NB
News Bulletin
Australian Branch

NUMBER 171 AUG 2014

Institution of MECHANICAL ENGINEERS

PRODUCED FOR INSTITUTION OF MECHANICAL ENGINEERS MEMBERS LOCATED IN AUSTRALIA
PRINT POST APPROVED PP317737/00060
PRICE $4.00

FSAE EDITH COWAN 2014 SEASON REVIEW

Edith Cowan University Formula SAE team's hectic 18 months of planning, building and preparation led to a major turn-around in fortunes after having to pull out of the 2013 FSAE competition. Team Leaders Alex Barry and Arron Lee sum up the season finale trip to the UK.

Edith Cowan University Formula SAE team after completing the Formula Student 2014.

After pulling out of the 2013 FSAE competition, every team member was eager to show what Edith Cowan University Racing was all about on the world stage at the FSAE UK finals. Hertfordshire University Racing were our gracious hosts for the first few days in the UK and provided us a workshop and storage space which we were very grateful for.

As most of you may know, anytime something custom is manufactured and put through its paces, something is bound to break and problems encountered. There was no shortage of problems with our custom engine during dynamic testing and the team quickly got very familiar with removing the engine and replacing components. We are running a custom engine based off a Honda CBR600RR motorcycle engine but with certain parts modified. The stock internals have been retained but are now housed inside a custom machined block to accommodate a reversed head; enabling us to drop the crank centre line down 120mm, seat the engine further forward to improve the weight distribution and direct the exhaust out the back of the engine and the intake facing the front which greatly improved the heat dissipation and insulation.

Winners of the Mercedes AMG High Performance Powertrains for 'Class 1 Best Powertrain Installation of an Internal Combustion Engine'.

A few days later we moved into our campsite within walking distance from Silverstone Circuit. It was fantastic to see so many teams from all corners of the Earth supporting the competition; the stage was set and our excitement was palpable. An early morning start – something that happens very often in Formula SAE - followed by a 20 minute walk saw our first day at the track and settled into our assigned garage. Half of the team members had to remain back at the University of Hertfordshire as we were still encountering issues leading up to the competition.

We attempted to pass scrutineering as quickly as we could in order to prepare and focus on the dynamic events. However the judges decided we needed to modify a few things such as the front wing bolts being too strong and therefore not shearing away in the event of a collision. Due to the lack of time and curfew in the garages we set our goal of passing scrutineering first thing in the morning.

ON THE INSIDE

FSAE EDITH COWAN 2014 SEASON REVIEW (CONT)

The car passed scrutineering early in the morning, just in time for the start of the static events, which consisted of a business, design and cost event presentation. Our custom engine garnered the most attention from judges and other teams alike and we were constantly getting bombarded with questions about it which we loved! We were very honoured to receive awards from Mercedes AMG High Performance Powertrains for 'Class 1 Best Powertrain Installation of an Internal Combustion Engine' and from Jaguar Land Rover for 'Innovation in Propulsion Systems'.

The dynamic events ran over the next couple of days with all of the events occurring on the first day except for the endurance, a gruelling 50 lap test of a car's reliability and performance which sees a lot of teams go home in tears. After our drivers walked the course preparing themselves for the sprint and endurance events, the car was prepared for our first event, which was acceleration; a timed 0-75m acceleration run. Considering the small problems we had right before our run, a time of 4.2 seconds by Nathan Van Vugt to place us in 11th overall and amongst the fastest combustion cars was a great result.

Last minute electrical fixes before heading out on to the track.

We then moved onto the skid pad, a figure-of-8 circuit that tests how well the car corners and maintains traction under a high-G load. Our driver Thomas Ayres managed the quickest time for us with a 5.1, however a cone was hit on the way out of the course and incurred a 0.2 second time penalty. Alex Barry pulled a clean 5.3 second average time, placing us in 12th place overall for the event.

- **Describe the engine and integrated 2 speed gearbox design. What are the advantages of this concept?**

  The engine is based off a Honda CBR600RR which we chose because we've run it for over 5 years and we wanted to have the same reliability as the CBR. The block is a machined billet casing that weighs in under 13kg and we have used a standard Honda CBR head. Internally the rotating parts are all from the CBR, but we have reduced the gears from 6 to 2 and made our own final drive to suit the FSAE tracks with 2 gears.

  The main advantage is that we have flipped the head around so now the exhaust is able to exit out the back of the car which means we have been able to push our engine closer towards the driver's back and don't need to worry about any heating issues through our firewall.

- **Could you describe your suspension design and the benefits behind it?**

  The front suspension uses conventional double A-arm wishbone with direct acting dampers. The rear suspension is a De Dion axle with Satchell Links. Using a De Dion axle has certain benefits when it comes to FSAE, we've been able to remove any requirements for a rear spaceframe as all of our suspension loads are fed straight back into the carbon chassis. Eliminating any need for a rear structure that takes suspension loads mean that we have lost the weight of that component.

- **Why have you gone for a full monocoque chassis and could you go into detail about your 'cut and fold technique'?**

  The use of the De Dion axle removed any need for a rear structure to take suspension loads and as such we have removed our rear spaceframe altogether. This simplifies the back end of the car and reduces the mass of the car.

  The process behind the cut and fold construction technique is that we have the flat panels made for us (aluminium honeycomb with carbon skins on both sides), by our sponsor Ayres Composite. We receive the panels and CNC route cut lines (for one skin only) for our bend angles on the internal skin. All hard points feature a bonded aluminium insert to take any loads and others feature a threaded insert for parts that need to be retained. The weight of our chassis is around 20kg with a bonded front roll hoop. The entire process takes no more than a fortnight to do from the start of the first join to the completion of the last join.

- **What has been the biggest technical challenge for your team this year?**

  Definitely the custom engine has been the biggest challenge the team has faced so far. Trying to do your own engine is no small project. There were many small hiccups along the line that were overlooked initially during the design and it has proven to be an issue when we ran it out, however we feel confident that we have tackled most of the problems we've had. Fortunately we have very capable students who were able to tackle the challenge and as the results show we were able to finish all our dynamic events in the first competition we have used this engine in.

In the afternoon the sprint event started up which is a single 730m lap of the endurance course, testing a car's upper limit in cornering, acceleration and braking. Alex Barry drove fiercely and ended up clocking a time of 58.121 seconds, placing us in 22nd overall for the event. The drivers complained that the car was not set up correctly and thus not performing at its potential, however they could still feel that it was a seriously quick car and a lot more could be extracted from it.

By this point of the competition morale was high but everyone was pretty exhausted with most staying up until the close of the pit lane garages at 11pm and getting to the track in the morning for 7am. Endurance was the most heavily points-weighted event in the competition so we were eager to place highly. The event was piloted by our drivers Thomas Ayres and Daniel Moreira who both produced excellent drives. Unfortunately a slow moving car ahead of us on the very final lap forced the car to stall and had trouble restarting. This was a very tense moment as the seconds ticked by we were increasingly anxious that the car would not restart and we would forfeit a lot of points. Eventually the car fired up into life and we finished endurance; a huge goal and sigh of relief for the team.

We attended the final awards ceremony where we were pleasantly surprised by the amazing effort of our very own Daniel Moreira which earned him the 'Top Individual Driver' award of the competition! This sent the team crazy and we walked away with 12th place overall for the competition, something we could be very proud of for our first international competition.

The quality of the competition was on another level and we will definitely be back on top of our game.

The team should be very proud of their efforts and hopefully this makes them hungrier for the 2014 Australasian competition. We would like to thank all of our supporters and sponsors for their continued support and Mercedes AMG, Jaguar Land Rover and Formula Student for the awards and holding the competition.

Please check out our Facebook page **https://www.facebook.com/ECU.Motorsport**

We absolutely love the support and are happy to offer tours and intimate access to our workshops and cars.

FORMULA STUDENT 2014:

Australian Universities made a grand show at the Formula Student 2014 event the world's largest student motorsport event held at the end of July.

An electric car from the Netherlands stormed to victory with TU Delft, from the Delft University of Technology, claiming the prize at Silverstone at the end of July with a total of 855.5 points. However, Monash University claimed 5th place with 821.2 points and Edith Cowan placed 12th with 542.7 points putting Australian expertise squarely in with the top tier.

After almost 12 months of planning, designing and building, about 3,000 of the world's best young engineers descended on the home of British motorsport to battle it out and see who would be crowned Formula Student 2014 champion.

Hundreds of people packed the paddocks to cheer on their teams, as a year of work and thousands of hours spent in the garage came down to eight technical and dynamic events. Taking place at the home of British motorsport from July 9-13, the competition welcomed 106 teams from 38 countries around the world.

Richard Folkson, Formula Student Chief Judge and President-elect of the Institution of Mechanical Engineers, said: "This year's competition was absolutely fantastic, and the quality of engineering on show has never been higher".

Alex Barry, team leader for the Edith Cowan university race team has provided a run-down of their performance in the event.

Alexander Barry
Edith Cowan University FSAE Team Leader
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"Photos courtesy of **Josh Florence**"

Car technical features:

- De Dion rear suspension: Sheet metal beam supported by Satchell links for triangulation
- Custom 600cc engine comprising of some standard Honda CBR600 components
- Carbon Fibre Aluminium Honeycomb monocoque chassis using cut-and-fold manufacturing technique
- Carbon Fibre aerodynamics package (Front and Rear wings)
- Car weight: 186.5kg
- Centre of gravity height: 180mm
- Light car weight largely attributed to the combination of the custom engine and De Dion rear suspension

TRIUMPH TROPHY 1215CC S

The Trophy 1215cc engine is the newest power unit in the Triumph range. It is a triple of course, continuing the line of successful three cylinder engines manufactured by this British motorcycle builder that stretches back to the Triumph Trident.

The Trident was launched back in 1968, unfortunately coinciding with a general decline in motorcycle ownership, due to the improved affordability of mass produced cars. Not long after, the Triumph company went through a few years in the wilderness. It was reborn in 1989 and has since regained its reputation and market share with the help of some well engineered triples.

The advantages of three cylinders are a reasonably smooth engine but without all the complexity that a six cylinder engine entails. The triple configuration also usually leads to a reasonably compact engine. The Trophy engine has a car type alternator, mounted behind the block, rather than having a traditional motorcycle type alternator mounted on the end of the crankshaft, this has enabled further narrowing. An added bonus of using the Denso alternator is that, rather cleverly, it switches to no-load when the battery is fully charged, stopping power wastage and saving fuel.

The attention to detail in the Trophy design can be witnessed when you see, as we did, an engine being dismantled before your eyes. All of the major parts of the engine, with the exception of the crankshaft, can be removed with the engine still in the bike.

Cliff Stovall, Triumph Australia Technical and Warranty Manager.

That must be a first for a production motorcycle, and something which should lead to lower maintenance costs.

Not only is dismantling possible whilst the engine is in the bike, it can also be done rapidly. With the rocker cover removed, the camshaft cage comes off in one piece, thus allowing the twin camshafts to be lifted out. Next the head comes off, and just as easily. Being all aluminium it can be lifted off by one person. With the sump cover removed, the big ends can be split and the pistons removed. Now here comes the really clever part. The engine uses wet liners, which are a rarity in motorcycle engines. What is even rarer, is that they can be removed with just a light tap. They are light too, being made from aluminium rather than cast iron.

Although the liners are a wearing part, rebuilding a high mileage engine will no longer require a re-bore and the fitting of oversized pistons. Simply tap out the liners and refit new ones. Slip in a new set of pistons, and you are ready for off.

The oil pump and oil cooler unit is the heart of a modern motorcycle engine. On the Triumph Trophy it even looks rather like a heart. This little masterpiece is a sealed unit with a fully sealed heat exchanger. I can almost hear you saying, but what if the pump seal fails, well the Triumph engineers have thought of that too. Water in the oil is avoided by having a drain, which puts any leaking water on the road, and not into the sump.

The overall build of the engine smacks of quality, the finish on the die cast engine casings is superb. The finish on the cylinder liners is even better. The engineers have even thought of the poor old service mechanic too.

Anyone who has carefully adjusted the valve timing on a high performance engine and then wondered why the performance drops off as the cam chain wears, will have had to deal with chain stretch. Triumph have cleverly provided cam sprockets which can be repositioned (a little) on the cam shaft, in order to bring the valve timing back to where it should be.

The Trophy engine shows just what can be achieved by combining good design with high quality manufacturing. A lesson for us all.

Brian Carter
Victorian Panel Member

VICTORIAN PANEL MOTORBIKE DUAL

The Victorian panel have hosted a couple of motorbike based events over the past few months. The first was a presentation held at the Gasolina café/bar set up in Melbourne's Docklands by Ian Drysdale who designs and manufactures V8 motorbikes titled "Australian-designed V8 Superbikes". Subsequently the annual Christmas in July dinner was held in July with a slightly out of the ordinary dinner accompaniment; Cliff Stovall, the Technical and Warranty Manager of Triumph Australia, stripped Triumph Motorcycles' latest 1215 cc three-cylinder engine alongside some excellent food and a couple of glasses of wine.

THE SPECTACULAR DRYSDALE 1000 V8

Putting a V8 engine in a motorcycle is easy, just build a bike big enough, like a Boss Hoss, and you can wrap it around anything. On the other hand, Ian Drysdale, the Australian engineering wizard, takes the idea of a V8 motorcycle to an entirely different level: he designed and built the engine first before building the bike and the results are just about as pleasing as you could possibly want.

Ian, as many of you know, played a major part in developing the Carberry V-Twin, one of the three major Royal Enfield single derived twins, plus he built the Godzilla V-Twin of his own design, using tapered cam lobes like the Mercedes-Benz F1 engines and master and link connecting rods like radial aero engines and he's responsible for design and machine work on Russell Sutton's radial engine builds. Drysdale also designed the prototype of the Vento 3 cylinder engine used in the Vento ATV and he's been the designer / builder / fabricator in many, many more projects. Referring to Ian as a "builder" is either high praise for the word or a serious slight to Drysdale.

Inspired by the 500cc Moto Guzzi V8 GP engine, the 90 degree Drysdale 1000 V8 originally appeared 20 years ago as a 750. Using two FZR600 16-valve cylinder heads, the 4 cam, 32 valve engine also uses Yamaha pistons, though the connecting rods are of Ian's own design and join together on a milled billet crankshaft inside his own sandcast cases. The exhaust is a twin 4 into 1 arrangement exiting under the seat.

The transmission is a six-speed cassette-type box with parts from a variety of manufacturers and slides out for service, delivering power through an FZR1000 clutch. The upside down fork, wheels and brakes come from an R1. The swing arm is Kawasaki ZZ-R1100 with an Öhlins shock mounted sideways.

Ian adds:
"The latest 1000-V8 is an ongoing development of the 1996 model 750-V8, and although outwardly very similar, it has a lot of refinements that are not immediately obvious.

One that is obvious is the rear exhaust system, we had to add of tailpipe in there to get the fuelling right, which was a squeeze in an already crowded space!

The changes to the rear suspension are also visible I guess, I was chasing a more linear rate as the 750-V8 was too radical a rising rate.

The main advance is the fuel injection - I had to butcher up BMW K100 throttle bodies for the EFI on my 750-V8 in the 90's as there were no injected Japanese bikes then! I now use 2 sets of modified 39mm Kiehen TB's from a CBR600 - it's a shame to have to cover them over, the 8 trumpets sticking straight up look fantastic."

The bike is very compact, especially when considering the engine, though much of the engine, including the heads, can be removed in situ.

The engine develops 150 horsepower and will spin to 15,000 rpm.

The bike you see in these photos is already in the hands of its proud owner, that's the first of five.

"I have plans to build one of the "street fighter" versions (naked with twin shocks and low pipes) for myself and another for my business partner, and I will consider building a couple more customer bikes. The price is the hurdle obviously, hand built specials are expensive animals and I currently need US$100,000 to make it worthwhile building one."

Pricey? Of course, but hand made excellence of this type is not found in factory showrooms and the skills and time of a builder like Ian are in demand for a great many other projects, but when the subject of V8 engines in motorcycles comes up, there are few that measure up to this level of craftsmanship.

Isn't it amazing what time, skill and the proper can-do attitude can accomplish? What an absolutely superb build.

Photo credits: Greg Parish
Paul Crowe

FROM THE CHAIR

Greetings!

You may well remember that it was not that long ago we celebrated the milestone of 100,000 members. You will be pleased to know our new target is 150,000. Our number one strategic objective is to diversify and grow professional membership in the UK and internationally, accompanied by other strategic objectives: to increase member engagement and value to members and their employers; to provide expert leadership to government, industry, members and the informed public on engineering; to develop awareness of engineering and the profile of the IMechE; to inspire young people about engineering; and to secure long term financial position.

In our Branch this year, we already had more professional review interviews than last year which is a very positive sign and a significant achievement towards our goal of development and growth. Our strategy is to retain all the Affiliates we are recruiting and to progress them to be Associates and Members. Our Young Member Section has a deliberate programme tailored just for that purpose, and so I encourage all young members to get involved and enjoy the benefits, and of course to develop their professional careers.

However, member benefits alone should not be the reason to join the Institution. Doing things together, being involved, and a sense of mission should be the ideology behind applying for membership. Our shared values and beliefs will tie us together producing synergy, which is a wonderful phenomenon, giving us a unifying power and enabling us to achieve things we couldn't even imagine achieving as individuals.

I am sure many of you have seen the inspiring actions of Perth commuters only a few weeks ago. Together, they lifted a railway carriage to release a fellow passenger who missed the gap and got caught between the platform and carriage. Of course it is our innate nature to help others, and learning here is the synergy. This is a good example of what we can do when we all act as one team. On the topic of membership, please remember to renew your membership at the end of each year, as almost six percent of our Australian Branch members were going to lapse their membership last year. The Branch contacted them personally just in time and the renewals took place. Some had valid reasons but most of them simply forgot about this process, which was due last December. The most popular excuse was moving house.

Please also be aware that should there be a need, members are welcome to make use of the services of our support network. Our team can offer a wide range of assistance. More details are at **www.imeche.org/about-us/support-network** .

During the last Council elections, our Young Member Section Chair, Amy Lezala, was elected an International Member of the Council. Congratulations Amy! This is a great opportunity to represent us and our interests Down Under to the Northern hemisphere.

I encourage all members to nominate for Branch Committee positions advertised elsewhere in this News Bulletin.

Kind regards.

Dayaratne Dharmasiri.
australiachair@imechenetwork.org

OCEANIA REGION NEWS

From a regional perspective the last few months have been busy, putting into place the various plans developed by the Oceania Region Board early in the year. Most of this centres on New Zealand but includes continued very strong support, and funding, for the Australian Branch.

Our New Zealand initiatives this year will focus on what we can do to support, encourage, and recruit young members. This is being led by the Oceania Region Young Member Representative, Belinda Herden. The initial approach is based upon establishing contacts in those universities in New Zealand offering mechanical engineering degrees. Those contacts will then be asked to facilitate access to the student body so that visits can be arranged. Belinda hopes to form a number of Student Chapters this year, and hold an inaugural Speak out for Engineering competition. A further step has been to advertise the position of New Zealand Young Member Representative. A good number of applications have been received and the selection process will conclude shortly. The young member who takes on the role will be a great help to Belinda in arranging the meetings, events and competitions "on the ground".

An item that is belatedly coming to fruition is the final of the 2013 Regional Speak out for Engineering competition. This was held over from earlier in the year due to programme congestion. The event will be held in Colombo, Sri Lanka, on 7 November 2014. The Oceania competitor will be Caitlin Prior who won the Australian final in Adelaide in February. I wish Caitlin every success in the competition, and hope she will enjoy participating in an inter region Young Member event "Engineering Tomorrow" that will be part of the whole weekend programme.

It is pleasing that I can now confirm to members that Head Quarters have agreed to our request that the new IMechE President, Group Captain Mark Hunt, will pay a visit to Australia and New Zealand in January 2015. Early plans indicate that the President will stop in Perth, Melbourne, Sydney and Brisbane, before crossing the Tasman Sea to go to Auckland and Wellington. His itinerary will include many chances to meet members, and for members to hear a presentation based upon his recent Presidential Address. Further details will be provided as the plans develop.

Ken Tushingham
Oceania region chairman

EDITORIAL

I was fortunate enough to recently take a trip to South Africa to view some manufacturing facilities there producing parts for the automotive industry. As with a lot of manufacturing facilities based in lower income countries there is a conflict between the lower wages and cost of production and the additional controls required to make full use of the available workforce. The engineer is in the position of having to design the processes to account for the abilities of the operators in order to utilise the lower labour rates to full effect. Significant hand finishing operations are frequently used in these locations which would never be viable in traditional manufacturing environments, but with these processes comes additional risk of variability and mistake. Further, the level of stringency and control required by the final customer may be alien to the psyche of the manufacturing location, especially in newly developed sites. These difficulties have been overcome time and again allowing companies to prosper in nations with otherwise far reaching developmental issues. Dealing with the culture and skills of manufacturing around the world is becoming increasingly commonplace and another facet that engineers find themselves dealing with on a frequent basis in the modern global age. The IMechE is currently focusing on engineers living around the world and looking to grow their membership globally. With the increase in global manufacturing locations, modern engineering and manufacturing is really becoming a global enterprise which can take you places you have dreamed of visiting and some you have not.

Matt Proudlock

News Bulletin Editor

AustraliaNews@imechenetwork.org

YOUNG MEMBER NEWS

The IMechE is the international community for Mechanical Engineers. We are in 140 countries with 20,000 members outside of the UK and, in Australia alone, we have nearly 1,500 members.

This expat nature of our overseas members means that our volunteers are transient. This has led to number of changes in the Young Member (YM) Panel. At this point in time I am conscious that not many will be aware of these changes or who your local representative is. So let me take the time to introduce you to the current team;

Oceania Region Representative - *Belinda Hernden*

Australia Branch YM Chair - *Amy Lezala*

NSW Rep - *Russell Ross*

QLD & NT Rep - *Jessica Heijneman (acting)*

SA Rep - *Michelle Bailey (acting)*

VIC & TAS Rep - *Matt Springer*

WA Rep - *Kally Baxter*

If you see them at an event, find them on LinkedIn or even see them hanging around on street corners, say hi. We have had a number of the panel move on to distant shores recently and we are working hard to find available replacements. We will keep you updated on who is your local representative.

Those of us who are continuing our role are beginning to plan the annual Engtravaganza. EngTrav2015 will be hosted in Melbourne on 1st March 2015, the day after the AGM and the 2014 Speak Out For Engineering national final. There are a few ideas in discussion amongst the YM Panel. If you have any suggestions or recommendations we would love to hear from you. Keep an eye out for leaflets later this year as spaces will go fairly quickly.

Amy Lezala

Young Member

Amy Lezala

Matt Springer

Belinda Herden

NEWS BULLETIN QUIZ

The first person to email the editor with the answers to the quiz below will win a high quality IMechE prize and the illustriousness which goes with it.

1. When did South Africa become a true democracy?
2. In terms of desktop manufacturing systems, what does FDM stand for?
3. What is a Synchrotron and where in Australia would you find one?
4. How many (inlet / exhaust) valves are used in the Drysdale V8 engine
5. Where was the 2014 IMechE Volunteers Conference held?
6. How many Australian teams entered Formula Student 2014 and what were there overall placings?
7. Which model of motorbike uses Triumph's 1215 cc triple Trophy engine?
8. How many members does the ImechE currently have?

Please send your entries to: **AustraliaNews@imechenetwork.org**

Congratulations to the winner of the previous wordsearch, Rudolph Chan who received his prize by post

QLD NEWS

In April 2014, the annual Queensland State SOFE Final was contested at the University of Queensland. As usual, there were many who took part as the presentation was conducted at the same time as final year presentations at the University. After much deliberation by the judges, Ms Mary Thatcher was judged the winner with her presentation on "The Analysis of Storage Integration of Solar Thermophotovoltaic Systems". Mr Ian Cartmill was the Runner Up with his presentation on "Dynamic Mechanical Interaction between Solid Projections and Skin: Impact and Surface Perturbations". Mary has been invited to participate in the next National SOFE Final to be held in Melbourne in February 2015.

In May, Committee Member, Roger Buckley organised various presentations from his colleagues and chaired the evening's proceedings on, "The Journey to Chartered Status" at the Hawken Auditiorium in the Engineers Australia Offices in Brisbane. This was well received.

The Committee Panel held its meeting in May at the Library and discussed various items including the organisation of the Annual Dinner and the Student evening planned for October.

The Queensland Panel hosted the Executive Committee Meeting in Brisbane on the 28th June. The Committee that meets face to face twice a year, spent a full day reviewing and discussing issues from a full Agenda.

Five Professional Review Interviews were completed to admit candidates as Corporate Members of the Institution. The Panel wishes the candidates every success in their applications.

The 2014 Annual Dinner will be held on the 21st August. We have already received firm bookings from many of our Members on what looks to be a very enjoyable night. The Guest Speaker will be making a presentation on "The Crescent Dunes Project – The world's most advanced solar thermal energy storage" With some planning now underway, we also look forward to another great turnout for the Student Evening planned for October at the University of Queensland.

Leslie Yeow
Queensland panel Chair

NSW NEWS

We have some exciting news this quarter. Two new panel members join us officially in NSW. Phil Donnelly as Honorary Secretary and Russel Ross as a Young Member representative.

The NSW Mechanical Chapter have had some recent popular technical presentations of late in conjunction with EA and ASME at the Engineers Australia auditorium in Chatswood.

In June Steve Williams gave a presentation on "An incomplete history of risk assessment" it was extremely popular with over 70 people attending.

In his presentation, Steve explored the history of risk assessment throughout society.

Steve outlined some of the key risk assessment techniques in use in industry, such as Failure Modes and Effects Analysis (FMEA), Bowtie, HAZOP, Workplace Risk Assessment and Control (WRAC) and highlight some of the current trends in their use.

Throughout the presentation, Steve drew on his experience (and mistakes) of facilitating risk assessment workshops and provided some practical tips and hints on what makes a good risk assessment, and how to achieve good outcomes.

The presentation was so popular we have asked Steve to do it again at our city location, we will send out information on the event in the coming months.

This coming October we are planning to hold our annual iMechE Speak Out for Engineering competition, to be held at the Engineers Australia auditorium in Chatswood. If you would like more information on how to enter please contact our Treasurer Ian Mash through the near you website or at ianmash@interfleet.com.au

Monika Sud,
NSW Panel Chair

VIC NEWS

The Victorian Panel continues its busy schedule for the year. We have a regular social networking event every 5 weeks or so in a Melbourne pub, which provides an opportunity for members to chat and socialise over a mid-week beer. It also provides the Panel committee with an opportunity to receive feedback on what we are doing well and where we can improve. The event in June attracted over 25 members, including university students who wanted to learn more about the Institution.

In June the Panel committee organised a presentation titled "Australian-designed V8 Superbikes" at the Gasolina café/bar set up in Melbourne's Docklands for motorcycle enthusiasts. The presentation was delivered by Ian Drysdale, who designs and develops V8 motorbikes from his workshop in Springvale, Victoria.

Inspired by the 500cc Moto Guzzi V8 GP engine, the 90-degree Drysdale 1000 V8 originally appeared 20 years ago as a 750. Using two FZR600 16-valve cylinder heads, the 4-cam, 32-valve engine also uses Yamaha pistons, although the connecting rods are of Ian's own design and join together on a milled billet crankshaft inside his own sandcast cases.

Ian also acts as a consultant in China, advising Chinese automotive and motorbike manufacturers on engineering design. Victorian Panel Chairman Andrew Lezala commissioned a Drysdale 1000 V8 and displayed his bike at the presentation. The event was attended by 35 members representing the IMechE and Engineers Australia.

The Panel's social highlight of the year is the Annual Dinner, which was held on 26 July at the Carringbush Hotel in Abbotsford. During the dinner Cliff Stovall, the Technical and Warranty Manager of Triumph Australia, stripped Triumph Motorcycles' latest 1215 cc three-cylinder engine. Cliff explained the technical innovations and design considerations that feature in the engine and passed around parts for guests to examine. There were 47 attendees, a record attendance in recent years, and we were delighted that a number of members of Engineers Australia (who are not members of the IMechE) joined us for the evening. The Victorian Panel would like to thank all members who attended this event and helped to make it such a success.

At the Annual Dinner, we took the opportunity to present Nate Martin from the University of Southern Queensland with the Frederic Barnes Waldron Prize for best student in Mechanical Engineering. Nate has moved to Victoria with his employment and the award was presented to him on behalf of the Queensland Panel.

Roshan Dodanwela

Hon. Secretary Victorian Panel

SA Panel Committee member Max Ratcliffe presented the 2013 UniSA Frederic Barnes Waldron Prize to Lee Houghton.

SA NEWS

The South Australian Panel had a fairly major reorganisation this year, with the panel now being made up by the following representatives

- Panel Chair – Ken Sumpter
- Vice Chair – Max Radcliffe
- Secretary – Elizabeth Smith
- Treasurer - Ken Sumpter
- IT coordinator – Barry Millar
- Young Members Rep – Michelle Jade Bailey

The panel hosted their annual yuletide themed lunch in July with Barossa resident Peter Stopford who was the Panel's Honorary Treasurer for eighteen years

"SA Panel Members and their partners enjoyed their annual Yuletide-themed Lunch in July, at the Edinburgh Hotel Mitcham.

SPARKIES BURNING BRIGHT!

Over two jam packed weeks in Brisbane and for the first time in Melbourne, the Spark Engineering Camp has brightened the lives of 100 lucky high school students.

Engineering activities, social events and personal development workshops have all combined to make Spark 14' our best camps yet! From the infamous egg drop, to bridge building, personality testing, university visits, a Robogals workshop and the all-important red faces talent quest, Spark 2014 was full of inspiration and excitement for our young students

SPARKIES BURNING BRIGHT! (CONT)

Brisbane students were able to experience first-hand one of the city's engineering icons by climbing the Story Bridge. From there, we travelled to the CSIROs Queensland Centre for Advanced Technologies to see Australian engineers leading the field in automation and robotics.

In Melbourne our Sparkies had the opportunity to visit Monash's Motorsport and UAS teams as well as a very special visit to the Australian Synchrotron. La Trobe University put on a laser tag workshop for us which showcased electrical engineering principles and had the students battling it out for the rest of the day.

On industry day, the students had a great opportunity to meet some real life engineers and ask lots of questions through the grad panel and mentor in a minute. Representatives from Conoco Philips, Lend Lease, Defence Force Recruiting and Norman, Disney & Young were among the recent graduates and experience engineers the students engaged with.

Our annual Keynote Address featured David Barbagallo, CEO of the Endeavour Foundation in Brisbane and Chris Varney, former Australian Youth Representative to the UN in Melbourne. Hearing their inspiring stories motivated our students to aim high and see that one person's actions can affect change in our world.

University scholarship sessions and presentations from the Staffies provided all important practical information on how to apply for and survive university. Social events also provided plenty of time for the students to make long lasting friendships which they will carry with them into the future.

Catherine Turnbull and Rhys Herriott
http://sparkengineeringcamp.ywb.com.au/

Engineering students with the support of big business offer opportunity of a lifetime to high school students.

For many young people finishing high school the choice to attend university is a given one. Their parents went and so it is next obvious step in their lives. For others, the decision is not as easy. This is why we started Spark. An initiative of Youth Without Borders, the Spark Engineering Camp aims to break down barriers which many high school students face in attending university. Whether they are from rural areas, indigenous backgrounds, foster care or maybe just the first in their family to take the leap, Spark is providing a catalyst for change in these students' lives.

Spark was born in 2011 at the University of Queensland and following three successful camps there we are expanding to Melbourne with a vision to expand nationally. The camp is offered free of charge to students which would not be possible without the ongoing support of our corporate partners.

Warwick King, President of ConocoPhillips Australia East states that: ***"Spark Engineering gives young people from right across Australia real-life exposure to tertiary engineering studies. We are very proud to support this initiative, and it is especially exciting to see past-Sparkies coming through into tertiary studies."***

In June/July this year we are offering 100 lucky students from as far as Perth the opportunity to attend our week long camps. The idea is to introduce them to engineering and inspire confidence and personal development which will allow them to realise their potential.

One student in this position last year was Yash Kamal - A student from Yeronga State High who, in addition to all the usual stresses of high school, was adapting to a move from Sweden. ***"When I first came to Australia, I couldn't sleep at night... I was very nervous on my first day of school."*** With the help of Spark Yash is now studying Engineering at the University of Queensland and attributes this to his Spark experience.

This year's camps will be hosted by St John's College at the University of Queensland, and Queens College at the University of Melbourne.

IMECHE VOLUNTEER CONFERENCE

Each year, IMechE volunteer from across the globe are invited to attend the Annual Volunteer Conference. This year saw York host the 5th IMechE volunteer's network conference on 4th- 6th April.

The 2014 conference was the biggest yet, with over forty training sessions available for volunteers to choose from. It was attended by approximately 180 delegates, including international representatives from 12 countries. This year, we (Roshan Dodanwela - Victorian Panel Secretary, Belinda Herden - Oceania Young Member Representative and Terence Love - Australian Branch IT Coordinator) were lucky enough to attend on behalf of the Oceania Region.

The conference gives members the opportunity to "Learn, Share and Network".

- **Learn** about the Institution strategy, developments and resources
- **Share** best practice
- **Network** with other volunteers, from all areas of IMechE and around the world.

The conference also provides an opportunity for Australian based volunteers to meet the IMechE staff and provide feedback on Institution activity in our area.

Colin Brown (IMechE Engineering Director) set the scene for the conference with his welcoming speech, which presented an insider's view on the IMechE's latest achievements and challenges, as seen from Headquarters. It was pleasing to hear that the IMechE is continuing to invest time and effort into improving their member services on a global level.

The remainder of the conference is structured to allow volunteers to attend the workshop sessions that are of most interest to them. Here are the highlights from the sessions each of us attended:

Committee Secretary Role *(attended by Roshan)*

This session was aimed at reviewing the role of a committee secretary, the tools available and to discuss the problems faced by secretaries and provide some practical solutions. Each secretary shared three top tips they had learned through their experience of being a secretary. An issue that seem to be common amongst all secretaries was that they required more help and training in communicating effectively, particularly in utilising Social Media. A possible solution suggested was to update the training manual for secretaries with more strategies for effective communication including Social Media.

What can we do to improve our digital communications? *(attended by Roshan)*

This session was run by Evelyn Alves, the Institution Digital Marketing Executive. The intention of this workshop was for participants to provide feedback on the Institutions emails, social media and website. There was an interesting and lively discussion as some participants expected training on the Institution's guidelines on Social Media as an outcome of the session. Evelyn's advice was to embrace Social Media (Facebook, Twitter and Linked In) to advertise Branch, Panel and Regional activities due to it's potential to reach non-members by peer promotion. Some top tips shared were

- Post regularly
- Appoint a dedicated committee member to post on Social Media
- Register Social Media feeds to a single and transferrable email account.

I was delighted when Evelyn mentioned that Matt Springer from the Australia Branch sets an example of excellent use of Social Media.

Near You enhancement demonstration *(attended by Roshan)*

Kevin Manning, IMechE Volunteer Operations, demonstrated the new "Ticket" facility that has been added which enables a member/participant to make a payment for an event using the Near You site. The enhancement requires logging into the Near You system. At the moment it's for members of the IMechE only and a guest log in for non-members will be rolled out shortly. The ticketing system is available for UK only and will be introduced to International Branches in the near future.

The creating of an event in Near You has been made easier and now you can add new addresses from the event creation page, (in the past addresses had to be created separately), also a Google Map location has been added to the address.

Support Network *(attended by Roshan)*

The IMechE support network is the personal support charity of the IMechE that provides advice, financial, practical or emotional support to members or their partners, children or adult dependants. Services are provided to eligible candidates irrespective of where they live in the world. Anni Broadhead, the CEO of the IMechE Support network conducted this session with the intention of promoting the services of the Support Network. Some examples of the services offered include help with financial difficulties, career advice, student loans and grants, care

and advice for older persons and general advice ranging from, housing, pensions, and personal relationship difficulties. Anni emphasised the fact that the Support Network is keen to expand their services to international members and eligible candidates.

The Library and its Services for International Members *(attended by Belinda and Terence)*

This session was hosted by Sarah Rogers, Head of Library Services. The intent of the workshop session was to highlight the online library features, which are available to all IMechE members. I was surprised by the extensive catalogue of online text books.

Steps to access online library:

1. Log in to the IMechE website
2. Go to Knowledge, Library
3. Select virtual library
4. Choose which database you would like to search in (hints below).

Looking for…	Try first…
Full engineering text books	Knovel
Books on interpersonal skills (ie. soft skills)	Ebrary
Business and market information	Knovel
Scientific or technical articles	Springer
Engineering tools (unit conversions, formulas, etc)	Efunda

The library team are currently working to develop a single search function, which will allow members to easily search through all the available resources without needing to select a specific database. In the meantime, if you have any questions the library team are happy to help.

Email: library@imeche.org

Young Member Grants, Awards and Competitions *(attended by Belinda)*

This informal session was targeted at the grants, awards and competitions available specifically for young members.

James Bates Grant – given to a group of young engineers to cover up to 50% of the cost of an engineering activity/ trip. The proposed activity needs to meet at least one of IMechE's strategic objectives to qualify for the grant. Members are encouraged to apply approximately 12 months before the proposed date, to allow enough time for the application to be reviewed and the funds awarded.

Young Member Board Charteering – "Developing your skills by giving something back". It is open to any IMechE young member who is pursuing an engineering project that will make a difference to the world. It offers up to £500 to enable you to support a charitable activity. Projects should be interesting, innovative and inspire others to get involved. All applicants will receive assistance to maximise the impact of their fundraising.

Young Member of the Year Awards Provides recognition to young members who contribute to the IMechE. Awards are given for five categories: Engineering Outreach, Engineering Innovation, Inspiring the Next Generation, Talent Development and Overall Young Member of the Year. Nominations close in August each year.

Speak Out for Engineering – A competition which is held annually in Australia, giving members a chance to develop their communication and presenting skills. Local heats are held in all major capital cities in Australia and all young members are eligible to enter. Keep an eye out for local heats to be advertised in the coming months.

Professional Development session – Chartership *(attended by Belinda)*

These one on one sessions provide members an opportunity to speak to an IMechE staff member about their professional development, which for me meant discussing the path to registration. My take away message from this session is that the staff in London are available to help guide members through the process. They will even review draft applications and provide feedback prior to submission. If you have any questions, contact the business development team: **bdm@imeche.org.**

In November this year, Rachel Leech (International Business Development Manager) will be visiting a number of cities in Australia to meet with young members and discuss options for achieving professional registration. This will be a fantastic opportunity for anyone wanting to learn more about the Chartership process, so keep an eye out for advertised events closer to the date.

Following the conference, international delegates were invited to visit IMechE headquarters, referred to by the locals as 1 Birdcage Walk. There we met with Joanna Horton (Head of International Development) and discussed some of the issues and difficulties faced by International Branches. Some key issues raised included the lengthy process involved in applying for Professional Registration, the non-availability of region specific promotional material and the difficulties in using some of the Institution's IT systems. The day ended with a tour of the building, which we were excited to learn has a rich history and is home to some significant engineering archives.

We felt privileged to be part of the 5th IMechE Volunteers Conference, representing the Australian Branch. It gave us an insight into how the IMechE operates and it was great to see how other passionate and dedicated volunteers go about their tasks. It was also evident that, although Australia is a relatively small branch and is geographically a long way away from Birdcage Walk, we punch above our weight and are one of the most active International branches.

Roshan Dodanwela, Belinda Herden and Terance Love

SPEAK OUT FOR ENGINEERING

A Comparison of the Desktop Additive Manufacturing Systems

In recent years, additive manufacturing technology has escaped from the confines of industry to land in the consumer space. Although 3D printing, as it is more commonly known, is now a rapidly growing market, little thorough study has been done on the print quality of consumer equipment. The aim of this final year thesis was to help fill that gap.

QMI Solutions, a manufacturing consultancy, had observed that two desktop 3D printers, the Cube and the UP!, were producing parts of vastly different quality. This was despite both printers utilising Fused Deposition Monitoring (FDM) technology and having near-identical hardware.

FDM, the most common technology used in consumer desktop systems, creates objects by extruding successive layers of molten plastic. Despite the conceptual simplicity of this process, the quality of the final print depends on myriad interrelating factors.

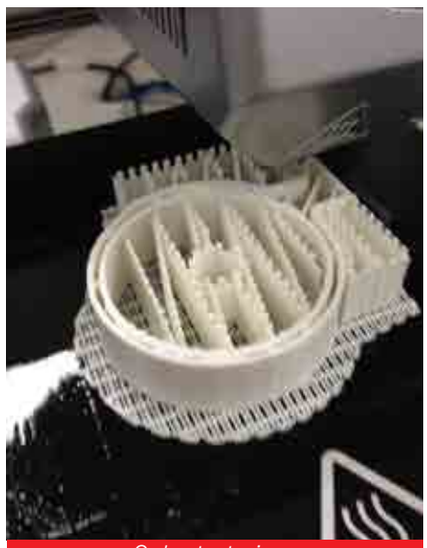
Based on the existing literature, as well as survey data from user studies, a number of key factors were identified for analysis in the thesis. In particular, the key parameters investigated were surface roughness and form, aesthetic form, flexural strength, and impact strength. The goal of the analysis was to quantify the differences between the two systems, along with the potential root causes, and to draw conclusions as to best practices for design.

In order to achieve this, three test pieces were used. These were developed based on work from previous studies as well as recommendations from the relevant ASTM standards. This was intended to allow for standardised testing, although some modifications were necessary in order to account for the limits of both systems.

In the event, the key difference between the two printers turned out to be the build strategy that they employed. This encompasses a number of decisions, including material usage, fill volume and pattern, and the amount of support material used. Importantly, the build strategy is not a function of the printer itself, but of the accompanying software.

In particular, the Cube software appeared to optimise material usage in a way which proved to be detrimental to the quality of the finished part. As a result of this decision, it did not provide sufficient support structures during the build process. This caused surfaces to warp and be disfigured, hampering the aesthetics and functionality of the finished product.

The two desktop manufacturing systems; the UP! (lef) and the Cube (right)

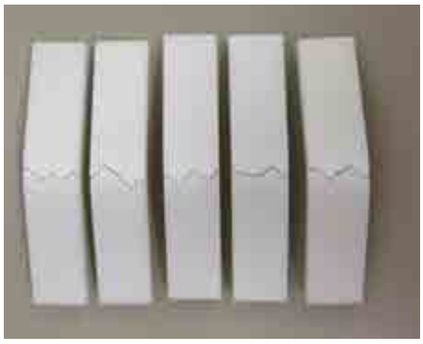


Cube test piece

UP test piece

In contrast, the UP!'s build strategy emphasised the creation of structural supports and ensured that sufficient infill was included in the part. While this significantly increased the amount of material required, it was highly effective in creating stronger, smoother, and more aesthetically pleasing surface finishes. The consequence of these different build strategies is that the Cube essentially produced thin walled structures, whereas the UP!'s parts were close to solid. This was reflected in the ultimate failure modes of both parts: buckling for the Cube, but de-lamination and ductile failure in the case of the UP!

As a result, the UP! outperformed the Cube in every test, with the sole exception of material usage. Unfortunately, even this was not an advantage for the Cube, which uses proprietary cartridges, with a resulting cost per print on par with some professional systems, without any of the associated quality advantages.



Although the overriding difference was found to be the software, differences due to the hardware configurations could not be eliminated. Unfortunately, it was not possible to swap the proprietary software used by each printer in order to eliminate the impact of hardware differences. To conclude, what was most interesting about this analysis was the extent to which the decisions hard coded into the software impacted on the aesthetic and mechanical quality of

produced parts. This suggests that software optimisation presents an important avenue for improvement for 3D printer manufacturers in the consumer space.

Caitlin Prior
SPEAK OUT FOR ENGINEERING 2013 OCEANIA REGION WINNER

SPEAK OUT FOR ENGINEERING 2013 / 2014

The Speak Out for Engineering regional final will be held in Colombo in Sri Lanka in November this year. The Oceania winning speaker Caitlin Prior will be travelling to Sri Lanka to compete against the best of the Oceania region presenting her comparison of two burgeoning desktop manufacturing systems.

Another Australian finalist, Ben Shields, presented his take on an intriguing years old problem with a modern technological twist by using robotics to prove the method cats use to right themselves in midair. Unfortunately Ben was unable to compete in the finals due to his newly found role in the Royal Australian Air Force. Both presentations showed keen technical insight combined with first rate presentation skills which impressed judges at the national and local level

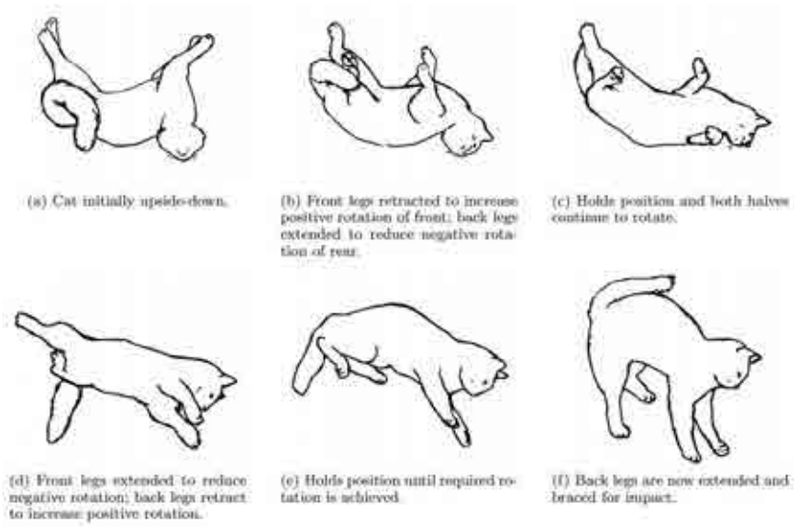
FALLING CAT ROBOT

2013 SA Speak Out for Engineering winner -Ben Shields - Falling Cat Robot Lands on its Feet.

In 2013 Ben was part of an Adelaide University project team whose objective was to design, build and test a robotic cat which, when dropped, would emulate the self-righting characteristics of a biological cat.

Over many years, engineers, scientists and botanists have theorised on the mechanics of self-righting, but this The project would also provide an opportunity to study and apply mechatronic principles.

Ben's introduction included a brief reference to previously published scientific papers on the subject, followed by some high speed photos of a falling cat. From which a set of sketches were produced: was considered to be the first attempt to actually develop a robotic model to prove the theories.



(a) Cat initially upside-down.

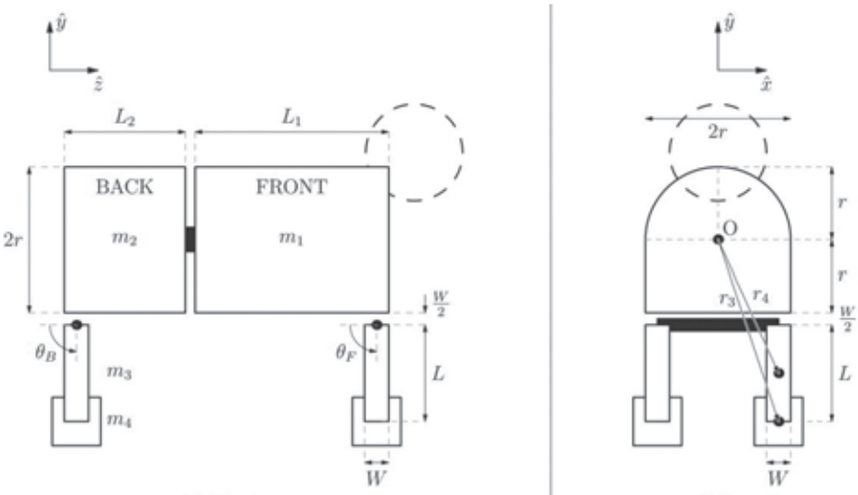
(b) Front legs retracted to increase positive rotation of front; back legs extended to reduce negative rotation of rear.

(c) Holds position and both halves continue to rotate.

(d) Front legs extended to reduce negative rotation; back legs retract to increase positive rotation.

(e) Holds position until required rotation is achieved.

(f) Back legs are now extended and braced for impact.



(a) Side view.

(b) Front view.

A biological cat uses a combination of spine flexion, perhaps some spinal twist, and leg extension to manipulate its moments of inertia and change the angular velocity in the front and back portions of its body. (Plus some split second thinking! Ed).

Ben outlined the simplified robotic cat envisaged. It had an overall height of 26cm, a length of 35cm, leg length 13cm, leg width 3cm. All up mass was in the order of 5.2kg. The robot cat comprised a front and rear body section which swivelled 180°relatively on a common axis. For simplicity, the head was omitted. An actuator controlled the relative rotation of these two body sections. Rotatable leg-pairs were fitted, for "legs in" and "legs out" movements. "Feet" were added to act as large point masses to increase the possible change of moment of inertia.

During programming, it was assumed that a drop height of 2 metres would be appropriate. The drop was divided into 6 time intervals. During each interval, the actuators would get to work, e.g. Front legs are half retracted, back legs are extended.

Simulation results were calculated from a set of system variables (time interval, masses, and lengths). Velocity profiles were generated to achieve the desired rotational action and were taken as inputs to the SimMechanics model which, in turn, generated step-wise torque inputs for the actuators.

In October, when Ben entered the competition, the model had been built, but not tested. At the conclusion of his presentation, Ben and his attentive audience engaged in a spirited question and answer session. It was generally thought that a possible practical use for the concept could be to assist with the orientation of space vehicles. A member of the audience asked if it could be incorporated into his tablet, as every time it was dropped, it landed on its screen!

As the SA winner, Ben would have automatically been eligible to compete in the Branch Final, held in Adelaide in February this year. However, on leaving University at the end of 2013, he enlisted with the RAAF and was unable to obtain leave to attend the competition. He has advised that the model has now been built and tested and that some deflection occurred in the frame of the body (manufactured in plastic using a 3D printer), preventing full orientation of the body sections. Stiffer body sections are being developed and testing is ongoing. Ben is hopeful that the project will be continued into the future and that successful testing will be achieved.

Stan Gafney
South Australian Panel Chairman

Photos of the finished robot (complete with realistic fur), the inner workings of the robot and the leg actuator mechanisms

NOMINATIONS FOR 2015/2016 AUSTRALIAN BRANCH OFFICE BEARERS

Included in this edition is a nomination form for 2015/2016 office bearers. A ballot paper will be included in the January 2015 edition of the News Bulletin. The closing date to submit ballot papers is 31 January 2015. Results of the ballot will be announced at the AGM on 28th February 2015.

Please note that there will be no election or voting at the AGM.

The newly elected office bearers will take up their duties during the third week of May 2015. All positions are declared vacant. The positions to be filled are shown on the voting form below.

The first stage is for members to nominate a person of their choice for a specific position using the nomination form contained in this issue of the News Bulletin. The form must be countersigned by the nominee to ensure their acceptance.

Please send the nomination form to the Branch Chairman, Dayaratne Dharmasiri, at the address on the form, to arrive no later than 30 November 2014.

A list of nominations will appear in the January 2015 issue of the News Bulletin.

Notes:

In the interests of a seamless transfer of responsibility for Branch activities, it has been found that the Branch Chairman should be chosen from among those who have served an immediate previous term as a Branch Committee Member, most usually Hon. Sectretary.

Australian Branch Nomination Form (2015/2016 Office Bearers)

Return to: AustraliaChair@imechenetwork.org

Or, Mr D Dharmasiri
Chairman, IMechE Australian Branch
PO Box 10187
Brisbane, QLD 4000

Institution of MECHANICAL ENGINEERS

Closing date for nominations: 30 Nov 2014

Dear Sir/Madam,

I, ……..nominate…… for the position of (tick box below)

Position on the Australian Branch Committee	Tick box
Australian Branch Chair	
Australian Branch Honorary Secretary	
Australian Branch Honorary Treasurer	
Australian Branch Assistant Honorary	
Secretary & News Bulletin Editor	
Australian Branch Young Member Section Chair	

Yours faithfully,

……
(Signature of nominator) (Date) (Membership no.)

I, ……. accept the nomination

……
(Signature of nominator) (Date) (Membership no.)

Note to nominee: Please attach to this form a short statement (~100 words) giving details of your education, career, date of joining IMechE, involvement with Panel or Branch and your vision statement for the

Institution of MECHANICAL ENGINEERS
Please address all *News Bulletin* correspondence to:
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Ph: (m) 0432 978 547
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Websites:
IMechE – **www.imeche.org**
Social Media – **Twitter: @IMechE_OzYM**
Check out the young members on **Facebook** *as well! Follow the links on their* **nearyou** *page.*