software is readily available to undertake sophisticated analysis of systems. However, the cost of the software licence is small compared to the process of learning the application of this complex and varied technology. Having understood the requirements of the Codes and Standards, the responsible party needs to determine whether they have available the resources to undertake the analysis and subsequent design of any mitigation devices.

The consequences of a surge failure can sometimes be avoided by an increased level of engineering at the design stage. The Codes and Standards *require* that level of engineering, which should be undertaken using the specialist expertise necessary to make informed decisions.

We live in a risk-adverse society. Rest assured that, when a system surge occurs, someone will not only be looking for who to blame but for someone with deep pockets to pay! So, it is surprising that many engineers still choose not to undertake a surge analysis when designing a piping system. Not only are they contravening the requirements of the Codes and Standards, they are leaving themselves open to considerable financial loss.

A full copy of the technical paper 'Are You at Risk from Not Considering the Potential for Surges in a Piping System?' is available by request from blenrayaust@yahoo.co.uk. In addition, a questionnaire can be provided that allows you to consider how your system may react to changes in the boundary conditions.

Geoffrey D. Stone

F I E Aust CP Eng; F I Mech E C Eng

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the knowledge society. The major portion of revenue collections comes from these knowledge workers as income tax.

The collapse of the Soviet Union and China's conversion to a market economy are the result of many complex issues. The failure of socialist states is primarily the result of the selfishness of leaders, the system's inelasticity for production improvement, the lack of incentives for productivity, people's lack of commitment and their inability to deliver results. Changes occurred too rapidly for people to respond and everything became an experiment. Many recent failures in business corporations are attributed to the human traits that led to the failure of socialist states. In fact, certain newly employed chief executive officers (CEOs) are functioning instead like chief experimental officers, introducing rapid changes and replacing the existing system faster than employees can manage.

On the other hand, China's success story of rapid economic boom and massive infrastructure development can be attributed to strong teams dominated by people with engineering training. Similarly, engineers at the helm will be a boon for development in other countries.

Conclusions: The knowledge society will lead the world. Knowledge-based intangible assets triumph over tangible capitals. Lifelong learning is essential for survival. Holding multi-disciplinary skills and knowledge in related fields boosts employees' careers. People skills are the most important of all. The rapid altering of business systems or sudden shifts in working culture can have far-reaching, negative consequences. Selfishness is a virus that will always hurt a business. Engineers as leaders are a blessing for the community.

Varan Karunakaran

Letter to the Editor

Relations between IMechE and IEAust

This interesting letter is from Mr E. C. (George) Fox from NSW, who was Branch Chair in 1964–65. Mr Fox says:

'Before 1960, IMechE reached an agreement with IEAust not to establish a branch in Australia, as it was perceived to be an interference to IEAust's activities. However, a decision was taken in 1960 to establish a local branch, and I was contacted with a request to help out. I had just returned from India and agreed to IMechE's request. While the branch was being formed, relations between IMechE and IEAust deteriorated.

'Not long after 1960, another organisation was showing interest in forming a Professional Mechanical Engineering body in Australia. At this point, C. H. Harper from IEAust got in touch with me, asking me to get an injunction to stop this taking place. An injunction was sought and was successful. Since then IMechE and IEAust have had a friendly relationship.'

Something To Think About

The editor received the following response to the question, 'Would a candle burn in the cabin of an orbiting space shuttle (not that it would be allowed!)? If so, what would the flame look like?'

An interesting question. A burning candle relies on gravity for the hot gases produced to rise above the flame and be replaced by fresh supplies of oxygen. In the absence of gravity, it is doubtful if a continuous flame could be produced.

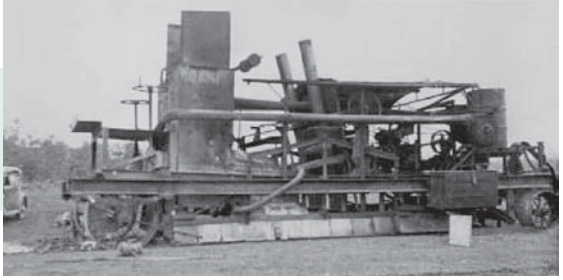
Ray Watson

Solution to the Sudoku puzzle in NB159

8	5	4	2	1	9	7	6	3
3	9	7	8	6	5	4	2	1
2	6	1	4	7	3	9	8	5
7	8	5	1	2	6	3	9	4
6	4	9	5	3	8	1	7	2
1	3	2	9	4	7	8	5	6
9	2	6	3	8	4	5	1	7
5	1	3	7	9	2	6	4	8
4	7	8	6	5	1	2	3	9

What is it?

Can anyone identify this curious machine?



Washdays

A little over two generations ago, coping with a family's weekly wash was a major operation, occupying two strong females (usually) for the best part of a day. It required a special room at the back of the house, containing two or even three concrete troughs with a cold water supply and a drain. There would also be a separate facility for boiling a sizable volume of soapy water. If the house dated from the nineteenth century, (Vulcan had one), this would be a substantial copper vessel mounted in brickwork with a chimney and a solid-fuel fire below; by the twentieth century, it might be movable and gas-fired.

Alongside these items, there would be a device for dewatering boiled and rinsed linen. This was called a mangle; today's children would not know what the word meant, let alone have ever seen one. It comprised a pair of rollers spring-loaded in contact and turned by hand, and was usually clamped to the division between troughs. (Very occasionally, it would be replaced by a rather dubious, centrifuge-powered – no doubt illegally, by the town's water supply – mangle that operated on the Pelton wheel principle.) After going through the mangle, almost all items had to be hung on a suitable line in the open air until more or less dry, rain permitting. Meanwhile, the 'copper' would have to be bailed out somehow.

So, washdays were quite an undertaking. But what do we see in terms of washday equipment today? Merely a modest-sized white cube with a door at the top or front and an array of knobs and switches. Labour is confined to putting in and taking out linen, already clean and nearly dry. Apartment dwellings often have an adjacent tumble dryer, requiring no more than the same effort.

We should always be suitably grateful, and really ought to regard the engineer as the patron saint of washdays.

Vulcan

AUSTRALIAN BRANCH CONTACTS

Chairman
Clive Waters
569, The Parade
Magill, SA 5072
Email: cwaters@optusnet.com.au

Honorary Secretary of WA Panel
David Allen
73 Seacrest Drive
Sorrento, WA 6020
Ph (w) (08) 6222 8253
Email: david.allen@ghd.com.au

Honorary Secretary of YM Panel
Michael Riese
14 Alison Avenue
Blackwood SA 5051
Ph (w) (08) 8362 5445
Email: Michael_Riese@gmx.net

BRANCH AND PANEL SECRETARIES

Honorary Secretary Australia Branch and NSW Panel
Ian Mash
75/26 Macpherson Street
Narrabeen, NSW 2101
Ph (w) 0417 672 281
Email: ian.mash@downeredirail.com.au

Asst Hon Sec, Australia Branch and *News Bulletin* Editor
Roshan Dodanwela
2/161 Victoria Road, Hawthorn East
Victoria 3123
Ph (w) (03) 98824410
Email: dodanwela@yahoo.com

Honorary Secretary of Victoria Panel
Varan Karunakaran
26 Sunburst Avenue
Balwyn North, Victoria 3104
Ph (w) (03) 9211 6445
Email: varan.karunakaran@yahoo.com.au

Honorary Secretary of Queensland Panel
Leslie Yeow
PO Box 1461
Brisbane, QLD 4001
Ph (w) (07) 3407 4619
Email: leslieyeow@energex.com.au

Honorary Secretary of SA Panel
Stan Gafney
34 Loch Lomond Drive
Modbury, SA 5092
Ph (h) (08) 8263 2229
Email: s.gafney@bigpond.net.au

Tasmania and ACT
Please contact Australian Branch Chairman, or Australian Branch Hon Sec.

PNG Representative
Dr John Pumwa
Head of Mechanical Engineering Department
PNG University of Technology
Lae, MP411
Papua New Guinea
Ph (w) (675) 4734851
Email: jpumwa@mech.unitech.ac.pg

Executive Committee:
Clive Waters
Roshan Dodanwela
Ken Tushingham
Ian Mash

Branch I.T Co-ordinator
Geoff Stone
10 Carrbridge Drive
Castle Hill NSW 2154
Ph (w) 02 8850 2313
Email: blenrayaust@yahoo.co.uk

Websites:
IMechE Australian Branch Website
www.imeche.org.au

IMechE UK Website
www.imeche.org

NOTICES

AFFILIATE MEMBERSHIP

The Affiliate Grade of Membership is available, with no joining fee or annual subscription, for students studying an approved Mechanical Engineering degree course. Upon Graduation, the student can apply for Associate Membership. For details, students should contact their nearest Panel Hon Secretary.

MEMBERSHIP

For information on how to apply for membership of the Institution, or transfer membership grade, refer to the website at www.imeche.org. Alternatively, contact Membership Helpdesk, c/o IMechE, 1 Birdcage Walk, London SW1H 9JJ. Telephone 001144 84522 69191.
Email: membership@imeche.org

Sponsors for membership should be Chartered Engineers, although not necessarily members of IMechE. Sponsors must be satisfied that the applicant should be considered for election to corporate membership and may be contacted for further information regarding the applicant at any time during process.

Applicants for grade of Fellow must be sponsored by at least one Fellow.

Engineers Australia members are eligible to apply for the equivalent grade of IMechE membership under the terms of the Mutual Recognition Agreement.

UPGRADE OF MEMBERSHIP

Those Australian members having the necessary experience and qualifications are urged to upgrade from Member to Fellow. The appropriate forms can be downloaded from the above website, or hard copies can be requested from the Branch Hon Sec.

SUBSCRIPTIONS

Payment of subscriptions by MasterCard or Visa can be made by registration on Other methods of www.imeche.org/imember/login.asp Other methods of payment include bank transfers in UK Sterling, bankers drafts and cheques made payable in UK Sterling.

CHANGES OF ADDRESS

If you change your address, please log in to www.imeche.org/imember/login.asp to make the changes. Alternatively you can write to IMechE, PO Box 87 Oakengates DO (District Office) TS3 3WT UK. (Phone number: 001144 1952 214060).

IMECHE PRIZES

The Following Prizes are administered by Australian Branch and details can be obtained from the Branch Hon Sec or from your nearest Panel Hon Sec:

- The Frederic Barnes Waldron Best Student Prize
- The IMechE Project Prize
- The Speak out for Engineering Prize
- The Paul Henderson Prize
- The Andrew Frazer Prize (PNG)

ARTICLES FOR NEWS BULLETIN

This Australian Branch Magazine is published three times a year. It features news of events being held at Branch level and in the various Panel areas. The Editor is constantly on the lookout for good articles on a wide variety of engineering topics. If you have an interesting theory, mechanical engineering experience or invention, please contact the Editor.

Articles or Letters for publication in *News Bulletin* should not exceed 3000 words, and are preferred in Microsoft Word format. They can be sent by email or posted on compact disk. Alternatively, clearly typed hard copies can be submitted.

Articles should be accompanied by good quality diagrams or photographs of about 1Mb for clarity, with captions, and not embedded in the Word document.

CIRCULATION

The *News Bulletin* is circulated free of charge to all Australian Branch Members. Should you prefer to not receive a copy of the *News Bulletin*, please advise the Editor, using the contact details in this publication.