

# WATT **now**

Be Enlightened

**Beautiful design** and  
clever technology

**Submersible  
technologies:** 23 5 12 2  
returning to the  
bottom of the earth

It's all about  
the **bike**

Celebrating  
serious  
**nonsense**

The **perfect** computer

Official Magazine of



October 2011



The largest manufacturer and distributor  
of electrical equipment in South Africa

ACTOM

# The spreadsheet pipedream and the end of an era

The government has said it will invest R2-trillion in infrastructure developments over the next five years. If it were to do so the investment rate would be around R400-billion a year and that's not only a huge amount of money to spend, but also an enormous bureaucratic challenge.

Just a few months ago, one of the government ministers of education (we have several) said that it was impossible for the education department to spend R6-billion in a year because tendering procedures, management of the money and appointment of contractors capable of doing the work took longer than that.

Can someone explain to me how the same government will spend R400-billion a year?

Somehow, with our shortage of skills, lack of management, scarcity of contractors and other specialists and the high demand for essential materials and components, it seems that there is no hope of spending that kind of money in any given year, let alone spending it consistently for five years on the trot.

So, while the promises are impressive the fact is that there is simply no capacity for South Africa or its authorities to turn that sort of claim into reality. It is not going to happen.

Take many of the 'major' projects that South Africa has embarked on over the past few years: the Gautrain (private contractors admittedly) took five years to complete and the Rosebank to Park Station link is still leaking. That cost R33-billion, nowhere near the R400-billion that government is talking about.

The Gauteng Freeway Improvement Plan was another major project. It cost somewhere around R25-billion and also took five years to complete – it's still not finished and will drag on at least until the end of the year.

Two projects alone, adding up to about R60-billion, took five years to finish. Now the government says it can do 6,5 projects of this scale every year. Who's going to believe that?

Of course I would love to see this kind of investment being made because it would make such a difference to unemployment levels around the country and would give a much needed capital injection to sectors such as construction, manufacturing, raw materials and commodities.

It would also provide tremendous opportunities for the services sector, which includes all forms of engineering. But let's get real – such infrastructure spending is way beyond the capacity of the country.

Sure we might say that a single new nuclear power station can be erected at a cost of hundreds of billions of Rands, but the mere fact that it will take between five and eight years to build means that these sorts of figures are little more than a spreadsheet pipedream.

My view is that, like so many other government predictions, it will never see the light of day.

Sadly this is the last issue of *WattNow* that Crown Publications will produce. The magazine is coming to an end at Crown but it is not ceasing to exist. The South African Institute of Electrical Engineers is taking the task on itself and has appointed a new managing editor, Minx Avarebos, to run the magazine and keep it running.

So while some things change, others may well stay the same.

All the people involved in *WattNow* at Crown believe that it will maintain the high standards that it has set over the years and that, under the capable guidance of the SAIEE, the magazine will go from strength to strength in the years ahead.

Until now it has been a roller-coaster adventure for everyone at Crown and has managed to provide some great editorial material for its readers. That's the true hallmark of a good magazine and long may *WattNow* continue.



Paddy Hartdegen - Editor  
paddyh@crowm.co.za



# WATTnow

**Editor**  
Paddy Hartdegen  
paddyh@crowm.co.za

**Design & Layout**  
Adèl JvR Bothma

**Published monthly by**  
Crown Publications cc  
2 Theunis Street  
Bedford Gardens  
Johannesburg  
Tel: (011) 622-4770  
Fax: (011) 615-6108  
e-mail: crownmag@crowm.co.za

**Publisher**  
Jenny Warwick

**Deputy Publisher**  
Karen Grant  
crownmag@crowm.co.za

**Technical Advisor**  
Ian Jandrell, PrEng, PhD

**Circulation and Subscriptions:**  
Norma Massey  
normam@crowm.co.za  
R240 (incl. Vat) per annum  
Postage extra outside RSA



All enquiries for WattNow:  
P O Box 140  
Bedfordview, 2008

All enquiries for SAIEE:  
P O Box 751253  
Gardenview, 2047  
s.bridgens@saiee.org.za



**SAIEE 2011 Office Bearers**  
President: Andries Tshabalala  
Deputy President: Mike Cary  
Senior Vice President: Paul van Niekerk  
Junior Vice President: Pat Naidoo  
Past President: Angus Hay  
Honorary Vice President: Graeme Hopewell  
Honorary Treasurer: Mike Cary

ISSN: 1991-0452  
Crown Publications cc. All material is strictly copyright and all rights are reserved. Reproduction without permission is forbidden. The views expressed in this publication are not necessarily those of the publisher or the SAIEE.

Printed by: Shumani Printers, Cape Town

# WATT'S

## WATT'S HAPPENING

### 1> Comment

Paddy Hartdegen wonders: Can the South African government possibly spend the required R400-billion a year on infrastructure developments?

### 4> Your next electric bicycle

William Golding described the journey of life as being like a man riding a bicycle. Susan Anthony said the bicycle gave women a feeling of freedom and self reliance. In this article, Gavin Chait explains why the bicycle, which is well over a century old now, still has not lost its capacity for innovation and transformation.

### 14> Queuing for mass-produced consumer products

Clever engineers do not separate design from engineering and, since well-designed consumer electronics fetch a significant premium over their competitors, good design seems to be more important than ever in our current recessionary times. Gavin Chait takes a look at some of successes of good design effort.

### 23> Spending is earmarked – but can it become a reality?

Without infrastructure, South Africa cannot remain competitive and yet the costs of repairing and maintaining infrastructure could make South Africa an even less competitive manufacturing and distribution hub. Paddy Hartdegen reports.



## 11> WATT'S GOING ON?

South Africa's new Ahrlac aircraft unveiled; Engineers urged to bolster new commission; New land grabs occurring throughout Africa; China spreads tentacles in Africa; Business labour signs accord to create jobs; CSP industry experts to gather in Johannesburg; Training courses.



## 45> SAIEE

What is 'Set Top Box Control' and why should you care?, by Gerhard Petrick, former Councillor of the Independent Communication Authority of South Africa.



# INSIDE

## 18> WATT'S TECHNOLOGY

How Steve Jobs changed my life; New water treatment technology being tested in South Africa; Gold and jewels dress the failed Tata Nano; Sending Twitter messages from your jeans; Will the deadline for digital migration be met?



## 38>

### WATT'S ENERGY

ABB's PV and CSP solar solutions; Siemens pulls out of nuclear energy industry; Bacteria used to make 'limitless quantities' of electricity; New power plant for Mozambique, gas fields for Tanzania; Blackout shuts-off power to five million people; 10-million prepayment meters in SA and more coming; Parts of Joburg to be powered by rubbish.

## 26> WATT'S SCIENCE

Return to the bottom of the earth; Ig Nobel awards celebrate serious nonsense; Sub-orbital flight test for SpaceShipTwo next year; Rocket launched from converted oil rig; Has the speed of light been surpassed?; Infected – a bandage with some gel can tell you; LOPES used to train the brain to use limbs again; At least 50 Goldilocks planets identified.



ABC Certified  
Total Paid Circulation 25, Total Free 3563, Total Circulation 3588  
April - June 2011

# Your next electric vehicle

by Gavin Chait



*“Magnetostrictive materials are used to convert magnetic energy into kinetic energy, and vice versa. In Formula One, these sensors help handle high engine revolutions in combination with intense thermal strains. They need no physical contact with other parts of the engine, are temperature-independent and are completely maintenance-free,” says Ford.*

Ford is proud of its new concept electric vehicle. Lithium-ion accumulator battery, DC brushless electric motor with an integrated controller and magnetostriction sensor train borrowed from Formula One.

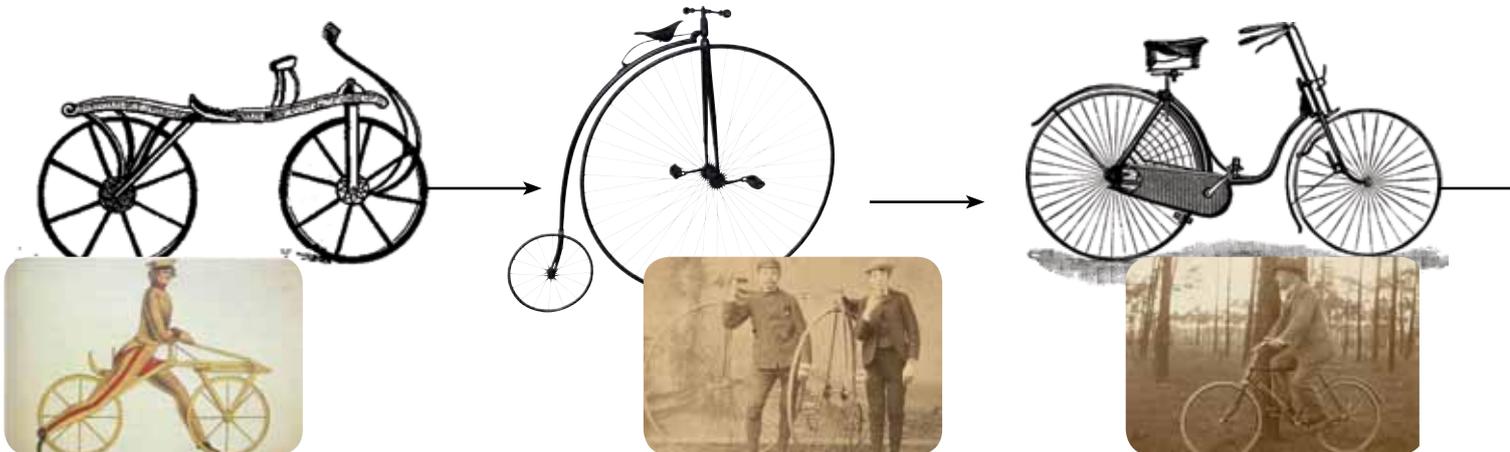
It produces 350W and has a range of 85km with a top motor speed of 25km/h. Not bad for a bicycle. The rear wheel is driven by the new Gates Carbon Drive belt instead of the old chain, saving grams of weight. Ford’s E-Bike is a welter of brilliant new ideas in bicycle design but it will never be put into mass production.

That hasn’t stopped some 30 million electric bicycles being sold across the world every year. The vast majority of these in China where there are an estimated 120 million in daily use. They are playing havoc with urban planning and vehicle legislation.

Should a large electric bike that can travel at 30km/h be permitted in a bicycle lane or be treated like a scooter? Different countries are responding differently but, in Europe and the US at any rate, they have decided that they are bicycles as long as their top assisted speed is limited to 25km/h. This is the second reinvention of the bicycle. Almost as soon

as the first bicycles were developed in the 1860s people stuck motor-drives on them. The first motorised bicycle was the Michaux-Perreaux steam velocipede produced in 1868. Bicycles were death-traps until 1885 when John Kemp Starley of Coventry in the UK introduced the Rover Safety. This featured the first diamond frame layout, wheels of equal size with the cyclist over the centre of the bike and able to reach the ground with both feet. Prior to that wheels were of all sizes and people fell off, often fatally.

“The main principles which guided me in making this machine were to place the rider



Draisine by Karl von Drais (1817) - Germany.

High Wheeler aka Penny Farthing (~1870)  
FWD (Front wheel drive).

John Kemp Starley’s Safety Bicycle  
(1885) † UK.

at the proper distance from the ground ... to place the seat in the right position in relation to the pedals ... to place the handles in such a position in relation to the seat that the rider could exert the greatest force upon the pedals with the least amount of fatigue," said Starley at a speech to the Royal Society of the Arts.

It was for bicycles that John Dunlop developed the pneumatic tyre and Edouard Michelin developed detachable tyres. Starley, the genius inventor of the bicycle frame, also developed the first lever-tension wheels where the spokes are under tension with opposing spokes holding the rim in place. In 1874 he invented tangent-spoked wheels, still used on every bicycle today. Hans Rehold invented the steel roller chain in 1880. The quick release wheel was patented by Tullio Campegnolo in 1930 and he followed that with the first gear-change derailleur mechanism in 1933.

The list of developments here helped in the creation of everything from the first motorcars to the Wright brothers' first aeroplane. Bicycles are the embodiment of engineering design and inspiration.

"The journey of life is like a man riding a bicycle. We know he got on the bicycle and started to move.

We know that at some point he will stop and get off. We know that if he stops moving and does not get off he will fall off," said William Golding, author of *Lord of the Flies*.

The first motorised bicycles used steam and were a tad dangerous. Sylvester Roper, an American, developed a twin cylinder steam velocipede in 1868, which featured a coal-fired boiler. In 1896, while he was demonstrating it, the cylinder exploded, killing him.

It wasn't until the internal combustion was invented that development took off. By 1896 you could buy petrol-driven engine conversion kits for your bicycle from the Thomas Motor Company. In 1901 Minerva, a Belgian company, began exporting a 211cc conversion unit which developed 1.5hp and could maintain a comfortable 30km/h.

As these engines gained in power, the standard bicycle frames became too fragile to support them. Stouter frames, bigger tyres and hardier components followed and the motorcycle stopped being merely a different type of bicycle.

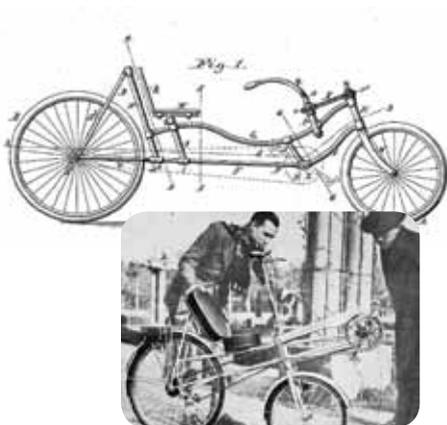
Not that powered bicycles stopped being developed. The British Cyclaid was a 31cc cycle motor attached to the rear wheel and was sold up till the 1950s. The French VéloSoleX was a complete heavy-framed motorised bicycle produced up till 1988 before produc-

tion was transferred to China. In 2005, production was brought back to France but with a new battery-powered system.

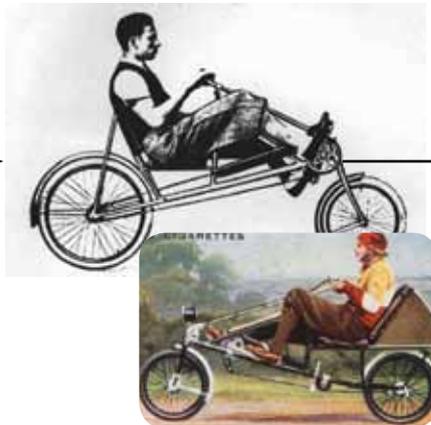
The modern electric bicycles are very different from their forebears. They are technically sophisticated and have been a boon to cycle manufacturers and retailers; they're more expensive and they have more complicated working parts that require regular servicing.

Start with the most important bit, the DC brushless (BLDC) electric motor and controller. The original motorised bicycles were driven by a chain between the motor and the rear axle. Modern motors are built into the hub. BLDC motors contain permanent magnets which rotate, and a fixed armature. This eliminates the need to connect current to a moving component, reducing wear-and-tear and the need for 'brushes' to transmit current. However, now that the armature is static the magnets, are kept turning by a controller that switches the winding phases. BLDC motors require no internal cooling since the moving part is on the outside and can be cooled by conduction.

The housing can then be entirely sealed, which protects it from dirt and water—exactly what you need if you want to power a bicycle.



Harold Jarvis longrider, patent excerpt (1901) - USA.



Velocar by Charles Mochet (1931) - France.



Ravat Shortrider (Vélo Horizontal) (1937) - France.



# BLACK OR BRIGHT

**you choose**



**energy efficiency @ work**

## Taking energy efficiency light years ahead

16-17 November 2011, Emperors Palace, Gauteng

### SAEEC2011 EXHIBITORS

An exhibition hall packed with decision-makers, more than at any other event. Exhibition space available at affordable rates.

#### EXHIBITION SPACE (3x3m<sup>2</sup>)

Your exhibit includes:

- Standard shell scheme cubicle
- Standard company name on fascia
- 1 x 15A power point with shared DB
- 1 x double fluorescent light
- Exhibitor manual for planning, installation, dismantling of booth

**R11,600 for corporate members** (R13,200 non-members)

#### SAEEC2011 DELEGATES

Full delegate:	R4,400
Student delegate:	R3,300
Group discount (5+):	R4,200
SAEE member delegate:	R3,900

*Registration fees include entrance to seminar sessions, registration pack, proceedings on CD, daily lunch and refreshments during break.*

#### 2x EXHIBITION SPACE (3x3m<sup>2</sup>)

Your exhibit includes:

- Standard shell scheme cubicle
- Standard company name on fascia
- 2 x 15A power point with shared DB
- 2 x double fluorescent lights
- Exhibitor manual for planning, installation, dismantling of booth

**R20,400 for corporate members** (R23,800 non-members)

#### SAEEC2011 SPONSORS

Enhance your company's prominence and visibility at this niche event by taking up one of the range of sponsorship opportunities offered.

**When booking quote: BW2WN to qualify for a prize.**

# SAEEC

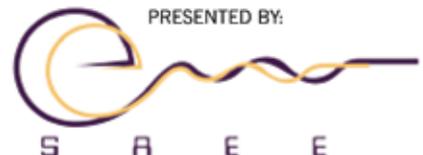


Southern African  
Energy Efficiency Convention 2011

### INFO

For more information contact:  
Erika Kruger  
Tel: +27(0)18 290 5130  
Cell: +27(0)82 428 7386  
Fax: +27(0)86 512 7122  
Email: [convention@saeec.org.za](mailto:convention@saeec.org.za)

PRESENTED BY:



The Southern African Association for Energy Efficiency (SAEE),  
chapter of the American Association of Energy Engineers (AEE).

To register and view information about the SAEEC2011 logon to [www.saeec2011.org.za](http://www.saeec2011.org.za).

At its simplest, the controller can be a rheostat but that destroys all the efficiency gains from the BLDC. Zilog, an embedded control system producer, has released a guide to building your own controller for a bicycle power train.

Its system requires Hall effect sensor transducers which vary their output voltage in response to a magnetic field. This can be converted into a measure of the position of the magnets around the armature and so permit control of the BLDC. Zilog calls for three Hall sensors placed at 120 degrees apart and allowing calculation based on readings from all three. Hall sensors can allow a motor to run at very low speeds. An alternative, which doesn't require additional hardware or controllers, is to measure the back electromotive-force (EMF) in the un-driven coils, however, this doesn't support low motor speeds and requires quite complex algorithmic modelling.

Bicycles are often ridden at low speeds, especially when you start, and so Hall sensors are necessary.

Voltage can be applied either sinusoidally to a three-phase winding, so permitting a smoother rotation, or trapezoidally in two phases at a time as a DC voltage.

According to Zilog, "Once the motor is running, the state of the three Hall sensors changes, based on the rotor position. Voltage to each of the three motor phases is switched, based on the state of the sensors (commutation). Hall sensor interrupts are counted to measure the motor speed.

Other peripheral functions are used to protect the system in case of overload, undervoltage, and over-temperature."

Controllers and BLDC also permit regenerative braking in which the motor is used as a generator to slow the bike down and convert this energy back to recharge the batteries. Bicycles aren't that heavy so the gain isn't that great, but it does help to extend range.

The controllers are intended to provide power-on-demand. This isn't a motorcycle with a throttle. Many countries permit electric bicycles only on condition that the power is an electric assist and so only provided while the cyclist pedals.

The brakes also form part of the control system so that the controller can convert the motor to generator as they are engaged.

Power levels are usually limited by law to about 750W and provide ranges of between 7 and 70km, depending on the amount of direct assistance provided by the motor to the cyclist. The majority of electric bicycles use traditional batteries for power but a number of them have looked to alternatives. Pearl Hydrogen Bikes from China uses a fuel cell based on a proton-exchange membrane and can generate about 200W. It has a range of 60 to 100km per charge. Oh, and the bike is ugly and weighs 32kgs. As far as Pearl is concerned, this is a niche product which show-cases its fuel cell range.

The full electric kit then consists of the rear-wheel and BDLC hub combination, a handle-bar mounted controller and a battery, usually mounted over the rear wheel.

As cities around the world attempt to cope with traffic congestion, and motorists with high fuel prices, the need for alternative vehicles is emerging. Many cities are already bike friendly and the introduction of safe electric bikes is growing: 700 000 were sold in Europe in 2010 and 200 000 in the US. Mainstream manufacturers have noticed.

Trek has introduced a conversion kit for some of its bikes and the FX+ is a beautiful looking item. Its popular FX road bike retails for about R12 000 and the added conversion increases that to R27 000. Giant has

its Escape Hybrid, Kona has SimpliCITY, Breezer has a whole series of electric bikes, and even the venerable Brompton – maker of the eponymous foldup commuter bicycle – is bringing out an eBrompton in 2012.

Each has chosen a different approach. Giant and Trek have gone for a full integrated rear-hub with the gear-chain, direct and assisted power all going into the same wheel. Breezer and Kona have left the rear suspension alone and gone for front-wheel support, reducing the complexity of the control system.

New technologies also create space for new companies. BionX, started by ex-Magna auto parts manufacturer CEO Manfred Gingl in 2001, provides conversion kits for existing bikes.

At the other extreme is the M55 off-road bicycle. Built in Üröm, Hungary over five years and with a \$400 000 grant from the New Hungary Development Plan, this 30kg beast is hewn from CNC milled aluminium, with titanium and carbon fibre. The motor provides 65km/h power with a range of about 100km. Cost? A shade over R350 000 for one of the 275 limited edition bicycles that will be produced.

There are few growth industries in this global of all recessions and electric bikes are being met with a degree of excitement not seen since early dotcom. In particular, ageing populations are eager consumers of mobility assist devices that allow previously active people to continue to enjoy the same accomplishments of their youth.

Toshiba invested R3.5 billion in a new plant in northwest Japan to produce new lithium ion batteries designed specifically for bicycles. Shimano, the world's largest supplier of bicycle gear-trains, and Shramm, its German competitor, are the biggest beneficiaries of the new demand for electrical components.

However, competition is fierce amongst new contenders. Pon, Holland's biggest ebike producer, has just purchased Derby Cycle, Germany's biggest, for R3 billion. Derby is the producer of Raleigh bicycles, familiar to South Africans. Pon has already purchased Gazelle, which has 30 percent of the Neth-





SIEMENS



# Driving economies forward at 350 kilometers an hour.

Siemens high-speed trains provide an answer for lasting growth.

Building a growing economy takes infrastructure that can keep pace – and go beyond. Energy-efficient Siemens trains already run through hot Spanish summers and cold Russian winters. They cross through the industrial hearts of Germany and China. In fact, in every corner of the

globe, Siemens has answers to keep economies moving: from hardworking commuter rail to one of the fastest series production trains on earth. Because wherever there are tough mobility questions, we're answering them.

[siemens.com/answers](http://siemens.com/answers)

erlands market. And if deep pockets aren't available, then some companies are turning to Kickstarter, the online crowd-sourced funding website. Conscious Commuter is looking to raise funds for its foldable electric bicycle. Gabriel Wartofsky, the company's designer, has already raised his R250 000 target in order to produce 100 bikes.

Wartofsky's bike "will be made from recycled aluminium and feature a direct-drive system powered by a frame hidden lithium-ion battery pack and a front wheel, 250Wt electric hub motor, giving the bike a pedal-assist speed of 25km per hour," according to Aaron Colter of Earth Techling.

We should be seeing this bike doing battle with the Brompton soon.

Still, it's not all straightforward. Bicycles ridden by non-typical cyclists who are less experienced in traffic and going faster than they would be able under their own power are dangerous.

"An electric bike rider is more likely than a car driver to be killed or injured in a collision, and as the number of riders has soared, fatalities in China have risen. And riders of these vehicles often choose to take bicycle lanes, where they mix with slower-moving bikes and pedestrians, adding to the potential for an accident," says Fan Wenxin, writing in the *New York Times*.

In December 2010, Shanghai decided to ban large electric bikes from bicycle lanes. However, electric cyclists make up 10 per cent of the population and their outrage was sufficient to reverse the law.



The bicycle has long been the vehicle for social change. Susan B. Anthony, the leader of the US suffragette movement, wrote in the *New York Sunday World* in 1896, "Let me tell you what I think of bicycling. I think it has done more to emancipate women than anything else in the world. ... It gives a woman a feeling of freedom and self-reliance ... the moment she takes her seat, she knows she can't get into harm unless she gets off her bicycle, and away she goes, the picture of free, untrammelled womanhood."

And writers had an enjoyable time. From Jerome K. Jerome's hysterical 'Three Men on the Bummel', to Mark Twain's 1884 essay 'Taming the Bicycle', in which he concludes: "Get a bicycle. You will not regret it, if you live."

Cycling has changed the world. In 'It's All About the Bike', Robert Penn details the history of the machine as he travels the world in search of the best individual components to build his dream bike.

"For many in the 1890s the future came too fast," he writes. "The decade saw the first international telephone links, the 'scramble for Africa', the foundation of Britain's Labour Party, the rationalisation and codification of global sports and the first modern Olympiad. Heroin, radium and radioactivity in uranium were discovered. The Waldorf-Astoria in New York and the Paris Ritz opened. Durkheim invented sociology. Landmarks of social thought included rights for works and old-age pensions. The Rockefellers and Vanderbilts amassed unprecedented amounts of private wealth. X-rays and cinematography were born. Verdi, Puccini, Tchaikovsky,



Mahler, Cezanne, Gauguin, Monet, William Morris, Munch, Rodin, Chekhov, Ibsen, Henry James, WB Yeats, Rudyard Kipling, Oscar Wilde, Joseph Conrad and Thomas Hardy were at the height of their creative powers. ... At the heart of it all was the bicycle."

Our own age, 120 years later, is no less exciting. In the midst of global recession we have seen the development of mass social communications, robots on Mars, pocket-sized micro-computers, breakthroughs in genetics and healthcare. Wealth creation has become truly open as ordinary geeks have become multi-billionaires through the creation of virtual products like Google and Facebook.

And through that, hundreds of millions of people in the poorest places on Earth are riding from poverty to wealth on their new electric bicycles. The bicycle, well over a century old, has not lost its capacity for innovation and transformation.



## South Africa's new Ahrlac aircraft unveiled

Two South African companies have invested almost R1,6-billion in building a new Ahrlac aircraft that is likely to sell for under \$10-million, has a range of 1 100 nautical miles and will be fitted with at least one 20mm cannon. It was developed by Aerosud and the Paramount Group and is known as the Advanced High Performance Reconnaissance Light Aircraft that gives it its name, Ahrlac.

It is likely to go into production by the end of next year and will be used in numerous applications including border control and surveillance. So far, a quarter-sized scale model has undertaken 80 flights but full flight-testing of the finished plane must still be done.

Paul Potgieter, managing director of Aerosud, says there is currently nothing like the Ahrlac in other parts of the world and it is being aimed firmly at countries in Africa where most countries convert cargo planes or turboprop fighters to undertake military and civilian surveillance operations. According to Paramount Group's chairman, Ivor Ichikowitz, the future of peacekeeping and defence in Africa relies on having airborne capabilities and this plane is ideal for these sorts of activities.

He says that apart from military applications it can be used by police forces as well as by forestry officials who need to patrol their plantations. He sees it having a multitude of applications in Asia, Latin America and Eastern Europe. The Ahrlac carries a crew of two in its bulbous cockpit and has a propeller mounted at the rear, allow-

ing them an unobstructed view during reconnaissance operations. The plane can stay airborne for up to seven hours on a single tank of fuel. It will be manufactured at Aerosud premises in Centurion outside Pretoria where the company makes wing components, seats and galleys for Boeing and Airbus.

The budget for its development and certification is \$200-million and it will become one of the first aircraft produced in Africa since Armscor Defence Institutes developed the Rooivalk helicopter in the 1980s.

By seeking customers in Africa, analysts say that Paramount and Aerosud will sidestep some competition from Western arms contractors who generally do not deal with the smaller African markets.

Paramount has been working on a number of defence projects that include refurbishing a fleet of Dassault Aviation SA's Mirage III and F-1 jets for Gabon and the Republic of Congo.



## Engineers urged to bolster new commission

South Africa's engineers have been called on to bolster the newly-formed Presidential Infrastructure Co-ordinating Commission, convened by President Jacob Zuma.

Public Works Minister, Gwen Mahlangu-Nkabinde made the call during the recent Engineering Summit organised by the Engineering Council of South Africa to improve the way in which the engineering profession engaged with government and other stakeholders on skills development and infra-

structure delivery. Mahlangu-Nkabinde says that engineers are needed on this commission in order to make a meaningful contribution to changes affecting South Africa. The commission will be supported by a management committee chaired by the Rural Development and Land Reform Minister, Gugile Nkwinti. It will have its own secretariat.

The management committee comprises the National Planning Commission's Trevor Manuel, Finance Minister Pravin Gordhan, Economic Development Minister Ebrahim Patel, Energy Minister Dipuo Peters, acting Co-operative Governance and Traditional Affairs Minister, Nathi Mthethwa, and Public Enterprises Minister, Malusi Gigaba.

Meanwhile, Mahlangu-Nkabinde has blamed "thugs and thieves" for the mess that has been unravelling within the Department of Public Works where dodgy contracts worth R40-billion are being investigated by the Special Investigating Unit. As a result of the investigation, no new work will emanate from

the Department in the coming months; seriously hampering urgent development work needed by South Africa's engineering professions. She claims that contracts were awarded to people who "do not have a clue what they are doing", adding that the collapsing infrastructure and "disgraceful roads" are a testimony to the lack of integrity in some sectors of the engineering community.

The investigation is still underway as various projects in the nine provinces are being scrutinised. The Democratic Alliance has called on Mahlangu-Nkabinde to resign in the wake of the police lease scandals and the other dodgy contracts that were awarded by her department. However, she says that the contracts were given to people prior to her taking control of the department and that she is blameless.

She has called on all members of the built environment in South Africa to work with the authorities to root out corruption and improve service delivery.

## New land grabs occurring throughout Africa

**D**emand for cheaper foods and fuels in the developed economies of Europe, Britain and the United States has resulted in major companies buying up millions of acres of land in different parts of Africa and driving people off as a result.

A report by Oxfam claims that in Uganda alone about 20 000 people were driven off the land to make way for a UK-based New Forests Company that intends growing plantations.

The report says the 'land-grabs' trend for buying huge tracts of land and transforming them into profitable farms with cash crops such as sugar, harks back to the Colonial era that damaged so much of Africa more than 50 years ago.

It says growing demand for food, the pressures of climate change, water scarcity and the competition for land from non-food crops such as those needed to make biofuels are driving people off much of Africa's fertile land. In its report on land-grabs, Oxfam says that as much as 227-million hectares

of land have been sold, leased or licensed in large-scale land deals since 2001, mostly by international investors.

However, it warns that a lack of transparency surrounding these deals – many of which are shrouded in secrecy – means that its difficult to assess exactly how much land has been acquired by multinational companies.

So far it has established that about 1 100 deals covering 67-million hectares – an area that is about the size of Germany – have been cross-checked and confirmed by the Land Matrix Partnership, a coalition between academic, research and non-governmental organisations.

Dame Barbara Stocking, chief executive of Oxfam, says that communities rarely hold full legal title to the land they occupy and women, who produce up to 80% of the food consumed in some African countries, generally have limited or no land rights.

She says the consequence of this is that people are driven off the land, have nowhere

to go and cannot continue to support themselves.

According to the report, the problem is not limited to Africa and it has found evidence of multinational land grabs in Indonesia, Guatemala and Honduras.

In Uganda, Oxfam is working with the community to ensure that the evicted families get full compensation or the equivalent amount of land that they have lost as a result of the deal.



## China spreads trade tentacles in Africa

**C**hina is spreading its trade tentacles throughout Africa and has emerged as South Africa's premier trading partner and one of the continent's most important partners in terms of trade, aid and diplomacy.

The Department of Trade and Industry reported that in 2009, 13,7% of South Africa's imports came from China and were worth a staggering R70-billion. In turn, China imported materials from South Africa worth about R48-billion in the same year.

So far this year, the DTI says that South Africa has imported goods worth almost R51,3-billion and exported goods worth R45,1-billion for the year. In terms of imports all the goods represent finished products whereas materials such as chrome, coal, manganese, copper scrap, nickel and lead dominate the exports.

According to Matthew McDonald, a research analyst at the Centre for Chinese Studies at the University of Stellenbosch, China is a controversial partner as its relationships do not come without caveats, both economic and socio-political.

He says that the goal for South Africa's policymakers is to close the gap between the vast amount of goods and services imported from China and the smaller amounts of goods and services the country exports to it. There is no doubt that China's role in Africa is growing exponentially and McDonald says that this trend

is bound to continue.

In September, China's Development Bank Corporation signed a controversial \$3-billion deal with Ghana amid allegations from the executive director of the Danquah Institute, Gabby Asare Otchere-Darko, that it is illegal as it breaches the Petroleum Revenue Management Act.

In Tanzania, China signed another \$3-billion deal to develop the Mchuchuma coal and Liganga iron ore projects in that country. They represent the largest investment venture in East Africa.

In Benin, President Thomas Boni Yayi has welcomed China's investments and urged it to invest in all sectors of that country's economy including infrastructure, food processing and energy.

Meanwhile, in Nigeria the country has announced that it intends to convert about 10% of its reserves into the Yuan currency as part of a plan to sell more products to China, to bolster its imports and encourage greater investment in the country.

Nigeria is currently an important source of oil and petroleum for China and it is seeking investment from China to increase its investment ties. Nigeria has announced plans to build a special economic zone for Chinese companies outside Lagos.





# CSP Today South Africa 2012

1<sup>st</sup> Concentrated Solar Thermal Power Conference & Expo  
7-8 February, Johannesburg, South Africa  
[www.csptoday.com/za](http://www.csptoday.com/za)

## South Africa's solar horizon: Navigate the IPP market to build a successful & productive CSP business in South Africa

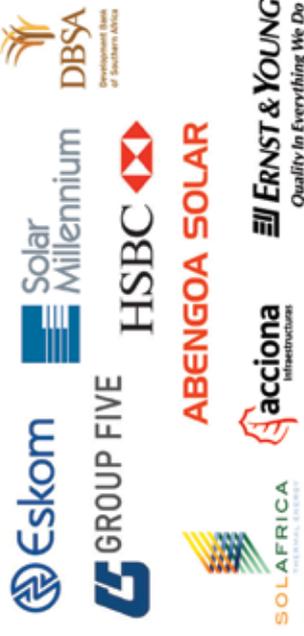
**Benefit from an information packed 2 days with answers on how to overcome the roadblocks for a successful South African CSP business.**

The future of CSP in South Africa has never looked brighter, and at the CSP Today South Africa 2012 conference you will gain the answers on:

- **South Africa's CSP status:** Get updates on how to align your CSP technology with South Africa's incentives & pricing to win RFPs for your projects
- **CSP technology tutorial:** Evaluate cost v efficiency, storage capability and South African adoption from trough to tower and beyond to get the best technology for your project
- **Long term IPP success:** Formulate your business plan to power into Phase II, use success stories and meet the buyers to get your project license in a competitive market place
- **Localising your project:** Streamline your CSP procurement through effective partnerships and local sourcing to meet requirements and grow a domestic market
- **International lessons learned:** Global CSP market on South Africa's doorstep: Journey the CSP plants of the world and get exclusive access to critical data from development to commissioning and beyond
- **Securing project finance:** Get financed fast! Prove CSP's bankability to your investors and the world to

Hear and meet with the leading international and regional solar experts

25+ speakers confirmed including:



Official Partners



For the latest programme visit:  
[www.csptoday.com/za](http://www.csptoday.com/za)

For more information contact:  
Heidi Hafes  
CSP Today  
+44 207 375 7206 / [heidi@csptoday.com](mailto:heidi@csptoday.com)

EXCLUSIVE  
€200  
DISCOUNT  
JUST QUOTE  
'WATTNOW'



## Business labour signs accord to create jobs

South Africa's sluggish and inefficient bureaucracy is hampering economic growth and job creation initiatives according to Viola Manuel, Cape Chamber of Commerce executive director.

She says that business, particularly in the Western Cape, is not getting satisfactory responses from the provincial government or the Cape Town council and there appears to be a lack of enthusiasm by these bodies to join an accord between business and labour that was signed in Cape Town in September.

The accord is the first of its kind to be signed between a regional chamber of commerce and a labour movement and the two parties have pledged to work together to create jobs, ensure that companies comply with the labour laws and find ways to stimulate

growth in the Western Cape. Unemployment levels in the Western Cape are at 22%, marginally lower than the national average of 25% but joblessness among the youth in the province is estimated to be as high as 40%.

Western Cape Premier, Helen Zille, has launched a Provincial Skills Development Forum that is intended to align skills with economic growth prospects and while Manuel says it is a strong model it is still in its infancy. However, Zille says the Western Cape Jobs Summit that took place in September provided the means to make meaningful progress on job creation in the province.

She says that all too often when the Cape Chamber of Commerce approaches government departments for information, they are reluctant to provide it, are defensive and do

not provide the details that are requested.

In a separate development, the Minister for Economic Development, Ebrahim Patel, says that over R100-billion will be channelled into a project to re-industrialise South Africa over the next five years.

He says the only way for developing countries to grow quickly is through major industrialisation programmes and this will necessitate significant skills development and improvement to the country's existing infrastructure.

Patel says the partnership between business and labour will help the government to reach its target of creating five million new jobs in the South African economy, which is part of the New Growth Path plan for the country.

## CSP industry experts to gather in Johannesburg

The CSP industry continues to grow globally and South Africa has emerged as a market to watch. With the initial phase of the renewable energy competitive bidding process well underway, CSP companies are paying close attention to untapped CSP territory for lucrative opportunities.

Following the qualification bid announcements due to take place by NERSA and the Department of Energy in South Africa later this year, CSP Today has launched the 1<sup>st</sup> Concentrated Solar Thermal Power Conference and Exhibition to take place in Johannesburg on the 7<sup>th</sup> and 8<sup>th</sup> of February 2012.

Leading international CSP companies will join forces with South African players to

discuss how to navigate the IPP market to build a successful and productive CSP business in this country. Confirmed international speakers include people from Abengoa Solar, Acciona, Torresol Energy, Solar Reserve, ACS Cobra and Solar Millennium. They will be joined by those South African organisations intent on shaping the country's CSP future, including Eskom, the Department of Energy, the Industrial Development Corporation and the DBSA.

CSP Today has partnered with the Southern African Solar Thermal and Electricity Association (SASTELA) and the Sustainable Energy Society of Southern Africa (SESSA), making the event the meeting place for CSP developers, EPCs Technology

Providers, Government Officials, Investors and industrial power off-takers.

The wealth of experience and knowledge will offer the opportunity to discuss issues that underpin building a successful CSP business in South Africa. The most significant topics include understanding the role and status of CSP in South Africa, achieving long term IPP success, localising the project, securing project finance, and evaluating the technology options based on South Africa's demand and infrastructure.

The CSP industry has a lot to offer South Africa and CSP Today is excited to be able to provide a platform for knowledge transfer.

**For more information contact: Heidi Hafes on +44 207 375 7206.**

## Training courses

### Connecting PV solar panels to the grid

A one day training course introducing the legislation pertaining to small and medium solar and wind energy grid feed-in systems; considering various grid-tied system types with or without battery back-up, using PV solar as a back-up system for load shedding; designing, specifying and calculating for inverter, PV solar panels and battery requirements, amongst others.

The course covers theoretical and practical aspects and is presented by Lapp Group, supported by a German solar and wind trainer teaching kit.

One CPD credit can be earned for ECSA requirements. The next course will be held on 26 November 2011 at the Lapp Building in Modderfontein, Gauteng.



# Queuing for mass-produced consumer products

By Gavin Chait

In 1738, Daniel Bernoulli published his *Hydrodynamica*. There he laid out his principle that a fluid with no viscosity will increase in speed simultaneously with a decrease in pressure.

No real fluid has no viscosity but that hasn't stopped the practical applications of this theory. Everything from the lift force experienced by an aircraft wing to vehicle carburettors can be modelled by Bernoulli's principle.

Giovanni Venturi took Bernoulli's principle further, using it to show that fluid pressure drops when it flows through a constricted section of pipe. Place your finger over the end of a garden hose while watering the daffodils to demonstrate what Bernoulli and Venturi were going on about.

All of which goes to explain how the Dyson fan works. James Dyson, who achieved his first success in redesigning the humble vacuum cleaner, is looking to repeat that success with the reinvention of the even humbler space heater. Instead of a visible electric coil protected behind wire mesh, or the oil radiators, the Dyson hot fan consists of a thin oblong loop mounted onto a cylinder. The base contains a brushless fan and

the air is channelled up and through the air-foil loop. As this high-pressure air expands it creates a Venturi effect, pulling in a large volume of air from the surrounding room and mixing rapidly. Dyson claims that this results in an amplification of the fan by 18 times.



This is all clever engineering. The hot air fan took two years to develop and will sell for about R3 000. Since you can buy a standard heater for less than R100 why would you ever spend so much money?

The short answer is that Sir James Dyson doesn't separate design from engineering.

"Surfboards and computers and skis always look like they were designed by people who really cared about them - vacuum cleaners simply weren't made by people with a passion for vacuum cleaners," says Dyson in an interview in the London *Telegraph*. "I was passionate because I hated using them. Prosaic products have tended to be ignored, but with the right engineers they become exciting things".

Good design seems to be even more important than ever in our recessionary times. Well-designed consumer electronics fetch a significant premium over their competitors. There is certainly a tremendous cost to the time it takes to create such designs but, when amortised over thousands of consumer products, the manufactured cost is not tremendously different from low-cost rivals.

What may be surprising is how few consumer electronics are well-designed. Dyson has chosen fertile ground and there is almost no end to the number of cheap home-electronics they could reinvent: toasters, kettles, washing machines, dishwashers.

Good engineering design is not simply about giving a ubiquitous device a new case. It is about reinventing it at a whole new

level. This is not strictly necessary to the advancement of a product category, or technology as a whole, but it does add fun and spontaneity to otherwise invisible products.

The Dyson vacuum cleaner channels air to create a vortex and so provide constant suction.



His bathroom hand-dryer creates a thin blade of air that scrapes water off your hand much as a windscreen wiper swipes a windshield. They're instantly recognisable as 'designed' objects.

Dean Kamen's Segway is a similar design solution serving a need few were aware needed filling. The Segway is a two-wheel, self-balancing personal transport device: a series of gyroscopic and levelling sensors work together to detect a user's orientation and weight distribution.



Actuators respond and power the two electric motors responsible for the wheels back and forth to keep a person balanced on top. Lean forward and the device can trot off at about 20 km/h.

It could have just been an electric scooter. Instead it is a new type of vehicle.

The surprising thing is how rare design and products come together. The returns on good design are immense. The most famous designs are not merely brand extensions; they're also closely associated with their creators.

In the 1980s, Mark Jordan and Tsutomu Matano were recent graduates from Pasadena's automobile design school, Art Centre. Bob Hall, then in charge of product planning at Mazda, had hired the two to create a two-seater roadster. Most car manufacturers had abandoned the roadster market and the team was given little money to create their prototypes.

In 1986, Matano and Jordan had completed a prototype and invited key Mazda decision-makers to California for a test drive. They put their new two-seater up against a Lotus Elan, Triumph Spitfire and MG Midget – none still in production, but all to give a sense of context. Their prototype incorporated double wishbone suspension, 50/50 weight distribution and a very tight gear box.

The product was approved. Released in 1990, by 2010 the Mazda MX-5 had sold 900 000 vehicles world-wide and prompted the launch of the Mercedes SLK, BMW Z3 and Audi TT along with a host of other wannabes. In 2005, the entire Mazda range was redesigned by Moray Callum.



But the person who has totally dominated consumer electronics design for almost 15 years is Jonathon Ive.

In 1997 he was an unknown labouring away at a mid-tier computer company with a rapidly fading market-share. The company had just hired a new CEO in a last-gasp attempt to save itself and he was looking for someone who could match his vision as his new design director.

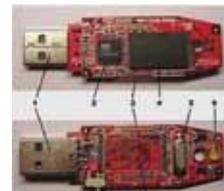
The CEO was Steve Jobs and the company Apple.

Their first product was the iMac, a translucent, all-in-one, desktop computer. Its



tear-drop shape and bright colours were a world away from the typical beige boxes of PCs. It sold two million units in its first year.

These weren't mere case modifications. The iMac abandoned serial ports and floppy drives, introducing USB as standard. The first USB flash-disks were introduced by IBM in 2000, so the iMac was quite a big bet that users wouldn't rebel at being unable to transfer their files around easily.



The success of the iMac led to 2001 and Apple's release of the iPod digital music player.



# Visio 2010 shares data visualizations with ease

## Four Reasons to Try Visio 2010

- 1. Simplify large and complex diagrams.**  
Add clarity to diagrams using Subprocess and Containers to group related shapes visually and logically. As a diagram grows larger or becomes more complex, Subprocess and Containers help you keep information more organised and understandable.
- 2. Bring your diagrams to life with real-time data.**  
See the entire picture with dynamic, data driven diagrams, connected to data sources such as Excel or SQL Server. Then, display real-time data right within your diagrams, based on conditions you define, using vibrant colours, icons, symbols and databars.
- 3. Identify operational inefficiencies.**  
Use Visio's business process analysis capabilities to capture, explore and communicate current business processes and identify operational inefficiencies.
- 4. Gain valuable business insights.**  
Link data to diagrams to visualise and explore complex data and make better decisions, faster.

The world is more complex than ever, and people need an easy way to simplify information, communicate it to others and ultimately make better decisions. Diagramming has always been a way to help organise information into easy-to-see, digestible parts. Whether on napkins, white boards or paper, diagramming helps convey thoughts and ideas.

*"Humans have always communicated visually, to make sense of the world and communicate quickly with others."*  
James Avenant

That's why the diagram is so powerful, and even more relevant in today's fast, global, news-intensive society. "What is lacking from today's diagrams are the operational data that contextualise the diagram at a point in time," said James Avenant, who heads the Microsoft Visio business at Microsoft South Africa.

Whether it's a network diagram, floor or plant layout or a business process, the latest tools in Visio 2010 help create visually-pleasing diagrams that simplify complexity and get everyone on the same page. With a large collection of pre-drawn shapes,

pictures and templates, and the dramatically improved user experience, every step is easier and more intuitive.

## What's new?

Since Visio 2007, users can connect external data to their Visio diagrams with Visio "data graphics". While this is an excellent way to visualise your data, it was limited to the desktop. In Visio 2010, this limitation is removed when the diagram is published to SharePoint.

This increases productivity by bringing together separate silos of information—such as a business process diagram and the operational data related to that process—into a single, up-to-date view, saving time and speeding up decisions. The icons, symbols, colours and bar graphs give a clear view of the information that matters to your business—and automatically links to popular data sources such as Excel and Access to help you display visuals that are always current.

For more information, visit  
<http://www.microsoft.co.za/visio> or contact  
[james.avenant@microsoft.com](mailto:james.avenant@microsoft.com)

**Microsoft®**

Microsoft®  
**Visio® 2010**



Flash memory music players already existed. Toshiba had just developed a 4.5cm diameter hard-drive but had no idea what to do with it. Portal Player had developed a music-player on a chip for IBM in 1999. Apple had already licensed a software platform called SoundJam and hired its programmer, Jeff Robbin, for what would become iTunes.

Even the iPod's celebrated scroll wheel has antecedents. Bang & Olufsen BeoCom phones have similar wheels for navigating saved telephone numbers. Hewlett-Packard's 1983 9836 workstation even had a wheel for scrolling text.

Taken together, the design and interface all seem self-evident. Ive stated his design philosophy back in 2006 as being to "make something that looks like it wasn't really designed at all because it's inevitable."

The same goes for Apple's iPhone, which packed in multi-touch capacitive screens, gyroscopes, GPS receivers and Wi-Fi.



So much has happened in telecommunications since 2007 that it's difficult to remember how limited wireless Internet connections used to be. The iPhone had to make compromises to preserve battery-life but it also drove innovation, from glass-making, to multi-touch capacitive interfaces, to software design.

Ive certainly didn't work alone. Phil Schiller, Apple's head of marketing, recommended the iPod's scroll wheel. Tim Wasko developed the iPod's software interface. Vinnie Chieco, a freelance copywriter, came up with the iPod brand name.

Design will always be a team effort. Putting together these dream teams is obviously not easy. Microsoft has struggled to redesign its offerings even while some of its hardware (keyboards and mice) is popular. Its version of the digital music-player, the Zune, was universally panned even as its interface became the basis for both Windows Phone 7 and the forthcoming Windows 8 operating system.

Mike Kruzeniski is the new Creative Director responsible for the Windows Phone.



He has written and presented extensively on his belief that new interactive designs must learn from print.

"If we pull Visual Design to the front of the product creation process, we can break free of the bad design habits that surround us. As Interaction Designers, we can stop polishing our icons, and focus on communicating the content inside, clearly and with style.

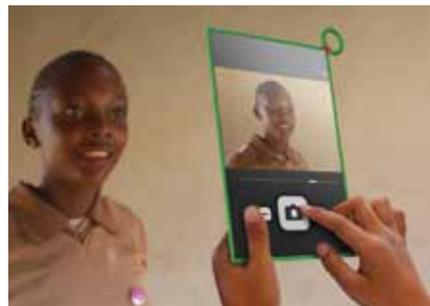
The rewards are simple: more beautiful products that are easier to use, and beautifully branded experiences with more room for self-expression."

This marriage of simplicity of design with high technology turns up in unexpected places—Jawbone is Bluetooth's headset for use with mobile phones.

The technology derives from Noise Assassin, a noise-cancellation software system developed by Alexander Asseily and Hosain

Rahman with DARPA funding. Their company, Aliph, was founded in 1999 to commercialise the work developed for the military.

The technology picks up vibrations from the person speaking and then amplifies that over the background noise. At the same time it amplifies the incoming voice. Clever technology. However, nothing without the design of Yves Béhar, founder of Fuse project. Béhar is also behind the charismatic (if unsuccessful) OLPC \$100 laptop project.



Plumen is even attempting the redesign of the compact fluorescent light bulb under its designer, Samuel Wilkinson.

Is design that important? Dyson vacuum cleaners sell for over R2 000. Hoovers and Electrolux, now sporting similar exterior designs, sell for well under R1 000. Apple computers sell for four times their competition.

Technology can fail because of bad design, but brilliant design cannot overcome technology limitations.

Antoine de Saint-Exupery, aviator and writer of *The Little Prince*, declared: "Perfection is achieved, not when there is nothing left to add, but when there is nothing left to remove."



# How Steve Jobs changed my life

by Paddy Hartegen

Steve Jobs made it possible for me to write books – relatively quickly if writing is ever quick – and he made it possible for Thandi to earn a living. Let me tell you how it happened.

When I received a commission to write my second book – it was never published but the client did pay – I thought it would be an excellent idea to invest in a computer and avoid the endless retyping needed to get a clean manuscript that could eventually be delivered to the client for approval.

My choices were limited: The Commodore, the Spectrum or that oh, so expensive but poorly engineered, IBM model. I think there might have been a couple of other gadgets that were way too complicated to comprehend.

Then of course, there was also the newest of the bunch, the Apple. I was late in coming to market sometime in about 1982, but the one I bought was an Apple IIE, with two floppy drives and a dot matrix printer. The system software and the program (AppleWrite if I re-

member correctly) and the proprietary ImageWriter printer, all ran off one floppy disk. The other one was used to save my work.

Using this ingenious electronic device was my introduction to the world of Apple and what a splendid introduction it was. At different times, various people tried to initiate me into the complex world of MS-Dos and I disliked every minute of it. I hated it then, just as I hate it now. I'm not a computer purist. I'm a writer and I want to write books. If I wanted to study computers, my brain would have been wired differently.

Apart from writing this book – which became the official archive of a major insurance company – I produced editorial material for a range of publications: for the Communications Group, for Systems Publishers, for the Building Industries Federation of South Africa and many more besides, on my Apple IIE.

In fact, it was the same Apple IIE that Jacquie, my late wife, and I shared to write the third book, a joint effort called the Complete

Book of Home Planning that sold tens of thousands of copies in various updated editions. Thanks again to Apple – and Steve Jobs.

Later, I received a more complex commission for an additional book, which was published under the title of *Our Building Heritage* and necessitated the use of a database to collate and keep track of the files and files of research material that were needed for this project.

The Apple IIE was out of its depth. We now needed a more modern option and while my instincts rebelled, my brain prevailed and I made the idiotic mistake of buying an MS-Dos machine.

If memory serves me correctly, it was an iteration of the XT but who made it, or why, remains a mystery. Benji, a buddy of mine in Rosebank, sold it to me because he said that I would be able to get the kind of database that I needed using this platform and anyway I could write on it too using WordPerfect.

For two weeks I persevered with this awful machine until my spirit was broken. I phoned Benji: "Benji," I said; a note of exasperated panic and desperation in my voice. "If you don't come down to my office in the next 20 minutes you won't find the XT anymore."

"What's wrong?" he asked puzzled.

"The bloody thing's useless," I bellowed. "I've dumped it outside on the pavement and if it's still there when I get back, I'll smash it because it is so bad." I put down the phone – and left.

Benji must have collected it because Jacquie said someone had picked up the bits and pieces. I wasn't there. I was in Braamfontein, busy buying my very first Mac – a decision I have never regretted.

And that's the point.

Mac computers worked. They worked then, as they work now (typing to you on my MacBook, 32 000 feet up in the air).

You don't need a certificate in DOS competency before you make it print (or before you can unravel the cumbersome mysteries of Windows). You don't even need to read the manuals. All you need (then as now) is to plug it in and get to work.

I guess I started work on the Mac in 1984, shortly after it was launched in the United States. I compiled a database that we used to keep track of the historical records we needed for *Our Building Heritage* using a Mac program that was never even released. It was a trial, built for demonstration purposes only and quaintly called PFS File.

It was brilliant and I wish it had been released. For me to write my manuscripts (and hundreds of thousands of other words) I used MacWrite until I came across another splendid piece of software called WriteNow. I used it for more than 10 years, wrote countless books on it, loved it and wish I could find it now.

Sometime in 1985, when Apple decided to withdraw from South Africa as part of an international disinvestment campaign aimed at the Nationalist government, I bought the last eight Mac computers that were available in the country. I bought them from Benji, the same retailer in Rosebank who'd tried to convince me to buy an XT.

And, having bought the last eight Macs in the country, I became one of the last (if not the very last) Apple (and Mac) evangelists in South Africa.

I am still an evangelist today but now have lots of friends who join me in singing Mac's praises, Apple's praises and Steve Jobs' praises. For Steve Jobs proved to me (as I proved to myself and others) that

the legacy he gave us is a range of computers and electronic devices that work for you and not the other way round.

To give you an illustration of this point I'll tell you about Thandi. In 1985 we were commissioned by an educational publisher in Cape Town to produce a book written entirely in Northern Sotho. The problem was that no-one in the company at the time understood North Sotho, let alone could type it.

But that's not something that concerns enterprising teams equipped with Macs. Our simple and elegant solution was to employ a 'temp typist', Thandi, who was fluent in Sotho. We agreed payment terms with her for the assignment, sat her down in front of the Mac, (she'd never worked on any computer before) and she started typing. In two weeks the manuscript was finished: 350 pages of typed Sotho virtually word-perfect.

Over the course of her days with us she learned to open her own work, save it and even print it. When we got it back from the client after proofing, it took just two days to do the corrections (both typist's and author's) – and we'd done the job. What a testimony to those computers.

I used Thandi for many other projects over the years and she never forgot working on the Mac. No other computer system could have done that in 1985. MS-Dos and WordPerfect vendors were making fortunes running training courses so people could use the computers they'd paid for. Why?

Because the computers people were using were all badly designed, unfriendly and a trial. You needed to be trained to work for the computer - it did not work for you.

Incidentally, I retired my first Mac in 2001 after more than 15 years of service - try doing that with a Windows machine.

More recently Apple introduced many more fantastic products: and it's the iPhone, the iPod, the iPad that awoke the world to the reality of Apple and Mac: The reality that says: "Apple makes electronic devices that work."

I used them and so did Thandi (and 30 other people that I employed). So did others. Thousands, even millions of others. Ask anyone in the media industry today about Macs and they'll be filled with even higher praise than I am. Ask the chaps at Pixar (or any other animation studio anywhere in the world) and they'll say the same thing. So will the war-correspondents in Algeria or the Oxfam workers in Sudan.

And you tell me what you want from a computer?

You want a computer that works.

Steve Jobs made them, and perfected them. In his earliest interviews he said that he wanted to make a computer that was easy to use and did not need a manual to make it work.

Then he said he wanted to make a dent in the universe.

He did both and for that I thank you Steve Jobs.

You were – and to me always will be – a truly great man.



Steve Jobs  
1955-2011

## New water treatment technology being tested in SA

A water treatment process that uses electro-coagulation technology can be used in South Africa after a local company, One-Source Group, licensed the technology from Welsh developers, R&A Properties.

One-Source-Water's director, Martin Mandala, says the electro-coagulation process changes the nature of pollutants in the water to remove those contaminants that include heavy metals, radio nuclides, arsenic and algae rather than using chemicals to do so.

The electro-coagulation plants are built inside containers, making them mobile and relatively easy to deploy and the technology can be scaled-up to work on existing water treatment plants.

Mandala says the technology is environmentally friendly and energy efficient and is already being used at more than 30 sites throughout Britain and Europe where it has proved to be an extremely effective way of treating contaminated water.

He says that while electro-coagulation water treatment pre-dates many of the conventional physical, chemical and biological processes that are used today, it is only recent advances in power control technology and the redesign of the reactor that have allowed this technology to become affordable and easy to deploy and use.

The group has already imported its first unit from the Welsh developers and it has been deployed on the Johannesburg West Rand for tests on acid mine drainage treatment where, apparently, it is working successfully.

According to Wayne Preece of R&A Properties, the unit will be moved to different sites to test its application and if demand for the unit is sufficient then a local manufacturing plant may be set up to make units here.

The government has set aside R225-million to deal with acid mine drainage problems on the West Rand amid predictions that mines will start decanting acid-laced water into the country's river systems within the next year or so.

The company says that it can provide potable water solutions in rural settings. The technology can also be used on sewerage plants to conduct an initial treatment of effluent, allowing existing treatment plants to operate efficiently above their design capacity.



## Gold and jewels dress the failed Tata Nano

Sometimes people build idiotic things and none more so, perhaps, than the gold, diamond and bejewelled Tata Nano that was built at a cost of £2,9-million as a tribute to 5 000 years of Indian craftsmanship.

Thirty jewellers, all applying traditional skills, used 80kg of 22-carat gold, 15kg of silver and a range of gem stones to bedeck the car.

Intricate filigree work, along with delicate and colourful meenakari work, was incorporated in the design to provide a gleaming Tata Nano, which was billed as the 'people's car' and is still the cheapest passenger vehicle on the market.

The car costs just £1 300 but the gold version is valued at 220-million rupees. Bhaskar Bhatt, chairman of Tata has said that the vehicle is not for sale and will be used purely as a marketing tool for the company and for India's skilled craftsmen who are renowned for making fine jewellery.

Many people – including Tata – have been concerned about sales of the vehicle; it sold only 1 202 in August this year, 85% lower than in July.

In November 2010, just after the car was launched, sales plummeted to 509 units and many people are wondering what is wrong with the car and whether its many problems can be resolved?

As a vehicle it is apparently perfectly serviceable. The main problem is that people don't want to be associated with owning the world's cheapest car. To add to the vehicle's woes, there have been reports of unexplained fires in some models and it did not get great reviews from the motoring press in India or the rest of the world as it was under-powered.

Matt Eyring, president of global consulting firm Innosight, says that the main issue is that it has been billed as a poor person's car – in the hope that buyers would upgrade from three-wheel scooters to a fully-fledged car – but this has not happened because poor people aren't buying it. And, he says, it's meant to be a cheap car that is not actually cheap at all.



## Sending Twitter messages from your jeans

In London, you can buy a pair of jeans that, using a Radio-Frequency Identification Device (RFID), will send Twitter messages about your location as you wander around the city.

These RFIDs use radio waves that can send data to a reader and that reader can be connected to the Internet to provide all manner of information about the person who is wearing the device.

Increasingly, physical objects are being registered online that are rapidly developing a sub-set on the Internet, which has been dubbed the Internet of Things (IoT). Devices such as computers, smartphones and tablets are already registered on the Internet but now all kinds of other devices are logging on, including motor cars, homes, any precious possessions and even the sheep and cows on a farm or the family pets at home.

As the Internet Protocol (IP) moves from IPv4 to IPv6, which can support about 340-trillion trillion addresses, more and more objects will start to automatically register themselves on the Internet. This, in turn, creates the smart buildings, intelligent cars and smart appliances that will be assigned an Internet address and can then be tracked or can allow two-way communication.

According to Rob van Kranenburg, a member of the European Commission IoT experts' group, the smart city of the future will be a matrix-like place with smart cameras everywhere, detectors and non-invasive neuro-sensors scanning the brains of people in the street for any signs of over-activity.

He says the IoT will allow every possession that a person has to be registered on the Internet and then be monitored all the time from anywhere. Van Kranenburg says there is a fine line between the benefits of smart technology and privacy concerns.

According to him, about seven billion humans beings will, sometime in the future, co-exist with 70-billion machines and perhaps 70 000-billion 'smart things' that include clothing, personal adornments and all manner of different devices.

There are practical applications for the RFIDs. A number of stores, including retail chain Wal-Mart, use RFID tags to enable employees to check stock by scanning items on shelves. These products are tracked from the manufacturer to the sales tills.

Although employees are expected to remove the tag from the item purchased, they sometimes forget to do so and that means the RFID is still active and can be tracked. Worryingly, an increasing number of hackers are learning how to decode RFID tags and use the information for illegal purposes. Because the information is transmitted using radio waves, it is possible for anyone to listen in and then decode information about the tag's location, what it represents and where it came from.



## Will the deadline for digital migration be met?

South Africa is unlikely to be ready to migrate to digital television by the deadline of April next year according to Congress of the People's communications spokesman, Juli Killian.

However, the Parliamentary Portfolio Committee on communications endorsed the Department of Communications' views that progress is on track and that the switch-over will occur on the due date.

South Africa plans to introduce the digital broadcasting system by 2015 to replace the analogue system that has been in use since the 1970s when South Africa's first television services were broadcast.

The Communications Committee has been holding public hearings about the switch-over and has confirmed that the necessary amendments to the legislation to allow this have been gazetted. However, Killian says the timelines are unrealistic and the regulatory framework is not in place.

Committee chairman Eric Kholwane says that he hopes that the Independent Communications Authority of South Africa (ICASA) will have sorted out the regulations by the middle of next year. The regulator caused an uproar when it announced that it would repeal the regulations that had been devised – and took two years to finalise – and start the process again.

Most of the manufacturers involved in making set-top boxes – that will be needed to convert digital signals to the analogue format so they can be used on older television sets – are ready for the digital migration.

The government has agreed to a 70% subsidisation for qualifying poor people in South Africa. Democratic Alliance shadow communications minister, Natasha Michael, is puzzled by the government's decision to opt for a set-top box that costs R700 a unit when cheaper converters, that cost just half of that, are readily available on the market.

Michael has asked Communications Minister, Roy Padayachee, to provide a detailed rationale on why the government has elected to use the more expensive units, claiming that it will be unnecessarily expensive for most South Africans who do not own digital television sets capable of receiving the new signal.

Meanwhile the Universal Service and Access Agency – which is managing the digital migration on behalf of the government – is being investigated for alleged financial mismanagement involving about R29-million.

The total cost of the migration is estimated at about R3,5-billion.



# Spending is earmarked – but can it become a reality?

*By Paddy Hartdegen*

*Africa needs to spend about \$38-billion a year on infrastructure development over the next ten years according to South Africa's Public Enterprises Minister Malusi Gigaba. He was addressing local and international delegates attending the African Renaissance Conference in Durban.*





National, provincial and local government departments and the parastatal and utility companies will invest about R2-trillion in infrastructure over the next five years and yet this huge amount of money is not sufficient to cover the backlogs and total needs of the country.

According to the Development Bank of Southern Africa (DBSA) the main focus of infrastructure delivery is to alleviate poverty, eradicate the backlogs in maintenance and new facilities and reduce unemployment through higher levels of economic growth.

Luther Mashaba, group executive of South African operations at the DBSA says that about R3,3-trillion is actually needed. However, he points out that the funding will have to be achieved through debt instruments to the value of R1,4-trillion.

He says that for the medium-term the expenditure will focus on health, education, energy, human settlements and especially water and sanitation.

Mashaba says that if R883-billion is spent over the next five years as planned by government and its many off-shoots, the operations and maintenance gap in South Africa will widen significantly to about R600-billion.

So far the government, parastatals and utility companies have planned projects for the energy, water, transport (including ports, railways and roads) and information and communication technology sectors. Some of these are well underway such as Eskom's power plants at Medupi and Kusile, while other projects are in different stages of completion.

For instance, part of the Gauteng Freeway Improvement Plan has been completed while large parts are still being finished and other sections are in the planning stages. The same applies to Transnet's rebuild plans for

its railway network, its passenger and freight services and its ports.

Mashaba points out that the estimated operations and maintenance expenditure over the lifetime of an asset – whether owned by government or a parastatal – is about five times greater than the original cost to create the asset in the first place.

He says that currently about 92% of all South African municipalities spend less than 5% of their operational expenditure on maintenance.

Economic infrastructure, which includes agriculture, mining, manufacturing and tourism along with entrepreneurial capital spending, totals R380-billion in South Africa, but the funding gap for this sector is R360-billion. This means that so far about R20-billion has been raised for these crucial sectors of the South African economy.

The government's Financial and Fiscal Commission has recommended that an additional tax be levied on local businesses to assist struggling municipalities to pay for their infrastructure needs. While no details of this plan have been released, the reality is that either the municipalities are wasting the money they have got or they need to raise considerably more money to pay for the essential work that must be undertaken to maintain the existing infrastructure.

The Commission says that this applies particularly to the eight major metropolitan areas of Cape Town, Johannesburg, Ekurhuleni, Tshwane, eThekweni, Nelson Mandela Bay, Mangaung and Buffalo City, where the bulk of residents live and where the affluent and successful businesses are centred.

Mashaba warns that the deterioration of the asset base – in terms of lack of maintenance of the existing infrastructure – is significant and serious and the maintenance

requirements for the metropolitan areas are growing year by year.

His views are borne out by the ever-increasing deterioration of roads, services, electricity supplies and water and sanitation in the major metropolitan areas. Added to this is the fact that rampaging mobs, dissatisfied with a lack of service delivery, are actively damaging the fragile infrastructure that does exist.

Illegal electricity connections, cable theft, burning tyres on roads and trashing of streets and communities are all symptomatic of the growing levels of frustration and dissatisfaction among residents who have high expectations that are dashed when government fails to deliver.

However, when the figures are closely examined, the disbursements show a picture that is surprising. For instance, disbursements by the DBSA were broken down as follows:

- Social infrastructure – 2%
- Sanitation – 4%
- Roads and drainage – 6%
- Water – 8%
- Education – 11%
- Transportation – 33%
- Energy – 36%

Thus the spending in crucial areas such as water, sanitation, education and roads was significantly lower than required while that earmarked for the transportation and energy sectors was predictably high as the major projects such as Medupi and Kusile are transformed into a reality.

The disbursements by the type of client were also intriguing:

- Metropolitan municipalities – 17,6%
- Secondary municipalities – 29,1%
- Under-resourced municipalities – 7,5%
- Education – 11,3%

## CORONA IN TRANSMISSION SYSTEMS

Theory, Design and Performance



Now available in the Eskom Power Series

# Volume 7

## Corona in Transmission Systems: Theory, Design and Performance

This is a comprehensive reference book on the corona design and performance considerations of high voltage ac, dc and hybrid ac/dc transmission lines. While corona losses may have an impact on the economic choice of conductors, radio interference and audible noise are the principal environmental consequences of corona on ac and dc line conductors. In some cases the radio interference, because of its influence on power line carrier performance, can be an additional factor. The corona-generated space charge environment is also an important design consideration in the case of dc and hybrid ac/dc transmission lines.

Treatment of the physical, analytical and experimental aspects of corona performance of ac and dc transmission lines is presented in this book. Example calculations are included throughout in order to provide a better understanding of the analytical techniques presented and of the orders of magnitudes involved. Explanatory photographs, diagrams, tables and graphs complement the text. Development of criteria and methodologies for the corona design of ac and dc transmission lines and their application to typical cases are also described.

This book is a valuable resource for transmission line design engineers and for those involved in carrying out corona research studies as well as for developing university undergraduate and graduate courses.

For further information contact: Lauren Baird: +27 11 629 5452 or Sanjeev Bisnath: +27 11 629 5702



**Volume 1**  
The Planning, Design and Construction of Overhead Power Lines



**Volume 2**  
The Fundamentals and Practice of Overhead Line Maintenance



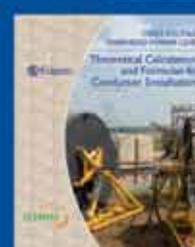
**Volume 3**  
The Practical Guide to Outdoor High Voltage Insulators



**Volume 4**  
Inductive Instrument Transformers and Protective Applications



**Volume 5**  
Theory, Design, Maintenance and Life Management of Power Transformers



**Volume 6**  
High Voltage Overhead Power Lines: Theoretical Calculations and Formulae of Conductor Installations



**Volume 6 Part 2**  
High Voltage Overhead Power Lines: Theoretical Calculations and Formulae of Conductor Installations



- Non-municipal clients – 34,5%

By the end of its 2010/11 financial year the DBSA's operations in South Africa had a loan book of R22-billion. New projects in the pipeline amounted to R12,1-billion but at the end of the year projects in implementation were worth R4,9-billion while those in various stages of preparation and appraisal were valued at R8,4-billion.

Similarly it says that while approvals were at R11,3-billion, disbursements amounted to just R3,1-billion because most of the approved projects have long preparation and lead times.

The report says that the reason for this is the slow progress made in converting approvals for tenders to commitments. It says that overall about 12 800 jobs were created and that basic services were extended to about 135 000 people throughout the country.

These figures are way short of the actual infrastructure needs of about R2-trillion and hopelessly miniscule in terms of the R3,3-trillion that is needed to put South Africa on a stable footing for the next 20 years.

What seems to be clear from the figures is that while the DBSA's South African operations have dedicated funds to a number of major and important projects, these projects are being delayed by the tedious and cumbersome tendering and approvals processes that result in extremely long lead times and even longer implementation times.

So instead of injecting significant amounts of cash into the economy – at a time when government expenditure is urgently needed for myriad reasons – the processes are being delayed by the government's own approvals processes as demanded by DBSA.

To complicate matters, the conversion of approvals into implementation of projects by national, provincial and local government departments as well as the respective parastatals and utility companies that have been granted loans in principle from the DBSA take an inordinately long time.

Mashaba admits that there are still huge

backlogs in the delivery of basic infrastructure with at least five million people not having access to basic services. He says about half the backlogs are in poorly resourced areas where about a third of South Africa's population resides.

However, the expenditure by DBSA remains focused in major metropolitan areas and the smaller municipalities (46,7%) or on those projects that involve non-municipal clients (34,5%) adding up to a total of 81,2% of its expenditure.

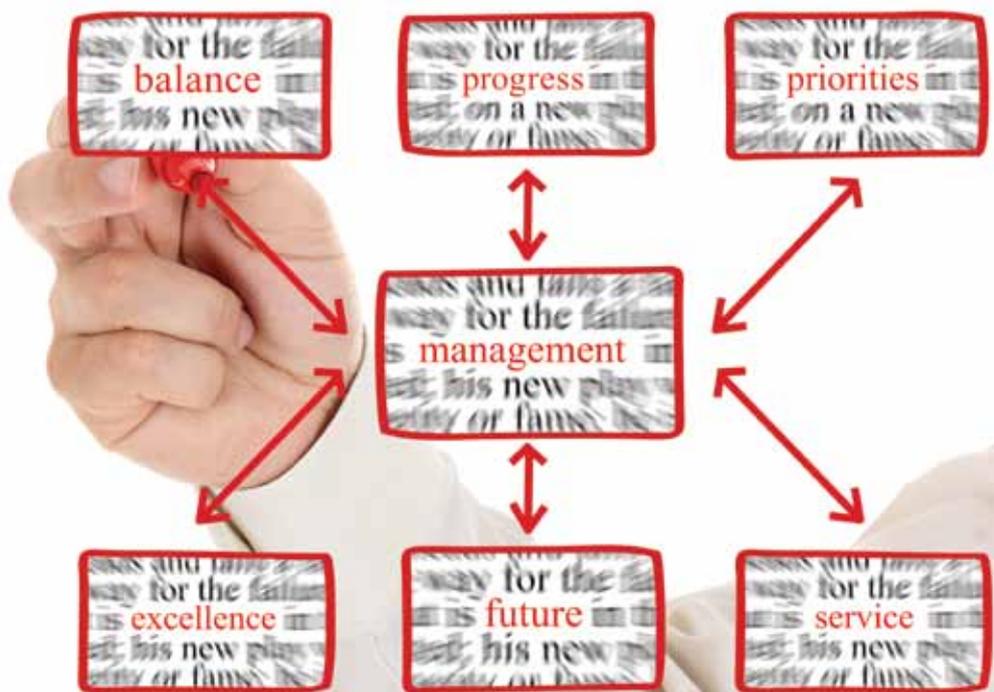
Mashaba says that in urban areas, housing is the most urgent requirement while in the rural areas all services are equally under-supplied.

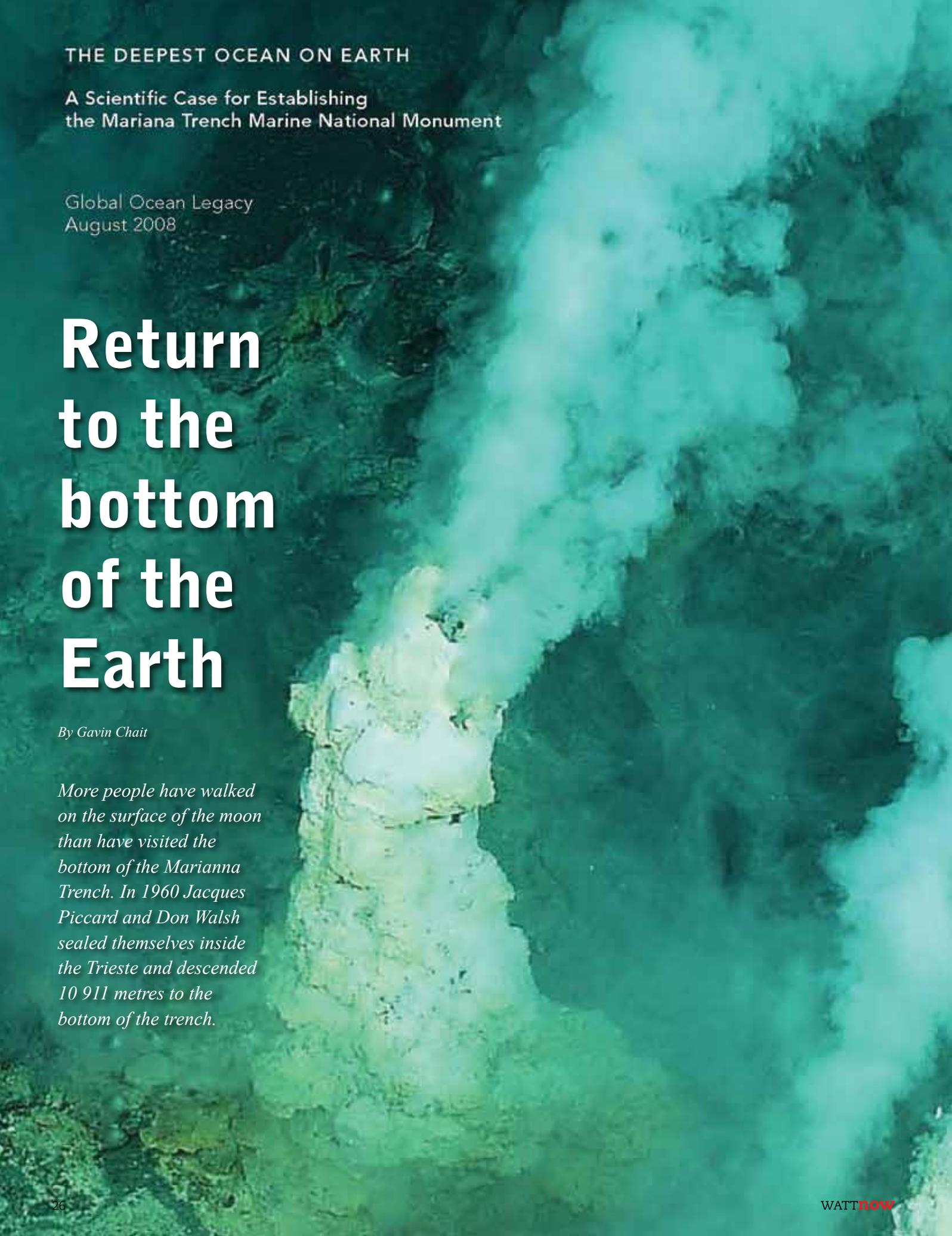
Mashaba concedes that the problems are exacerbated by the fact that the main implementers of national government initiatives are the provincial government departments and municipalities and these have a lack of sufficient institutional and financial capacity to reduce the backlogs.

South Africa clearly has failed to maintain the infrastructure that it built up over decades of investment – for reasons that may range from a lack of skills and training to rampant fraud and corruption – and is now going to have to find a way to pay for this in future. Exactly how the funding shortfalls will be achieved is unclear at this stage but the warning signs – of higher taxation and additional user-pays systems – seem to be there.

Without infrastructure, South Africa cannot remain competitive and yet the costs of repairing and maintaining infrastructure seem to show that taxation levels will rise, pushing up manufacturing and distribution costs and making South Africa an even less competitive manufacturing and distribution hub.

South Africa, it seems, is stuck between a rock and a hard place, and neither one of these can bend.





THE DEEPEST OCEAN ON EARTH

A Scientific Case for Establishing  
the Mariana Trench Marine National Monument

Global Ocean Legacy  
August 2008

# Return to the bottom of the Earth

*By Gavin Chait*

*More people have walked on the surface of the moon than have visited the bottom of the Mariana Trench. In 1960 Jacques Piccard and Don Walsh sealed themselves inside the Trieste and descended 10 911 metres to the bottom of the trench.*

Descending at a rate of 0.9 metres per second, it took four hours 48 minutes to reach the bottom. At 9 000 metres one of the external Plexiglas window panes cracked from the cold. There wasn't much they could do in the craft once they hit bottom. They believed they saw a small flat fish that looked a bit like a sole, but is thought to have been a sea cucumber, and then stared out at the murk which their descent had thrown up.

After 20 minutes, and with the cabin temperature dropping to 7 °C, they ascended. It took a brisker three hours 15 minutes to return to the surface.

Piccard and Walsh remained the only people to visit the Marianna Trench for 51 years. Now there is a race between three teams to see who can get back there first.

The Marianna Trench is 2 500 kilometres long with an average width of about 70 kilometres. Its deepest known maximum point is at Challenger Deep, near the Southern end, where it drops to 10.91 kilometres. That is two kilometres deeper than the height of Everest. The trench forms part of the ring of fire, a crest of volcanic islands in the Pacific Ocean, where the Pacific continental plate is subducted beneath the smaller Mariana Plate. As the pressure rises, minerals are forced to the surface along the plate and erupt as a series of volcanoes on the Mariana Islands.

The pressure is over one thousand times atmospheric pressure: 1,086 bar.

Any craft that makes it this far down is beyond the reach of any assistance. No one else will have the technology to come down and get you.

In 1936, Leslie Charteris published 'Saint Overboard' in which his eponymous hero, Simon Templar, is forced to pilot an experimental bathysphere to recover treasure from a sunken ship. Charteris was a keen treasure hunter and felt quite Jules Verne about his invention. In the 1963 reprint of the book he issued an apology about the archaic technology he had presented, such was the pace of

development over that 20-year period.

Jacques-Yves Cousteau invented his prototype Aqua-Lung in 1943 for his film *Epaves* (Shipwrecks). By 1951 his open-circuit scuba equipment was available for sale around the world.

All this made Charteris' vision of divers in bulky containment suites with thick air hoses pressurised from the surface being supplanted by mini-submersibles, all a bit obsolete. At the time, though, Charteris had been writing about a very real and cutting edge invention.

In 1929, William Beebe, an American naturalist hoping to survey the ocean floor around his research station in Bermuda, was joined by Otis Barton, an engineer interested in the deep ocean. Barton's solution to the high pressure environment was to develop a 2.5 centimetre thick cast-steel sphere about 1.5 metres in diameter. Three openings were left for viewing, although one was initially stoppered with a steel plug. The glass was made from fused quartz and was 7.6 cen-



William Beebe (left) and John T. Vann with Beebe's bathysphere, 1934.



timetres thick. Their survival would depend on a set of high-pressure oxygen cylinders with CO<sub>2</sub> and moisture being collected by soda lime and calcium chloride mounted to the walls.

General Electric provided a lamp to light up the gloom outside and Bell Laboratories provided a telephone system. Electric and telephone cables entered the sphere through a compression seal known as a stuffing box. The entire contraption weighed two and a quarter tons and had all the comfort of climbing into a washing machine and closing the door behind you.

Between 1930 and 1931 the men made a series of dives, testing their equipment – resolving issues with their umbilical cable tangling – and gaining in confidence. Beebe became the first person to notice that the ocean filters out the higher frequencies of light as one descends until only violet and blue remain.

In 1932, with funding from National Geographic, Beebe decided to install glass in the third window slot and mount a camera there. When the Bathysphere was hauled to the surface following the first unmanned testing of its new window, the craft was almost full of water.

Beebe realised that the water must be under incredible pressure and ordered the crew clear. He then began to loosen the bolts on the 180 kilogram door.

"Suddenly, without the slightest warning, the bolt was torn from our hands, and the mass of heavy metal shot across the deck like the shell from a gun.

The trajectory was almost straight, and the brass bolt hurtled into the steel winch thirty feet away across the deck and sheared a half-inch notch gouged out by the harder metal. This was followed by a solid cylinder of water, which slackened after a while into a cataract, pouring out the hole in the door, some air mingled with the water, looking like hot steam, instead of compressed air shooting through ice-cold water," wrote Beebe later.



Celebrating 25 years  
of business to business  
publishing excellence.

[www.crown-co.za](http://www.crown-co.za)



Beebe and Barton's Bathysphere went to a depth of 670 metres. That is only six per cent of the depth of the Challenger Deep.

Around the same time, in the early 1930s, Swiss physicists, inventors, explorers and all-round nutcase twins Auguste and Jean Piccard were experimenting with high-altitude ballooning. Auguste had designed a pressurised gondola that would allow him to safely ascend beneath a massive weather balloon.

The Piccards between them invented high-altitude balloons, frost-free glass and pyrotechnic actuators that went on to be used in the space programme.



Bathyscaphe Trieste Gondola Sphere.

This is the actual vessel as used by professor Auguste Piccard on his ascent into the stratosphere in 1932. It was his second ascent and he reached over 16km into the sky beating his previous height from the year before.

They also were the model for Herge's Professor Calculus in the *Tintin* series, as well as for Jean-Luc Picard in *Star Trek*.

Auguste's final altitude record was 23 000 metres. Shifting his attention to submersibles, Auguste began redesigning his gondola to withstand ocean pressure. However, there was another problem.

A submarine has a set of tanks that are flooded with water to descend and then emptied with compressed air to resurface. At the depth of the Marianna Trench this just won't work. Instead Auguste suspended his bathysphere, with its single window,

is sufficiently less dense than water to ensure that the craft would resurface, but sufficiently resistant to pressure that the containment ship wouldn't require additional strengthening.

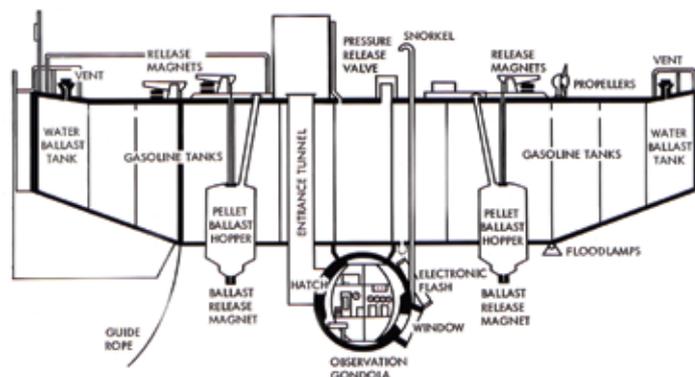
The craft was very much like a blimp with the 2.5 metre diameter and 3.5 cm thick steel gondola suspended beneath it.

Ballast consisted of four tons of iron filings suspended in containers within the floaters by a powerful electro-magnet. If anything went wrong and power was lost then the iron would automatically be released and the craft would ascend. Otherwise the crew could decide at any stage when to drop the ballast.

Jacques Piccard, Auguste's son, led the expedition. Since 1960 only two other missions have returned to the trench.

Kaikō, a remotely operated underwater vehicle (ROV) built by the Japan Agency for Marine-Earth Science and Technology, completed over 250 dives on the trench throughout the period 1995 to 2003. In May 2003, during Typhoon Chan-Hom, Kaikō was lost when its tethering cable was broken.

Nereus, a hybrid ROV capable of autonomous work as well, became the third craft to reach the Challenge Deep bottom in May 2009. A 20 kilometre long traditional communications tether is just too heavy and bulky to control.



The Bathyscaphe Trieste (as diagramed above) was essentially a balloon which Piccard referred to as a float.

beneath a large set of interlocked buoyancy tanks. The final version of his bathyscaphe (named for the ancient Greek words for deep ship), the *Trieste*, consisted of two water ballast tanks and eleven buoyancy tanks containing 120 000 litres of petrol. The liquid



The Woods Hole Oceanographic Institution wanted to develop a craft that would be lighter and more manoeuvrable.

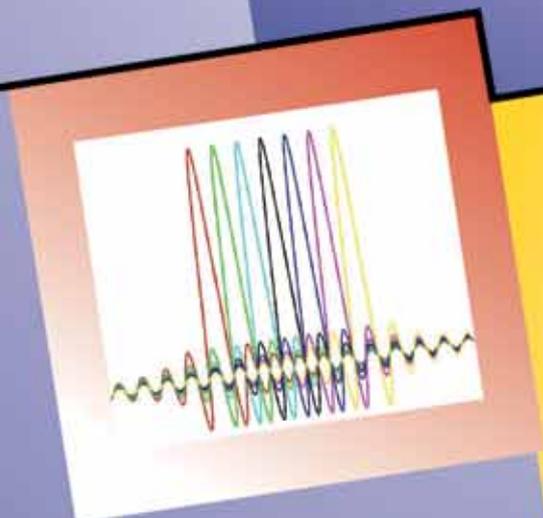
The umbilical is a hair-thick fibre-optic cable some 40 kilometres long. Buoyancy is



# POWER LINE COMMUNICATIONS: University of Johannesburg

## Our Research Interests

- Powerline Communications
- Digital Communications
- Coding Techniques
- Information Theory
- Video Communications
- Networks



## Our Research Partners

- University of Duisburg-Essen, Germany
- Technical University - Delft
- University of California (Davis)
- Walter Sisulu University
- North-West University
- University of Witwatersrand
- Chinese University of Hong Kong
- NRF, THRIP
- Protoclea Advanced Image Engineering
- Hysignal, Los Angeles

Telecommunications Research Group  
Electrical and Electronic Engineering Sciences  
Faculty of Engineering and the Built Environment  
University of Johannesburg  
P.O. Box 524  
Auckland Park  
2006

Phone: +27 (0)11 559 2147  
Fax: +27 (0)11 559 2357  
E-mail: [hcferreira@uj.ac.za](mailto:hcferreira@uj.ac.za)  
[pvanren@wsu.ac.za](mailto:pvanren@wsu.ac.za)  
[tgswart@postgrad.uj.ac.za](mailto:tgswart@postgrad.uj.ac.za)  
[ktouahada@postgrad.uj.ac.za](mailto:ktouahada@postgrad.uj.ac.za)



maintained by 800 9-centimetre diameter spherical ceramic pressure housings, and 2 000 lithium ion batteries power the device. It is also capable of contour tracking under its own control. Many of these technologies will be needed by the new manned teams.

The two most advanced teams are those headed by Richard Branson, of the Virgin Group, and James Cameron, creator of the smash-hit film *Avatar*.

Virgin Oceanic is likely to make it first and the 'race' between the teams is theoretical; no one is in a hurry to get killed. As William Beebe said of his first experiences in the *Bathysphere*, at that pressure you wouldn't drown "the first few drops of water would have shot through flesh and bone like steel bullets."

Virgin Oceanic was originally the vision of Branson's long-time aviation partner, Steve Fossett. When Fossett died in a plane crash in 2007, the craft and his massive multi-hull yacht, the *Cheyenne*, were bought by Graham Hawkes who then convinced Branson to continue with the project.

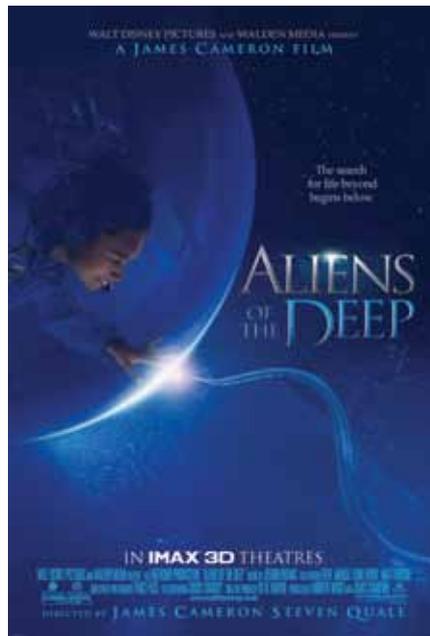
The Virgin Oceanic is a blocky winged craft designed not just to descend but also to fly around with an absolute operating time of 24 hours.



At the moment the craft can carry one crew-member and descend at a rate of 76 metres a minute meaning that a round trip can be done in about five hours. Hawkes and the pilot, Chris Welsh, are currently testing the vessel near Guam.

James Cameron first became interested in submersible technologies while filming 'Titanic' and used ROVs to explore both the

*Titanic* and *Bismarck* as research for the film. His intention is to film his experiences in high-definition and 3D. So far he has pressure-tested the cockpit and is assembling the craft in Australia with his designer, Ronnie Allum, who previously worked with him on his 2005 documentary 'Aliens of the Deep'.

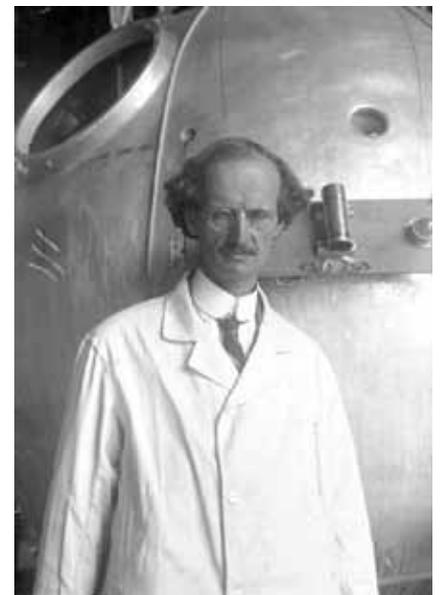


Perhaps the most ambitious of the three is Bruce Jones' *Triton 36 000*. He is the person pitching it as a race to support his ambition to create a three-person submersible featuring a massive spherical glass dome. His intention is to take paying passengers, descend at 150 metres per minute to get to the bottom in 75 minutes. He then plans to sell the craft as recreational vehicles for \$15 million each.



Rayotek Scientific is developing the 1.8 metre diameter glass sphere required for the *Triton* and it is clear that both companies see this as an opportunity to develop commercial products.

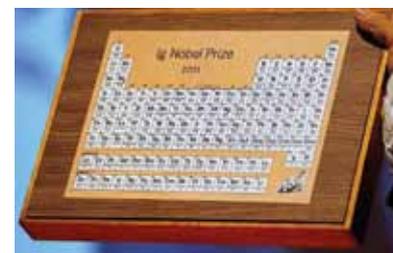
*"It is possible for man to descend into the sea depths using means created by him. The problem is to overcome physical obstacles by using physical principles,"* said Auguste Piccard in a Rolex commemorative article on the first descent. *"Everyone is in the habit of trusting a railway bridge. We trust the eternal laws of physics."*



Auguste Piccard.

Now new adventurers will trust those laws to keep them safe once more.

## Ig Nobel awards celebrate serious nonsense

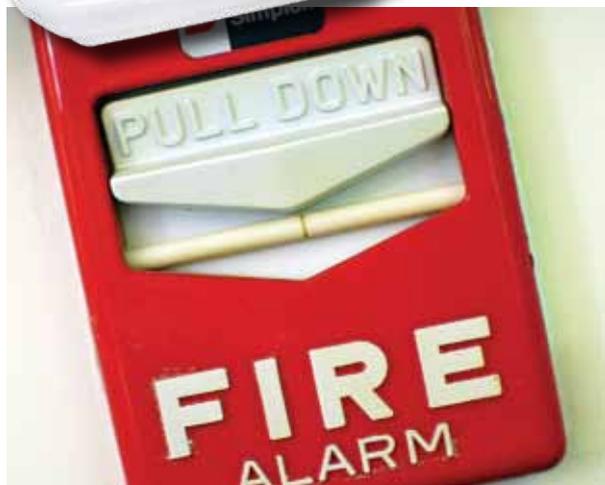


This year's Ig Nobel award for chemistry was awarded to a group of scientists who invented a fire alarm system that sprays a cloud of wasabi (Japanese horse-radish) at a sleeping person who is deaf. The fumes are so strong that they succeed in waking anyone, whether they are deaf or not.

The Ig Nobel Awards have been celebrated for the past 21 years and are a spoof of the real Nobel prizes that honour the achievements of great people around the world.

Some of the entries for the Ig Nobel awards make fascinating reading but the wasabi fire alarm was rated as one of the most ingenious inventions. The alarm costs ¥50 000 (R5 382) and was developed after scientists experimented using hundreds of different and really bad odours including rotten eggs to try and awaken deaf people when they were sleeping.

The active ingredient in wasabi is allylisothiocyanate, which acts as an irritant in anyone's nose. The irritation is sufficiently compelling to wake a person up. According to Makoto Imai of the Department of Psychiatry at Shiga University of Medical Science, air-diluted wasabi is the only substance that will always wake someone.



Another scientist, Mirjam Tuk of the University of Twente in the Netherlands won the Ig Nobel award for medicine. She investigated how well humans make decisions when they are faced with painful or stressful situations, such as when there is a powerful need to urinate.

She found that people who are better equipped to resist the urge to urinate are also better at controlling their impulses on cognitive tasks. For example, she found that her subjects were stronger-willed when it came to resisting a small reward promised for the next day in order to receive a bigger reward at some time in the future.

Tuk shared the award with Professor Peter Snyder, a neurologist at Brown University. They were working on a bigger study aimed at understanding self-control.

Karl Teigen of the University of Oslo won the Ig Nobel award for psychology for his work on why people sigh. He posed the question to a group of students to teach them about research methodology. In choosing the subject, he realised that there were no empirical studies on sighing. They found that the most common reason for sighing is linked to resignation rather than sadness or disappointment.

The Ig Nobel award for physiology went to Dr Anna Wilkinson of the University of Lincoln who spent six months training a red-footed tortoise to yawn on command.

She then used the trained tortoise to see if other tortoises had the urge to yawn when her tortoise yawned. Wilkinson says that the experiment proved that there is no contagious yawning among tortoises.

An Ig Nobel award for physics went to a French and Dutch research team who tried to establish why discus throwers get dizzy but hammer throwers do not.

Other awards included:

- Literature – John Perry of Stanford University for his Theory of Structured Procrastination, which among other things states: "To be a high achiever, always work on something important, using it as a way to avoid doing something that's even more important".
- Biology – Daryll Gwynne and David Rentz for discovering that certain kinds of beetles mate with certain kinds of Australian beer bottle.
- Mathematics – a long list of people who have all predicted that the world will end at a specific time. The awards celebrate the importance of teaching the world to be careful when making mathematical assumptions and calculations.
- Peace – Arturas Zuokas, the mayor of Vilnius, Lithuania, for demonstrating that the problem of illegally parked luxury cars can be solved by running over them in a tank.
- Public safety – John Senders of the University of Toronto in Canada for conducting a series of safety experiments on a major highway while a visor repeatedly flaps over the driver's face, blinding him.

Almost all the award winners attended the award ceremony in Boston and each one was given 60 seconds to make an acceptance speech. The awards were presented by real Nobel laureates.

## Sub-orbital flight test for SpaceShipTwo next year

SpaceShipTwo, the first prototype of a sub-orbital passenger craft, will undertake its first powered test flights next year and, if successful, will start offering tourists sub-orbital flights from Spaceport America in New Mexico.

Virgin Galactic chief executive, George Whitesides, says that full duration tests of the RocketMotorTwo engine have been completed. The engine has been developed by Sierra Nevada Corporation and uses hybrid liquid nitrous oxide and rubber fuel. It is the largest rocket motor of its type in the world.

The motor will be integrated with the SpaceShipTwo next year and then short duration tests will be done, firing the motor in bursts, before working up to complete sub-orbital flight tests towards the end of next year.

SpaceShipTwo is carried aloft by the WhiteKnightTwo carrier and when it reaches a maximum altitude of just over 15 000m it is released from the carrier. It then fires its rocket motor to carry it to a height of about 100 000m.

Each craft has a crew of two and can carry up to six people.

It is made of carbon composites and is about 18m long, with a diameter of 2,2m so that people can experience the feeling of weightlessness when they reach maximum altitude. Aerodynamic forces create its stability and control while in the atmosphere but once it moves

beyond that it follows a ballistic trajectory. Small thrusters drive the reaction control system, allowing the pilots to manoeuvre the vehicle while in space and provide tourists with different views of the Earth and outer space.

WhiteKnightTwo takes off with SpaceShipTwo hanging between two fuselages and carries it to launch altitude. It has a dihedral wing with a wingspan of almost 43m and is capable of flying in zero-G parabolas and making 6G turns.

It can be used as an in-flight trainer as it can duplicate SpaceShipTwo's approach flight path angle when it returns from sub-orbital flight.



## Rocket launched from converted oil rig

Sea Launch, a rocket company that operates from a converted oil rig in the middle of the Pacific, is back in business having emerged from bankruptcy protection last year. The company put up its first satellite payload last month.

The satellite, owned by Eutelsat, will beam television stations to the Middle East and North Africa. Sea Launch experienced a spectacular rocket failure in 2007 and this forced the company to restructure its finances as orders for payloads dried up and its debts continued to rise.

Now, Sea Launch's chief executive, Kjell Karlsen, says the company is back in operation and is in a much better position to compete with other companies that supply launch services. The company is now



owned by a Russian-led consortium headed by Energia Overseas. Its rig, which operates as the launch pad, and its command ship are located off Long Beach in California but when it is due to launch a payload into space, the rig is towed to the equator at 154 degrees West Longitude.

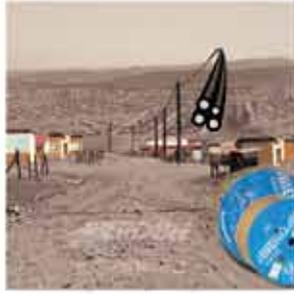
The equatorial launch location gives a rocket a boost from the Earth's rotation allowing it to lift heavier payloads into orbit. Sea Launch uses the Ukrainian-Russian Zenit-3SL vehicle, which generally has a good reliability record despite the 2007 catastrophe.

The rocket put Eutelsat's Atlantic Bird 7 spacecraft into orbit just 67 minutes after it blasted off from the oil-rig-cum-launchpad. Eutelsat says that Atlantic Bird 7 is much more modern and more powerful than any other of the company's satellites. It will provide high-definition channels to its customers.

Stations that are popular in the Middle East, including al-Jazeera and al-Arabiya will be switched to the new satellite once it has completed all its operational tests.

Atlantic Bird 7 was built by Astrium and weighs 4 600kg. Its geostationary orbit is 7 degrees West Longitude and it has an operational life of 15 years.

Up to 44 Ku-band transponders are connected to the broad high power footprint for North Africa and the Middle East while a second footprint covering North-West Africa, across the Maghreb countries down to the Gulf of Guinea, will be connected to the 12 Ku-band transponders designed for consumer broadcasting services.



# Aberdare, **cab**le you can trust

Aberdare Cables is a leading manufacturer of cables with a customer base including power supply authorities, railway and transport organisations, municipalities, and companies in industries such as petrochemical, mining, wholesale, industrial, construction and domestic building. The company offers a wide range of state of the art products with customer specific adaptation, design capabilities and full technical back-up service. This and their extensive project experience make them the supplier of choice for cable, related accessories and special cable projects.

181A Barbara Road, Elandsfontein, Gauteng P.O. Box 1679, Edenvale 1610, South Africa  
Tel +27 (0)11 396 8000 Fax +27 (0)11 396 8010 [www.aberdare.co.za](http://www.aberdare.co.za)



**ABERDARE**  
CABLES

Driven by Powertech 

## LOPES used to train the brain to use limbs again

A group of Dutch scientists has developed robotic legs that can be used to improve the mobility of stroke patients. The device is known as a Lower-extremity Powered ExoSkeleton, or LOPES, and works by training the body and mind of a patient to learn a natural step.



The machine is being tested on spinal injury patients who have regained some restricted movement in their legs and scientists hope to have a commercial version of LOPES available sometime within the next year.

Engineers at the University of Twente in Enschede have been working on the project for several years. The device is not mobile but works as a treadmill to train the muscles and the brain of the injured patient.

It can either do the

walking for the patient or it can be used to improve one or other leg. It can also detect when the patient is not communicating with the leg.

Dr Edwin van Asseldonk explains that, for instance, when a patient is not lifting a foot appropriately the device detects this and compares it with a reference pattern and then exerts a force or torque to assist the subject in lifting the foot correctly.

One of the test subjects, Petra Hes, suffered a stroke at the age of 17 and since then has been unable to correctly lift or flex her left foot properly because of a condition known as drop foot. More importantly, her body cannot remember how to do so.

The machine provides the necessary force that enables her to move her left leg and foot in the way it should move and, as the exercises are repeated the brain gradually learns, or remembers, how to move properly.

She says that the push she felt when the machine lifted her knee was what she had forgotten and once it repeated the exercises she learned how to move it correctly all over again.

Van Asseldonk says that by physically moving the patient's limbs, the machine helps to develop the necessary brain signals that are required to create proper movement. He says that for stroke survivors, it's important not only to get signals to the brain but to remind the brain how to send signals to the damaged limb.

Two private companies are co-operating with each other to build the LOPES device for commercial use. It will be tested at two rehabilitation centres in the Netherlands before being rolled out to other clinics around the country.

## At least 50 Goldilocks planets identified

European astronomers have discovered what they call a new Goldilocks planet that is 36 light-years from Earth and is circling its star at the right distance for liquid water to exist on the surface. The planet is a candidate to host life.

Known as HD 85512b, it is in the constellation of Vela and orbits its star at about a quarter of the distance the Earth circles the Sun. Its year lasts for just 58 days. However, its distance from the star indicates that it is in a habitable zone and observations show it has some signs of an atmosphere.

Astronomers have cautioned that it will take years of careful observation from telescopes that have yet to be built before they will be able to establish if the environment is suitable for life or, indeed, if life exists there.

The planet is now at the top of the list for potential Goldilocks candidates and is one of 50 new exoplanets – planets that orbit around a star – being observed by astronomers at the European Southern Observatory in Chile.

Researchers at the University of Geneva, led by Stephanie Udry and Michael Mayor have been searching for exoplanets for the past eight years. About 16 of these are so-called super-Earths with masses that are less than ten times that of the Earth.

The Geneva astronomers use a sensitive spectrograph known as Harps (High Accuracy Radial velocity Planet Searcher) to detect a wobble in the stars' motions as planets swing around them. The wobble reveals the mass of the exoplanet.

The star that the Vela planet circles is known as HD85512 or Gliese 370 – named after the German astronomer Wilhelm Gliese. The star is orange in colour and about two-thirds the size of the Sun with about an eighth of its luminosity. Astronomers say that the planet is potentially habitable if it has more than 50% cloud cover.

However, they cannot yet say if the Vela planet is composed of rock, steam, iron, diamonds or anything else as they do not yet have the equipment to establish this.



Artist's drawing (from 2007, before this announcement) of the planetary system of Gliese 581. Credit: ESO.

# Mentorship

The SAIEE is offering mentorship and advice to young engineers.

The offer comes at a time when our country is suffering a shortage of skills, and we believe that mentoring is an essential requirement in the training and development of the next generation of engineers.

If, as a member of SAIEE, you believe that you need a mentor you can request a mentorship service from the Institute.

The service will be of particular benefit to those young engineers working under the leadership of busy and pressurized engineers, who may not have the time to spend with the young engineers discussing and planning their career paths.

This service is particularly relevant to young engineers who are working in an environment devoid of engineers or with non technical managers. The young engineer may feel frustrated because he or she cannot benefit from the wisdom of an experienced engineer.

It will give a young engineer, the mentee, a chance to talk to a mentor, who will be his or her advisor, teacher and role model, away from the work environment. His or her mentor, matched to a similar profile, will understand the mentee's work and per-

sonal situation having been there him- or herself.

The mentee will be able to discuss problems and frustrations with his independent mentor, who would have no stake in the outcome, and who would be able to provide an unbiased opinion and advice. The mentee might not be able to do so with his superiors, particularly if he is unhappy, and is considering an alternative career.

The mentor and mentee could arrange to meet regularly, but not too often say a few times a year, when both should have enough time to listen properly to what the other has to say.

The mentor could recommend to the mentee what course of action to take without being too prescriptive while the final decision and the consequences remain with the mentee.

Among its more than 5000 members the SAIEE has many experienced engineers who are willing to act as mentors. They are spread across the country and include engineers who are experienced in steelworks, furnaces, rolling mills, mining, manufacturing, electrical generation, transmission and distribution through to light industrial, process control, instrumentation, telecommunication, robotics, automation, software development and engineering management of these sectors.

So if you feel that you would benefit by talking to a mentor, please contact Ansie Smith on the number below. She has a database to match the profiles of mentors and mentees.



## Prospective SAIEE Mentors

If you feel you have the time and interest to help mentees, please contact Craig Smith on [craigs@saiee.org.za](mailto:craigs@saiee.org.za) or 011 487 9042

In addition you gain CPD credits, for when you are required to re-register.

## Has the speed of light been surpassed?

The tests that appear to show that sub-atomic particles can travel at speeds faster than the speed of light are being scrutinised so that scientists from other universities and research laboratories can determine if the approach contains any mistakes.

A team of scientists at CERN, the world's largest physics laboratory, has shown that it may be possible for particles to travel faster than the speed of light, thought to be the ultimate speed limit in the Universe.

If they are right, then much of modern physics – as outlined by Albert Einstein's theory of special relativity – could come crashing down.

Thousands of experiments have been undertaken to measure if any sub-atomic particles can exceed the speed of light and so far none has. Now, scientist Antonio Ereditato of the Opera collaboration has opened up the research data that his team has collected to all scientists in an effort to find any possible mistakes in their calculations.

For the experiment, CERN scientists prepared a beam of muon neutrinos and then sent them through the Earth to an underground laboratory at Gran Sasso in Italy to see how many show up as tau neutrinos.

In the course of their experiments, scientists found that the particles showed up 60 billionths of a second earlier than they would have done if they had been travelling at the speed of light. The fractional change of 20-parts-in-a-million occurs consistently.

The team then measured the travel times of neutrino bunches 16 000 times and reached the same level of statistical significance that, in scientific circles, would count as a formal discovery. However, the team is aware that "systematic errors" could make an incorrect finding look as though it were fact and for this reason decided to

publish their findings and measurements.

Ereditato says the results are "crazy" and need to be understood before any claims are made that the speed of light has been surpassed.

Meanwhile a spokesman for the MINOS neutrino experiment said that there are three potential sources of error in timing measurements. These are distance errors, time-of-flight errors and errors in the timing of neutrino production.

Neutrinos are produced using a proton beam from one of the accelerators that feeds them into the Large Hadron Collider. They hit a fixed target and produce unstable particles that decay, releasing a neutrino.

The protons move close to, but not at, the speed of light; as do the unstable pions.

To complicate matters, the timing of the protons and the structure of the two bunches used in these experiments was not even. So the researchers created a profile of the proton bunch.

They compensated for the timing of the kicker magnet that pushes the bunch out of the accelerator and then added detectors that registered them passing the hardware to get a clearer sense of their timing.

So far the OPERA team does not see any errors in its measurements and it cannot account for the 60 nanosecond gap between the neutrinos' arrival and the speed of light.

The paper has listed dozens of potential errors in its calculations, but it still comes to the same conclusion that its findings are statistically relevant. Now other scientists will check to confirm the findings and only then make the claim that the speed of light has been surpassed.

## Infected – a bandage with some gel can tell you

Scientists at Sheffield University have developed a special bandage that contains a gel which clings to the molecules that bind to bacteria and then activate a fluorescent dye to indicate an infection. The dressing emits a pinkish glow under ultraviolet light when harmful levels of bacteria are present in the wound.

The scientists hope the new bandage will help doctors to successfully heal troublesome wounds like ulcers. Army medics will also use it to identify soldiers who have infected injuries from the battlefield.

Professor Sheila MacNeil, one of the researchers at Sheffield says that knowing when a wound is infected can help it to heal quickly. The first tests have been successfully conducted using the bandage but it will take another two to three years before the clinical trials are held.

According to MacNeil, the gel can help to get rid of up to 80% of the germs that often accompany a battlefield injury.

Using current techniques it can take several days to determine if a wound has been infected with bacteria as a swab must be taken and then identified under laboratory conditions. Bacteria, which are identified by the gel, include those that cause legionella, salmonella, E.coli, MRSA, C difficile, meningitis and peritonitis.

MacNeil says the use of the gels will help doctors and nurses make rapid and informed decisions about wound management and reduce the over-use of antibiotics. When contained in a gel and applied to a wound, the level of fluorescence detected will alert clinicians to the severity of the infection. MacNeil says that polymers are irreversibly attached to fragments of antibiotics, which bind to either gram negative or gram positive bacteria, both of which cause serious infections.

She says the polymers incorporate the fluorescent dye and are engineered to recognise and attach to bacteria, collapsing around them as they do so. It is the change in polymer shape that generates a fluorescent signal that can be detected using a hand-held ultraviolet light.

MacNeil says the research has demonstrated that the polymer PNIPAM, modified with vancomycin and containing ethidium bromide shows a clear fluorescent signal when it encounters gram-negative bacteria. Other polymers are shown to respond to *S. aureus*, a gram-positive bacterium.



The polymers activate a pink fluorescent dye when they come into contact with bacteria.



A one-axis tracking system that tracks the sun from east to west through the day gives a 22% gain over flat mounted systems.

# ABB's PV and CSP solar solutions

*Peter Middleton visits ABB Power Generation to find out about the company's solar ambitions in South Africa.*

On September 19, 2011, ABB announced that it would construct two pilot solar photovoltaic (PV) power plants for Eskom. The plants, to be located on greenfield sites adjacent to the coal-fired power stations at Lethabo in the Free State and Kendal in Mpumalanga, will both require 1,0Ha of land and will be the first of their kind to be built in the country.

At Kendal, ABB will provide a fixed tilt solar PV power plant with a station capacity of 620kW and production potential of 11 445 398kWh a year and, at Lethabo, the installation will comprise a single-axis tracking solar PV power plant with a peaking capacity of 575kW and production potential of 12 491 479kWh a year.

The PV plants, which are not connected in any way to the Department of Energy's recently floated renewables procurement programme (currently being labelled the REBID process), will be designed to operate independently to produce electrical power for use by the existing power stations. The fast track projects are scheduled to be

completed by November 2011, just prior to COP 17. "ABB has an extensive offering of products, systems and service solutions for the solar sector and has successfully executed a significant number of turnkey PV and CSP projects around the world," says Goetz-Dietrich Wolff, local business unit manager for power generation at ABB. "We have been the full EPC developer of more than 45 PV plants and responsible for connecting 91,4MWp to grids around the world in 2008/2009 and 78,1MWp in 2010. Currently, we have 31 PV plants under construction that total in excess of 210MWp," he says.

In addition: more than 100 PV plants around the world use ABB products; 1 167MWp are under negotiation; and US\$5,46-billion of project work has been quoted.

On the CSP side, ABB recently invested in Novatec Solar, a leading provider of linear Fresnel CSP technology, which uses flat mirrors to concentrate the sun's energy onto a linear receiver to produce steam. Globally

the company can lay claim to involvement in more than 25 CSP plants contributing 10MW of grid connections, and a further 575MW of CSP are under construction across four countries, Spain, Egypt, USA and Algeria.

The company has developed a standard modular concept for all PV technologies and for all markets – 'one partner, one solution'. Each part of the solution, solar PV panels, trackers, inverters, transformers, control system, etc., is delivered in pre-tested, containerised 1,25MW modules for scalability, cost efficiency and rapid installation. "Whether the plant has a capacity of 1,25MW or 100MW, the modules are easy to integrate and the solution is repeatable at any site and in any country," Wolff points out.

"The two Eskom projects are small pilot projects for COP 17, but bigger projects will launch once the results of the REBID programme are announced," he adds. "We expect several PV proposals to be submitted in the first round of bidding, which closes on 4 November. The bidders must have a firm

EIA in place prior to bidding, though, and my feeling is that only around 400MW will meet this requirement."

Regarding the tariffs that are likely to emerge for PV as a result of the REBID process, Wolff predicts that since the maximum allowable is set at R2,85, the initial bids are likely to be close to that, but could drop slightly in the future.

He believes that the DoE's full PV allocation of 1 450MW will be allocated and installed very quickly; possibly within the first two or three rounds of the bidding process. Round two is likely, therefore, to be very competitive.

The CSP allocation, in spite of the fact that 200MW has been allocated, is expected to be a little slower. "For CSP, the DoE requires a full year of measurements from the chosen site. For PV, they accept data from an irradiation and temperature database, like MeteoNorm or PVGIS, for example," says Wolff. The result is that few people are ready to meet all the CSP bidding requirements. Eskom is likely to put out a separate request for tenders for its 100MW CSP plant in Upington towards the end of next year, and if ABB is chosen, that plant will be of the linear Fresnel type.

Back to PV systems, Wolff describes the basic features of ABB's modular design. "We connect a series of panels onto one string and then couple several strings in parallel onto a single inverter. Our normal plants, i.e. those in the MW range, use two 600kW inverters per module and these connect to a single 1,25MW step-up transformer, i.e. we connect each module at 22kV to the grid."

The string of series panels raises the input voltage to that required by the inverter and parallel strings raise the input current to the optimum required. "If, for example, we wish to use 230Wp panels that produce 29,5V per panel at 7,8A, and the inverter is rated at 500kW and requires an input voltage of between 450 and 750V, then we would string 21 panels in series to give an input voltage of  $21 \times 29,5V = 619,5V$ . To get

the required current we would string 104 parallels together to get an input current of  $104 \times 7,8A = 811,2A$ ," Wolff calculates.

"The efficiency of each panel differs," he says, "and if you mix low and high efficiency panels in a string, the efficiency of the entire string reverts to that of the worst performing panel. You need to match the efficiencies of each panel in each string."

For both of the Eskom showcase projects, high efficiency monocrystalline PV panels have been chosen. Though the most expensive, they offer the best possible efficiency of 19,5%. For large scale PV plants, efficiency is the key differentiator, as fewer panels, structures, tracking systems, land and civils are required to achieve the target power output. Current panel efficiencies for monocrystalline, polycrystalline and thin film solar panels are 20%, 15% and 8% respectively. The choice of which to use on any project comes down to the specific cost per kWh of energy produced. In South Africa, where irradiation levels are very good

– about double the levels of Germany and 35% better than Spain – but temperature is not that hot, monocrystalline and polycrystalline panels are the most cost effective. Thin film technology comes into its own when ambient temperatures are very hot.

"Developers judge us by our net price per watt-peak (Wp)," Wolff says. "And Wp is not the maximum power output. It is a measure of the nominal power output of a panel tested by irradiating the panel with  $1\ 000W/m^2$  of light power and measuring the peak power produced while varying the resistive load on the module between open and closed circuit."

For long term success on a large-scale PV plant, losses must be minimised and efficiencies optimised at every stage.

The Eskom systems, essentially, will be the same except for the tracking system. "Fixed tilt solar systems (e.g. Kendal) have fixed land requirements of about 2,0Ha per MWp. They are also associated with easy and fast installation – a 1,0MW plant can



ABB has been the full EPC developer of more than 45 PV plants and is currently involved in 31 new plants currently under construction.

# Earth Wire Monitor – EWM550

Profit and production are the key to your success.

However, if these are to be achieved by compromising on safety, then best you reconsider your business model.

The EWM550 is a unique device offering you increased peace of mind in the most hostile of operating environments.

It works with the electrical supply system to monitor and alert you to a deterioration of the earthing system allowing you to react before your production is affected – but protecting your plant and personnel in the case of a dangerous condition developing.



## Features

- ▶ Continuous monitoring of earth bond integrity.
- ▶ Connects to 400/525V 3-phase system.
- ▶ For safety the maximum energy available at the local earth is 380/525V limited to 0.3 Joule / pulse.
- ▶ Three different trip times and levels available for discrimination.
- ▶ Able to withstand failure of one phase or 50% supply voltage.
- ▶ LED indication for trip condition, also when power is off.
- ▶ Totally solid state, shock-proof: no moving parts.

be installed in around five days once civil works and land preparation have been finished," claims Wolff. Hence ABB's confidence in its ability to install a working plant before November this year.

Optimising the tilt angle of a fixed solar PV plant can give an efficiency improvement of 7 to 14% over a flat panel installation. A single-axis tracking system designed to track the sun from east to west through the day, gives a 22% gain over a flat mounted system. For example, the Lethabo system, which is 45kWp smaller than the Kendal system, will produce about 1,0GWh/year more energy because of tracking. The down side, however, is that tracking systems need nearly twice as much land to avoid shadows and increased complexity and cost is associated with the tracking motors and mechanism. A two axis tracker, which aligns the panels to suit the season and tracks the sun through the day, can give a 35% gain, but the cost of the more complex mechanism usually outweighs the generation gain.

Inverter efficiency also matters. While it is easy to achieve high efficiency when operating at near to an inverter's rated load, when the sun is low in the early morning and late evening, the input power might be below 20% of the full rated power, causing additional losses. To compensate, ABB interconnects strings of panels across several inverters and then switches them via a self-learning neural network. "When the total power is down, we switch as much power as possible to a single inverter and shut down inverters that are not needed. This keeps the efficiency of the working inverters high and avoids losses in those that are switched off. The neural network allows real values to progressively maximise the output," Wolff explains. This allows generation earlier in the morning, later at night and reduces the effects when light intensity is low, on cloudy days, for example.

Also contributing to efficiency optimisation is automation and the control and supervisory systems. As well as solar tracking, switching and performance maximisation functions controlled by the supervisory system, Wolff lifts out troubleshooting and remote monitoring as key features of the

company's modular PV system design. "We monitor the output of every string and every critical component of the plant. Automatic reports are generated and email and SMS notifications are sent as soon as a problem occurs. The result is an extensible and scalable solution for any plant size that offers 'dispatchability' and flexible production based on requests by grid operators," he says.

Apart from the 'message of intent' associated with the two Eskom PV plants, the power generated will be directly used for local consumption at the two power stations: for feed water pumps and other necessary services. "By dropping the Auxiliary load used by the plants, the power stations will be able to export more of the power they produce from coal. There is, therefore, a cost pay-back and tangible reductions in carbon emissions," adds Wolff.

On the CSP side, a similar supplementary solution is being mooted. ABB is proposing to use its linear Fresnel technology to create steam to feed into coal fired boilers, also to reduce the stations' dependence on coal.

In the short term, though, Wolff sees exciting times for ABB's PV technology. "We know of several REBID projects of 5 to 10MW, which, because they require less than 20Ha of land, are associated with simpler EIAs. But for economics of scale reasons the bigger the more competitive," he adds.

"We already have a market share in Europe of around 10% and are targeting a higher share from the bids currently on the table in South Africa," he concludes.



The 3,6MWp Sapeu fixed tilt PV installation installed in Sicily, Italy as a turnkey project by ABB in consortium with the panel manufacturer.



Novatec Solar's Puerto Errado 2 Thermosolar Power Plant in Spain, a 30MW linear Fresnel CSP plant due for completion 2012.

## Siemens pulls out of nuclear energy industry

Siemens has announced that it plans to quit the nuclear energy industry in response to the disaster at the Fukushima plant earlier this year. The announcement comes at a time when the German government has said that it will close down all nuclear plants in the country over the next few years.

Siemens chief executive, Peter Loescher, says that the company is positioning itself with German society and its political leaders who want a complete withdrawal from the nuclear industry.

The long-planned joint venture with Russian nuclear firm Rosatom has also been cancelled. Just two years ago Siemens announced that it would work with the company to build up to 400 nuclear plants by 2030.

Loescher says that the company will continue to make steam turbines and other components that are used in the nuclear sector and will look for other projects with Russian

partners in areas such as renewable energy.

He says that Germany's shift towards renewable energies is the "project of the century", adding that the country is on track to generate about 35% of its energy using natural power sources by 2020.

Meanwhile Rosatom says that it is not concerned about Siemens opting out of the joint venture. The company says that the joint venture with Siemens would have been worth as much as \$1,5-trillion but says that



it will now seek new partners to work with it on providing the nuclear energy that is needed throughout the world.

According to Rosatom's chief executive, Sergei Kinyenko, his company and Siemens will continue to co-operate in many other fields, including radiation medicine.

He says the partnership with Siemens will benefit the two companies in many other fields and that neither company would "lose anything" in the cancellation of the nuclear energy joint venture.

He says that uranium mining, uranium enrichment, fuel manufacturing, power generation and scientific research remain open for future joint ventures with Siemens.

China has announced plans to buy two nuclear reactors from Rosatom while the Russian company has also signed deals with Britain's Rolls Royce to co-operate on future nuclear energy projects.

## Bacteria used to make 'limitless quantities' of electricity

A group of American researchers has shown how fuel cells fuelled by bacteria can produce seemingly limitless supplies of hydrogen. Until now fuel cells needed a small amount of electricity to power the process.

The problem is that at the moment the current cost of operating the new technology is too high to make it commercially viable. The findings have been published in the Proceedings of the National Academy of Sciences.

Co-author of the paper, Bruce Logan, says the bacteria they use occur naturally in the environment but release electrons outside of the cell and so produce electricity as they break down organic matter.

He says it is possible to use these microbes, inside a microbial fuel cell, to generate electrical power and to use the device to make hydrogen gas. Logan says the real breakthrough is that it is no longer necessary to use an electrical power source to provide energy to the system and get the technology going.

Instead, by adding some fresh water, some salt water and some membranes, the electrical potential that these unlock can provide

power. The microbial electrolysis cells used to make hydrogen use reverse electro dialysis, the term referring to the energy gathered from the difference in salinity between fresh and salt water. Logan says that, in practice, the reverse electro dialysis system would use alternating stacks of membranes to harvest the energy because the movement of charged atoms from saltwater to freshwater creates a small voltage that can be used.

He says that while desalination normally consumes electricity, with reverse electro dialysis technology, it's possible to produce electricity instead. He concedes that the technology is in its infancy but points out that, like solar energy, it will get cheaper in future.

The next step for the research team is to develop larger-scale cells and use these to better evaluate the costs of using the technology.

Furthermore, while hydrogen is an efficient energy carrier, its costs are high and it often produces the same level of greenhouse gases as fossil fuels. A working model of the microbial fuel cells is currently on display at London's Science Museum.



An example of a microbial fuel cell has gone on display at London's Science Museum.



Naturally occurring bacteria are able to produce electricity as they break down organic matter.

## New power plant for Mozambique, gas fields for Tanzania

Jindal Steel has confirmed that it will build a 2640MW coal-fired power station in Tete, where extensive coal reserves wait to be exploited. The plant will cost about \$3-billion and is expected to start operating by 2015.

The electricity will be used domestically and sold to neighbouring countries as Mozambique is already supplying power to Zimbabwe and South Africa, two countries that are struggling to meet their growing demands.

Tete has attracted foreign investment because of the coalfields and both Vale and Rio Tinto are developing coal mines there after the fields were abandoned during Mozambique's civil war that ran from 1977 to 1992.

The country is also developing a 1 500MW hydropower project with Brazilian partners, Camargo Correa, the Mozambique investment company, Insitac Group and state electricity firm EDM.

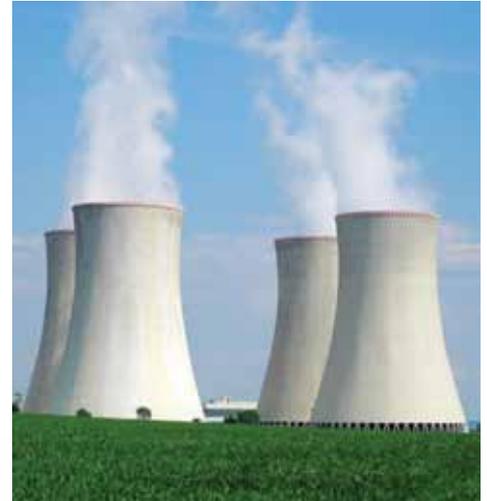
Meanwhile, Tanzania has confirmed that its natural gas reserves are now estimated

at 10-trillion cubic feet (tcf), higher than the original estimate of 7,5 tcf following further discoveries of gas fields in the offshore regions.

Tanzania has confirmed gas resources in seven of the offshore fields. They are all sited in deep waters off the country's coastline. Two of the natural gas fields are already supplying gas to the country's capital of Dar es Salaam where it is used to produce electricity and as an energy source for certain industries.

The country is looking for a \$1-billion loan from China to build a natural gas pipeline from Mtwara in the southern part of the country to Dar es Salaam, as demand for energy in the capital rises sharply.

Tanzania began exploring for natural gas in the 1950s and has exploitable reserves in West SongoSongo, Mnazi Bay and Mkuranga. There are about 15 exploration companies involved in the hunt for natural gas. There have been other major gas deposits found in Uganda and Mozambique.



## Blackout shuts-off power to five million people

A huge blackout that was allegedly caused by human failure left about five million people in parts of California, Arizona and Mexico without power. The outage was caused by an employee who carried out a procedure at a substation in Arizona, which knocked out the electricity supply.

The San Diego International Airport had to cancel all outbound flights and traffic in the city came to a standstill because all the traffic lights stopped working. At least 70 people had to be rescued from elevators in the city by the fire department.

San Diego Gas and Electric's president, Mike Niggli says that it was a major failure, which caused total disruption in the city – something he says that has never happened before.

Police in California reported that while there were some traffic jams, the city functioned smoothly and all hospitals switched to their own back-up power systems.

The procedure in Arizona first caused the failure of the high-power line carrying electricity to southern California and this caused a domino-effect across the whole of the south-west region of the United States, spreading to Mexico.

The power failure in Arizona caused a blockage at California's San Onofre nuclear plant, a second major source of power to San Diego according to Niggli.

All of the company's 1,4-million customers in the city were without power. Moreover, the blackouts also affected about 3,5-million people in Baja, California, while about 50 000 people of Yuma in Arizona were also without power.

The power outage only lasted for a few hours before the respective power companies began restoring power to residents and it took just over 24 hours to get the power fully restored to all customers who were urged to conserve energy during the disruption.

Just two weeks after this blackout, another major blackout hit Mexico City, forcing the airport to close after two power generators stopped operating. Then, a short circuit in the airport's six generators meant that they could not kick in as the cable lines burned, leaving the airport in darkness.

The outage affected at least 237 flights and lasted for more than 12 hours. The cause of the outage is not known, but officials are investigating problems with mains supply and back-up generators.

## 10-million prepayment meters in SA and more coming

Prepayment meters are gradually gaining acceptance in South Africa according to Energy Minister, Dipuo Peters, who says that access to electricity is such that 80% of the population can now use electrical power in their homes.

She says that prepayment meters represent a critical part of the plan to provide universal access to electricity for all South African residents. Originally, the prepayment meters were seen as a mechanism that could be used to force people to pay for the electricity they used.

Peters says that Eskom has been a pioneer of the use of pre-paid meters in Africa, where few countries have opted to use the system to get people to pay. Eskom was the first utility in the world to start a large-scale roll-out of

prepayment meters on a national basis.

The utility says that today there are 10-million of these meters installed in homes around the country and confirms that other emerging markets are now turning to Eskom for guidance, using their knowledge and expertise to guide plans for the installation of prepayment meters in other countries in Africa.

In South Africa, qualifying households get a free basic allocation of electricity equivalent to 50kWh a month and municipalities are given grants that can be used to provide tokens to indigent people on a monthly basis.

The installation of prepayment meters started in 1988 but it was only in 1994 that a mass rollout of the system began as part of the new independently-elected government's

Reconstruction and Development plan. Since then about 300 000 prepayment meters have been installed annually. About four million of the 10-million prepayment meters are managed by Eskom itself while the others are controlled by municipalities.



## Parts of Joburg to be powered by rubbish

Rubbish at Johannesburg's landfill dumps is being transformed into electricity and could soon be providing power to

about 12 000 homes around the city through a pilot project that is being run by the City of Joburg's infrastructure and services department.

The first power from a landfill site started three months ago when the Robinson Deep processing plant came on line. The plant is generating electricity but is not yet complete.

The Marie Louise, Robinson Deep, Ennedale, Linbro Park and Goudkoppies landfill sites will all be converted to renewable energy by June next year and will produce about 19MW of power, enough to provide electricity to about 12 000 homes.

The project's cost is estimated at R200-million and is being undertaken by Ener-G Systems. Most of the gas from the landfill sites is produced by bacterial decomposition of the materials and occurs when organic waste is broken down by bacteria that are naturally present in the waste.

Organic waste includes food, garden waste, street sweepings, textiles, wood and paper products. As the organic matter decomposes it produces the biogas and if this

is not managed correctly, it migrates into the atmosphere as methane, which is 21 times more harmful to the environment than carbon dioxide.

The system used to create electricity works by trapping the methane and burning it to generate heat and make electricity. Perforated pipes are installed into the landfill sites and the gas passes into the system of pipes that lead to a chimney where it is burned.

The second phase of the project is scheduled to start next year when the generators required to make electricity are installed. The generators will be connected to the city's grid to use the additional electricity that is generated.

The Infrastructure Department's Palesa Mathibeli says that the council is negotiating an independent power producer agreement with the Department of Energy. He says the power will be sustainable for at least the next 15 to 20 years.

Ener-G was appointed in 2007 to plan, design and implement the system on behalf of the city.



## What is ‘Set Top Box Control’ and why should you care?

by Gerhard Petrick

South Africa is getting ready to change from Analogue Television to Digital Terrestrial Television (DTT) which will deliver more channels at better quality and will allow the release of some broadcast spectrum for other services such as rural broadband data delivery.

DTT transmitter networks are currently being deployed across South Africa and trial transmissions are already operational in Gauteng. The change to digital will have a significant impact on all television households in South Africa as viewers will require a DTT receiver before they can view digital transmissions and before the analogue networks can be switched off.

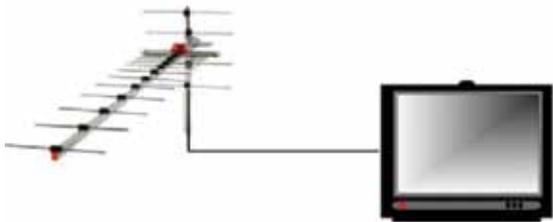


Figure 1: Home reception environment for analogue television (status quo).

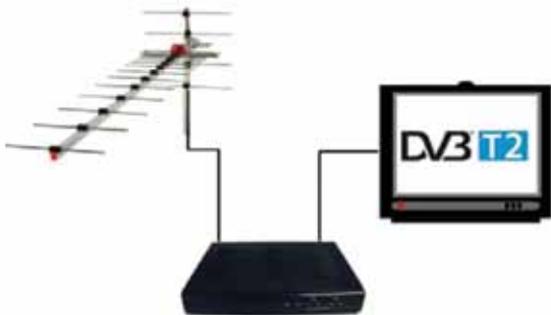


Figure 2: Home reception environment for DTT using a Set Top Box converter with an analogue television set.

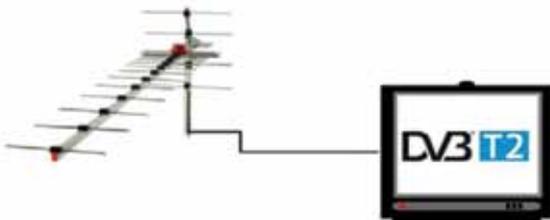


Figure 3: Home reception environment for DTT using an integrated digital television set.

Government’s Broadcasting Digital Migration (BDM) policy focuses strongly on the digital ‘Set Top Box’ (STB) that will assist homes to migrate to digital. The STB is to receive the digital signals and convert them for display on existing analogue television sets in the home.

New integrated digital television sets (IDTV) will have an integrated digital receiver (as is the case for analogue television today) and will not require an external STB.

Much of the BDM policy is devoted to functions expected from the STB, strategies around local manufacture and an ownership subsidy scheme to allow poorer households to purchase a STB.

In the mix of these issues the BDM policy mentions the desire that the STB should facilitate e-government services, be uniquely addressable, allow for over-the-air software downloads and have STB control that would “enable addressable messaging and the ability to turn off lost or stolen decoders”. Whilst these requirements seems perfectly reasonable, the technicalities of the respective STB control systems that could be employed to deliver this functionality could have far reaching implications for broadcasters and the viewing public in general.

STB control systems range from basic secure systems that would protect Government’s investments in subsidised STBs to advanced conditional access systems that would encrypt and obscure content as is commonplace in PayTV.

Implementing a system that would obscure and encrypt video content could signal the end of clear free-to-air (FTA) television in South Africa. The unintended consequences of such a technological solution that, in effect, sets up additional barriers to entry that will impact most on vulnerable groups—illiterate, poor, socially deprived, disabled and aged—that might not be able to successfully install and activate the STB, cannot afford to call national TV and may not be able to operate the STB under the conditions required for continuous activation to be maintained.

Arguably, STB control would negatively impact on the ability of the South Africa viewing public and vulnerable groups in particular to access FTA television services. STB control that encrypts audio and video content is associated with huge implementation and operational challenges and cost consequences that, when considered in totality, would outweigh the possible benefits of a STB control mechanism as contemplated in the policy. A lot has happened since the BDM policy was first published in 2008. These developments may indeed have moved well beyond what was contemplated in the policy and what was anticipated would serve the interest of the South African viewing public.

### No encryption of the video content

Broadcasters and manufacturers started work on the technical specifications for the STB and commercial launch transmissions in 2008. Minutes of one of the first meetings with the South African Bureau of Standards capture the position on encryption clearly as, “Broadcasters object to the encryption of the FTA (free-to-air) services”.

This pronouncement was significant as it confirmed the view that STB control would be a secure and robust system that would protect the subsidised STB without in any way inhibiting access to the FTA transmissions.

Based on the common understanding that STB control would not mean “encryption of the video content”, the first draft of the technical standard for STB referenced the SABC and e.tv as custodians of a STB control mechanism that should be implemented.

In order not to impose a mechanism that would restrict trade, the STB control mechanism and technology must be made available to anyone wanting to manufacture STBs.

In 2011 the SABC and e.tv jointly issued a tender for the provision of STB control solutions.

As expected, vendors of encryption- and conditional access systems, as commonly used for PayTV services, responded with solutions that would require encryption of the video and audio content. In a presentation given to the SABS committee working on the revision of the STB standard a STB Control solution that entails the full encryption of the video and audio content was recommended to both the SABS committee and the Department of Communication in July 2010.

### Consequences of encryption of the video content

Across the globe, the successful migration to DTT has been earmarked by the availability of numerous high quality FTA television channels on DTT.

Compelled by the new services and quality, viewers spent their own money to acquire a DTT receiver of their choice and started watching DTT. Migration successes have thus been driven by the availability of great FTA content and affordable digital receivers.

There aren't any examples of terrestrial public broadcast services or commercial FTA broadcasts on DTT being encrypted. Except for a few PayTV operations, DTT broadcasts across the globe are based on FTA deployments, which have to a large extent facilitated the mass production of integrated digital television sets, STBs and other receiver types for an international market.

It follows that retail stores are stocked with universal low cost DTT receivers and television sets that are easily installed and operated. The user merely plugs in an antenna and switches on the DTT television set to start viewing.

Should South Africa opt for a STB control system that encrypts the terrestrial FTA public- and commercial television services on DTT it is likely to be the only country in the world to do so.

In order to have access to FTA content South Africans would then require customised STBs fitted with the decryption or conditional access control system.

Implementing this system on the STB will add to the cost of the receiver. It is more complex and costly to implement the conditional access and decryption system on IDTV receivers and even more expensive and complex to implement it on low cost USB-type receivers.

### Trends in DTT receive equipment

Internationally, the STB is making way for the IDTV set. As is the case for analogue television today IDTV sets allow consumers to connect an antenna and power to a television set and watch FTA services. No one wants their living room cluttered with STBs.

The trends in retail sales in the UK are shown in Figure 4. Sales of STBs are down and decreasing whilst sales of integrated digital television sets are up and growing.

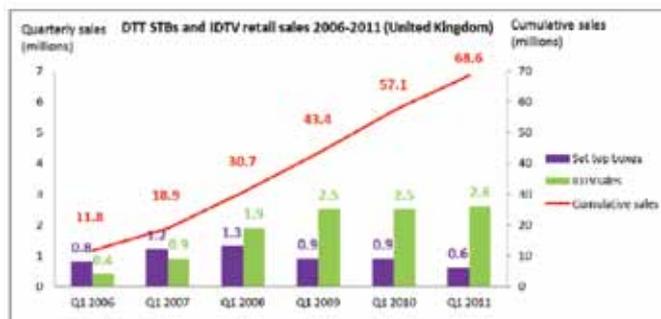


Figure 4: Retail sales data of integrated television sets and STBs for DTT in the United Kingdom (a typical FTA market) showing that consumers demand integrated television sets rather than STBs (Source: Sales figures from GfK as adjusted by Freeview and published by OFCOM).

The Communications Market Digital Progress Report published by the UK regulator for Q1 2011 reports that “Integrated digital television sets (IDTVs) accounted for over 81.3% of sales in the quarter (2.6 million units). Almost all TV sets sold (99.6%) included an integrated digital decoder. Freeview set-top boxes accounted for over 596,000 sales in the quarter, down by 30.3% on Q1 2010” (Own emphasis) .

Leading manufacturers have since 2009 been integrating tuners into their products and the trend toward IDTV sets is not unique to the UK. The STB for digital terrestrial television is considered a temporary digital adaptor for viewing FTA services on an old analogue television set during the analogue to digital migration period. Consumers clearly aspire to IDTVs.

Some integrated television sets are produced with a slot that can accommodate an external Conditional Access Module (CAM). Both the slot and the CAM add significant cost to the IDTV option. Both would be required to enable viewing FTA content on a IDTV should STB control with audio and video encryption be deployed as is being recommended for South Africa.

Whilst it may be possible to get integrated television sets with special slots and modules that can accommodate a conditional access system (i.e. STB control), many low cost and small screen integrated television sets that are mass produced for an international FTA market are not readily fitted with slots for these modules. Adding these slots and providing the conditional access modules costs almost as much as an external STB.

STB control customisation for the South African market will introduce costs and limit the number and types of receivers that will work in South Africa. Consequently South Africans may never benefit from the high volume, mass produced integrated television receivers becoming available at ever decreasing prices. South African consumers are likely to see the more expensive option of the STB being entrenched for years to come.

## Managing STB control

In addition to adding to the cost and complexity of the receivers, the implementation and maintenance of a conditional access system for STB control will impact on the South African home in several ways.

A hugely complex and expensive back office system and database with national call centres and customer service centres would have to be established and meticulously maintained to support a national subscriber base of 11 million television homes. A failure of the system could result in a national blackout of FTA television, whilst poor maintenance could result in viewers or groups of viewers being disconnected from time to time.

As in PayTV, every STB in every home would need to be activated and authorised to receive the FTA services. Once activated, the STB would continually need to receive entitlement messages allowing it to remain activated. Whilst details of the conditional access system to be used remain unclear, users are likely to be required to leave STBs plugged in and powered up permanently to ensure that their receivers remain activated. This will have power demand implications on the national grid and power cost implications on the home. Losing the activation permissions will require re-activation and viewers will not have access to television until re-activated.

Viewers will be required to call a TV call centre to have their STB enabled or re-activated. This introduces access to a telephone, ability to pay for calls to a TV call centre as well as access to a stable power supply as prerequisites for having access to FTA television in South Africa.

The operation and maintenance of a STB control system is associated with significant complexity, direct- and indirect costs and additional universal service and access requirements that may not have been adequately considered.

## Rights and obligations of the viewing public and the television licence fee

The constitution of South Africa entrenches the right to receive and disseminate information. The Electronic Communications Act defines and references the principles of universal service and universal access, and defines the role of the Universal Service and Access Agency of South Africa. The Broadcasting Act in its preamble refers twice to universal access and spells out that the legislation seeks to encourage "the development of South African expression by providing a wide range of programming that refers to South African opinions, ideas, values and artistic creativity by displaying South African talent in radio and television programming and by making use of radio frequencies that are public property and that provide a public service necessary for the maintenance of national identity, universal access, equality, unity and diversity"

The principle that broadcasting constitutes "a public service necessary for the maintenance of national identity" within the context of universal access is given substance in the Broadcasting Act. At the same time the Act makes it clear that "No person may use any television set unless such person is in possession of a television licence..."

South Africans thus have the right to access television services and the obligation to pay a television licence fee.

A review of the annual financial statements of the SABC contextualised against the television household statistics published by the South African Advertising Research Foundation provides some sobering insights.

Whilst the SABC reports on the revenues from licence fees and the costs of collecting the licence fees, the annual report remains silent on the number of households paying their TV licences. Assuming that 5.92% of the South African television homes qualify for a concessionary licence the total number of households paying television licences can be calculated by dividing the revenue declared by the published license fee applicable. This result is shown in Figure 5 as "Number of TV licences paid (Estimated)" per financial year reported on.

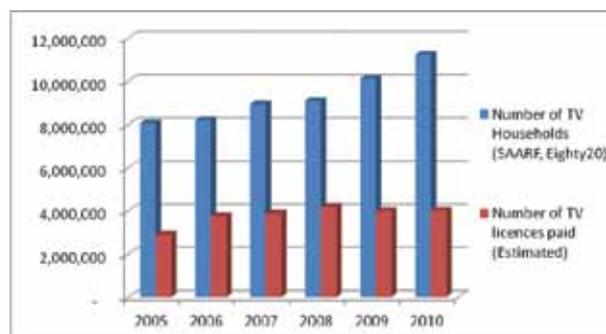


Figure 5: Number of television households in South Africa and television licence fee payments.

It would seem that less than half the television households meet their obligations in terms of the required television licence fee. One may speculate on the reasons for this figure but according to the notes in the annual reports of the SABC, it is a result of the economic climate, unemployment and poverty.

Figure 5 highlights a significant conundrum facing anyone operating a STB control mechanism for FTA television in South Africa:

By law only households with paid-up television licences may use a television set. The argument on whether or not it would be legal to enable a STB for a home that has not paid its television licence is best left to the legal experts. It would seem schizophrenic to impose fines and penalties on a household for using a television set without a paid-up TV licence while a national STB control management centre enables the STB for the very household being prosecuted.

The reality is that less than half of current television households have a valid TV licence and in many cases may not be able to afford it (granted there may be many that simply do not pay).

Implementing STB control that would disable homes that do not have a paid-up television licence would result in more than half South African television households no longer having access to any television services.

On the other hand, deploying a complex and expensive national STB control system that encrypts audio and video services and that is set-up to enable access to everyone regardless of payment seems



continued...

rather pointless and wasteful. South Africa is likely to see a revision of the policy on the TV licence fee and how it is levied.

If, however, STB control is not to be used to manage access based on TV licence payments then surely the requirement for STB control in its entirety or the implementation of a simple secure solution that does not require encryption of the audio and video content must be reconsidered.

### Merits of STB control

It has been argued that STB control offers numerous features and benefits that include the ability to switch off a stolen STB, direct unique messages to the home, enforce payment of the TV licence (as discussed above) and protect local manufacturers. It would seem that some public debate and analysis of these features is required.

Consider, for example, the ability to switch off a stolen STB. This feature seems to have had prominence well beyond its significance. Being able to switch-off a stolen STB seems irrelevant if one considers that STB control comes at huge cost to the consumer and will do nothing to disable a television set that might have been stolen along with the STB and costs far more to replace.

STB control was further said to be critically important in preventing subsidised STBs from leaving South Africa. The subsidy mechanism that has since been developed by the Universal Service and Access Agency of South Africa (USAASA) will, however, not rely on STB control when disbursing the subsidy. The subsidy scheme as presented to stakeholders in August 2011 will grant a subsidy once to qualifying needy individuals identified by their national Identification number. The subsidy would apply only to locally manufactured STBs. As the subsidy is to be granted once to an individual acquiring one locally manufactured STB, there is little if any risk that huge volumes of subsidised STBs would be leaving the country - even if the STBs were universal FTA receivers.

The assumed ability of STB control to protect local manufacturers and prevent 'grey' products from entering South Africa has been used as key justification for the costly mechanism. Whilst a requirement for STB control might give local manufacturers a head start, it cannot be used to restrict trade. In order to comply with the World Trade Organisation treaties that South Africa is signatory to, the STB control mechanism would have to be made available to any manufacturer locally or internationally that may want to manufacture STBs for this market.

It would seem that enforcing a STB control system may actually restrict the offset market for locally manufactured STBs as the STB manufactured for the South African market would have to be de-customised before these could be sold and operated in other FTA markets in SADC and beyond.

The subsidies to be provided to needy South African homes for the acquisition of locally manufactured STBs will benefit local manufacturers far more than a restrictive STB control mechanism that would be available to competitors in any event.

The recommendations on STB control suggest that it would ensure that STBs conform to the South African standard. However, STB

control as a standalone mechanism could be implemented and operational on a non-conform STB. Only a strong conformance regime with type approval as is being pursued in South Africa would prevent non-conform or 'grey' products from local- and international manufacturers ending up on the retail shelves.

### The power to decide

The implementation of a STB control mechanism that would encrypt FTA television content would result in the termination of clear FTA television as it is available to analogue television viewers in South Africa today. It would impose a fundamental change in how South Africans access public- and commercial FTA television news and entertainment content. This clearly was not what stakeholders understood STB control to be in 2008.

Now that the STB control solution under consideration is no longer a basic secure STB control mechanism but a conditional access system that will require encryption of the audio and video content, the impact and magnitude of any decision thereon may no longer be something that should be left to two broadcasters to adjudicate. It is indeed questionable if the SABC and e.tv are empowered by law to consider, adjudicate and implement any technology control mechanism that would encrypt FTA television and impact on how the public receives and accesses FTA television broadcasting services and the type and cost of receiving devices available.

If allowed to continue, it would seem that this fundamental and revolutionary change to encrypt FTA television would be imposed on South Africans without due public consultation.

Surely a decision to encrypt all FTA television can only be considered within the context of a fundamental review of the broadcasting policy and the funding model of the SABC.

### Time to deliver

South Africans have been hearing about digital terrestrial broadcasting since 2001 and were promised its imminent deployment back in 2008. Time is of the essence if South Africa is to meet its own- and its international commitments on digital migration.

STB control and its implementation is the single most significant issue holding back the manufacture of digital receivers and the launch of DTT services in South Africa. It may also be the single biggest operational stumbling block to a successful migration and consumer uptake.

The best way forward may be one that seeks to avoid the risks, costs and complexities of implementing a system that may have more negative and unintended consequences than short- or long term benefits.

#### *About the Author:*

*Gerhard Petrick is a former Councillor of the Independent Communications Authority of South Africa. He is registered with ECSA as Professional Engineering Technologist – Electrical. He is also registered with the Society of Broadcast Engineers as Senior Broadcast Engineer and is a Senior Member of the SAIEE. He writes in his personal capacity.*

# THE **JUDGES** ARE SHARPENING THEIR **PENCILS**

We have managed to secure the following **judges** for the 2011 competition, each with their own specialities and engineering **interests**:

- **Tobias Nittel** – SEW-EURODRIVE Germany
- **Andreas Keller** – Festo Germany
- **Chris Oliver** – Festo South Africa Didactic Division
- **Stefan Molenaar** – Managing Director – HG Molenaar (Machine Builders)
- **Jacques Du Sautoy** – Automation Specialist – Nestlé South Africa

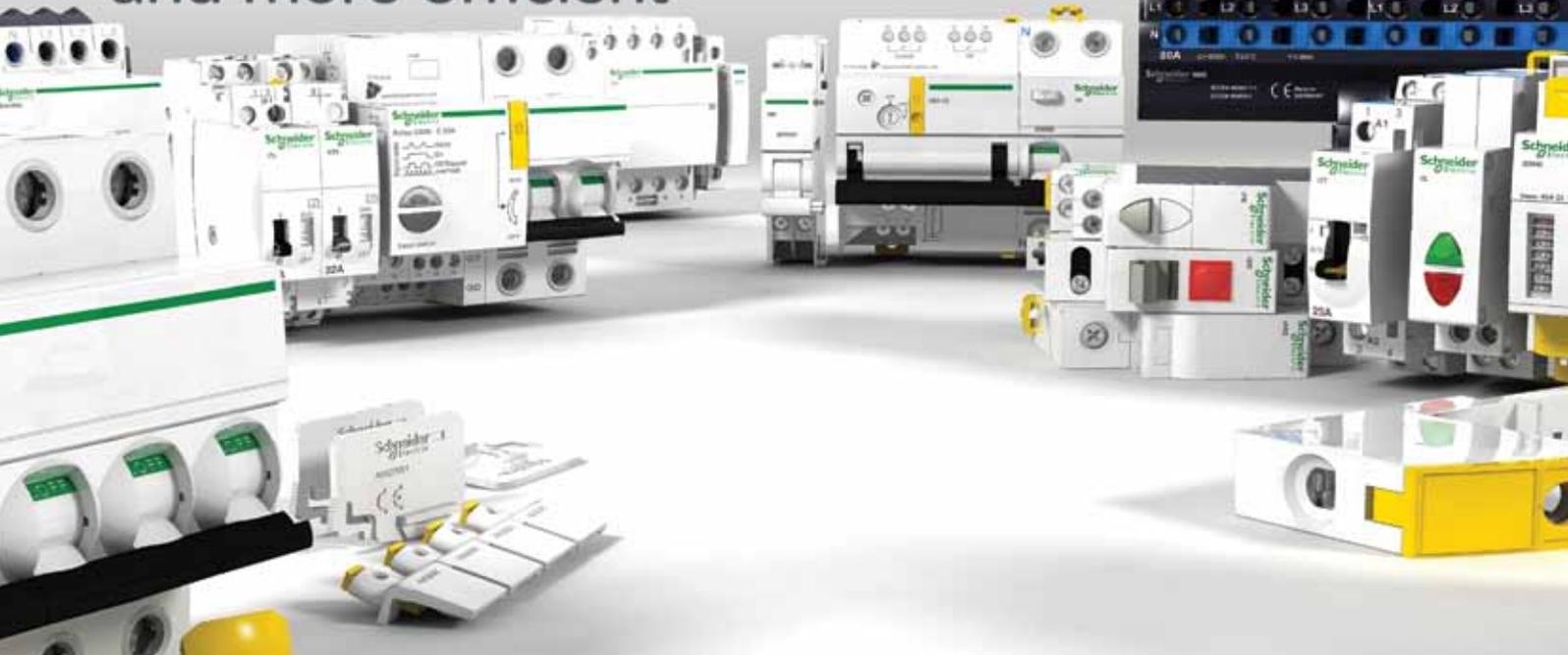
The criteria for judging include:

- Creativity
- Business Acumen
- Presentation
- Technical Accuracy
- Level of Difficulty and Practicality
- Budgeting
- Project Planning

Visit [www.pneudrive.co.za](http://www.pneudrive.co.za)  
for more information.



# The new modular system that makes your power distribution installation safer, simpler and more efficient



## Save up to 15% on design and installation time with the Acti 9 system

Acti 9 ensures better safety, installs easily, increases service continuity, and streamlines your workflow

### What makes the Acti 9 so special?

Designed and built to the highest standards, the Acti 9™ is the result of five generations of low-voltage industry experience. With 21 new patents, its innovative features give you many industry-unique benefits. For example, it offers complete safety: VisiSafe™ provides reinforced insulation on iC60 miniature circuit breakers and iID residual current circuit breakers. The downstream circuit is always safe, regardless of overvoltage conditions, wear, or operator experience. Combined with its Class 2 front face, where clearances are more than twice the industry standard, it exceeds even the most demanding safety requirements.

### A better use of energy, from start to finish

The Acti 9 also gives you unmatched efficiency in your day-to-day operations. VisiTrip™ lets you identify a fault in one glance, so you can quickly diagnose, resolve, and reclose circuits. Plus, super immunization of its RCDs guarantees the highest continuity of service and electrical immunity, even where switchgear contends with electromagnetic or chemical interference.

Component selection is easy, design is simplified, and upgrades are painless. As new installation standards emerge or building requirements are modified, Acti 9 easily scales to meet your needs. And because it is 100 per cent recyclable, you can meet any environmental requirements and minimize impact through your installation's lifetime of use and eventual recycling.



Available only from Schneider Electric™

Patented features offer industry-unique benefits like unprecedented safety, even in the most demanding environments.



#### Super immunization

Guarantees the highest continuity of service and electrical immunity.



#### VisiTrip

Identifies faults in a single glance for fast diagnosis, resolution, and reclosing.



#### VisiSafe

Guarantees the downstream circuit is always safe, even in overvoltage conditions.



#### Class 2 front face

Guarantees risk-free handling during the lifetime of the installation.



Enroll at **Energy University** today: it's **FREE**  
Terms & Conditions apply

Visit: [www.SEreply.com](http://www.SEreply.com) Enter Code 95938t

**Schneider**  
Electric