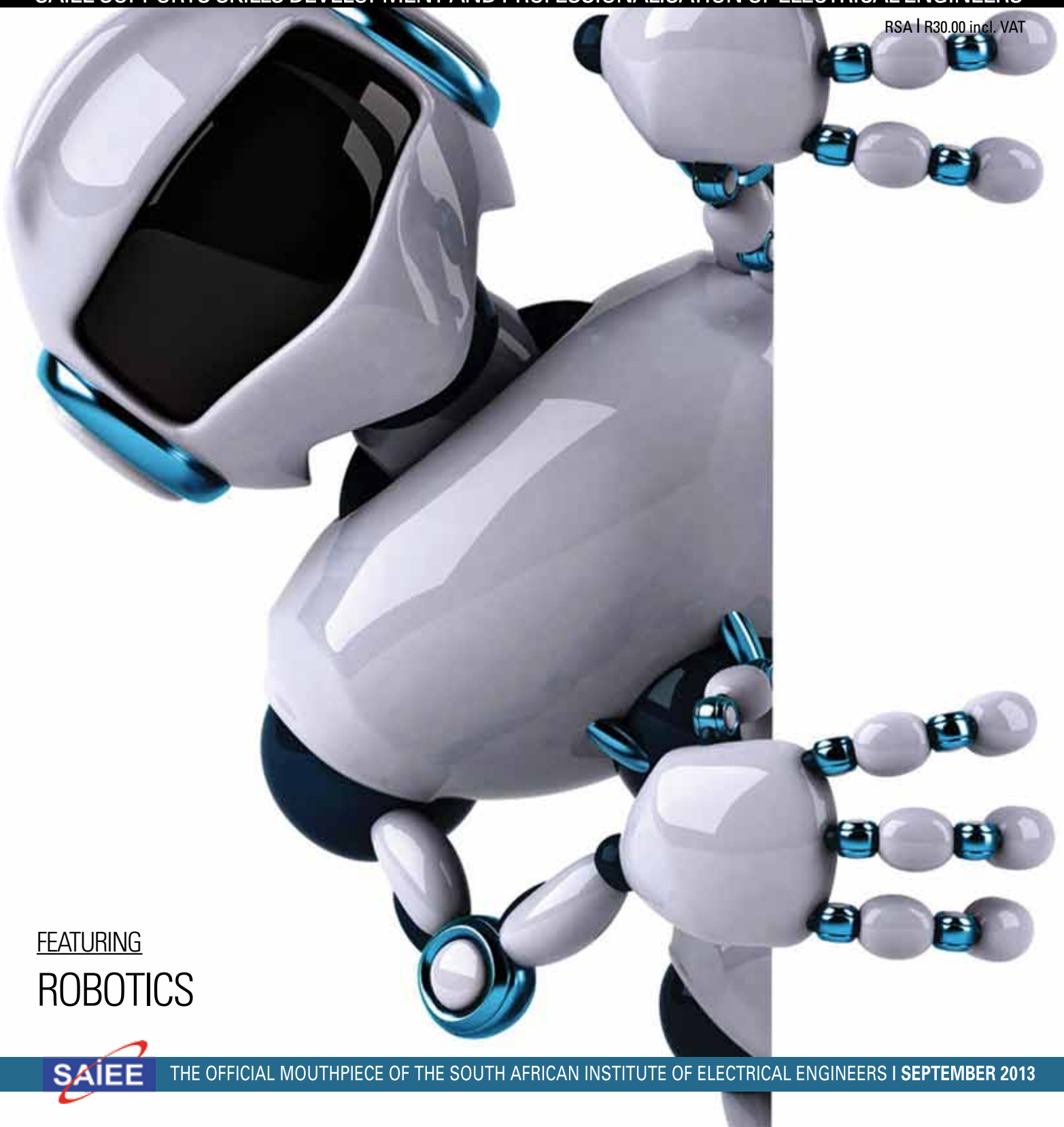
wattnow

SAIEE SUPPORTS SKILLS DEVELOPMENT AND PROFESSIONALISATION OF ELECTRICAL ENGINEERS

RSA | R30.00 incl. VAT



FEATURING

ROBOTICS

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wattnow magazine

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Spring has almost sprung as the monotonous routine of dark and cold winter days are almost a thing of the past and we all look forward to the warmer and brighter days of a spring full of scented blossoms, new promise and fresh opportunity.

Opportunity indeed, our featured article relates the fascinating story of Easton La Chapelle, a 17-year old native of Colorado, US who, with limited resources and a whole lot of ingenuity, invented a robotics hand, which cost less than $400. In his own words *"he just wanted to make something useful"* and that's exactly what he did. Read the full story on page 26.

Continuing with the theme of robotics we take a look at the job market in 2045 and ask ourselves... will we have to compete with machines to find a job? With September being the current annual 'strike' month in RSA, it might be on the cards sooner than we think. Read the full story on page 30.

On page 40 we discuss the oil chemistry of transformer oil. In order to prevent catastrophic failures, suppliers and end-users should educate themselves about oil and the maintenance thereof.

What to look forward to:
The **watt**now magazine is a media partner at the 6th IEEE Robotics and Mechatronics (RobMech) Conference taking place at the University of Kwa-Zulu Natal. Do not miss this event - read more on page 24.

We are in the final stretch of our annual iPad competition and the winners will be notified within the next month and will receive their iPads at the annual SAIEE Banquet, to take place in the 1st of November 2013 at the Wanderers Club. Contact Gerda Geyer on geyerg@saiee.org.za to book your tickets.

Want to become part of the **watt**now magazine? Want to earn additional CPD credits? Share your knowledge and experiences with the greater engineering community and send me any white paper or article you would like to see published. The theme for November is 'Hydrogen' and the deadline for article submission closes 7th October.

Happy spring - happy reading!

Minx

Earn CPD Credits

*Visit www.**watt**now.co.za to answer the questions related to these articles to earn your CPD points.*

Greetings to you all from the desk of the SAIEE President.

The lifeblood of the SAIEE is the activities of its members hence it is important for all SAIEE members to take an active part in the activities of your institute.

The South African Institute of Electrical Engineers is a voluntary association that provides many benefits to its members. It continually looks after the interests of Electrical Engineering and the maintenance of standards.

Government has announced that, under the leadership of the Planning Commission, it has developed the National Development Plan through which it intends to embark upon a programme of development for the year 2013, and beyond. It has invited the nation to join Government in a massive infrastructure development drive. President Zuma announced that together, we are going to launch a huge campaign of building infrastructure nationwide. This will boost the level of the economy and create job opportunities. As such, and based on sound business principles, Government has announced the launch of various Strategic Infrastructure development Projects (SIPS) and a concomitant Capital Investment Programme of hundreds of billions of rand.

I commend the NPC for the development of the National Development Plan, as a blueprint that provides clear guidelines for the development of our country. I am also very impressed that most of the NDP goals involved will have a direct bearing on the Electrical Engineering discipline. I am concerned however, that this careful planning does not extend to implementation of these projects. In order to prepare for this massive infrastructure development, we require detailed targets and timelines.

The Council for the Built Environment (CBE) has solicited assistance from the voluntary associations such as the SAIEE to assist them in identifying the Engineering resources that will be required for these projects.

I recently attended a meeting of the CBE where it was decided to appoint various discipline specific Occupational Teams. These are to devise methodologies determining how many Engineers will be required for the design and construction of these projects, in addition to our current requirements. This bodes well for the profession, and we as the office bearers of the SAIEE will ensure that we participate in all forums to ensure that our members benefit from such developments.

Government does not make clear who is going to manage these projects. I believe that Government should have an inward look at the re-professionalisation of Engineers within their own technical service delivery departments.

The time has come that the SAIEE should join with our sister institutes and provide discipline specific mentorship services for Engineers in the various Government, and parastatal technical service delivery departments. The profile of Engineers in Civil society needs to be closely examined so as to ensure that the Profession gets the respect it deserves.

In other activities during the past month, the SAIEE launched a new Centre in Bloemfontein. This is to be known as the SAIEE Central Region.

The inaugural meeting was attended by approximately fifty enthusiastic Engineers in the Region. They have nominated ten senior SAIEE members who will convene a meeting to appoint a committee to start up the new centre.

Initially, Mr Ben Kotze, who is a lecturer in the Department of Electrical, Electronic and Computer Engineering at the Central University of Technology, Free State (CUT) will be the convener of the group. He will arrange the first meeting, and coordinate the appointment of the executive team of Chairman, Vice Chair and secretary to run the centre.

I would like to see that we have a centre in all regions to facilitate an opportunity for all members to attend meetings and participate in SAIEE activities.

All the best for this month, chat again next month.

Paul van Niekerk | Pr. Eng | FSAIEE
SAIEE President 2013

WATTSHOT

Gadgets and gizmos for you... go ahead, spoil yourself! You deserve it!

App Cufflinks Set (3 pairs)

Some people wear their heart on their sleeve – others wear their favourite Apps. This set of six cufflinks is perfect for the App-sessed. Choose to wear any combination of the Email, Message, Calendar and other well known Apps.
Price: R275 (incl. VAT)

Bezu Balls Magnetic Puzzle

BezuBallz are Powerful Rare Earth Magnets that can be shaped, moulded, torn apart and snapped together in unlimited ways and combinations. Once you pick them up, you can't put them down!
Make sculptures, puzzles, patterns, shapes, stick to the fridge, or knead them in your hand for stress relief.
Price: R495 (incl. VAT)

Sphero Robot Ball Gaming System for iOs and Android

You shake it and Sphero begins to glow softly in your hand. So you put it on the ground and fire up one of the several free Apps and this strange little glowing orb reveals itself to be a rather remarkable robot. Sphero works with both iOS and Android systems, using a Bluetooth network. It charges hassle-free in an induction cradle. There are several official Apps available.
Price: R1,499 (incl. VAT)

iHelicopter RC iPhone® Helicopter

Controlled using your iPhone, iPad or iPod Touch, the iHelicopter is the world's coolest RC helicopter.

Even before you start it, just by holding it in your hand you will love it. Meticulously crafted with stainless steel, the skeleton is robust to withstand even heavy falls on marble floor from ceiling height. Covered with white-painted acrylic, the body is streamlined and beautiful. The iHelicopter is a true thing of beauty, just like the iDevices which you use to control it.

Flying the iHelicopter is easy and a lot of fun. All you need to do is download the FREE controller App from the App Store and plug in the transmitter. The App features a band selection (A/B/C) which makes it possible to have 3 iHelicopters flying in the same area. You can use the app to perform a variety of movement, including left/right rotation, forward/back, hover and land.
Price: R799 (incl. VAT)

Remote Wireless DVR Monitor

Having this wireless monitor means you can monitor the goings on from a secure/ remote location. The color 2.3 inch LCD screen will show you a real-time video transmission (that looks great with H.264 video compression) and also allows you to pan, tilt, and zoom around, making sure everything in the room is harmless.

Even better, the camera's microphone will clearly pick up any noise nearby and transmit it automatically to the monitor, even when the screen is off. This remote monitor has a wide range of uses, and allows any situation to be monitored from a far wether at home or the office or out on the road. It can also be used as a baby monitor to ensure the little one is safe and happy. Price: R2,299 (incl. VAT)

Wahoo Blue Heart Rate Strap

Wahoo Fitness Blue HR heart rate strap is the world's first Bluetooth Smart heart rate strap made for the iPhone 4S, iPhone 5, NEW iPod Touch (5th generation), iPad (3rd and 4th generations).

This heart rate strap and App combination transforms your iPhone into an all-in-one training device, great for runners, cyclists, and other fitness enthusiasts. The Wahoo Fitness Blue HR heart rate strap connects wirelessly to your iOS device without the need for any adapters and delivers accurate real-time heart rate data through the free Wahoo Fitness App.

With the Wahoo Blue HR and your favorite fitness App, you now have your heart rate data, your playlists, your phone, GPS maps and more - all in one device!
Price: R899 (incl. VAT)

01 Binary Watch Turning Disc

01 THE ONE watches are like none you've ever seen before. These exceptional timepieces feature LED displays and a binary time-reading system that will change the way the world tells time. An 01 THE ONE watch is perfect for mathematicians, scientists and computer experts who want a truly one-of-a-kind watch.

01 THE ONE watches are designed using the binary code, which consists of only the numbers zero and one. Zero represents the off state, while one represents the on state. Combined in groups of eight, these numbers can represent hundreds of different values including time. Revolutionizing the watch market, 01 THE ONE watches are distinctive and completely unique.
Price: R1,899 (incl. VAT)

Remote Control Robot Arm Kit

The Robotic Arm kit arrives disassembled and contains all the pieces you'll need to make your very own desktop droid. It's remarkably easy to set up so you don't need to stress about soldering or advanced electronic engineering: as long as you have a screwdriver and some wire cutters you have all you need to get started from the moment you open the box. Once it's finished you'll have hours of fun finding out exactly what it can and can't do, using its controller to power the five joints and motors to swing the arm around and pick things up with its pincer like grippers - complete with spotlight for night work.

The best thing about it is that once your friends and family have stopped arguing over who gets to have a go next, you can swell with pride and tell them "I made that".
Price: R950 (incl. VAT)

All the products featured on pages 8 & 9 are available online at www.mantality.co.za unless specified differently.

WATTSUP

Back row (L-R); Greg Hoets, Keith Bull, Jan Jordaan, Kevin Gordon, Patrick O'Halloran and Garry Craig. Front (L-R): Gavin Strelec, Gerda Geyer and Charle Leibbrandt.

Patrick O'Halloran and Dries Wolmarans.

Godfrey Kerr and Stan Bridgens.

Anthony Falconer and Hennie Scholtz

Wayne Fischer

Keith Bull and Charle Leibbrandt

Antonio Ruffini

Gavin Strelec, Chief Engineer, Eskom Research, Testing and Development

Keith Bull from ARB.

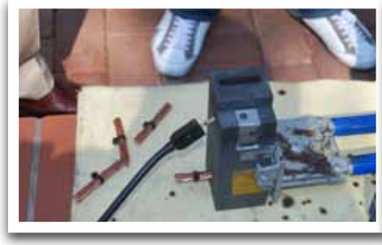
Lectro-Tech display.

We had a full house!

Demonstrating the difficulty to cut through a copper-plated steel rod.

Jan Jordaan from Copalcor demonstrating the ease of bending a copper-plated steel rod.

Measuring the thickness of the copper-plated steel rod.



Demonstration of exo-thermic welding by ARB.

Safe remote ignition of the exo-thermic welding.

The ease of bending a copper-plated steel rod with a pipe bender from Copalcor.

ERADICATION OF COPPER THEFT WORKSHOP

Copper is generally the preferred method of earthing, for a number of technical reasons and despite alternatives being available and tested, theft deterrent solutions have curiously not been widely applied, mainly due to practical and cost issues. At this workshop, speaker Gavin Strelec, Chief Engineer, Eskom Research, Testing and Development addressed these concerns, and encouraged practical application without any technical compromise, yet significantly lower life cycle costing.

George Debbo

WATTSUP

EMERSON ANNOUNCES THE WORLD'S FIRST TRUE WIRELESS GUIDED WAVE RADAR LEVEL TRANSMITTER

New IEC 62591 Guided Wave Radar transmitter extends continuous level monitoring to difficult to reach locations The Rosemount® 3308 wireless GWR transmitter has been introduced to meet the need for accurate level monitoring in remote or difficult to reach locations where installing new cabling would be costly or impractical.

GWR transmitters are widely used for a broad range of measurement and control applications. These include process level measurement in vessels and storage tanks in refineries, oil fields, offshore platforms, chemical and industrial plants. For example, in well production applications, GWR transmitters are used to measure the level in tanks used for the storage of production, and the delivery water and injection chemicals. Accurate and reliable level instrumentation helps avoid the risk of oil spills that impact the environment and require expensive labour and equipment to clean up.

Emerson's Smart Wireless technology significantly reduces installation and configuration time. Since there is no need for cabling, trenching, conduit runs and cable trays, costs are typically reduced by 30 per cent or more compared with a wired solution. Once a wireless network has been established, any WirelessHART™ enabled device can join the network and take advantage of the benefits of an existing Smart Wireless infrastructure. This makes it easy to make changes or move devices around to meet specific requests.

Emerson's Rosemount 3308 - the world's first true wireless Guided Wave Radar level transmitter

Lefadi Makibinyane
Newly appointed CEO | CESA

MAKIBINYANE TO STEER CESA TO NEW HEIGHTS

Makibinyane holds a Bachelor of Engineering Degree with Honors (Chemical Engineering) from the University of Teesside, Middlesbrough, in the United Kingdom, a post Graduate Certificate Management Development Programme Program (in Project Management) as well as Masters in Business Leadership from the University of South Africa School of Business Leadership, in Pretoria.

He sees expanding the market base of CESA members for the trading of their services, as one of his primary tasks as well as to invigorate the advocacy voice for CESA members in both public and private sector.

This will help in bringing back the rational that consulting engineers are the front-end engineering loaders of every technical/ infrastructure development as their service focal area lies in design, material selection.

Makibinyane believes that corruption destroys value and compromises quality of service by denying the community delivery of service and efficient infrastructure. *"The Engineering profession promotes ethical behavior and conduct as an integral principle of technological work and service. The work of an Engineer centres on harnessing the might of science for safe human use and benefit within the constraints of the natural environment. One cannot achieve any quality of service as an engineer if you are corruptly natured; (sic) hence fairness and equality is a prerequisite requirement for the development of an engineer".*

He cautions that any consulting engineering member firm caught participating in corrupt activities shall not only lose their membership of CESA but their work and existence as a firm.

CESA will ensure that such a member gets blacklisted on the National Treasury database and gets removed as a vendor for Consulting Engineering Services from the databases of both public and private sector clients.

"It should therefore be the premise and commitment of CESA, under my leadership, to instill in members the proper and ethical conduct in discharging of their duties to our clients" aver Makibinyane.

ZEST WEG GROUP ACQUIRES HAWKER SIDDELEY

The Zest WEG Group, a local subsidiary of leading Brazilian motor and controls manufacturer WEG, has acquired the entire business of Hawker Siddeley Electric Africa in South Africa.

Hawker Siddeley is recognised among the pioneers of mini substations and has become one of the largest manufacturers of mini substations, unit substations and distribution transformers in South Africa, with the capability to design and manufacture the complete range presently used in the country's industrial sector.

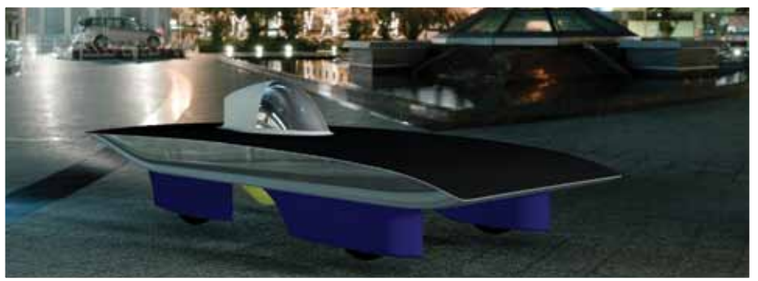
Louis Meiring, chief executive officer of the Zest WEG Group, says the rationale behind the acquisition of this leading local manufacturer is simply that while the Zest WEG Group has enjoyed tremendous success in the African market with the supply of large transformers - typically 20 MW and larger - it has not been able to participate in the transformer sector with products from 50 kVA to 20 MVA, in both distribution transformers and mini substations.

"It made absolute sense to fill this gap in our product range via an acquisition that would give us instant access to a product segment in which historically we could not compete," says Meiring. *"The acquisition means that we can now make the most of opportunities to supply a spectrum of our products on a turnkey basis. Pursuing this route will also give us a cost leadership advantage."*

"A cornerstone of our business is our relationship with the market and, over a period of time, a number of our existing customers have made it clear that there has been a definite need for additional local manufacturers of transformers. Listening to the marketplace has always been a major differentiator for us and will continue to be part of our modus operandi. In addition, the acquisition is in line with our philosophy of localisation and local investment and aligns with the localisation requirements of Eskom and other parastatals. Zest WEG Group is now part of a major global corporation - we started out as a South African company and we maintain a strong commitment to contributing to the development of the local economy and the people of South Africa.

Louis Meiring | Chief Executive Officer
Zest WEG Group

Meiring adds that the acquisition has come just at the right time for the Zest WEG Group, which is making robust progress against its holding company's 2020 strategic plan. The plan, initiated by WEG headquarters in Brazil in 2011, is poised to accelerate the expansion of its global network of businesses and manufacturing plants and is expected to ensure that the Group increases its sales by at least 17% year-on-year until 2020, when it aims to arrive at a turnover of US$10-billion.



WITS TEAM TO COMPETE IN SOLAR CHALLENGE

The heat is on for a team of students from Wits University who are racing to find sponsorship and finish building their 'Sun Dog' in time for the Sasol Solar Challenge.

Every two years, teams of students from tertiary institutions around the world design and build solar powered vehicles to compete in the Sasol Solar Challenge which covers 5 400km of variable South African terrain. The race is the longest of its kind anywhere in the world.

In 2012 a Wits team competed in the challenge for the first time and finished fourth. The 2014 event will be the fourth ever Sasol Solar Challenge and Wits is planning to compete using a brand new vehicle – the Parhelion – which is being built largely by the School of Mechanical, Industrial and Aeronautical Engineering.

The name 'Parhelion' was inspired by a phenomenon of the sun which results in the formation of a halo or circular rainbow around the sun. The colloquial term for this phenomenon is 'sun dog'.

According to Team Leader Bradley Rautenbach the Wits team wants to push the boundaries of technology and showcase the feasibility of renewable energy in the transport and energy sectors. The Parhelion is designed to optimise energy from sunlight using a semi-monocoque carbon fibre chassis, along with latest generation lithium-ion batteries, which will ensure that the car is extremely lightweight.

The next race will take place in September 2014.

WATTSUP

UNISA LAUNCHES CUTTING-EDGE SCIENCE CAMPUS

The University of South Africa has officially opened its new science campus in Florida, Johannesburg. The campus houses UNISA's College of Agriculture and Environmental Sciences (CAES) as well as its College of Science, Engineering and Technology (CSET).

Professor Mandla Makhanya, UNISA's Principal and Vice Chancellor, says UNISA intends to play a key role as a provider of science education – hence its investment of close on R1-billion into developing a campus which offers state-of-the-art facilities to enable the teaching and learning of science in a world-class environment.

"The Science Campus is aligned with and responsive to national imperatives and priorities, and the official launch today marks a further milestone in our university's rich history of 140 years," Makhanya said.

"We have chosen the first day of National Science Week as a fitting day for the launch of the UNISA Science Campus to highlight UNISA as a destination of choice for the study of science (including agriculture and environmental sciences), engineering and technology."

Derek Hanekom, the Minister of Science and Technology, delivered the keynote address at the official opening of the UNISA Science Campus. *"We are delighted that UNISA has partnered with the DST during National Science Week to promote the study of science among South African youth,"* the Minister said. *"Science, engineering and technology have been identified as areas where there is an acute shortage of skills in South Africa, and must receive intense focus in both basic and higher education."*

The UNISA Science Campus offers state-of-the-art laboratories and high-end equipment, thereby advancing science education and research at a national level. It contains 12 buildings, a library, two auditoriums and a large study area. The campus includes a Horticultural Centre, a multi-purpose research and training facility designed to meet the education and research needs of students in a range of programmes including agriculture, ornamental horticulture and nature

Derek Hanekom
Minister of Science & Technology

conservation. Short learning programmes ensure the centre's relevancy to the broader community and green industry.

According to Makhanya, the enabling facilities will support UNISA as a premier university as one of the mega universities worldwide - to play a more significant role in terms of the sciences.

"The university will now be able to create an environment which truly stimulates research and innovation, supports researchers and scientists, and meets the educational and training needs of its distance learning students, at both undergraduate and postgraduate levels," he said. *"In this way the university's beneficial capacity will be enhanced and extended as a resource to students, scientists and researchers alike."*

Doug Gunnewegh
Managing Director | Helukabel South Africa

MOISTURE RESISTANCE ELECTRICAL CABLE GLANDS

A new range of cable glands that prevent all forms of moisture entering cable enclosures has recently been launched by leading cable manufacturer, Helukabel.

The latest in an extensive range of cable glands and accessories, the new Helutop HT Air PA range has advanced features to form a tight seal regardless of conditions or temperature extremes.

The use of specially developed synthetic materials enables the glands to be used in a wide range of corrosive environments where metallic and other materials may not be suitable. An effective temperature range of between -20°C up to +80°C also makes it ideal for harsh environments where integrated pressure compensation and ventilation features are incorporated into the design to prevent water condensation .

MAMELODI SOS CHILDREN'S VILLAGE GOES GREEN

H E Mr Tian Zuejun, Bongi Ngema-Zuma, Siphiwe Maphanga and Soka Matlala

The installation of 15 Apollo Solar Geyser units at the SOS Children's Village in Mamelodi is one of the ways that the South African Embassy of the People's Republic of China is celebrating its 15 years of relations with South Africa. The installation has been commissioned with an underlying theme of "Sunshine Green Friendship Future" that underscores the Embassy's hope for the children at Mamelodi.

Mr Tian Xuejun, the Chinese Ambassador to South Africa and Ms. Bongi Ngema-Zuma, South Africa's First Lady, were in attendance at a hand-over ceremony that took place during August 2013 at the Mamelodi SOS Children's Village.

Ambassador Tian Xuejan highly applauds the work of SOS Children's Villages in promoting children's wellbeing, and says that, *"Children are the future of a country and their development bears in the development of the country and the nation. As South Africa's good friend, brother and partner, China sincerely wishes South African people, including children, a better and happier life, and is ready to extend a helping hand."* He also states that, *"China has some experience in the utilisation of solar power and is willing to share its expertise with South African people."*

"The installation of Apollo Solar Geysers at our SOS Children's Village in Mamelodi is a considerable contribution to our greening efforts at the village," says Siphiwe Maphanga, National Director of SOS Children's Villages South Africa.

"We sincerely thank the Embassy of the People's Republic of China in South Africa for aiding us in our efforts. The development of renewable energy projects such as these will greatly benefit the environment and expand upon the diversity of our nation's energy supply," he adds.

"The growing energy crisis in South Africa and the ever-increasing electricity rates have a profound impact on the operational costs that are involved in the running of a Public Benefit Organisation (PBO) such as SOS Children's Villages. This project will have a positive effect on our bottom line and I am quite excited to see our next electricity bill," concludes Maphanga.

Martiens van der Merwe, Managing Director of Richmond Mining and Exploration, and Henk Stander of the Division of Aquaculture at Stellenbosch University, inspecting the new Aquaponics system being installed at the Welgevallen Experimental Farm.
Photo: Engela Duvenage

MINING COMPANY SUPPORTS RESEARCH INTO AQUAPONICS AT STELLENBOSCH UNIVERSITY

Experts in aquaculture and agronomics of Stellenbosch University (SU) have joined forces with the mining company, Richmond Mining and Exploration, in a research project to discover the best aquaponics techniques to adopt when fish are farmed together with plants or vegetables. A successful outcome of this project is expected to be a large-scale commercialisation of the processes that are developed.

Richmond Mining and Exploration is funding among others a new aquaponics system which will be used in the following year for experiments by staff and postgraduate students of the SU Division of Aquaculture and the Department of Agronomics in the Faculty of AgriSciences.

Since August, a team from Richmond, under the leadership of executive director Martiens van der Merwe, have been hard at work at the Welgevallen Experimental Farm to install the necessary infrastructure.

In aquaponics the principles of hydroponics and aquaculture are integrated to raise fish and plants together in separate units. The aim is that the plants, which include anything from lettuce and water lilies to tomatoes, should gain most of their nutrients from the water which circulates out of the fish ponds.

Richmond Mining and Exploration started to take an interest in aquaponics after acquiring a farm in the Dullstroom area which is rich in kimberlite and on which 21 trout ponds are situated.

According to Mr Martiens van der Merwe, managing director of Richmond Mining and Exploration, mining companies have a responsibility towards the surrounding communities to not only provide employment through their mining activities but also to ensure economic sustainability by setting up additional commercial options.

WATTSUP

THE 4TH NATIONAL ENERGY BAROMETER SURVEY (NEBS) IS OPEN FOR BENCHMARKING

For the 4th consecutive year, Energy Cybernetics has been making its Energy Barometer tool available to building owners and facility managers to participate in the National Energy Barometer Survey (NEBS). The Energy Barometer is a non-intrusive and cost-effective process to determine the energy consumption stance of a building in relation to others in a similar market and environment. NEBS endeavors to compile an accurate database of building energy use information in the country and is supported by the Central Energy Fund (CEF), the National Energy Efficiency Agency (NEEA), the South African National Energy Development Institute (SANEDI) and the Energy Training Foundation (EnTF).

This year's participation carries no costs and participants receive their ranking result that indicates where they are in accordance to others in their respective industry.

Building owners and facilities managers are invited to enter their shopping centres, corporate headquarters, banks, hotels, hospitals, car dealerships and general office buildings into the NEBS to find out how they are faring against other similar buildings in the industry.

Building owners and facilities managers that have been participating in NEBS since its inception have reported being able to track their energy efficiency investments' performance against others in the industry, been able to identify what further potential savings could be achieved, and have reported increased staff awareness and participation in energy efficiency initiatives due to the teamwork required to make a success of sustaining energy savings.

Participating is fairly easy by logging onto www.energybarometer.com, mouse over the registration button and complete the required information such as: building size, energy consumption from your utility bill for the year January to December 2012, the weather patterns to your area, etc. The website contains easy to follow instruction on the documentation required to make your online entry as quick as possible.

The closing date for completing NEBS entries is 23 September 2013, whereafter the data will be analysed and audited upon which all participants will receive an emailed NEBS certificate of their results.

Andries Steenkamp
Worley Parsons, Cape Town

Andre de Klerk
Eskom, Johannesburg

Jaco Perold
Powertech System Integrators

ENERGY TRAINING FOUNDATION ANNOUNCES TOP SAEE STUDENTS FOR 2012

The demand from industry and government to grow the greening sector has created a vast market for 'Green' job training in South Africa. In 2012, the Energy Training Foundation (EnTF) trained almost 400 persons of which 260 wrote international US-based Association of Energy Engineers (AEE) Certification examinations. EnTF is proud to announce the three top students, recognised by the Southern African Association for Energy Efficiency (SAEE), whom received the highest marks for their examinations during the 2012 year:

- Certified Energy Manager (CEM)
  Andries Steenkamp, Worley Parsons
- Certified Measurement and Verification Professional (CMVP)
  Jaco Perold from Powertech IST
- Certified Energy Auditor (CEA)
  Andre de Klerk from Eskom

BASIL READ MATOMO APPOINTED FOR FREE STATE RENEWABLE ENERGY PROJECT

A joint venture, between Basil Read Matomo (Pty) Ltd and Isolux Ingenieria, has been appointed by SunEdison to build a 60 megawatt (MW) AC solar photovoltaic (PV) plant in Boshof, Free State. The Boshof region experiences some of the highest solar irradiation levels in the country, and which makes it well suited to electricity generation by solar PV. The project forms part of government's Renewable Energy Programme.

"We are excited about this project and look forward to creating an enviable track record for energy turnkey projects through our joint venture with Isolux," says Director of Energy for Basil Read Matomo, Marius von Wielligh.

The scope of the project covers the construction of 60 MW AC solar PV power plant including the substation and interconnection facility required for connection to the 132kV ESKOM grid.

The project is expected to break ground at the beginning of August 2013 and a fast-track implementation would see connection to the national grid by the end of August 2014.

"Our JV is committed to creating value-add for shareholders and upholding the important economic development obligations, as required by the Department of Energy," Von Wielligh adds.

South Africa has a high level of renewable energy potential and presently has a target of 10 000 gigawatt-hour (GWh) of renewable energy, or approximately 5% of the country's total power generation, to be installed by the end of 2013.

The Minister of Energy has determined that 3 725 MW to be generated from renewable energy sources are required to ensure the continued uninterrupted supply of electricity.

Marius von Wielligh
Director of Energy | Basil Read Matomo

This IPP Procurement Programme has been designed to contribute towards the target of 3 725 MW and facilitate socio-economic and environmentally sustainable growth, while stimulating the renewable industry in South Africa.

INTEREST IN ELECTRICAL ENGINEERING BY THE MEDIA - BY DIRK VERMEULEN

The Historical Section of the SAIEE was recently invited by the freelance journalist, Andy Stead, to contribute some of our museum artefacts on the Screenafrica display of antique equipment. This was recently on display at the Mediatech Exhibition held in July at the Northgate Dome.

We contributed our showcase of valves displaying the substantial contribution of Hendrik van der Bijl to the origins of electronics. In addition, we included the prototypes of Wadley's receivers and several other items. Andy suggested that I should be present to describe the work of these two significant South African electrical engineers. With our forthcoming museum coming close to reality, and my book on the history of electrical engineering in South Africa about to be published, we were glad to take this opportunity to gauge the reaction of largely non-engineering visitors to our historical wares. Clearly, most of those attending this exhibition were associated with the media, and this further whetted our appetite for hearing their reactions.

With the exception of our 'Jacob's ladder' high voltage travelling arc, our artefacts had little visual appeal, and considerable background explanation was needed to support the interesting parts of their stories. This required not just a few words, but more than ten minutes of talking. We are creating audio-visual displays for our museum to serve this purpose, but at Mediatech I provided this service face to face.

We were not disappointed by the response. Not only male, but also female visitors of all races showed considerable interest in the stories surrounding van der Bijl and Wadley. This has encouraged us to believe that our forthcoming museum should be publicised amongst potential visitors from all walks of life.

Visitors enjoyed hearing the stories surrounding our exhibits.

Though most of us are interested in the products and services provided by our associates, we usually imagine that these are too abstruse to be shared with the general public. Many people are becoming more and more dependent on our services, and we should make sure that they understand that electricity don't just happen - it depends on the efforts of electrical engineers.

Driving the Energy Revolution

On Friday, 16 August, the UJ Solar Society hosted its first open day and the official launch of the UJ Solar society.

The UJ Solar Society provides a platform where students can get involved in the UJ Energy Movement. The programme, at the University of Johannesburg, promotes research, education and industry participation on alternative energy issues. *"South Africa is well positioned to become a world leader in alternative energy applications. In order to realise this potential, energy innovation must be promoted through technology development and commercialisation"*, says Prof Willem Clarke, CEO of Resolution Circle. *"The UJ Energy Movement provides a platform to develop a skills base focused on energy innovation, while creating an environment favourable for industry collaboration."*

The programme is driven through the joint efforts of the Electrical & Electronic and the Mechanical Engineering Science Departments, along with Resolution Circle at UJ. Resolution Circle is a training, research and development ecosystem that designs innovative, commercial, technology-focused solutions for industry in partnership with the university.

The society's goal is to raise awareness of the UJ Energy Movement and the efforts of the UJ Solar Team to design and build their third solar powered electric vehicle. Amongst others, the vehicle will participate in the 2014 Sasol Solar Challenge. The Sasol Solar Challenge is a biennial event, which aims to promote interest in renewable energy technologies.

UJ's involvement in alternative energy vehicles began in 2010 when they competed in their first South African Solar Challenge with a hybrid vehicle, which finished first in its class. In 2011, the project was expanded to include three new three-wheeled vehicles (2 hybrids, 1 solar). In 2012, a new solar vehicle, Ilanga I.I was designed and manufactured to compete in the Olympia class of the 2012 Sasol Solar Challenge. Despite the challenges that were faced by the team in the 2012 challenge, Ilanga I.I placed second in the Olympia class, with the hybrid vehicles taking first and third place in the Technology Demonstration class. Additionally, the University received the Technology Innovation Award in recognition for their commitment to support energy efficient vehicles by entering three vehicles (one solar and two hybrids) in the challenge.

The programme has proven to be very effective as a teaching tool to develop both technical expertise and much needed supplementary skills. To fully capitalise on these benefits, wider student participation in a multidisciplinary environment across several faculties is encouraged. The programme is developed as a platform to educate students at various stages of university education, both at undergraduate and postgraduate level, and will be expanding the support base across the University by involving students from several different departments at UJ.

The UJ Solar Society was established to take advantage of student participation beyond the Faculty of Engineering and the Built Environment. The society organises students from different faculties to support the objectives of the programme and to encourage participation outside the engineering curriculum.

Students participating in the programme are also expected to participate in the community outreach programme, hosting and visiting schools, presenting the efforts of the UJ Energy Movement at science fairs, trade shows and exhibitions. It is estimated that the UJ Energy Movement has reached over 180 000 people through more than 18 school visits and 17 exhibitions, including the National Science Week, Eskom Innovation Summit, UJ Open Days, the South African Solar Challenge and the Sasol Techno-Ex.

In an on-going effort to promote science, engineering and technology to the South African youth, the UJ Solar Team donated their first prototype vehicle, Ilanga I, to the Deutsche Schule Johannesburg (DSJ), the only school entry in the 2012 Sasol Solar Challenge.

Ilanga I (isiZulu for sun) is a three-wheeled solar-powered vehicle that was initially built to compete in the 2012 Sasol Solar Challenge. wn

UJ Students inspecting what's under the hood!

Warren Hurter – Junior Engineer and Project Manager, UJ Solar showing Minx Avrabos (wattnow) the cockpit of the Solar Powered car.

The youth from the Deutsche Schule Johannesburg completely excited about the donation of the Ilanga I.

TO SIGN UP FOR THE ENERGY REVOLUTION, VISIT WWW.UJSOLAR.CO.ZA/SS

Visit to Eskom National Control Centre

I was privileged to be one of a small group of SAIEE Members who visited the Eskom National Control Centre on 28th July 2013.

MYLES FOWLDS | FSAIEE

The Centre is a National Key Point with tight security, but after relinquishing our cellphones and cameras, we were not subjected to further body searches.

The Control Centre itself is a small replica of Houston mission control, with five control desks studded with monitors and a most impressive North Wall with a live screen of some 20 by 15 metres.

The screen has on line displays of every Power Station on the Grid, and the state of each Generating Set at those Stations.

In the centre is a large graphical chart showing the instantaneous demand for the whole grid plus a comparative curve which, we were told, could show previous historical daily demand. Then there is a large map of the country showing all the major transmission lines and their instantaneous state (energised or not energised.)

On the right hand side are three frequency indicators with instantaneous frequencies at Simmerpan, Dhuva and the Cape.

The various desks are each arranged to control load, frequency, planned and unplanned maintenance at all the stations and forward planning.

A very slick operation controlling our nearly 40 000 MVA load and it was all eloquently explained to us by Al'Louise van Deventer, a Control Centre Manager.

I was particularly delighted to be able to attend this visit, as I was fortunate enough to visit the "National" Control Centre in 1956, when the load was a measly 3 000MW.

It would amaze today's controllers to realise what their jobs would have been then. The Centre was housed in a small house on the same site as the present Control Centre, with a central room, not much bigger than a lounge.

I hope my memory serves me right, but as I recall, the whole network was displayed on a back wall of this room, with the transmission lines done with runs of tape.

Circuit breakers were represented by cup hooks screwed into the wall. Their state (open, closed) was shown by coloured tags hung on the hooks!

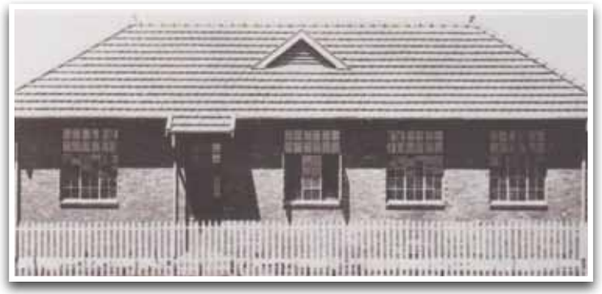
NASA Mission Control Centre, Houston, Texas

The Power Station outputs and the various total loads were shown on small voltmeters.

Communication was mainly by telephone and the then new wonder - Telex.

So we come to the operators, who were required to manually control the whole system, change the tags when breakers were operated, and understand which lines were available or were out of service.

The real problem came when there were storms, as not only were transmission lines lost and breakers tripped, but the phone lines failed too! This system remained on operation for over thirty years, and I would like to extend an amazed voice of gratitude to those stressed, but obviously successful, operators, who kept the lights on most of the time.

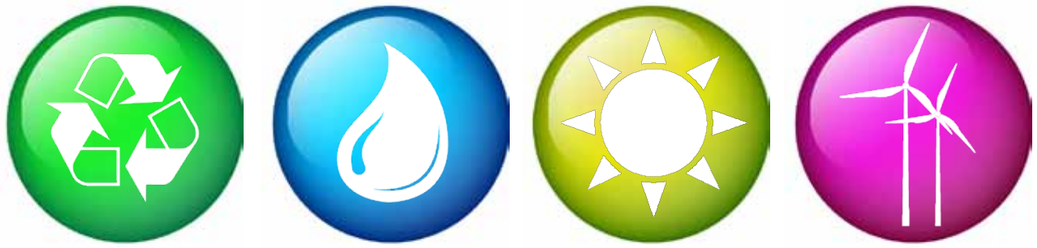


*ESKOM Control Centre in the Fifties**

It is my impression however that, today, with a vastly increased network, wonderful SCADA systems, fibre optic and microwave communications, but a limit of capacity and rapid load changes during each day, that the operator's jobs remain stressful, and require us to extend our continued gratitude to them. wn

** Photo copied from "A Symphony of Power" with permission from Allen Morgan*

SAIEE SUMMER COLLOQUIUM



EXPERIENCES IN SA'S RENEWABLE ENERGY DEVELOPMENT

SAIEE HOUSE | SAASTA AUDITORIUM | OBSERVATORY | JHB
FRIDAY | 18 OCTOBER 2013
10:00 – 14:00

Mike Carey, Immediate Past President of the SAIEE, invites members to come forward and share their experiences in developing renewable energy solutions for South Africa. The colloquium proceedings will be published in a special proceeding of the Institute and shared with all members.

GUEST CONTRIBUTIONS INCLUDES

- **Eskom Transmission Expansion Planning** - Integration of Independent Power Producers to the South African National Grid;
- eThekwini Electricity - Experiences from the Hazelmere COP 17 Solar PV Pilot Project;
- eThekwini Electricity – Experiences from the Springfield Waste to Energy Power Project;
- Wind Power Association of SA – Experiences and Forward Plans for Wind Generation;
- Durban University of Technology – Research into Wave and Tidal Power Generation;
- University of Kwa Zulu Natal – Launch of the Smart Grid Research Laboratory.

The summer colloquium will be hosted jointly with the Department of Science and Technology, National Research Foundation's SAASTA unit.

The presentations will be delivered in the SAASTA Auditorium. Members are welcome to prepare and show off their exhibitions and to market their experiences to fellow members.

The event will be structured to be summer casual; with all day networking, dining and entertaining around member exhibition and presentations.

There is a free event for members and their families; self catering and members are requested to bring, braai and share.

FIRST CALL FOR REGISTRATION:

1. For Presentation - 20 September 2013
2. For Exhibition - 30 September 2013
3. For Attendance - 5 October 2013

Kindly do register and reserve your participation at the 2013 colloquium.

Thank you

ORGANISING COMMITTEE

Mike Carey (Chairman)
Gerda Geyser (Secretariat)
Stan Bridgens
Refilwe Buthelezi
Tiego Moroaswi
Ezekiel Matlou
Mark Strydom
Dawid Bavin
Veer Ramnarian
Pat Naidoo
Prof Nelson Ijumba
Prof Theo Andrews
SAASTA/NRF

SAIEE

RobMech 2013

Presented by the advanced Robotic and Mechatronic Research network

www.robmech.co.za

The IEEE 6th Robotics and Mechatronics (RobMech) Conference 2013, in association with IEEE Robotics and Automation Society (RAS) and the South African Institution of Electrical Engineers (SAIEE), provides a platform to showcase and gauge the current state of advanced robotics and mechatronics research in South Africa.

Research facilities in southern Africa and beyond are invited to present and share their work. The conference is open to all industries, research institutions, and hobbyists. The conference brings together researchers, academicians, application engineers, users, and policy makers of CAD/CAM, robotics, and factory automation.

The conference and subsequent local and international collaboration is critical for the development of a competitive South Africa that can be a major player in the global market. It is important that South Africa makes use of its limited resources, by sharing and working with local and international partners. Mechatronics, Robotics and Advanced Manufacturing are also a critical technology for the development of South Africa's manufacturing and automation industries.

The IEEE 6th RobMech Conference is presented by the Advanced Robotics and Mechatronics Research Network, (ARMRN) allows the sharing of expensive infrastructure, while contributing to human capital development and collaboration between Academic sectors and industry.

ARMRN is made up of representatives from the CSIR, the University of KwaZulu Natal, the Central University of Technology in the Free State, the Nelson Mandela Metropolitan University in the Eastern Cape, the University of Stellenbosch in the Western Cape, and others.

The dates for the conference are the 30 – 31 October 2013. It will be held in the new Engineering Building at the University of KwaZulu-Natal. The R20 million structure boasts the latest innovations, and is designed to create an enabling environment for the students, while providing a "green" hub for university, industry and community-related activities.

Registration forms fo the conference is available at www.robmech.co.za.

The registration fee is payable before 1 October 2013 and includes full participation, lunches, refreshments during breaks, afternoon demonstrations and networking cocktails.

The UKZN Mechanical Engineering Open Day displays will happen on Tuesday 29 October 2013. Delegates are welcome to view the displays during that time. The projects will also be on display for a limited period on 30 October 2013.

COST INVOLVED		
Delegate Registration	R2,200	US$ 220 for delegates outside of SADC
IEEE / SAIEE Members	R2,000	US$ 200 for delegates outside of SADC
Student Registration - paper presenter	R1,500	US$ 150 for students outside SADC
Exhibition fee	R5,000	Per stand - includes registration for one delegate.

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IEEE

IEEE Robotics & Automation Society

UNIVERSITY OF KWAZULU-NATAL

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SAIEE

RobMech 2013 Conference Secretariat
UKZN Conferencing Services
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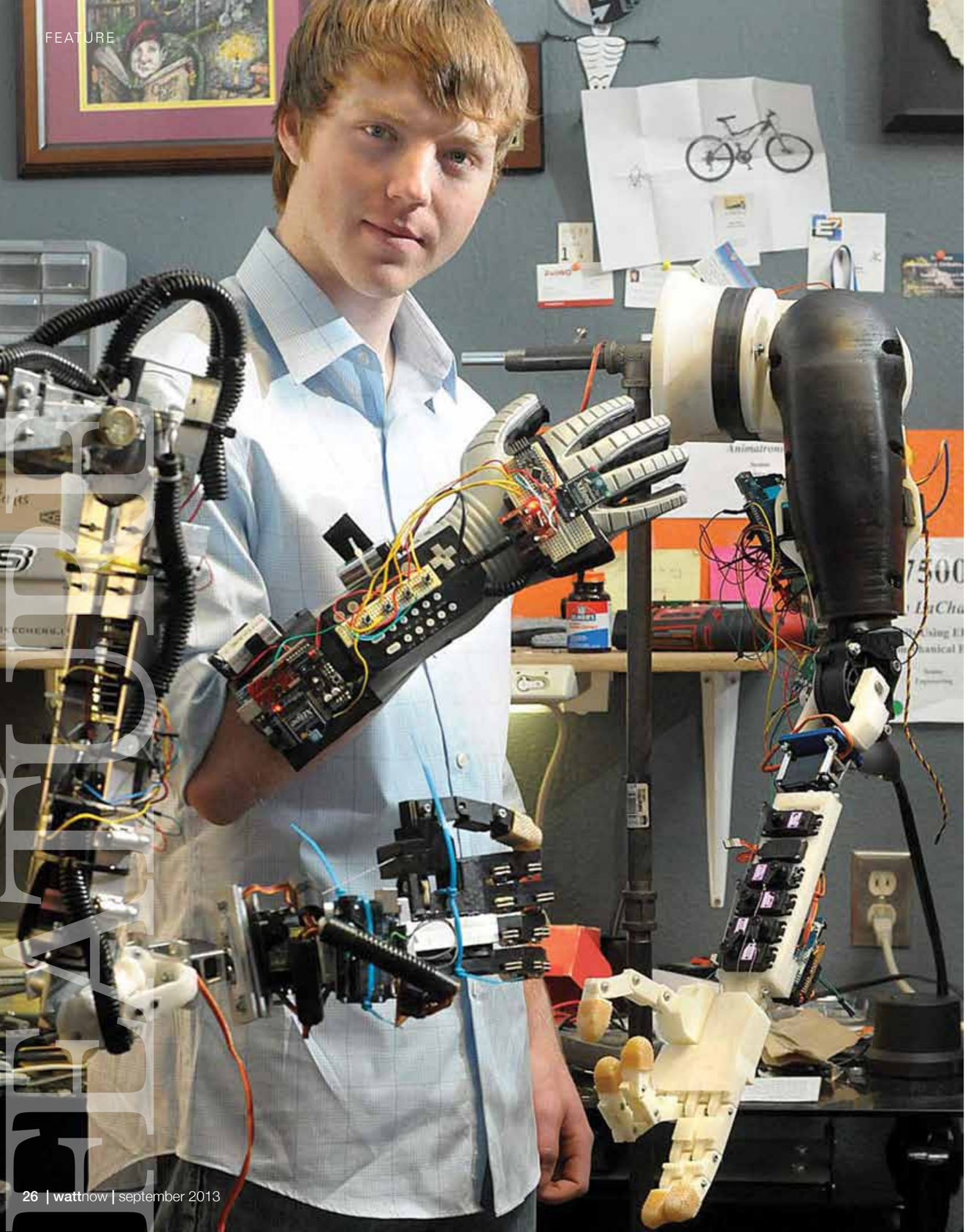


17 year-old inventor making robotic history

Easton LaChappelle used 3-d printing and electronics to do on his own what his school couldn't teach him--and what the market needed - and it will sell for less than R4 000.

BY I LIZ PRESSON

Easton LaChappelle's story offers a reminder of the simplest key to success - if you want something badly enough, do the work and find creative ways to achieve your desired outcome.

If traditional systems aren't providing what you need to accomplish your mission, then break away - break away from your 9-5 job, break away from the agenda that's set by conventional mind-sets. Easton broke away from the limitations of the public education system and taught himself what he wanted to know.

For LaChappelle, this meant learning how to build a better prosthetic arm: *"I tested a need in the market with a Kickstarter campaign. The need was there, so now I'm working to fill it. That's my mission,"* said LaChappelle. *"The educational system has boundaries, and you don't have to work within the boundaries of systems. You can do things to achieve your own outcomes - that's what I'm doing."*

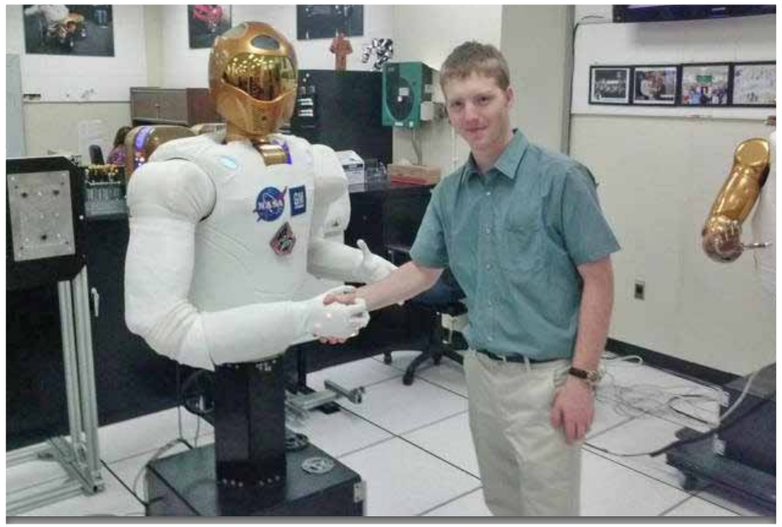
After meeting a young girl with a prosthetic arm and realizing that her parents had to pay $80,000 for it, he knew something had to change. LaChappelle's mission is to reinvent conventional prostheses so he focused the desire he's always had to take things apart and put them back together again in a new way.

Living in a small town in Colorado, LaChappelle has had to teach himself everything - Electronics, Coding, and how to use a 3-D printer. *"This year's graduating class had 23 people. The nearest RadioShack*

17-year-old inventor

continues from page 27

is an hour away," LaChappelle says. But lack of access and the learning curve hasn't stopped him. Neither has the fact that he's 17 and has little money to buy components. LaChappelle conducts all of his work in his bedroom. *"Just the other day, I heated acetone in a mason jar in my room to make the 3-D-printed hands look more human,"* he admitted to an audience of thousands in his recent TEDx talk (www.youtube.com/watch?v=CfmNXPMjChs).



Easton with Robonaut, working member of the NASA spacecrew.

To learn how to program the electronics and wireless communication technology, like the XBee, LaChappelle turned to online communities like Instructables, SparkFun, and Hack-a-Day. To keep costs down, he coordinated with a friend in New York to get two 3-D printers.

He takes every opportunity to speak about the robotic hand and inspire others. The connections he's made through doing so have helped him fulfill his vision of creating an arm that's lighter than a human's, but has the same strength.

The first version was a wireless hand that was controlled by a glove. *"I found flex sensors and sewed them onto a glove. I made my own custom PCB boards and a custom servo shield. Then, I added XBee modules for wireless communication."*

Now, the hand has more functionality than a traditional prosthesis and more strength than a human hand. The next generation can sustain 50 pounds of weight on an individual finger. *"The strength of the hand is so great that it's almost dangerous,"* LaChappelle says.

The system uses a wireless brain EEG headset that picks up 10 different channels of the brain to move the arm. And, since accessibility is key, the prosthesis will be sold for less than $400. Unlike some of the more advanced options that are currently on the market, amputees don't need a risky surgery to use the arm, it's something that can be taken on and off.

The technology is so useful that it's also caught the attention of NASA, where LaChappelle is now working as an intern on the Robonaut, a robot that will become a working member of the space crew. The Robonaut mocks human movements to perform maintenance tasks and duties that are too dangerous for astronauts.

With self-training and a dedication to a focused mission, LaChappelle has taken what started out as a glove with sensors to a robotic arm that's now one of the world's most advanced prostheses with a waiting list of over 300 amputees. The things that LaChappelle has taught himself are proving valuable to NASA, and he's helping an experienced crew build a robot that will be used in space and in industrial applications worldwide.

In all of the success that LaChappelle has experienced, he says, *"I just wanted to make something useful. This is what I'm meant to do."* wn

Job market in 2045... will we have to compete?

In a recent IEEE Techwise interview between Moshe Vardi, Professor of Computer Science at Rice University and interviewer Stephen Cherry, the future of human work in light of advancing robotic technology was discussed. The question: will humans have to compete with machines for jobs in the future?

BY | DAVID RUSSELL SCHILLING

Vardi is the author of a recent article *"The Consequences of Machine Intelligence"* in which he describes the *"inexorable progress of [Artificial Intelligence] over the past 50 years"* and the likelihood of further advances between now and 2045. He notes Ray Kurzweil, founder of Singularity University, has predicted humans will become immortal by 2045, when they will be able to download their consciousness to computers. But others, such as Sun Microsystems co-founder Bill Joy believe robotics, genetic engineering and nanotechnology are threatening to make humans an endangered species.

A LACK OF DISCUSSION ABOUT SOCIAL IMPLICATIONS OF NEW TECHNOLOGY

Vardi points out that humans tend to discuss new technologies only after they have been widely adopted. Technological progress is ongoing without much discussion of implications for society, human health and the environment.

For example, Americans adopted automobiles which, while improving mobility greatly, also led to pollution issues and permanently changed the way people interact. Opportunities to build subways instead of freeways were shelved under political pressure from oil companies and some manufacturers.

Vardi believes advances in robotics are moving along the same line with widespread research and development but not a lot of discussion about what it might mean for humans.

Vardi believes automation technology and software will lead to robots that can do nearly everything a human can do. If this turns out to be the case the vast majority of people will be out of work while engineers and scientists compete for the remaining "sweet spots." Jobs that require human to human interaction like sales or some medical positions will remain but tollbooth collectors, checkout clerks, waiters and other service positions could be taken by robots.

Vardi concludes by saying these issues should be discussed by politicians, economists and the general public so major labor force issues can be minimized or eliminated. As early as 1930 John Maynard Keynes wrote, *"the increase of technical efficiency has been taking place faster than we can deal with the problem of labor absorption."*

This problem remains today. Keynes imagined that by 2030 most people would only work 15 hours a week, occupying themselves with leisure the rest of the time.

As 2045 is just a generation away, Vardi notes now is the time to begin discussing and analyzing potential consequences of advancing technology. wn

Bridging the skills gap

The effective use of Commercial Off The Shelf (COTS) solutions and manufacturing development kits reduces the learning curve for implementing new technologies. This enables embedded products to get to market faster, explains Martin Hill of Microchip Technology.

BY | WILLEM HIJBEEK | FSAIEE

The latest generation of microcontrollers (MCUs) offers designers' higher integration and a wider range of peripherals and functions. This demands a wider range of design skills for successful implementation. The good news, however, is that MCU manufacturers are investing in resources that enable engineers to quickly gain the necessary embedded design skills, or significantly reduce the learning curve for implementing new technologies.

Microcontrollers are blurring the boundaries that once separated the design disciplines of software engineering and hardware engineering: traditionally, software engineers designed application software for microprocessors; whilst hardware engineers created microprocessor-based systems by combining an MCU and external components. The introduction of the first high-integration MCUs changed this.

They replaced the significant engineering effort required to develop a design from an MCU, external memory, peripheral, interface and discrete circuits, with the need for hardware engineers to write firmware for low-level driver-type applications.

MICROCONTROLLERS AND MORE

This means that embedded engineers need to add proficiency in C and Assembly language as well as debugging to their existing skills of hardware circuit design, microcontroller interfacing, PCB layout, design for manufacture and a detailed knowledge of EMC/EMI, and other regulatory standards and product approvals.

It is hardly surprising, therefore, that embedded engineers are increasingly looking to gain a competitive edge, and get products to market faster. That is why the availability of software libraries, sub-systems, and advanced development tools has become an essential part of the MCU selection process.

Bridging the skills gap

continues from page 33

This article discusses a number of scenarios. It suggests application-based strategies for choosing the right microcontroller, and using the manufacturers' tools and resources to simplify implementation and reduce time to market.

BLURRING THE BOUNDARIES OF MCU PERFORMANCE

Microcontrollers provide an extremely wide spectrum of computing power and peripheral integration. The choice is widened still further with high-performance cores, such as the PIC32MX1 and MX2 MCUs, being offered in reduced pin-count packages. Developments such as this mean that high-performance MCUs are moving into applications which would once have been the domain of the more established cores.

Higher levels of integration also present designers with complex trade-offs: performance enhancements such as faster, or improved cores, can deliver plenty of MIPs. but However very high levels of analogue functionality can reduce real-time performance.

Of course, device fit, form and function is only part of the selection process. There are other factors and decisions which can have a significant impact, such as design strategy, time to market, vendor support and cost. The questions which must be asked are: "Could COTS solutions help to shorten time to market?", and "*Which design strategy will provide the fastest design cycle?*".

The foundations of embedded designs

Typically, embedded systems need a user interface, display and some form of connectivity and these fundamentals have not changed over the years. Their complexity, however, has increased however , whilst the cost has reduced. This means that a colour graphics LCD, touch interface and wireless connectivity are now considered essential if a product is to be competitive. There are, of course, still valid reasons for selecting more traditional segmented LCDs, mechanical type switches for the user interface and wired connectivity. However, fashion sells, and customers can be fickle,which makes these design decisions crucial to the financial success of the design for a consumer electronic product.

BRIDGING THE SKILLS GAP

In a fast-paced market, new and improved technologies can come along just as the designer has mastered the skills introduced by the previous technology breakthrough.

Fortunately, Commercial Off The Shelf (COTS) solutions can support rapid product development by bridging the skills gap. COTS solutions can take many

Figure 2–Upgrading a kitchen-top appliance by adding a touch interface

forms. These can include source code and configuration tools for implementing a communication protocol stack, through to a full software development framework.

This can include including a RTOS, peripheral driver support libraries, system timing analysis, optimised for a specific application, such as automotive. It is becoming increasingly impractical to being generate a new design by writing all of the required code and starting hardware development from scratch. Some industries, such as automotive, actively discourage this 'blank canvas' design strategy by specifying the software development tools which must be used during development.

Silicon vendors and third-party development tools are also moving designers away from an 'all-my-own-work' approach by supplying, for example, a free IDE to ease debugging, and tuning of a specific application such as motor control, or a touch interface.

Another way in which to achieve higher integration, and a faster time to market, is to link new microcontroller peripherals to other peripherals so as to form sub-systems. Touch-screen applications can be implemented with a Charge Time Management Unit (CTMU), or using the Capacitive Voltage Divider (CVD) technique, and both could be linked with an analogue MUX to form a sampling sub-system for multiple touch buttons, or linear and rotary sliders.

Another example would be to use a Parallel Master Port (PMP) to drive a Low Cost Controller-less (LCC) graphics panel or using an integrated graphics controller. New general-purpose peripherals, such as the Configurable Logic Cell (CLC) can also be used to reduce the external component count. Designed to link with a range of other internal peripherals, CLCs are a useful addition to the embedded engineer's tool-kit. Integrated high-speed comparators and op amps are also particularly useful system components for power-supply and motor-control applications.

RESOURCES TO REDUCE TIME-TO-MARKET

Application notes, as well another COTS solutions and tools support new applications and peripherals, and help to reduce time to market by eliminating the need for embedded designers to re-invent the wheel.

Similarly, code examples address specific problems ranging from initialising peripherals to implementing algorithms.

IMPLEMENTING A TOUCH INTERFACE

The design strategy, and the tools which will be most helpful in reducing time to market, will depend on the specific challenges presented by each design.

Take for example, the challenge of implementing a new touch-screen interface to replace the mechanical push buttons on an existing kitchen-top appliance design using a PIC16 to drive a motor and a segmented LCD.

Clearly, the first goal would be to re-use as much of the existing design as possible: if the existing code is written in Assembly language, the aim should be to find a developed touch solution in a higher-level language. This would deliver a fast design process and overcome any in-house skills gap.

[Show All]	[Show All]	[Show All]		
Application	**Function**	**Product family**	**Title**	**Last Update date**
Algorithms (Building Blocks)	DSP & Signal Conditioning	dsPIC30F, dsPIC33F/E	dsPIC DSC Acoustic Echo Cancellation Library	11/07/2011
Algorithms (Building Blocks)	DSP & Signal Conditioning	dsPIC30F, dsPIC33F/E	dsPIC DSC DSP Algorithm Library	11/22/2011

Figure 1 - Code examples

Bridging the skills gap

continues from page 35

Figure 3 – Accessories design has different challenges

Typically, the strategy for this design would be as follows:

- Select a microcontroller from the same general product family which provides the basis for compatibility, or partition the design using two microcontrollers;
- Select a microcontroller with the peripherals required to provide the new functionality and memory, as well as analogue support to reduce component count;
- Look for a COTS solution which uses C code for the touch interface;
- Re-use and mix the existing Assembler code and C code for the new functionality, but partition the design into separate files. Alternatively, partition the design using separate microcontrollers with communications support for interfacing between them;
- After porting the code, run the application without the additional functionality and test the behaviour;
- Design and debug the touch interface using support tools;
- Environmentally test the touch interface and then integrate with the complete application and re-test.

INTERFACING TO SMART PHONES OR TABLETS

Designing a new accessory for a smart phone or tablet computer presents different challenges, such as the need to connect to Android® or Apple® phones or tablets, in addition to charging, control and other functions. Given the fast-paced nature of this market, a rapid design cycle is imperative.

The overall design strategy would be to:

- Research support for the Apple and Android platforms;
- Determine the overall application memory and resource requirements;
- Look for a COTS solution for the phone/tablet interface;
- Consider contracting-out the interface design if the skills are not available in-house;
- Select a microcontroller which supports the appropriate COTS software framework;
- Develop the accessory and the interface.
- Choose a development boardwith relevant demos;
- Decide whether to download the free, standard or professional version of the XC16 or XC32 C Compiler;
- For Android, download the free Android Framework COTS software package, which is part of the Microchip Applications Libraries (MAL). Use the appropriate COTS software package, XC C Compiler and MPLABX IDE to develop and debug the accessory interface;

The brief for a new design for a smartmeter would probably include a QVGA colour graphics display, an over-laid resistive touch display panel, radio link to a remote sensor and WiFi connection to the internet. Minimising software development time would be critical, as the design would also need a RTOS to perform task scheduling and resource management.

The typical design strategy would be to:

- Use high-level language;
- Make extensive use of COTS RTOS, communication protocol stacks and support libraries/tools;
- Adopt a modular approach to the hardware design;
- Provide a clear roadmap for the design to become the basis for additional products.

SUMMARY

Embedded systems are becoming more complex but, for many designs, COTS solutions enable a fast time to market, and can even minimise the need for designers to undertake the steep learning curve introduced with each new technology.

These design resources, such as online design centres, code examples, application notes, development boards and more, have become an essential part of the tool-kit for innovative embedded design and a critical factor in microcontroller selection. wn

Ignore online security practices at your own peril

Internet security and privacy are areas of growing concern for most businesses, and with the increasing use of Web 2.0, the potential risk is unlikely to abate in future.

BY I RIAAN RUDMAN I SENIOR LECTURER I STELLENBOSCH UNIVERSITY

This trend is driven by the new generation of internet users entering the workforce and bringing with them a familiarity with Web 2.0. Organisations have responded by ensuring that users gain access to data and resources, without thinking about whether users should have access, how they gain access and how that access is controlled.

I have been conducting research to determine which practices users followed when using Web 2.0 sites. I specifically investigated how users manage their identity, as well as their awareness of the risks relating to Web 2.0, and how they manage these risks.

Findings include that although users were aware of the risks, it did not have much influence on their online behaviour because they felt that their activities did not expose them to the risks highlighted in the media. A common sentiment was, *"It only happens to other people."*

Most users take some measures to protect themselves online, but they implement these controls or safeguards in a haphazard manner, not addressing all the risks. This means that they are still exposed to threats. In order to limit the risks of Web 2.0, safeguards could be implemented – by relying on computer settings, limiting use of the internet, self-protection and training, policy implementation or review controls, to name but a few. One needs to ask, how effective are these safeguards?

Some users customise the security settings of their browser or the Web 2.0 site, but most do not – often because they do not know how to do this. Consequently in most cases, the settings are incorrectly configured. Many organisations have internet policies that govern the use of company resources. The majority of the users indicated that they would comply with such a policy, if they are aware of it. Many users stated that they have not even read the policy document governing internet usage.

Monitoring internet activity is frequently cited as a safeguard, however, research showed that many users would only limit their activities online or stop using the internet if they aware of the fact that they were being monitored. Many of them did not know whether they were being monitored or could be monitored, nor did they know how to determine whether their activities were being monitored.

Other users argued that with the large volume of online activity, it would be impossible for their activity to be monitored effectively and, consequently, they would not change their habits irrespective of whether it would expose them to risks.

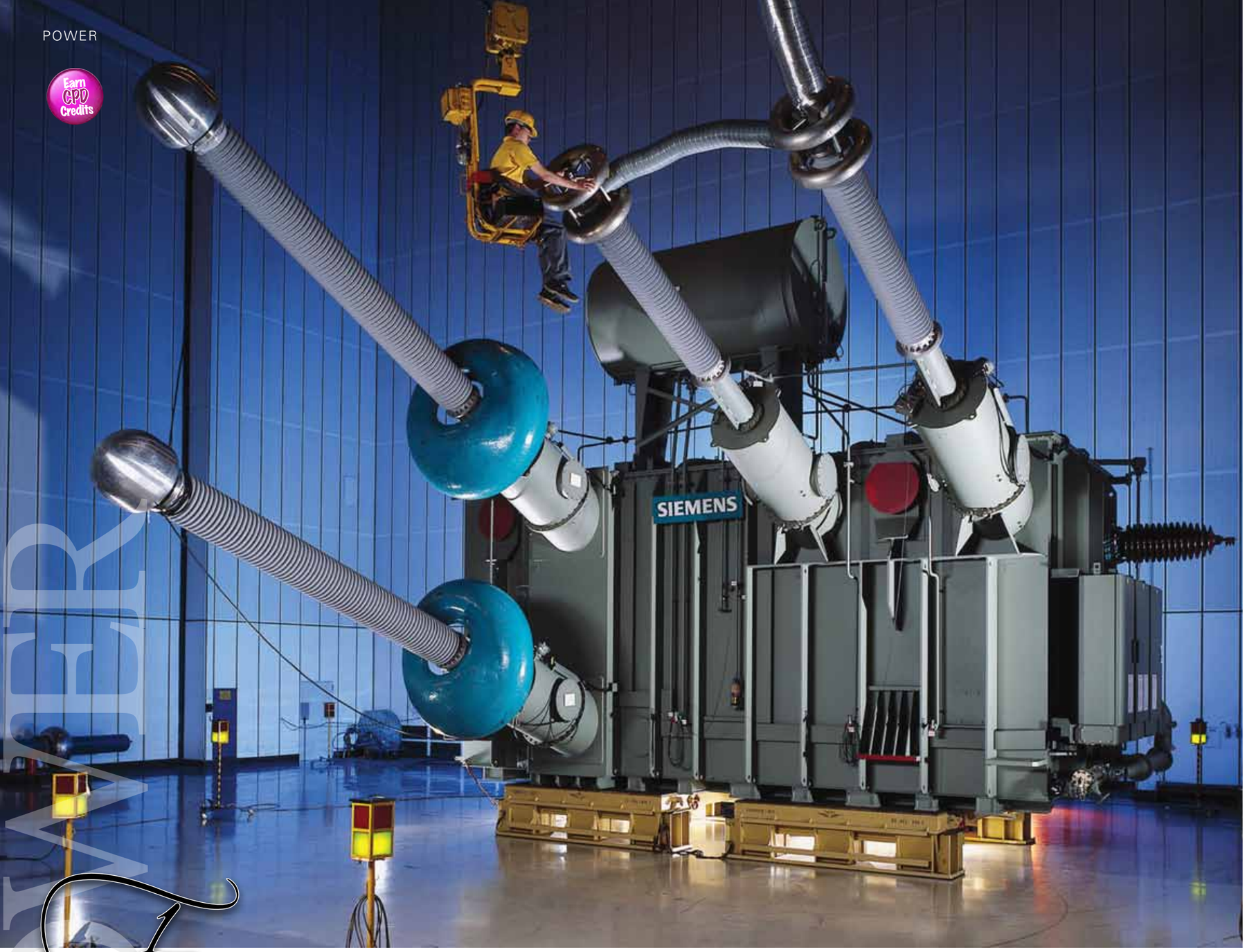
Limiting information submitted to the Web 2.0 site is also a popular method of protection. Two thirds of users included in my research only made their information available to their friends. Others restricted access to their profiles by giving as little personal information as possible, only disclosing information to known friends, and relying on password protection.

This is not always the best solution. The research shows that relying solely on the users to safeguard the company's assets is ineffective. An alternative is to block access.

This seems to be an unpopular control mechanism and could have a negative impact on staff morale. One could rather 'white list' sites, rather than black listing sites. The best safeguards probably lie in implementing automated safeguards, where possible. It may seem as if educating users on the risks posed by the internet is being flogged to death in the popular press. Research has indicated that user education can never be taken too lightly, especially if it comes to protecting such an important business resource as information.

Web 2.0 constitutes a paradigm shift in the use of online technology – from a static web browser to a dynamic, instantaneously updating interface, relying on content created by users.

Examples include content generation (blogs, wikis, RSS feeds), social networks (Facebook, LinkedIn, Twitter), sharing video and audio recordings (podcasts and apps like YouTube), trading products (eBay), and even living in virtual worlds (Second Life). WN



Transformer oil chemistry affecting the South African market

Approximately a 100 mineral oil refineries have been identified in Europe, Sweden and Norway and together they process around 700 million tons of oil per year. Installations are spread around the European geography, generally located near the coast. Refineries are industrial sites that manage huge amounts of raw materials and products and they are also intensive consumers of energy and water. In their storage and refining processes, refineries generate emissions to the atmosphere, to the water and to the soil, to the extent that environmental management has become a major factor for refineries.

BY: ANNELIE LOMBARD I ESKOM ENTERPRISES (PTY) LTD

For every million tons of crude oil processed (European refineries range from 0.5 to more than 20 million tons), refineries emit from 20000 - 820000 tons of carbon dioxide, 60 to 700 t of nitrogen oxides, 10 – 3000 t of particulate matter, 30 - 6000 tons of sulphur oxides and 50 - 6000 t of volatile organic chemicals. They generate, per million tons of crude oil refined, from 0.1 - 5 million tons of wastewater and from 10 - 2000 tons of solid waste [1].

REACH is a new European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH). The new law came into effect on 1 June 2007 [2].

The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. At the same time, innovative capability and competitiveness of the EU chemicals industry have to be enhanced. Best Available Techniques

Transformer oil chemistry

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(BAT) regulations are imposed on refineries and in summary BAT implies all techniques, including technology, planning, construction, maintenance, operation and decommission, which are applicable in practice under acceptable technical and economical conditions and are the most effective for the provision of a high level of protection for the environment as a whole. In some European countries from October 2007 all installations should have received an Integrated Permit setting emission limits based on BAT [3].

The REACH regulations and subsequent BAT regulations have thus affected the oil industry environmentally in Europe and are slowly but surely affecting Asia and the USA based refineries as well. As a result of these end-users are experiencing changes in lubricating, turbine and other oil formulations or even total withdrawal of some products from the market. Crude oil is a mixture of over 17000 different organic and inorganic compounds, which will differ substantially from one geographical area to another. Thermal fractional distillation is a process utilised to heat the crude to boiling point to vaporise its constituent molecules. The vaporised constituents are then cooled as it moves up the fractional distillation tower. The heaviest constituents will condense lower down in the tower where the temperature is at its highest and the most volatile compounds will condense further up where the temperatures are lower, thus resulting in the crude's different distillate fractions. These distillate fractions or condensate streams comprise of multiple molecular compounds. These compounds will affect the properties of the condensate stream. Different processes are then utilised to derive at the required characteristics of specific oil. In the production of lubricating and transformer oils additional processes are utilised to remove sulphur and other unwanted compounds.

A number of processes are employed during refining following crude fractionation. Processes such as solvent extraction, hydro-treating and hydro-cracking are specifically employed during transformer oil production, each resulting in an end product with different chemical characteristics. Most Group II and III oils, such as turbine oil, but also insulating oil is also hydro-finished to reduce the aromatic content and contamination. The hydrocracking process subjects the oil to extreme temperatures and pressures in a hydrogen atmosphere in the presence of a selected catalyst. This process is utilised to stabilise reactive components in the oil [4].

INTRODUCTION

The South African transformer or insulating oil market was dominated by the usage of naphthenic uninhibited oil for several decades. This however is rapidly changing and may have catastrophic consequences for uninformed users, regenerators and recyclers of transformer oil.

The primary functions of the transformer oil are to insulate, as well as to function as a heat transfer medium to transfer the heat from the windings to external cooling equipment.

It is thus important that the oil possess good insulation and dielectric properties. This will include, but are not limited to low moisture content, high dielectric breakdown voltage and good anti-ageing properties thus a low tendency to form oxidation breakdown products such as acids and sludge. The equipment manufacturer as well as the end-user will normally specify the full detail regarding the required characteristics.

These requirements of the power industry as well as environmental legislation explained above have placed refiners under pressure to control the refining process and deliver non-corrosive naphthenic oil at an economically viable price. The end product conforming to corrosive sulphur, negative gassing characteristics and other requirements are defined by the crude oil chemistry that is obtainable as well as the refining process utilised by a specific refiner. As a result only some refiners are capable of producing uninhibited (class U) products whilst others can produce only inhibited (class I) and others class U and I. Class U will typically contain a concentration of 0.08 – 0.4% added anti-oxidant or oxidation inhibitor [3].

SOUTH AFRICAN TRANSFORMER OIL INDUSTRY

Although South Africa has used mainly naphthenic oil, the bulk of electrical insulating oil used in Southern Africa are mineral oil mixtures of hydrocarbon compounds originating as crude oil from different geographical areas around the world. As a result oils currently in use comprise of slightly different chemical structures, most with higher amounts of naphthenic compounds than paraffinic compounds, but also containing low amounts of Polyaromatic Hydrocarbons (PAH) as well as aromatic compounds. Paraffinic refers to carbon atoms bonded to one another in straight chains or branched structures, whereas carbon atoms bonded to one another to forms 5, 6 or 7 carbon rings are referred to as naphthenic.

Naphthenic crude chemistry differs from one source to another and in many cases the chemistry does not allow for the production of uninhibited negative gassing oil. To achieve this complex balance of chemistry between natural inhibitors that must be left in the oil to achieve good oxidation stability, negative gassing and non- corrosive characteristics is very challenging. If a crude is sourced that contains this chemistry it is a delicate process to refine it to the degree described. Finding the right crude and controlling the processing needed for this has proven very challenging [3].

Uninhibited oil must contain natural inhibitors, which are semi reactive and probably sulphur containing. However, the identification of such unique compounds present in the oil are yet to be achieved as the composition of oil, which comprises in excess of thousand different hydrocarbon structures are currently not possible. Corrosive sulphur testing has become more stringent, resulting in the removal of natural inhibitors during more demanding refining processes to achieve stable oil. This has reduced the supply of available uninhibited class U transformer oil in the marketplace.

Less than 5% of the crude oil available worldwide is naphthenic crude. It is important to the electrical industry to find crude oil with sufficient naphthenic characteristics (which is wax free) as this type of crude is normally very viscous with a high organic content as well as a sulphur content varying from 0.2% to 3%. Refiners overcome the high organic acid content, which is very aggressive, through blending with paraffinic crude; however this results in an unpopular waxy product. Naphthenic crude therefore has to be sourced, segregated and isolated from paraffinic contamination and as a result naphthenic oil producers must work with crude oil producers that are willing to segregate the crude in the production fields and storage terminals.

GASSING TENDENCY

Gassing tendency is the property of an oil to absorb or release hydrogen under

Transformer oil chemistry

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thermal or electrical stress conditions. It is an important characteristic to consider for special equipment such as High Voltage (HV) instrument transformers, bushings and cables as gas evolving oil will be highly detrimental for these applications. It is a measure of the rate of absorption or evolution of hydrogen into oil under prescribed laboratory conditions. Evolved hydrogen may cause the formation of bubbles, which may have detrimental effects in electrical equipment with limited or confined spaces. These gas absorption properties could be related to oil aromaticity, which is subject to indirect control by the oil's oxidation requirements. Additives such as tetralin and others have been proposed to reduce the gassing tendency of some oils and may be found in oils on offer in the near future.

CORROSIVE SULPHUR

The amount of sulphur present in oil and thus the corrosiveness of transformer oil can be controlled by a refiner's process. If the requirement is to eliminate or greatly reduce the risk of corrosive sulphur then the user should look for severely refined transformer oil, which has corrosive sulphur compounds, stabilised. It must be noted however that the more sulphur stabilised within the oil the less likely it will make a totally uninhibited class U oil, this implies that inhibitors will be added resulting in class I products.

The natural inhibiting process of uninhibited oil depends on the remaining sulphur compounds or the natural inhibitors in the oil during refining. If the oil choice is to use totally uninhibited oil then it is advised to choose oil that has been fully certified as free of corrosive sulphur by specific methods. The chemistry to support totally uninhibited oil is diminishing in the naphthenic crude supply, resulting in limited availability of class U oils. The primary crude sources that have traditionally been rich in the natural inhibitors to make uninhibited class U oil have become very hard to find. The process of refining to produce an inhibited class I transformer oil lends itself to ensuring that the corrosive sulphur is stabilised. This also allows a refiner to pull from a wider variety of naphthenic crudes to keep up with demand.

There are different types of sulphur compounds found in refined transformer oil but not all types are considered to be corrosive or reactive. These are:

- Elemental (free) sulphur, which is very reactive;
- Mercaptans (thiols), which are very reactive;
- Sulphides (thio-ethers), which are also reactive;
- Disulphides, which are stable; and
- Thiophenes, which are very stable.

Some sulphur compounds can actually aid in the oxidation stability of the transformer oil and may also act as metal passivators and deactivators reducing the catalytic effect on oil oxidation in transformers. Corrosive and reactive sulphur compounds can react on contact with copper and other metals. Copper in a transformer is by far, the least resistant metal to sulphur corrosion.

In oxygen deficient environments corrosive and reactive sulphur species combine with copper, aluminium and other metals to form various compounds such as copper sulphide. Copper sulphide is graphite grey, dark brown or black in colour. Copper sulphide may be formed both on the outside and on the inside of the paper. Non- corrosive sulphide can become corrosive after being exposed to elevated temperatures on hot metal surfaces and thus produce metal sulphides. This attack would corrode the metal surfaces. Oil is not the only material that contains sulphur.

The effects of corrosive/reactive sulphur not only adversely affect the conductor material and other metal surfaces but can also have a drastic effect on insulating materials such as paper. Serious contamination due to sulphur-containing surfaces can drastically reduce the dielectric strength of the paper insulation while no or very little change has taken place in the mechanical strength of the paper as measured by Degree of Polymerisation (DP). Identifying the sources of sulphur contamination and being able to monitor concentrations of corrosive and reactive sulphur will help detect problem areas earlier. Other than draining and flushing with new oil, a commercially viable remedial process that has been proposed is the addition of passivator or metal de-activators [5].

PASSIVATORS

Corrosive sulphur problems in insulating oil have been experienced internationally and a number of failures have been well documented. Passivation of the oil was offered as a quick solution of this problem at a time when panic struck the electrical industry. The addition of passivator was proposed based on limited experience with insulating oil, but based more on the experience with lubricating oils. The chemical additive N-Bis (2-ethylhexyl)-aminomethyl-tolutriazole functions in a mineral oil are as a metal deactivator or passivator. The recommended concentration in oil is 100 ppm (mg.kg^{-1}). The Chemical composition is $C_24H_{43}N_4$, which translates to 74.4% carbon, 11.1% hydrogen and 14.5% nitrogen.

N-Bis (2-ethylhexyl)-aminomethyl-tolutriazole has a high viscosity (80 mm^2/sec), low melting point (-30°C) and solubility of 5% in oil and esters, and 0.01% in water and a density of 0.95 g/ml. The boiling point and decomposition temperature is not documented. The chemical structure is given Figure 1.

Immediately following the addition of passivator increased dissolved gas concentrations, particularly hydrogen, have been observed in some transformer oils, which were dosed with 100 mg.kg^{-1} passivator, which is the recommended level. It is thus of utmost importance to be aware of the presence of passivator in the oil. This compound was also found to be removed from the oil by certain in-line oil purification systems as well as regeneration processes. If it is present in the oil the levels should be maintained and thus monitored on a regular basis.

OXIDATION STABILITY

Insulating or transformer oils contain a certain amount of natural inhibitors, which retard deterioration due to oxidation. When transformer oil has been oxidised, a part of these natural inhibitors is fully utilised or destroyed. Following the explanation above new oils are now refined to the extent that natural inhibitors no longer provide

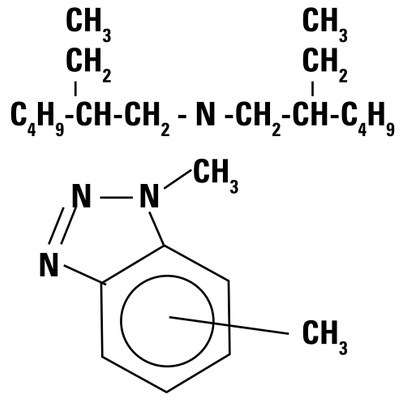

Figure 1: Chemical structure of N-Bis (2-ethylhexyl)- aminomethyl-tolutriazole used as metal passivator

Transformer oil chemistry

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the anti ageing characteristics as required by the end user. Anti-oxidants are added to the oil to achieve the criteria as required. Anti-oxidants, also known as oxidation inhibitors, interfere with the oxidation process by chemically converting oxidation products to benign products. In addition, some oxidation inhibitors interact with the free catalytic metals (primarily copper and iron) to remove them from the oxidation process. The most commonly used inhibitor is 2, 6-di-tertiary-butyl-paracresol and is commonly referred to as DBPC, is a solid that is insoluble in water, but soluble in transformer oil. The decomposition products of DBPC are oil-soluble and are also oxidation inhibitors to some extent.

An inhibitor or antioxidant additive has the effect of slowing down the oxidation of oil and thus the formation of by-products in the form of sludge and acidity. It is important to know whether and in what proportion the antioxidant additive has been added in order to monitor the additive depletion rate during service.

CONCLUSION

As a result of the above gassing tendency, inhibitor and passivator content as well as corrosive sulphur amongst other important properties needs to be specified. With oil having a highly positive gassing tendency, the application of the oil need to be carefully considered as mentioned above. When oil contains a passivator and inhibitors, these need to be monitored during the life of the equipment to ensure that the levels of depletion do not drop to less than 25% of the original added value. Whilst the residual values of these products need to be monitored following purification and regeneration, certain in-line processing as well as mobile regeneration units is also known to remove these chemicals. It can thus be summarised that end users need to be informed. Oil is not just oil anymore. In order to prevent catastrophic failures, suppliers of various services as well as end users must expand their knowledge on this subject and educate themselves in order to make informed decisions about oil and the maintenance thereof. wn

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September

COMPILED BY | JANE BUISSON-STREET
SMSAIEE | PMIITPSA

September comes from the Latin words *septem*, meaning seven and *septimus*, meaning seventh. In ancient Rome, September was the seventh month of the year. When the Gregorian calendar was adopted, it became the ninth month of the year. It is one of the four months with thirty days.

1 September

1830 Sarah J. Hales poem "Mary Had a Little Lamb" is published in Boston.

1878 Emma M. Nutt becomes the first woman telephone operator.

1939 Germany Invades Poland
At 5:30am more than a million of Adolf Hitler's troops invaded Poland, smashing the Polish defences in a move that has committed the Allies to war.

1951 The Premier, Britain's first supermarket, opens in London.

2 September

1666 The Great Fire of London breaks out and burns for three days, destroying 10,000 buildings including St Paul's Cathedral.

1752 In 1752, the British Empire adopted the Gregorian calendar nearly two centuries later than most of Western Europe. In the British Empire that year, 2nd September was immediately followed by 14th September.

4 September

1881 The best-lit factory in America opened in New York today. The Edison Electric Light Company's new 'central power station" in Pearl Street generates enough electricity to light up 7000 of Thomas A. Edison's new incandescent lamps.

5 September

1997 Nobel Peace Prize winner Mother Teresa died in Calcutta, India, at age 87.

7 September

1986 Bishop Desmond Tutu was today enthroned as Archbishop of Cape Town, the leader of two million South African Anglicans. He is the church's first black leader.

8 September

1886 Thousands flock to Witwatersrand in South Africa as public gold digging is permitted.

10 September

1846 The sewing machine is patented.

1894 London's taxi driver George Smith is the first person to be convicted of drunken driving while in charge of an electric cab. He is fined 20s (£1/$1,80).

14 September

1959 Man reached out and made contact with the moon today. Lunik II, a soviet spacecraft, crash-landed on the moon after a two-day journey. It sent back a stream of scientific data during the time.

15 September

1859 Death of Isambard Kingdom Brunel, probably the greatest British engineer.

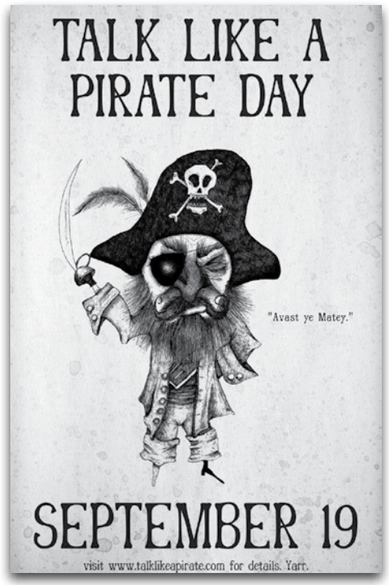
1890 Agatha Christie, author of nearly a hundred books (mysteries, dramas, poetry and nonfiction), was born in Torquay, England.

1928 The first robot to be made in Britain is demonstrated at the Model Engineering Exhibition.

17 September

1908 The first fatality involving powered flight occurred as a biplane piloted by Orville Wright fell from a height of 75 feet, killing Lt. Thomas E. Selfridge, his 26-year-old passenger. A crowd of nearly 2,000 spectators at Fort Myer, Virginia, observed the crash of the plane that was being tested for possible military use. Wright himself was seriously injured.

1931 Long-playing records are demonstrated by RCA-Victor in New York.



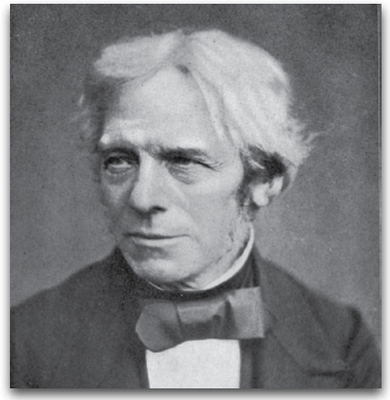
19 September is International Talk Like A Pirate Day.

1888 The world's first beauty pageant takes place in Belguim and is won by 18-year-old Bertha Soucaret from Guadeloupe, who collects the 5000-franc prize.

20 September

1967 "Cricket is a game which the British, not being a spiritual people, had to invent in order to have some concept of eternity." (Lord Mancroft)

1989 F.W. De Klerk was sworn in as president of South Africa. He began an era of reform aimed at ending apartheid and was succeeded by Nelson Mandela.



22 September

1791 British scientist Michael Faraday was born in Surrey, England. His discovery of electromagnetic induction proved that moving a magnet through a coil of wire produces a current, resulting in the development of electric generators.

1828 Shaka, chief of the Zulus and founder of the Zulu empire, was killed by his two half-brothers.

1999 The record for drinking Ketchup belongs to Dustin Phillips (USA). On this day, he drank a 14 oz. bottle of Ketchup through a 1/4 inch straw in 33 seconds.

24 September

1948 The Honda Motor Company is founded.

1968 Swaziland joins the United Nations.

2005 Hurricane Rita makes landfall in the United States, devastating Beaumont, Texas and portions of south western Louisiana.

26 September

1973 Concorde makes its first non-stop crossing of the Atlantic in record-breaking time.

28 September

1889 The first General Conference on Weights and Measures (CGPM) defines the length of a meter as the distance between two lines on a standard bar of an alloy of platinum, with ten per-cent iridium, measured at the melting point of ice.

1951 CBS makes the first colour televisions available for sale to the general public, but the product is discontinued less than a month later.

30 September

1882 Thomas Edison's first commercial hydroelectric power plant (later known as Appleton Edison Light Company) begins operation on the Fox River in Appleton, Wisconsin, United States.

1968 The Boeing 747 is rolled out and shown to the public for the first time at the Boeing Everett Factory.

1902 Rayon is patented. Rayon is the oldest manufactured fibre, having been in production since the 1880s in France, where it was originally developed as a cheap alternative to silk. wn

In retrospect
...April - over the Ages

The 'April happenings' published in the April issue of **watt**now, included two of the worst man-made disasters in history. Here is some further interesting technical information on these terrible incidents.

BY | BEV LAWRENCE | FSAIEE

TITANIC

The Titanic was gashed down its length along the waterline, as seen when the wreck was discovered in 1985 by Dr. Robert Ballard's amazing deep-sea expedition. Amazingly they were actually searching for two US Navy nuclear submarine wrecks!

In the summer of 1985, Ballard was aboard the R/V Knorr on a trip with his new deep sea underwater robot craft, the Argo. The trip was financed by the U.S. Navy for secret reconnaissance of the wreckage of two Navy nuclear powered attack submarines which sank in the 1960s, and not for Titanic. The Navy agreed it would finance Ballard's Titanic search only if he first searched for and investigated the two sunken submarines. After the mission was completed Ballard was free to hunt for Titanic.

When they searched for the two submarines, Ballard and his team discovered that they had imploded from the immense pressure depth. That implosion littered thousands of pieces of debris all over the ocean floor. Following the submarines' large trail of debris led Ballard and his team directly to them. Ballard already knew that Titanic imploded from pressure depth as well, much the same way the two submarines did, and concluded that it too must have also left a scattered debris trail.

Using that lesson, Ballard and his team had Argo sweep back and forth across the ocean floor looking for Titanic's debris trail. Ballard's team took shifts monitoring the video feed from Argo as it searched the monotonous ocean floor two miles below.
In the early morning hours of September 1, 1985, observers noted anomalies on the otherwise smooth ocean floor. At first, it was pockmarks, like small craters from impacts. Eventually debris was sighted as the rest of the team was awakened. Finally, a boiler was sighted, and soon after that, the hull itself was found.

What an amazing discovery – truly looking for a needle in a haystack!

Subsequent samples of the steel used to construct the hull showed very high Ductile-to-Brittle Transition Temperature of 33˚C (modern steel DBTT is -60˚C!!!) caused by high oxygen content in the steel. The rivets used to hold the steel plates together also failed. The 91m gash together with failure of the rivets caused the front six compartments to flood in very short time, tipping the front of the ship down.

The poor bulkhead design allowed water to spill over their top to flood the ten remaining compartments, with sinking in two hours. We've learned a lot about metallurgy and ship design since then, but accidents still occur, like the Costa Concordia last year. It will be interesting to see an analysis of that crash, and why it got into such trouble so quickly despite the modern use of double hulls, watertight bulkheads and good steels!?

CHERNOBYL NUCLEAR POWER PLANT

The "Over the Ages" article (**watt**now, April 2013) states that *"a catastrophic failure of one of the reactor's welded pressure vessels was the cause of the meltdown of fuel in the core"*. It is generally well known that a test was being carried out (apparently to see if the reactor coolant pumps would remain operational if there was a Grid failure resulting in the unit tripping and ceasing to supply Auxiliary power from the generator. It took over a minute to obtain standby power from the diesel generators). The operators were not competent to perform the test correctly, resulting in overheating of the (unstable design) reactor, and eventual explosion, blowing open the reactor pressure vessel, and releasing several tons of radio-active material.

Wikipedia includes a fascinating account of the incompetent approach of the Management and Engineers involved:
An inactive nuclear reactor continues to generate a significant amount of residual decay heat. In an initial shut-down state (for example, following an emergency SCRAM [emergency shutdown of a nuclear reactor]) the reactor produces around 7 percent of its total thermal output and requires cooling to avoid core damage. RBMK reactors, like those at Chernobyl, use water as coolant. Reactor 4 at Chernobyl consisted of about 1,600 individual fuel channels; each required a coolant flow of 28 metric tons (28,000 liters or 7,400 US gallons) per hour.

Since cooling pumps require electricity to cool a reactor after a SCRAM, in the event of a power grid failure, Chernobyl's reactors had three backup diesel generators; these could start up in 15 seconds, but took 60–75 seconds to attain full speed and reach the 5.5MW output required to run one main pump.

To solve this one-minute gap, considered an unacceptable safety risk, it had been

In retrospect...

continues from page 51

The Union of Concerned Scientists estimates that there will be 50,000 excess cancer cases resulting in 25,000 excess cancer deaths.

theorised that rotational energy from the steam turbine (as it wound down under residual steam pressure) could be used to generate the required electrical power. Analysis indicated that this residual momentum and steam pressure might be sufficient to run the coolant pumps for 45 seconds, bridging the gap between an external power failure and the full availability of the emergency generators.

This capability still needed to be confirmed experimentally, and previous tests had ended unsuccessfully. An initial test carried out in 1982 showed that the excitation voltage of the turbine-generator was insufficient; it did not maintain the desired magnetic field after the turbine trip. The system was modified, and the test was repeated in 1984 but again proved unsuccessful. In 1985, the tests were attempted a third time but also yielded negative results. The test procedure was to be repeated again in 1986, and it was scheduled to take place during the maintenance shutdown of Reactor Four.

The test focused on the switching sequences of the electrical supplies for the reactor. The test procedure was to begin with an automatic emergency shutdown. No detrimental effect on the safety of the reactor was anticipated, so the test program was not formally coordinated with either the chief designer of the reactor (NIKIET) or the scientific manager. Instead, it was approved only by the director of the plant (and even this approval was not consistent with established procedures).

According to the test parameters, the thermal output of the reactor should have been no lower than 700 MW at the start of the experiment. If test conditions had been as planned, the procedure would have been carried out safely; the eventual disaster resulted from attempts to boost the reactor output once the experiment had been started, which was inconsistent with approved procedure.
The Chernobyl power plant had been in operation for two years without the capability to ride through the first 60–75 seconds of a total loss of electric power, and thus lacked an important safety feature. The station managers presumably wished to correct this at the first opportunity, which may explain why they continued the test even when serious problems arose, and why the requisite approval for the test had not been sought from the Soviet nuclear oversight regulator (even though there was a representative at the complex of 4 reactors).

The experimental procedure was intended to run as follows:

1. The reactor was to be running at a low power level, between 700 MW and 800 MW.
2. The steam-turbine generator was to be run up to full speed.
3. When these conditions were achieved, the steam supply for the turbine generator was to be closed off.
4. Turbine generator performance was to be recorded to determine whether it could provide the bridging power for coolant pumps until the emergency diesel generators were sequenced to start and provide power to the cooling pumps automatically.
5. After the emergency generators reached normal operating speed and voltage, the turbine generator would be allowed to freewheel down.

The consequences of this incompetence were enormous. The power station staff, their families, the Ukraine and USSR, the nuclear industry – indeed virtually the wholeworld have been affected in one way or another. No new nuclear plants were ordered until the next century!
Some of the radiation was wind-blown for thousands of kilometres around the world, but most of it lies on the ground around the power station and its environment.

The nearby town of Pripyat was evacuated of its 100 000 residents and will never be inhabitable again. It seems there was no written pre-tested test procedure, and no engineers or managers in attendance to give guidance. Three senior staff members were sentenced to 10 years in prison. 500 000 workers were involved in containment and clearing up operations costing 18 billion roubles, and still ongoing!

The Chernobyl Forum estimates that the eventual death toll could reach 4,000 among those exposed to the highest levels of radiation (200,000 emergency workers, 116,000 evacuees and 270,000 residents of the most contaminated areas); this figure includes some 50 emergency workers who died of acute radiation syndrome, nine children who died of thyroid cancer and an estimated total of 3940 deaths from radiation-induced cancer and leukemia.

The Union of Concerned Scientists estimates that, among the hundreds of millions of people living in broader geographical areas, there will be 50,000 excess cancer cases resulting in 25,000 excess cancer deaths. For this broader group, the 2006 TORCH report predicts 30,000 to 60,000 excess cancer deaths, and a Greenpeace report puts the figure at 200,000 or more.

The Russian publication Chernobyl concludes that among the billions of people worldwide who were exposed to radioactive contamination from the disaster, nearly a million premature cancer deaths occurred between 1986 and 2004. wn

Benjamin Stephanus Janeke

Benjamin Janeke celebrated his 95th birthday in May 2013, and in September will achieve 50 years of SAIEE membership.

BY I LES STUART I FSAIEE

Born on 5 May 1918, Ben obtained his basic education in Petrus Steyn, and remained a dedicated student throughout his life, obtaining numerous certificates along the way. He was awarded an NTC1 in 1936, before taking up an apprenticeship with the Public Works Department at the Government Printer in Pretoria in 1941, and obtained his Electrical Wiremen's Certificate in 1944.

During the second world war, he was retained as a key person to provide technical support on essential military equipment and improvement of the performance of strategic weapons and systems.

After the war he became Chief Laboratory Technologist at Stellenbosch University, and remained very involved in electrical engineering.

In the 1960's he moved to the George Sawmills as Regional Engineer in the Department of Forestry. When the regional offices moved to Knysna in the 1970's, Ben relocated to what was eventually to become his retirement home.

Regrettably, he is now in a care facility for Alzheimer's sufferers in Mossel Bay.

Benjamin Janeke – we salute you! wn

Guernsey's German Occupation

When visiting London in June of 2012, we decided on a short visit to one of the Channel Islands called Guernsey. There are regular ferries to the three inhabited Islands, but we chose a one-hour flight on a budget airline. Since I am a museum-a-holic, we visited a number of museums containing relics from the Nazi German occupation of these Islands during the Second World War.

BY | DEREK WOODBURN | FSAIEE

The Islands were originally the fiefdom of William the Conqueror, and they became English when he successfully invaded England, and became its King. He and his Barons introduced many French words into the English language, though he himself was illiterate. On a small island a few hundred metres off the harbour, is a Victorian lighthouse and the medieval "Castle Cornet", which has seen many battles throughout its history.

The Nazis made substantial changes around the island, with massive concrete emplacements added to the Castle for guns and equipment as a defense point, but its historic character is still strong. These days it is linked to the town by a causeway.

This fascinating Castle has seen many battles, including the English Civil War in the 1640's. During a thunderstorm in 1672 its store of gunpowder blew up in a huge explosion.

Part of the Castle was used as the local jail for many years. A noonday canon is still ceremonially fired from the ramparts.

Although Guernsey is very close to France, and nearly all the signs, street and building names are in French, almost everyone speaks English.

Some eighty percent of the children and half the adult population were transported to England in June 1940, ahead of the German occupation. At the conclusion of the War, all those returning spoke English.

Exploring the island is easy using the local buses. One bus goes around the whole island in a clockwise direction, taking an hour, and another does the same in the opposite direction. Each trip costs £1. The trip from the airport to our hotel by bus cost £1 each compared with £10 each by taxi.

Guernsey's German Occupation

continues from page 57

Guernsey has its own beautiful breed of cows, with huge udders, producing rich, creamy milk. (The largest Channel Island, Jersey, is perhaps better known to South Africans for its breed of cows). The first church on the Island was constructed in about 1055. Guernsey has its own currency, and its own flag, consisting of the "English" red cross on a white background, with a smaller gold cross superimposed on the red cross.

A building close to the harbour of the Capital, St Peters Port, houses an old Victorian sweet shop, and rooms of a home restored to the condition it was during the Nazi occupation. It is run by the British National Trust. The shop-front still has the original Victorian wooden, vertical slatted sliding blinds. These are operated by turning a handle, which drives a cranked steel bar to move the blinds across the curved glass shop front. A continuously running recorded voice in the museum tells the story of how, as the available food supplies became more and more scarce during the war, the family's pet cat disappeared, probably having become meat for someone's stockpot. It also told of how two teenaged Guernsian boys were watching a German soldier digging a trench. Their comments must have infuriated the soldier, who swung his shovel around and decapitated the one young Guernsian. Any local person, who was discovered with a crystal set built to listen to the British Broadcasting Corporation broadcasts on the state of the war, was executed by shooting, for listening to British "enemy" propaganda.

Victorian sweet shop

The French writer Victor Hugo, who wrote the well-known stories of "les Miserable", and "The Hunchback of Notre Dame", had been exiled by Napoleon from Paris to Guernsey for ridiculing him. The home in which he lived between 1856 and 1870, overlooking the harbour, has been turned into a museum to Victor Hugo. Several rooms in the house now form the French Embassy in Guernsey. The multi-storied home is full of dark and elaborate wood carvings, carved four-poster beds, carpets on the ceiling, and weird tiles and mirrors.

Many underground storage areas and hospitals were dug out using thousands of slave labourers from the Eastern European prisoners-of-war, many of whom starved to death or perished in the tunneling process. The Nazis were convinced that their base in Guernsey would be under constant attack from the Allies, though it seldom happened. One museum we visited, called "la Valette" had been built as an underground refueling storage depot for the German submarines.

The submarines could moor in deep water close to the fuel depot, refuel, and be away again very quickly. There had originally been three huge storage tanks in the depot, but two of them were removed to make room for the exhibits. A large range of weapons, land mines, photographs of Adolf Hitler and the Swastika flag he composed, uniforms and vehicles of both sides in the conflict is on display. Visitors from other European countries, which have restrictions on the display of the Swastika, are surprised to see it displayed.

A German Occupation Museum, located in a country farmhouse, has a large display showing some of the day-by-day interaction between the locals and the occupiers.

In a public garden near the harbour we found a beautiful war memorial to the Guernseyans who fought and died in the Anglo-Boer War.

Anglo-Boer War Memorial

Because of the "pinching" effect of the tides of the North Sea and the Atlantic Ocean, the Islands experience very high tidal changes, probably over 5 metres, and sometimes more. We saw photographs of seafront shops flooded to halfway up their shop-front windows. The sheltered harbour level was a good 5 metres below the roadway at low tide.

Walking up the hill from St. Peters Port one afternoon we came across a young lady walking downhill, talking animatedly in Afrikaans on her cell phone. We soon discovered the reason in that there are South African offices of Old Mutual and First National Bank in Guernsey. The Island is one of the tax havens for those who invest off-shore.

Surely a very informative and stimulating visit to Guernsey.

On the light…(er..) side

Mechatronics - the marriage of mechanical and electronics engineering - promises great things in the future. However my marriage (and life), which is firmly based in the present, could really have benefitted from some artificial intelligence around the place over the last 5 years or so.

MEGATRONIC - PROMISES

BY I ANGELA PRICE

Scientists, books, movies and myths have all predicted that, in the near future, we will be working and/or fighting with and living alongside robots. Some of us however, have already had a taste of this predicted future…. my poor husband is one such pioneering individual.

As so many of us can testify to, nothing prepares you for having kids and certainly not for the inevitable lack of sleep that accompanies this wonderful (life-shattering!) period. With our youngest child nearly turning three, and hopefully soon out of nappies – we feel like we have turned a corner, and can see some light at the end of the tunnel. But, for the better part of the last 5 years, I have felt as though I have been functioning on auto-pilot, just going through the motions, with very little to differentiate me from a robot. Nights and days have all blurred together in an automated monotony of feeding, changing and settling babies. Quite understandably, my husband could be excused for thinking he has been living with a robot…..except perhaps for the whole artificial intelligence thing. Pregnancy, 'porridge brains' and the lack of sleep quickly laid waste to any form of intelligence I may once have had. Child rearing has very effectively reduced me to a walking, (barely) talking feeding machine.

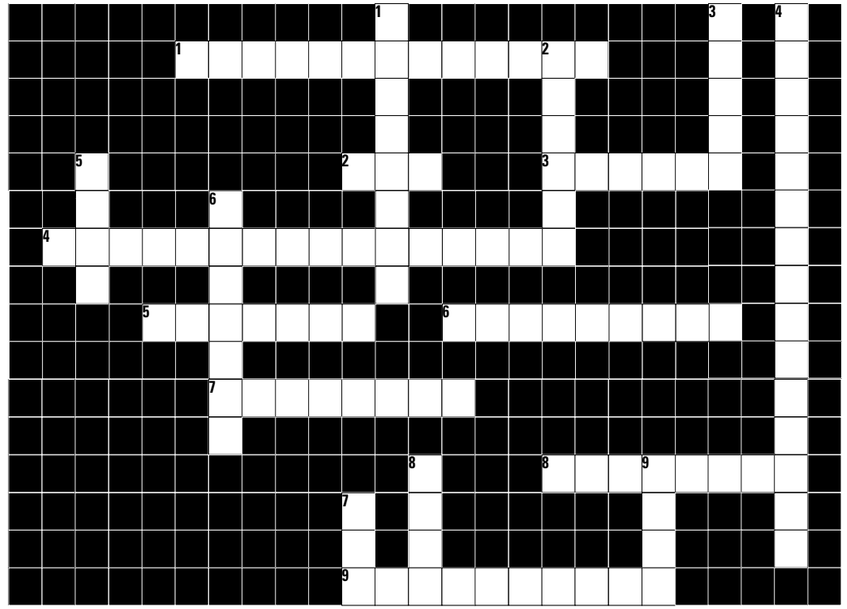
Unfortunately for me, I am living on the wrong side of the robotics revolution - maybe I should call it evolution, since it is clearly an evolving field of study/science. Several times I have found myself wishing that artificial intelligence was already an affordable and common household norm. Imagine the life-changing difference a robotic wet/night nurse could make…. (would we call them nurbots?). I do wonder though how much comfort a baby could take from being nursed by a cold tin can… but if said 'nurbot' were able to plug a dummy back into a yelling baby's mouth and rock it to sleep for hours on end, I predict it would be a best seller with all the sleep deprived parents out there. With the advances in the robotics field leading to robots with more and more human-like characteristics and features, one artificial intelligence researcher (David Levy) feels it is 'inevitable' that humans and robots will eventually marry. Some researchers even believe that in the foreseeable future your perfect partner will be available to spec and purchase – thereby offering some individuals a workable alternative to the problem of being unable to find a suitable partner from within our own gene pool. Thinking through these rather 'artificial' scenarios even leads to the idea of artificial children (remember the tear-jerking 2001 movie AI?). Imagine the robotics engineer, who can 'build' his own kids, thereby sparing his wife 9 months of pregnancy, child birth and the following years of porridge brain….. indeed that could be a very sought after individual in some female circles.

If you think this line of thought is disturbing or a bit to 'out there' you should do a Google search on 'living with robots'…the returned results are even more 'alternative'. There you will find articles about people living with (and even sleeping with!) robots in the future. David Levy even predicts that robots and human will legally be able to marry by the year 2050! Well……some of us have done it already! wn

Have some fun and stand a chance to win R1000.
Complete the August issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, September 2013 Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **30 September 2013**. The winner of R1000 will be announced in the November 2013 issue of the **watt**now magazine.

R1000 win

BERGMAN FISHER ASSOCIATES, DESIGNERS OF A SAFER GREENER ENERGY EFFICIENT FUTURE, ARE THE PROUD SPONSOR OF OUR CROSSWORD PUZZLE.



ACROSS

1. See 1 down.
2. Zero Moment Point (abbr.)
3. Shape Memory Alloy. (6,4)
4. Which term is coined by Professor Hans Moravec, Principal Research Scientist at the Carnegie Mellon University Robotics Institute in describing the near future evolution of robot technology? (10,5)
5. The elastic polymer from Hanson Robotics used for constructing Robotic faces. (7)
6. What forms the "muscles" of a robot, the parts, which convert, stores energy into movement? (9)
7. One-wheeled balancing robot. (8)
8. The name of the robot built by Dr. Ruixiang Zhang at Stanford University, California. (8)
9. A section of technology that deals with the study and application of pressurized gas to produce mechanical motion. (10)

DOWN

1. A new plastic material that can contract substantially from electricity, and have been used in facial muscles and arms of humanoid robots and to allow new robots to float, fly, swim or walk. (13,8)
2. Name of the sailboat robot built by IFREMER and ENSTA-Bretagne. (6)
3. What is the name of NASA's urban robot? (5)
4. In 1495, who was the inventor of a mechanical knight? (8,2,5)
5. What is the name of the toy robot dinosaur, which can exhibit several apparent emotions? (4)
6. What was the name of the first industrial robot with six electromechanically driven axes invented by the KUKA Robot Group in 1973? (7)
7. Robotic Mobility Platform (abbr.)
8. See 3 across. (6,4)
9. Unmanned Aerial Vehicles (abbr.)

July issue winner:
Johan Uys | Bellville

July issue answers:

ACROSS
1 iPad **2** Pat **3** NESC
4 Dynamic Disturbance **5** Golf **6** Day
7 Charity **8** Fault **9** Woodburn **10** Events

DOWN
1 Intrinsic Safety **2** Naidoo
3 Nineteen **4** Arcflash **5** Felix Bosch **6** Derek
7 Ampacity **8** Price **9** OSHA **10** DME

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. **watt**now magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the **watt**now magazine. 7. Closing date for entry is 30 September 2013. 8. The winner will be announced in the November 2013 issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

Calendar of events

If you want to see your function or event listed here, please send the details to Minx Avrabos at minx@saiee.org.za

SEPTEMBER 2013

6	Bernard Price Memorial Lecture	Wits, JHB	geyerg@saiee.org.za
16-18	3 Day MBA - Power & Electricity	Johannesburg	www.terrapinn.com
18	SAIEE Charity Golf Day	Rand Park Golf Course	geyerg@saiee.org.za
25-28	Eskom Expo for Young Scientists	Birchwood Hotel, Boksburg	geyerg@saiee.org.za

OCTOBER 2013

9-11	Africa Electricity 2013	Sandton, Johannesburg	www.africaelectricity.com
13-17	22nd World Energy Congress, DAEGU 2013	Daegu, Korea	www.daegu2013.kr
18	President's Summer Colloquium	SAIEE House, Johannesburg	geyerg@saiee.org.za
22-24	FILTECH International Conference & Expo	Wiesbaden, Germany	www.filtech.de
23	SANEA Lecture	Cape Town	www.sanea.org.za
23-24	CPD Course: Stress & Time Management	SAIEE House, Johannesburg	roberto@saiee.org.za
29-31	Johburg Indaba, Investing in Resources & Mining in Africa	Sandton, Johannesburg	www.joburgindaba.com
30-31	Robmech 2013	University of KZN, Natal	www.robmech.co.za

NOVEMBER 2013

1	Annual SAIEE Banquet	Wanderers Club, Johannesburg	geyerg@saiee.org.za
4-5	CPD Course - Short circuit currents	SAIEE House, Johannesburg	roberto@saiee.org.za
19-20	CPD Course - Mastering Series	SAIEE House, Johannesburg	roberto@saiee.org.za
26-29	CPD Course - Project Management	SAIEE House, Johannesburg	roberto@saiee.org.za
28	SAIEE National Student's Competition	University of Pretoria	geyerg@saiee.org.za

18 SEPTEMBER 2013
RANDPARK GOLF CLUB I JHB
For more info contact GERDA GEYER
011 487 3003; or
geyerg@saiee.org.za

SAIEE CHARITY GOLF DAY

The annual SAIEE Charity Golf Day is taking place on the 18th of September at the Randpark Golf Club in Johannesburg. The SAIEE President, Paul van Niekerk, has chosen Girls & Boys Town as his charity. The playing fees per four-ball costs R2000 (non-sponsored) and R1 800 (sponsored). Come join in the fun, as there are many prizes to be won.

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