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Private partnerships hold the key

The world as we know it cannot function without a working infrastructure. Whether it's for communications, transportation, electricity or water – so it's really surprising to me that Africa is managing to function at all given the state of the continent's existing infrastructure.

Of course, much of South Africa is a hallmark for the rest of Africa as its infrastructure still works. Perhaps that's why so many multinational companies and organisations are based here in the first place. But if we then look at the rest of the continent it's a testimony to self-destruction.

The first thing that people do, when asked about the state of infrastructure on the continent, is blame the past and, unlike them, I am not about to do so. The reality for me is that Africa has shown that, without an established and working infrastructure in most of its countries, it has managed to thrive in certain areas.

The ADB estimates that Africa will have to spend about $93-billion a year to improve and create a working infrastructure on the continent and South Africa's own Minister of Public Enterprises, Minister Malusi Gigaba, puts a figure of $38-billion a year on infrastructure spending needs.

I don't know which figure is right, all I do know is that billions of dollars have to be invested before the continent's infrastructure will reach a position where it functions properly and provides the kind of efficiency needed to be a part of the modern world.

For many African countries the expenditure figures are not only astronomical but practically impossible and the consequence of this is that they cannot boost revenue levels or export earnings because they cannot get them to the market that will buy them. Equally, the productivity levels are way down – compared with other developing countries like China, India and Brazil – and this has a corresponding impact on the competitiveness of Africa on world markets.

So Africa is being smashed by the everlasting conundrum: it cannot spend money on fixing its infrastructure without being able to earn the money and it can't earn the money because its infrastructure is so poor. There must be solutions to this and my own opinion – coloured as it may be by the opinions of other much more learned souls – is that private public partnerships hold the key to resurrecting and then maintaining our infrastructure.

There is the old saying that if you have nothing then you have nothing to lose and this is particularly true when it comes to partnerships with the private sector.

Investors who spend their own money on making a success of something have an enormous amount to lose whereas people who have not access to water, electricity, roads or telecommunications actually don't care much for it because they haven't got it anyway.

To turn around and expect the "government to provide" is simply out of the question in Africa because the governments cannot provide. They don't have the money, the skills, the expertise or the experience.

But private investors do.

So while we are highly critical of the toll roads around Gauteng – and the rest of the country for that matter – the reality is that by handing out concessions to private consortia we are certain that the roads network will remain functional and, at worst, in a reasonable condition.

The same applies to other major concessions such as the Gautrain, the mobile network operators, the telecommunications companies and even Eskom – although there is some debate over whether it's a concessionaire or a government body.

Each of these organisations has a vested interest in looking after and maintaining what they have got because that's what creates individual wealth for shareholders.

And in my view, the secret to Africa's infrastructure creation plans lies in allowing investors to raise the money, provide the projects, charge individuals for usage and let shareholders earn a return on investment over a sustained period.

I don't know what other solution we might find – because governments throughout the continent have proved that they cannot do the job themselves. The only choice is to turn to the private sector.

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Forensics in an age of television

by Gavin Chait

"Mr Proctor, I'm arresting you for the murder of Gwen Dlamini," says Grimsby Matanzima, CSI Gauteng detective, as he bends Proctor's arm behind his back to arrest him.

"What are you talking about?" Proctor demands, his face flushing in anger.

"On the morning of 15 February you placed her body amongst the wreckage of a 15 car pile-up on the N1 outside Pretoria. A pile-up you caused, Mr Proctor," says Grimsby, with some satisfaction. "A pile-up you caused just so that you could hide the body of your murder victim."

"You can't prove anything!" shouts Proctor, his heart pounding.

"Oh, yes?" gloats Grimsby, "but I can. You cut yourself shaving three weeks ago, didn't you Mr Proctor?"

"What of it, lots of people cut themselves shaving?"

"Yes, Mr Proctor, but on the day of the multi-car pile-up the cut was still fresh. You bled Mr Proctor. One drop. And from that drop we isolated one cell from Gwen's face. We created a DNA profile of you. Our computers built up a three-dimensional model of the killer, including that characteristic scar down your left cheek. You're nabbed Mr Proctor. Take him away lads."

Insufferable garbage, isn't it? This episode of CSI: Gauteng is fake, but the principles apply to any television forensic investigation show and you can take your pick: The Mentalist, CSI, Cold Case, Bones, Law & Order, Monk, Midsomer Murders and so on.

The BBC even has an ostensibly documentary-based forensic medicine series called History Cold Case in which bodies, which may be thousands of years old, are subjected to modern forensic analysis. The hour-long show always runs to an epic conclusion where the cause of death is revealed along with a reconstruction of the corpse's face.

Most of these shows take existing science, turn the volume all the way up to eleven, and then have the test results completed so fast that they can meet the forensic technicians in the field where they're busy with a shoot-out. History Cold Case could be said to be 'real' but even so the bodies are chosen in advance and, in order to have a face to show, all the heads must be intact.

If the implications were only for the stultification of television viewers then no problem. However, expectations from forensic pathology are being influenced.

In the US, there are now hundreds of colleges offering studies in forensics, mostly driven by interest generated by television shows. In 1999, four students graduated with a degree in forensic pathology at West Virginia University; by 2004 more than 400 people were majoring in the subject. This is small-potatoes in comparison to the leading universities. Ohio State has 53 715 enrolled forensics students, Minnesota has 51 140.

The majority of these students are women. That can only be a good thing; establishing science as a trendy and exciting career path. However, not everyone knows what they're getting themselves in to.

In the US it takes 13 years of study after finishing high-school in order to qualify as a forensic pathologist; four years undergraduate, four years medicine, four years of clinical pathology residency, followed by a one year forensic pathology fellowship. It's even longer in the UK.

Pathology's popularity has entirely passed South Africa by. For almost a decade, the government's Forensic Chemistry Laboratories has battled to operate. Political interference has left the organisation bereft of senior leadership and cripplingly understaffed. The current case backlog means that routine toxicology cases in Johannesburg are six years behind. Outstanding cases rose from 328 in 2000, to 4 574 in 2009.

But even in the most sophisticated labs toxicology reports don't take five minutes to run. Neither is it possible to get DNA out of blood corpuscles, or get tissue samples from air in a room. These media-created perceptions are having an effect in the courtroom.

The 'CSI effect' is now commonly referred to by legal authorities and the mass media. It applies to concerns that juries in capital cases regard crime labs as pristine scientific sanctuaries employing the most skilled people using the latest technology and who – this is the critical bit – never, ever make mistakes.

According to forensic pathologist Cyril Wecht, Hollywood shows "... tend to embellish and exaggerate the science, ignore actual time lines for testing and raise expectations of the general public, law enforcement and judicial system to an extremely absurd and totally unrealistic level."

Craig Cooley, writing in the New England Law Review in 2007, cites a number of cases where forensic evidence (or lack thereof) has led to mistrials. Some have ended quite badly. Cooley cites the case of Odell Barnes who was accused of murdering his next-door neighbour. Critical evidence was the victim's blood on his trousers. Barnes declared that the blood must have been planted there. Forensic evidence showed that the blood was indeed the victim's but further tests showed that the blood contained a large amount of blood-preservative. The blood had been planted. Despite this a jury convicted Barnes. In 2005 he was executed.

DNA evidence is considered entirely irrefutable, even if there are extenuating circumstances. Like preservative.

Yet let's not forget that without Star Trek mobile phones and tablet computers may never have stimulated sufficient demand for the things to be invented, or found a ready market when they were.

Until the 1980s, forensics laboratories wanting to use DNA in investigations would have needed buckets of blood to extract sufficient DNA. In 1983, Kary Mullis, then working at Cetus Corp as a chemist, developed a technique to use DNA polymerase to copy small strands of DNA almost indefinitely. In 1986 he started using polymerase from *Themophilus aquaticus* (Taq), a thermophilic bacterium, which could withstand significantly higher temperatures, radically reducing the cost of DNA replication and allowing the process to be automated. His discovery is now known as the polymerase chain reaction and means that microscopic amounts of DNA can be amplified indefinitely. Mullis won the Nobel Prize in Chemistry in 1993.

Of course, this also means that poor forensic technique can result in erroneous DNA being amplified.

The Phantom of Heilbronn, also known as the 'Woman without a face', was first identified as the killer of a 22-year-old female police officer who was fatally shot in Heilbronn in April 2007. Investigators linked the murder to other crimes all over Germany, and then other parts of Europe.

Then the crimes started getting weird. Matching DNA was found on the remains of a cookie from a robbery in Budenheim in 2001; a toy pistol used in the robbery of Vietnamese gemstone traders in Arbois, France, in 2004; and then a spate of robberies and murders all across Europe.

By January 2009 police were offering a R3 million reward for the phantom's capture. On the 40th occasion of the DNA sample turning up police became concerned. The burned body of a male asylum seeker in France was being tested to see if he was known to anyone. The results that came back were the phantom's.

It turned out that the cotton-wool swabs being used all came from the same factory in Austria. While sterile, the swabs weren't certified DNA free.

The first recorded use of forensics in solving a murder was in 1248 in Song Dynasty China when Xi Yuan Lu wrote that an investigator tested various blades on animal carcasses to establish the type of murder weapon. Discovering it was a sickle he instructed everyone in the village to bring him their sickles. Flies, attracted by the blood, settled on the murder weapon and the killer was unmasked.

In the 16th century, Italian surgeons, Fortunato Fidelis and Paolo Zacchia, studied the changes in bodies as a result of disease, documenting their findings. By the 18th century standard texts, like 'The complete system of police medicine' by the German, Johann Franck, began to appear. James Marsh, an English chemist was able to confirm arsenic as the cause of death in an 1836 murder trial.

Sometimes forensics appears quite mundane. A 1784 Lancastrian murder resulted in conviction when the newspaper scraps used to wad the pistol identified as the murder weapon were matched to torn newspaper in John Toms' pocket.

Juan Vucetich, a Croatian-born Argentine police official, became the first person to use fingerprints in an 1891 criminal case when he matched a bloody print on a door to Francisca Rojas who had killed her two sons.

DNA only turns up in a small minority of cases. Most of the time pathologists are called upon to find the mechanism and manner of death. A bullet from what type of gun, fired at what angle and from what distance? Was it murder, accident, natural causes or a suicide? The famous toxicology reports determine whether poison, drug overdoses or disease were involved in death.

In 'Forensic identification using skin bacterial communities', Noah Fierer, *et al.*, from the University of Colorado, demonstrated that the nature of the hundreds of species of bacteria found on our skin is sufficiently unique as to offer a new form of identity. "Only 13% of the bacterial phylotypes on the palm surface are shared between any two individuals," says the study.

This isn't quite ready for use in forensic labs but expect to see it on television quite soon.

Veil of secrecy in renewable bidding process

The tendering process for green power has begun, but a veil of secrecy may be drawn over the process as the Request for Procurement (RFP) document being used by the Energy Department requires that all bidders sign a confidentiality clause.

The Energy Department says that its intention in including this clause is to protect the commercial information of bidders and prevent collusion, but experts in public finance say they are "baffled" by the stipulation.

The confidentiality agreement requires that bidders do not share RFP documents provided to them once the R15 000 registration fee has been paid, or divulge any information about the bids. It is so stringent that bidders are not even permitted to disclose whether they intend to place a bid.

According to the Energy Department's acting deputy director-general Ompi Aphane, the intention of the confidentiality clause is "not to hide things from the public" but to protect the commercial information of bidders from competitors. Derek Luyt, acting director of the Public Service Accountability Monitor at Rhodes University, says that confidentiality clauses are fairly standard as they prevent suppliers from disclosing information before the winning bid has been disclosed. He adds, however, that it is odd for this to be applied to the procurement of renewable energy.

Meanwhile, Gavin Woods, professor of public finance and a director of the University of Stellenbosch's anti-corruption centre, says that he can't see how a confidentiality clause will circumvent collusion. He says that government officials seem naively to believe that by imposing tighter anti-corruption rules people will automatically comply with them.

The Independent Power Producers' Procurement Programme, known as Rebid, replaced the Renewable Energy Feed-In Tariff last month and bidders are now asked to bid for projects based on fixed tariffs.

The official request calls for proposals for financing, construction, operation and maintenance of any offshore wind, solar thermal, solar photovoltaic, biomass, biogass, landfill gas or small hydro technology project.

Successful bidders will enter into an implementation agreement with the Department of Energy and a power purchase agreement with a customer – typically Eskom, the state-owned power utility.

The process will comprise two phases: the first phase will look at technical feasibility, grid connectivity and environmental acceptability while the second phase will require companies to offer prices that are capped by the National Electricity Regulator.

South Africa faces a 'carbon chasm' as emissions continue

Only 31 companies of the Top 100 listed on the Johannesburg Stock Exchange have set targets to reduce greenhouse gas emission according to the International Carbon Disclosure Project which, in conjunction with KPMG, released a report entitled South Africa's Carbon Chasm in August.

It says that the commitment to reduce national emissions to 34% by 2020 should be quantified and disclosed as a matter of urgency and that the government also needs to move swiftly to create a policy that is geared to low carbon growth.

South Africa is facing a 'carbon chasm' defined by what needs to be achieved compared with what is being done to reduce carbon emissions.

The report says that penalties should be imposed for companies that fail to cut emissions and the government should introduce incentives for those companies that do so. The report says that it's essential that the 69 Top 100 companies that have not done so should set carbon reduction targets that are open to public scrutiny.

According to Joanna Lee, the project's chief partnership officer, the most striking fact is that although only 31 companies have set emission targets, these targets represent 93% of the JSE's emissions profile.

She says that the power sector is currently responsible for 45% of South Africa's total emissions compared with just 26% globally.

South Africa's emissions from its power stations are set to increase by at least 2% a year as new power stations come on stream or older power plants are returned to service, despite new technologies being used to reduce emissions.

Lee says that energy efficiency measures, which can be applied by all major businesses, need to play a major role in reducing power consumption, as this is crucial for tackling climate change but, at the same time, makes good business sense.

Yvo de Boer, former head of the United Nations' climate change secretariat and a special adviser to KPMG, says that climate change is widely seen as the most serious challenge facing the world today.

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Reserve margins tight as maintenance begins

The Duvha power station's Unit 4 in Mpumalanga will be returned to service by the middle of next year after the return-to-service project at the power station posed a number of challenges for Eskom, according to chief executive, Brian Dames.

The unit was extensively damaged earlier this year when a statutory turbine overspeed test went wrong, forcing a technical investigation and subsequent inspection by the insurers. Dames said that there would be follow-up action based on the technical investigation.

His comments come at a time when the risk of blackouts in South Africa increases because Eskom is entering its summer maintenance period – a period that is "more challenging" for the utility, according to spokesperson Hillary Joffe.

The National Planning Commission's Anton Eberhard told parliamentarians that South Africa's current reserve margin is tight in spite of the warmer weather because the maintenance phase means that power stations are taken off the grid when routine work is being undertaken. The 600MW that was lost when the incident occurred at Duvha earlier this year meant the power supply situation in South Africa became critical as the loss represented more power than Eskom has been able to contract from municipalities through a co-generation agreement.

Joffe says that while Eskom's normal maintenance period runs from September until May, the utility had managed to get some early maintenance work done because in the first few months of winter, demand was lower than had been forecast.

She concedes that there is a sizeable backlog in maintenance but could not be specific saying that all maintenance work due at South Africa's power stations is carefully categorised according to its urgency.

Eskom's Dames said at the previous quarterly briefing on the country's power supply situation that many power stations had reached the midpoint in the planned life of the facility and this meant that these generation plants needed more maintenance in order to improve their reliability.

He says that the current low reserve margins mean that it is still difficult and tricky for Eskom to shut down plants for routine maintenance work.

Angola's economy urged to diversify

Carina Kiala, an executive at Angolan legal counsel firm Lourdes Caposso Fernandes and Associates, has said that the Angolan economy needs to diversify in order to sustain its economic recovery. Angola's economy is strongly linked to oil and this is a challenge for investors because of the commodity trade trap. Kiala said that the country would like to reduce dependence on development assistance and that there was a strong political will to diversify trade.

She warned that the mounting indebtedness of the country was one of the major challenges facing Angola, which has identified four strategic partners as key to its future diversification and economic growth. These are China, United States, Brazil and Portugal.

China has already offered a large export credit line to the country, one that none of the other BRIC countries is able to compete with. According to Kiala, Angola is keen to enhance its relationship with South Africa and is looking for investments in some of its secondary sectors such as manufacturing, telecommunications, tourism and retail as well as the financial sector.

Kiala pointed out that last year cement was Angola's largest import product because of the booming construction and real estate sectors in that country.

Earlier this year, a discussion paper entitled 'Making the Most of Commodities Programmes' written by Raphael Kaplinsky of The Open University and David Kaplan and Mike Morris from the University of Cape Town suggested that there were several key problems facing Angola including:

- Weak local capability in terms of human capital at a higher technical level and in manufacturing.
- A local content policy that is skewed towards localisation, resource revenue and supply of crude derivatives, which mitigate against industrial development.
- A disjuncture between the country's industrial policy and its local content policy in the oil and gas sectors. This is combined with implementation loopholes in both policies which invite systemic corruption.

The discussion paper recommended that research and development activities be localised, that firms with manufacturing capability be encouraged and incentivised to enter the local supply industry and that there is a development of stronger knowledge networks between local suppliers and multi-national firms.

It has urged a greater investment in human resource training at technical levels and the need for more cohesion in policy development to stamp out possible channels for future corruption.

Koeberg shutdown not linked to oil spill

Koeberg power station has shut down Unit 2 as part of an automated safety procedure that was triggered by the protection system on a motor, according to Eskom. It is not yet known if the shutdown was caused by a mechanical or instrumentation failure.

The shutdown comes after there has been considerable speculation that an oil spill at Bloubergstrand would affect Koeberg's operation. Eskom, however, has categorically denied that there is any connection between the shutdown and the spill.

The Seli 1, a Turkish vessel ran aground in September 2009 and the vessel has finally started to break up, spilling huge amounts of bunker oil into the sea and causing widespread pollution across the beaches of the Western Cape's Atlantic Seaboard.

According to Cape Town's mayoral committee member, JP Smith, the rapid response of the city's disaster management teams averted serious pollution of marine life and the environment after the ship broke apart in the rough seas. The Turkish bulk carrier was driven aground at Bloubergstrand after its engines failed. It was carrying 660 tons of heavy fuel oil and 60 tons of diesel fuel.

Delays and indecision by the owners of the vessel, Ataduru Denizcilik, and the South African Maritime Safety Authority (among others) meant that a relatively simple refloating operation failed to get underway. The spring storms of 2009 then seriously damaged the vessel, halting all plans to refloat it.

It is not the first time that Koeberg has been threatened by oil spills. When the bulk carrier Treasure sank off Robben Island in 2000, spilling 1 300 tons of oil into Table Bay, Koeberg staff deployed booms around the water intake at the power station.

Koeberg uses seawater for cooling and there were serious concerns that oil would be sucked into the cooling system, halting it. However, offshore winds blew the oil slick out to sea averting any damage to the plant.

Broadband target could help create jobs

South Africa's Department of Communications believes that it will be possible to achieve universal broadband Internet penetration by 2020 and has called for a single national plan that will meet this goal, according to Deputy Communications Minister, Obed Bapela.

The plan will involve the public and private sectors and government has already started work on devising a national broadband strategy that will ensure there are complementary services delivered by both sectors.

Broadband is defined as a minimum of 256kB/s but this could be increased to a minimum of 2MB/s. Bapela says that the government is sticking to international standards set by the United Nations' International Telecommunications Union for its infrastructure.

He says that 100% penetration of broadband would not imply that every citizen in South Africa would have a personal connection to the Internet but rather that they would have access to broadband services through community infrastructure in schools, libraries or other public facilities.

His comments formed part of a meeting between government and key information and communication technology executives regarding the job-creation strategy being adopted by government to boost economic growth in South Africa and get millions of youths off the streets.

The Communications Department believes that it has the capacity to develop at least 160 000 jobs through broadband infrastructure initiatives that form part of its goal for universal access over the next 10 years.

The comments come at a time when the South African economy has recorded its slowest pace of growth in the past two years. Results for the second quarter show that economic growth was just 1,3% compared with analysts' forecasts of 1,6%.

While the growth figures are low, there is some hope that this might prompt a further interest rate cut from the Monetary Policy Committee when it next meets. Analysts say the drop in economic growth will make it even harder for job-seekers to find work as fewer companies are taking on staff and this might fuel social tensions in the country.

Finance Minister, Pravin Gordhan has set aside R20-billion for job creation initiatives but an economic growth rate of about 7% a year is required for these job creation efforts to be sustainable.

The current data indicates that the South African economy will grow by just 3,5% this year, well below the required levels.

From profits to losses – all in a year for M&R

From making profits of R1,1-billion last year, Murray & Roberts is now set to report a R1,74-billion loss this year after it incurred significant charges and contract completion costs for the Gautrain.

If these 'significant charges' are excluded from the company's figures, M&R says it would have made R1,3-billion, down from the R2,2-billion last year. The company's revenue for the year was an impressive R30,5-billion, up from R27,9-billion last year.

Group chief executive Henry Laas says that aside from difficult trading conditions, the group's profitability was impeded by 'challenges' on major projects.

The Gautrain project has now been completed and the Gorgon Pioneer materials offloading facility is due for completion before the end of the year. These two will place the group in a net debt position by December.

The losses are related to a number of different projects including the R1,15-billion incurred on the Gautrain civil engineering joint venture as well as a provision that has been made for the Competition Commission's investigation into alleged tender collusion among contracting companies.

An amount of R582-million has been set aside for contract completion costs on the Gorgon Pioneer Materials Off-loading facility and R164-million impairment on legacy contract in the Middle East.

The Gorgon Pioneer project is expected to generate about Au$20-billion that will be spent on goods and services over the next four or five years and has committed $9-billion to Australian industry.

As part of the Gorgon development project, Chevron Texaco developed liquefied natural gas process facilities on a greenfields site that incorporates an onshore LNG plant, a loadout jetty and a materials offloading facility. M&R was involved in the materials offloading facility.

DRC growth prospects

The Democratic Republic of Congo has sacked the directors of state-owned energy utility SNEL amid allegations of mismanagement and corruption within the organisation.

Communication Minister Lambert Mende said that the sackings have come just months ahead of crucial elections in the country where President Joseph Kabila hopes to be re-elected despite his critics saying that he has done little or nothing to stem rampant corruption and growing political instability in the eastern parts of the country.

With its mighty Congo and network of rivers, the DRC has tremendous hydro-power potential but just 11% of the population of about 60-million has access to electricity.

SNEL is currently embarking on a major maintenance project to repair broken equipment in the country at a cost of about $50-million.

The utility has blamed wide-scale power cuts on technical failures and low water levels at the existing hydro-electric plants on the Congo River.

The DRC is expected to exceed its economic growth target of 6,5% for the year but the country has been urged to do more to increase transparency in the mining sector according to the International Monetary Fund.

Large deposits of copper, cobalt and gold have boosted economic prospects for the country but it is still facing major logistical and funding challenges to ensure that its general election goes ahead as scheduled on 28 November.

The IMF says that the country has maintained good financial discipline, and strong economic growth in the second half of this year means it may well exceed its growth targets.

The country's annualised inflation rate is still high at 19,91% but the high global prices for minerals are boosting domestic revenues and allowing the country to perform at a better than expected level.

When Spot leaks oil; fun with robotic pets

By Gavin Chait

In 1996 Bandai released the Tamagotchi. As of 2010, 76 million people worldwide have purchased the little egg-shaped plastic keychain, switched on the unit and watched as an electronic egg hatched into a digital chicken. They have fiddled with the buttons to feed, clean, punish and reward their virtual pets and then buried them when they died.

The Tamagotchi Effect is now a recognised psychological term for the development of an emotional bond between humans and machines, robots or even software.

Discovering that 76 million people enjoyed the company of a needy virtual pet may about as dispiriting as finding out that 35 million people a month like tending virtual farms on FarmVille.

The success of the Tamagotchi led Adam Powell and Donna Williams to launch Neopets in 2000, which allows the creation of virtual pets living in the world of Neopia.

You get to do all the things you would normally have to do with a real pet – feed them, walk them, groom them, educate them – but without the fur, smells or genuine affection.

In 1999 Sony released the AIBO, a robotic pet dog. AIBO means Artificial Intelligence roBOt and is a manufactured acronym to fit with the Japanese word for partner. Although eventually discontinued in 2006, the AIBO have developed a dedicated following. The four-legged device uses a camera to see and navigate its environment and can recognise a small range of spoken commands.

Program settings allow it to start 'life' as a puppy and then mature, or simply start as a mature dog.

It's easy to dismiss all this as a peculiar deviancy by people who like the idea, but not the reality, of real pets. However, there is some very sophisticated engineering behind these toys.

AIBO uses Scale-Invariant Feature Transform (SIFT), an algorithm in computer vision enabling it to process its environment, detect and identify features in the images it produces. The original algorithm was produced by David Lowe, a professor at the University of British Columbia.

A training image is used to create a comparative model that will be used by the algorithm once that object is immersed in a more chaotic environment filled with other objects. Collision avoidance is different from object recognition. Knowing that an object needs to be avoided (a wall, a chair, a door) doesn't require knowing what that object is. Recognising a ball from a door, however, has implications for robot response.

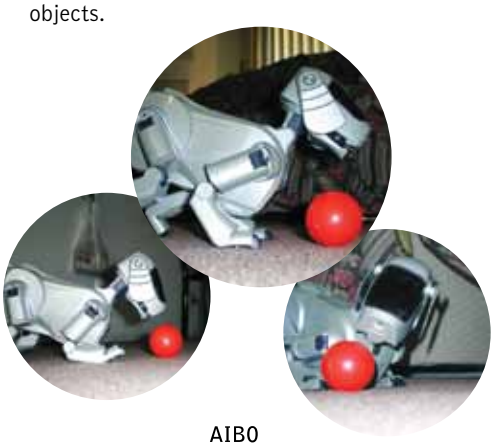
The first step is to identify features on the object whose relative positions won't change according to the orientation of behaviour of the object. A door frame will vary depending on whether it is open or closed. Similarly, articulated objects appear quite different depending on the shape they take.

Reference images are used to extract sets of keypoints and stored in a database. Objects in a new image are identified through scale-invariant feature detection using a Difference of Gaussians function. Dominant points are then assigned as keypoints and further processed to determine orientation and scale.

The reference objects are stored in a k-dimensional binary tree algorithm called Best bin first, which returns the nearest neighbour for a large search query. In this case, the identified object is compared to the reference library and a set of nearest-neighbour matches is returned, defined as keypoints with a minimum Euclidean distance from a given descriptor vector. Lowe eliminated 90% of false matches by rejecting anything with a distance ratio greater than 0.8. For the trade-off of discarding 5% of potential correct matches, there is about a 100 times performance gain over exact nearest neighbour searches.

Lowe uses a Hough transform, used in feature extraction which attempts to identify imperfect instances of objects by a voting procedure carried out in a parameter space. Each cluster of features 'votes' as to its position and orientation (known as its 'pose'). Once the voting is complete then a hash table is created predicting the model orientation, location and scale. Each hash table cluster of three or more features is selected and ranked into decreasing order of size. These form the various components of the complete object pose. The more of them there are the greater likelihood of object recognition.

Each cluster is verified via linear least squares analysis on the affine transformation relating to the model image. Outliers are discarded and the final set of clusters is subjected to Bayesian probability analysis to compare it to the remaining reference objects.



AIBO

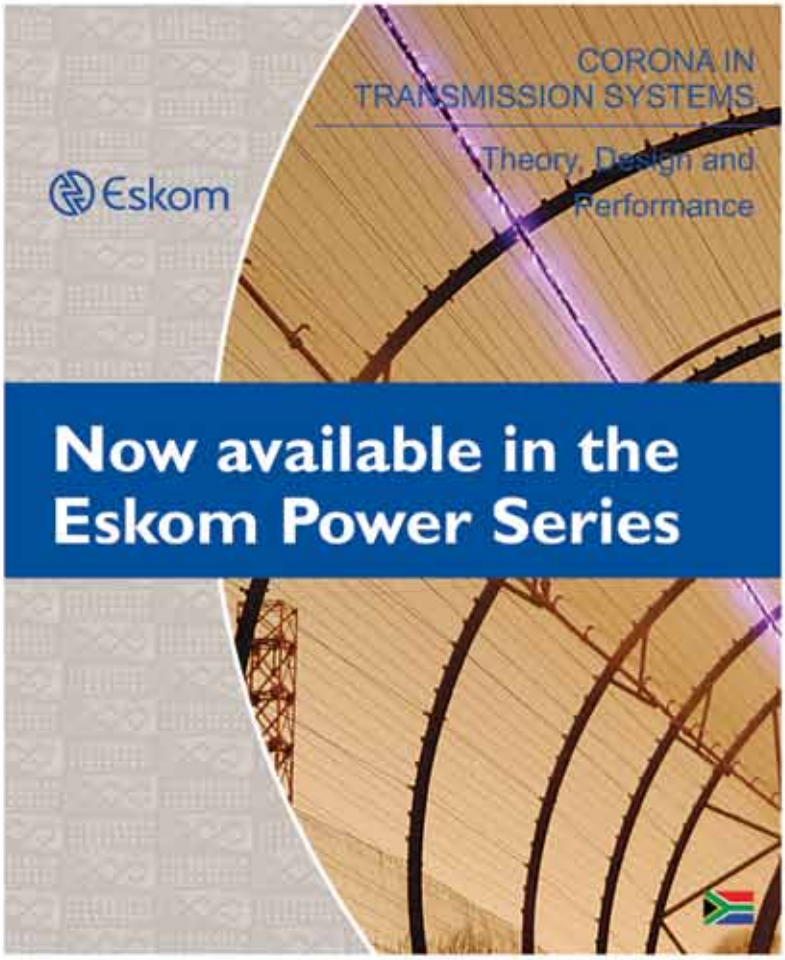
All of this has to happen sufficiently quickly for the robot to respond in real time.

Given AIBO's integration of camera, processing and mobility, it wasn't long before machine intelligence researchers began using it as their test dog.

In 1997 the Robot Soccer World Cup was established with the goal that 'by mid -21st century, a team of fully autonomous humanoid robot soccer players shall win the soccer game, complying with the official rules of the FIFA, against the winner of the most recent World Cup.'

From 1999 till 2008 various teams of AIBO robots performed in the 'RoboCup Four-Legged Robot Soccer League'. Yes, it is as bizarrely cute as it sounds. The University of New South Wales was the most successful, competing in the final six times and going on to win three times.

AIBO



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NAO

Paro

The standard league has now been replaced by Aldebaran's NAO humanoid robots. The intention here is that it is purely about algorithm and process optimisation, rather than teams having to produce a physical robot with all the control systems that entails.

For both the AIBO and NAO object recognition and processing are only part of their overall offering. As with the Tamagotchi, these robotic pets use recognition as part of the path towards emotional interaction with their host.

Judith Donath, founder of the Sociable Media Group at the MIT Media Lab, has defined four behavioural patterns required to ensure an emotional bond.

Pets should be autonomous in that their actions should be internally motivated and create the illusion of having their own goals and desires. This implies that the pet should not always respond to commands, or should make demands of its own for attention or nourishment. A machine that simply does what it's told is just a machine.

Pets should be dependant requiring feeding and entertainment. For instance, the Paro Therapeutic Robot, developed by AIST, a Japanese manufacturer, responds to being stroked with affection, or to being stroked too aggressively by mewling. Its power lead plug is designed to look like a dummy and it will make sounds requesting food when its battery runs low.

The Tamagotchi – famously – die, and don't come back to life, when not fed.

Pets require interaction of feeding, cleaning and playing, which results in behavioural change in the owner. Interaction creates a routine, embeds the pet in the host's life and creates a degree of emotional investment.

Lastly, the pets, as a result of that interaction, develop certain personality traits.

"Artificial pets are a good example of how we use metaphorical thinking to conceptualise behaviour. If we think of them as games, the time spent playing with them is entertainment and somewhat self-indulgent; if we think of them as animals, time spent playing with them is care-taking, an act of responsibility and altruism. It is obsessive to leave a meeting or dinner because a game requires attention, but it is reasonable to do so if a pet is in need," says Donath.

Programming these intelligences is complex. Wei-Po Lee, Tsung-Hsien Yang and Bingchiang Jeng of Sun Yat-sen University in Taiwan have developed a set of neural networks to mimic the development of intelligence. "With current technologies in computing and electronics and knowledge in ethology, neuroscience and cognition, it is now possible to create embodied prototypes of artificial living toys acting in the physical world," they say.

The field is known as human-robot interaction (HRI) with many of the commercial devices being aimed at the market for rehabilitation and long-term support of the elderly. NAO, for example, can identify specific people, respond to voice and interact with its environment. More than 350 universities use the platform as the basis for HRI research.

Recognition of a host's emotional response comes back to similar algorithms as in SIFT, with reference emotions being looked up based on facial recognition.

The process of creating emotionally grounded architecture in the AIBO is described in 'An Ethological and Emotional Basis for Human-Robot Interaction' by Ronald Arkin, Masahiro Fujita, Tsuyoshi Takagi, Rika Hasegawa of the Sony Digital Creatures Lab in Tokyo and Georgia Tech in Atlanta. AIBO has an instinct and emotional model which has six internal variables defined as: nourishment, moisture, bladder distension, tiredness, curiosity, and affection. These are range bound by a further six instinct variables: hunger, thirst, elimination, tiredness, curiosity, and affection.

While the responses AIBO is capable of are bound, they can be manipulated via a semi-random process of shifting the variables within the defined ranges and then responding or interacting appropriately.

Combined with object recognition, the robot can associate behavioural patterns with these objects. It learns that it could kick a ball, but could 'eat' a tomato. By interacting with an object, or receiving appropriate feedback, it then adds these associations to a look-up table of behaviours.

Is this real intelligence, empathy and emotion? No, not yet. We have entered the uncanny valley identified by Masahiro Mori in 1970 in which the robotic responses are close to human but alien.

Once they cross this barrier then the difference will be moot. Down Spot, naughty robot, did you just leak hydraulic fluid all over the carpet?

Fighting the machine – artificial intelligence for gamers

By Gavin Chait

"The problem with nuclear arms is that - provided they have an effect that is at least a little close to reality - we can hardly prevent the players from using them enthusiastically. Even if they cause massive pollution, nuclear winter, etc – a defeated enemy in a destroyed, hostile world brings you closer to victory than a strong enemy in a paradise. It was ethics that kept man from using them, not strategy. But this is a strategy game..." says Steffen Gerlach, creator of the C-evo freeware strategy game based on Sid Meier's Civilization.

Gerlach illustrates the fundamental difference between pure artificial intelligence and that needed by gamers; a purely rational tactical game played by a machine using all of its advantages of speed and foreknowledge would not be a very entertaining experience.

Imagine a first-person shooter like iD's landmark 1993 Doom with monsters that reacted in microseconds and knew exactly where you were hiding because they could look it up on the game controller's map? Or a strategy game like Civilization where the computer knows exactly what you're building and where your troops are located?

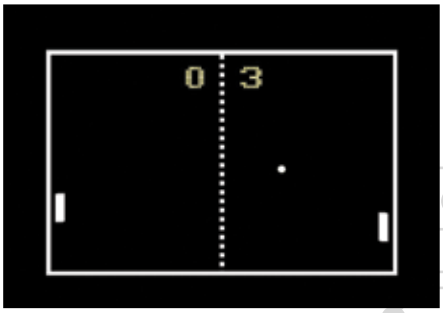
What is required is for a game's opponents to be clarified into a series of discrete non-player characters (NPC) each of which applies a set of heuristics to interact with their environment. The earliest implementations are in 'pathfinding' where an NPC must navigate across terrain within its own line-of-site, paying attention to any physics (walls, obstacles) in pursuit of the gamer.

"The objective of AI in most computer games has usually been to provide opponents. The reach of AI is limited in this application. Most players prefer opponents who fight bitterly, but rarely win. The objective of opponent AI is merely to assure that their defeat looks gallant and animated. The player must feel that his wits and skills solely are responsible for the opponents' demise," says Aleks Jakulin, a statistician at Columbia University working in the field of game artificial intelligence.

Space Invaders, one of the earliest popular computer games (and available as a programming tutorial for the ZX Spectrum) used hardwired objects – the rows of space invaders – which moved in a fixed pattern.

They don't dodge out of the way and increasing difficulty simply increases their speed of movement.

The first real game AI was in Pong, where the computer paddle moves in response to where you hit the 'ball'. The paddle was limited by the speed of its response and the computer would calculate the angle of the ball and move within the speed limit to hit it. That artificial reaction time would change, depending on the difficulty level. Hardly complex analytics.



1980s Pack-Man applied pathfinding to the defined environment of a maze in which ghosts pursued (or ran away from) the gamer. Each had its own distinct speed and approach, but it was still relatively simply analytics.

The first platform fighters – like Mortal Kombat on Sega Genesis – used lookup tables of movements and responses and minimal analytical state-space calculations to determine appropriate responses. More complexity was limited by the requirement of fighting in real-time. This was different from, say, chess where the computer could spend time on its calculations.

Games featuring real-time and strategic environments consist of the physical geography of where the game takes place and of the NPCs that populate that space and with which the player interacts.

The geography will have an internally-consistent set of physics and heuristics that will define the way in which NPCs and players can act. Some of the original race-track games had no concepts of momentum, drag, torque, torsion or mass. You went as fast as you could and tried to respond fast enough when the corners arrived without worrying that you needed to slow down in advance to prevent skidding. Modern games appreciate that different types of vehicles have different masses, different responsiveness, different power; that turning rapidly into a corner may cause a vehicle to roll and that a vehicle may go out of control.

When a randomly generated map is complete, the computer first has to create a layer of understanding of how that terrain would work. It needs to understand where the hills are, how they would be interpreted by a viewer and where objectives are. This is equivalent to the calculations you make when first looking at an obstacle course. You don't make a big deal out of it but you are quickly getting an understanding of the geography. You already innately understand the physics.

The computer converts the grid-like map into spheres of influence: how much cover a given barrier will provide during an attack; the ease with which a gold deposit can be mined; the speed with which a particular















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stretch of cambered road can be approached.

Modern games also allow the environment to change and for NPCs to respond to that changing environment. If you move something, it isn't sufficient to move around that box, it is also important to 'remember' that it has moved and to respond in a way that supports the narrative.

In early first-person shooters, you could kill enemies all day and leave the bodies all over the show without causing too much offense. In Uncharted 2 or Batman: Arkham Asylum – both released in 2009 – bodies left lying around alert NPCs to come find you and get you into worlds of trouble.

In Civilization V, building a city near a critical resource – even if you can't access it – can cause a war.

Your interaction with the environment leaves traces. Again, this is similar to hide-and-go-seek as a kid. An open door that you remember as being closed is a dead give-away as to where someone may have gone.

Obviously the game itself knows where you are and can direct forces accordingly, but that makes the game appear to be cheating and is frustrating for the player. What is needed is for NPCs to interact with that environment and be subject to the same physics as the player. They need to be able to see, hear and feel. More importantly, they can't just stand in the open, guns blazing. They need to be capable of figuring out a path to where you are, which minimises their exposure to you. They need to be able to 'think'.

This is very process intensive. Dave Pottinger, the technical director on Age of Empires 2 – a real-time strategy game involving massed armies fighting set-piece battles – writes, "Pathfinding is one of the slowest things most RTS games do (e.g. Age of Empires 2 spends roughly 60 to 70% of simulation time doing pathfinding)."

Consider the calculations in a game like Age of Empires. Two armies meet in a field to do battle. The armies are divided into divisions – cavalry, infantry, artillery, and so on – and each must be placed in a position where it can be most effective. Treating each division as a single NPC is useful, up to a point, but also unrealistic. In real life, individuals within a division will each aim to minimise their risk or achieve glory. The experience of the individuals has an impact on future behaviour. Some may run away if they feel they're losing.

The computer needs to orientate its army according to the conformation of the ground (based on the earlier spheres of influence) and then respond according to what you're doing. It needs to keep troops in reserve, recognise the range of your artillery and guess where they might be if it can't see them.

And all of this has to happen sufficiently quickly to ensure that the game isn't held up.

In a completely different environment, the first-person shooter requires NPCs to make split-second decisions while running around a map. John Laird is Professor of Engineering at the University of Michigan. He specialises in ensuring that NPCs interact with human players in ways that are not superior but that offer realistic and enjoyable interactions. "When computer generated forces are used for training (and other purposes), the primary goal is to replicate the behaviour of a human; that is the behaviour should be realistic. Without realistic, human-like behaviour, the danger is that human trainees interacting with the CGFs [NPCs] will have negative training."

Laird's research group created the Soar language, a cognitive architecture for developing systems that exhibit intelligent behaviour. Soar was used to create a robot that can play against humans in the Quake FPS environment. Consider the following set of high-level tactics used by this Quakebot, detailed in Laird's 2001 paper, 'An exploration into computer games and computer generated forces':

Collect-powerups:

- Pick up items based on their spawn locations.

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- Pick up weapons based on their quality.
- Abandon collecting items that are missing.
- Remember when missing items will respawn.
- Use shortest paths to get objects.
- Get health and armour if low on them.
- Pickup up other good weapons/ammo if close by.

Attack:

- Use circle-strafe (walk sidewise while shooting).
- Move to best distance for current weapon.

Retreat:

- Run away if low on health or outmatched by the enemy's weapon.

Chase:

- Go after enemy based on sound of running.
- Go where enemy was last seen.
- Ambush.
- Wait in a corner of a room that can't be seen by enemy coming into the room.

Hunt:

- Go to nearest spawn room after killing enemy.
- Go to rooms enemy is often seen in.

"Inherent to Soar is a learning mechanism, called chunking, that automatically creates rules that summarise the processing within impasses. Chunking creates rules that test the aspects of the situation that were relevant during the generation of a result. The action of the chunk creates the result. Chunking can speed up problem-solving by compiling complex reasoning into a single rule that bypasses problem solving in the future," writes Laird.

Strategic conflict games – whether based on military campaigns and resource extraction (like Civilization or Age of Empires) or first-person shooters (like Doom, Quake or even Halo) are really just pathfinding problems taking account of internal game physics. Much harder is creating realistic non-conflict interactions based on story-telling. Most games still deal with this via a series of cut-scenes that leave the player running a gauntlet and passively watching a story.

What happens if the story itself is dependent on the way in which characters interact? This requires that we can see more in the actions of NPCs than just a bunch of pixels moving across a screen.

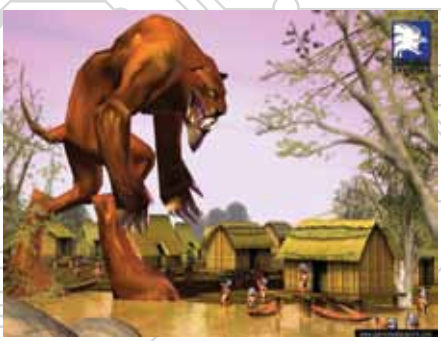
"Although the intentions, perceptions and motivations of the artificial creatures could be described with language, this approach is far too cumbersome for most games. We are not creating artificial friends; we are just trying to enrich the player's environment," says Aleks Jakulin. "Emotion in current computer games is either non-existent or absolutely superficial (state: running away, state: fighting aggressively, state: waiting for the enemy). But games themselves are intended to provide a very different kind of fun than drama, and they do not require the full spectrum of emotion."

"In recent years, there has been an upsurge of nurturing games, real-time strategy games, and team-based action games. The crucial aspect of the AI in all these games is that the AI primarily supports the player, not only secondarily opposes him. No longer is the reach of AI programming limited to assuring a predictable defeat. However, the challenges too increase: the player is monitoring almost every step made by his AI-controlled entities. State-of-the-art AI is required for such games, and the role it plays is amplification of player's intelligence and skill," says Jakulin.

The most 'basic' of these is The Sims. You start by controlling one character and then, through marriage and social interactions, can build up management of the interactions of whole networks of characters.

Each has its own motivations, wants and needs. Here the player doesn't work as much to fight the machine as with it, to create a narrative. This is still not pure machine learning.

In Black and White, Lionhead Studios created a classic "God Game" in which – as in Civilization – the player acts to build up a society and then dominate the world by fighting other empires.



In Black and White, however, the society you dominate must be co-opted into cooperation and the means by which you can do this is with your own Creature.

In Civilization you just build cities where you want them, create armies and go to war

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when you're ready. In Black and White you need to convert villages to your cause. The way in which you go about this – through kindness or violence – will train your creature who will then act independently to enforce your will.

The creature's AI is modelled on three components: symbolic attribute-value pairs to represent the creature's understanding or belief about any object; a set of decision trees representing learned experiences of objects; and a set of neural networks representing the creature's desires.

When your creature interacts with an object you, the player, can punish or reward it. If you want to be a brutal god, you can reward your creature every time it tortures a villager. Or you can punish it to stop it and reward it when it gives the villagers food. Whatever you do builds up a complex personality in which your creature lives.

Heavy Rain revolves around four people living through tremendously traumatic experiences in their lives. You interact with and for each of these characters in a world filled with NPCs.

The way you interact has consequences in the way they treat you, the way the story evolves and where it ends up.

Even in backdrop environments – moving through a street full of people – the way you move can lead to a way in which crowds respond. In Assassins Creed, a player who runs straight through a crowd of people will find they don't magically get out of the way. They may even choose to set upon you if the law is trying to catch you. However, walk carefully amongst them and soldiers running in pursuit will find the crowds cause them similar problems while giving you good cover.

All of these interactions require a large body of mathematical modelling. Simulating the Collision Avoidance Behavior of Pedestrians, written by Franck Feurtey at the University of Tokyo, describes a way of simulating crowds for modelling how pedestrian areas in shopping malls and public transit areas can be built. Now the equations are used to model patterns of movement in games.

Bayesian Networks allow NPCs to build conditional probability maps based on a limited set of behaviours they may adopt. Based on changing conformation of the ground (the interaction of objects on a map) NPCs will reweight their Bayesian Networks and respond accordingly, pathfinding through the map.

The purpose of all these approaches is not to create some perfect artificial intelligence. It is to create a gaming experience. If the computer gets too good then it would always win and that wouldn't be an enjoyable game.

You don't want NPCs that worry about being put in the line of fire when they're your soldiers and resent you for it. Neither do you want a computer that spends all its time thinking up new ways to annihilate you.

The future of the best of gaming is now in playable stories populated by characters that interact realistically and appropriately. Escapism has never been so real.

Cyber-crimes cost $114-billion worldwide

Cyber-crime cost individuals $114-billion last year and about 431-million people fell victim to cyber-crimes according to the Norton Cyber-Crime Report 2011. Over 74-million people in the United States were victims of cyber-crimes and they suffered direct losses of $32-billion.

Cyber-crime cost China about $25-billion, Brazil $15-billion and India $4-billion. The report says that 69% of online adults had fallen victim to cyber-crimes in one form or another, resulting in more than one million cyber-crime victims reporting crimes every day.

In China, 85% of online adults reported that they had been victims of cyber-crime while in South Africa the figures were an astonishing 84%. Symantec, the company that compiled the report, says that there is now a growing level of cyber-crime on mobile phones.

It says that already, ten percent of adults online have experienced some form of cyber-crime via their mobile phones and the number of new reported vulnerabilities on mobile phone systems has increased from 115 in 2009 to 163 in 2010.

Adam Palmer, the head of cyber security at Symantec says that few people seem to take cyber-crime seriously even if they fall victim to it and he warned that cyber-crime is much more prevalent than many people realise.

He says that over the past 12 months, three times as many adults surveyed have suffered from some form of online crime and yet less than 30% think that they might be a victim of cyber-crime within the next year.

Symantec interviewed more than 20 000 people in 24 countries for the cyber-crime survey. It found that men aged between 18 and 31 who used mobile phones to access the Internet were most likely to fall victim to a cyber-crime. The most prevalent and most preventable form of cyber-crime is computer viruses and malware with 54% of respondents saying that a virus or malware had exposed them to fraud.

The next most prevalent category was online scams (11%) and phishing exercises (10%).

There are currently 286-million unique variations of malicious software (malware) circulating on the Internet compared with 240-million reported in 2009.

Thermal imaging technology can catch cable thieves

Long-distance thermal imaging technology, similar to that used in war zones around the world, is being considered to combat copper cable thefts in South Africa.

Energy Minister Dipuo Peters has called for cable theft to be classified as a crime of economic sabotage, which would carry much stiffer sentences than cable thefts currently do. Cable theft disrupts service delivery of electricity, telecommunications and transport.

The much-praised Gautrain has repeatedly been halted by cable thefts – mostly between Hatfield and Centurion – much to the frustration of commuters who have praised the service for its reliability and speed.

Now Carl Ziess Optronics has offered its thermal imaging technology to Gautrain operators, Bombela, according to Roberto Bruzzaniti, head of the German company.

Bruzzaniti says the company has also approached large parastatals including Eskom, Transnet and Telkom and suggested that they too use this technology to catch cable thieves.

Carl Zeiss South Africa is a subsidiary of the German company but Denel has a 30% stake in the local operation. The thermal imaging technology allows the detection of large objects such as vehicles over distances of up to five kilometres.

To implement the technology, the thermal imaging device is connected to a laser range-finder and a GPS system. The hardware is mounted on masts that are about 35 metres high and operate in conjunction with other security equipment to provide visual confirmation that a cable theft is underway.

The thermal imaging system detects body heat and can operate in total darkness to detect thieves and alert police to the fact that a crime is in progress.

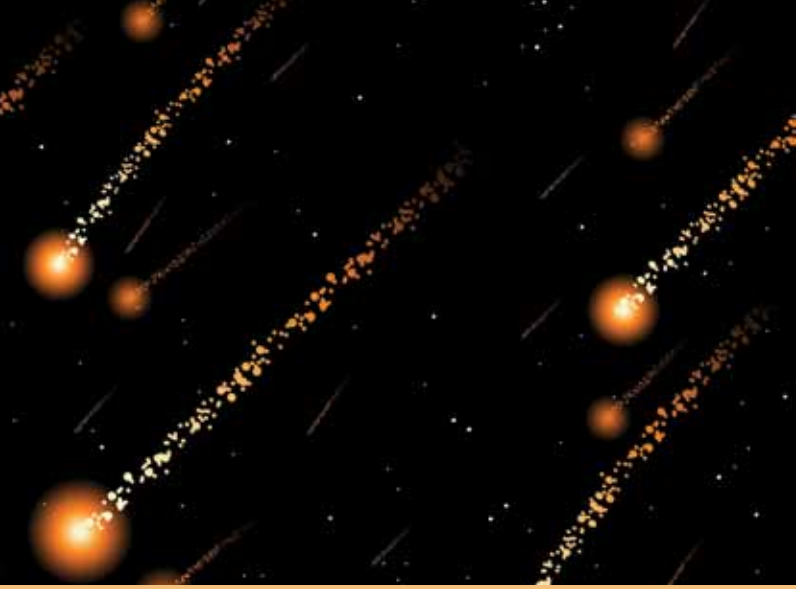
The South African Chamber of Commerce and Industry produces monthly statistics on copper thefts throughout the country and confirms that copper cable thefts cost South Africa R15,8-million in July and R14,37-million in June.

Many people have called on Parliament to introduce new penalties that discourage scrap metal dealers from buying stolen cable but to no avail.

For instance, a dealer, Frederick Kritzinger, was released on R5 000 bail by the Polokwane Magistrate's Court after being found in possession of R3-million in suspected stolen cables. Police found 11 000kg of copper cable at his scrap metal business in Futura, an industrial area of Polokwane.

Scrap dealers throughout the country are currently operating with impunity, buying up large stocks of cable stolen by thieves and selling it to overseas scrap metal buyers.

At the moment, cable theft is defined as 'petty theft'.



Gold may have fallen from the heavens

Millions of meteorites that hammered into the Earth's surface billions of years ago are thought to have brought gold to the planet, according to a study published in *Nature*.

The study says that almost four billion years ago, during the throes of planetary formation, the Earth was a mass of molten minerals that were ignited by collisions with planet-sized bodies that kept striking it.

The collisions are thought to have resulted in tons of liquefied gold and platinum that was sufficient to cover the planet with a crust of these minerals that was about four metres thick. The gold and platinum and many other minerals gradually sank to the centre of the Earth and created its core.

These theories are not new but what has puzzled scientists and geologists for years is why trace amounts of gold have remained in the Earth's outer crust and in the mantle.

In fact, the precious metals are perhaps thousands of times more abundant in Earth's silicate mantle than they should be after the meltdown that occurred in the planet's early phase.

A trio of researchers, led by Matthias Willbold of the University of Bristol analysed ancient rocks from Greenland and, using cutting-edge technology, they measured the isotopic composition of tungsten, a very rare element which, like gold and other heavy metals, gravitated to the Earth's centre during the formation of the core.

Comparing the samples taken from Greenland with rocks elsewhere on the planet, researchers detected a tiny but unmistakable 15-parts-per-million difference in the abundance of an isotope called 182W.

When atoms have the same chemical makeup but a varying number of neutrons, which change the atom's mass, they have different isotopes, minute variations of which can indicate the origin and age of the mineral.

The researchers say that the abundance of 182W is consistent with the theory that excess gold is a by-product of an ancient meteorite shower. They say that the precious metals – which drive many economies and key industrial processes – were added to the planet by a "lucky coincidence" when the Earth was pummelled by about 20-billion tons of asteroidal material.

10-million smart meters go to British homes

British Gas is to install smart meters in 10-million homes so that users can monitor the actual electricity and gas being used. The government has ruled that all homes in Scotland, England, Wales and Ireland must have smart meters installed by 2020.

British Gas is the largest energy supplier in the UK and says that it will use the data from the smart meters to encourage customers to reduce energy usage by making "informed choices".

Dean Keeling, managing director of British Gas Smart Homes, says that the smart meters will help consumers in many different ways, from seeing the power consumed by individual appliances to assessing whether home insulation needs to be replaced or repaired.

Individual meters that monitor gas and electricity consumption will be installed free-of-charge in the first 10-million homes that have been chosen for the first phase of the project.

At its most basic level the smart meter measures energy consumption and displays the cost to the customer based on prevailing billing prices. For those people who have smarter appliances, such as new models of fridges and washing machines, the meters will record more detailed information and provide a breakdown of the amount of electricity used by these appliances.

Furthermore, users can fit smart plugs to the older appliances and the power used at that outlet will be recorded and provide a breakdown of consumption.

The information collected from the appliances and plugs is transmitted to the smart meter using the short-range ZigBee wireless communication standard, before being relayed to British Gas' central system via a GPRS mobile data connection.

British Gas says it is hoping soon to provide even more sophisticated control systems that will operate on smart phones or tablet computers.

It has promised that the data collected from the power consumption of individual homes will not be passed on to any third parties for marketing purposes. A limited pilot project has been operated in about 400 000 homes in Britain for the past few years.

Search still on for nuclear fusion to make electricity

Britain has joined forces with an American laser laboratory to develop clean energy using nuclear fusion. The process uses lasers to compress atomic nuclei until they join, releasing energy.

British company AWE and the Rutherford Appleton Laboratory have joined with NIF to help make laser fusion a viable commercial energy source. The notion of harvesting energy from nuclear fusion is not new and Britain has a long heritage of using magnetic fields to try and harness this source.

The country is home to the Joint European Torus, the largest magnetic facility in the world and a testing ground for the International Thermonuclear Experimental Reactor.

But magnetic fusion attempts have been constricted by budget considerations and part of the problem is the technical ability for this technology to reach a break-even point where it is producing more energy than it is consuming.

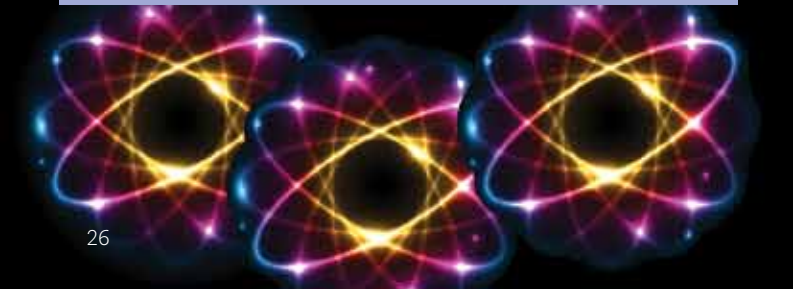
Laser fusion uses pellets of fuel made of isotopes of hydrogen, called deuterium and tritium. A number of lasers are fired at the pellets to compress them and in the process the hydrogen nuclei fuse to create helium and neutrons whose energy can be captured as heat and used to drive a steam turbine.

The aim is to achieve 'ignition' of the fuel so that a self-sustaining fusion reaction starts to occur, resulting in the production of more energy than that needed to start the ignition process.

NIF's director, Ed Moses, says that the ignition process is getting closer and closer and he expects that the facility will achieve this within the next two years or so. He says a single shot of the NIF's laser – the largest laser in the world – released about a million-billion neutrons and, for a fraction of a second, produced more energy than it had used.

Britain currently leads the 'High-Power Laser Energy Research' project, a pan-European venture that started in 2005 and hopes to move laser fusion technology towards a commercial plant.

John Coller, director of this project says that a functioning laser power plant would need to cycle through more than 10 fuel pellets a second, or a million a day. But he adds that the technology presents incredible opportunities if it can be made to work.



Amazon's new tablet could rival the iPad

Amazon is due to release a new tablet computer that many analysts believe will rival the Apple iPad, which currently dominates the tablet computer market worldwide.

Details about the new tablet computer are still sketchy but it seems that the Amazon tablet will cost $249, have a seven inch screen and will run a modified version of Google's Android operating system. It will almost certainly have a combination of 3G and Wi-Fi connectivity similar to the latest version of Amazon's Kindle.

Apparently Taiwanese manufacturer, Quanta, has been given an order to produce between 700 000 and 800 000 of the new devices.

There are already dozens of tablet computers available from suppliers including Research in Motion that makes the Playbook – compatible with BlackBerry phones and recently launched in South Africa – and offerings from Samsung, Asus and Motorola.

According to market analysts, however, the reason that Amazon may have an edge over other manufacturers is that it is a conduit to a lot of content and has the infrastructure to allow users to buy this content immediately.

Like Apple, Amazon is one of the 10 biggest merchant holders of credit cards numbers in the world. Surprisingly, Google has almost no financial relationship with its users and its business is based on 'advertisers' rather than customers.

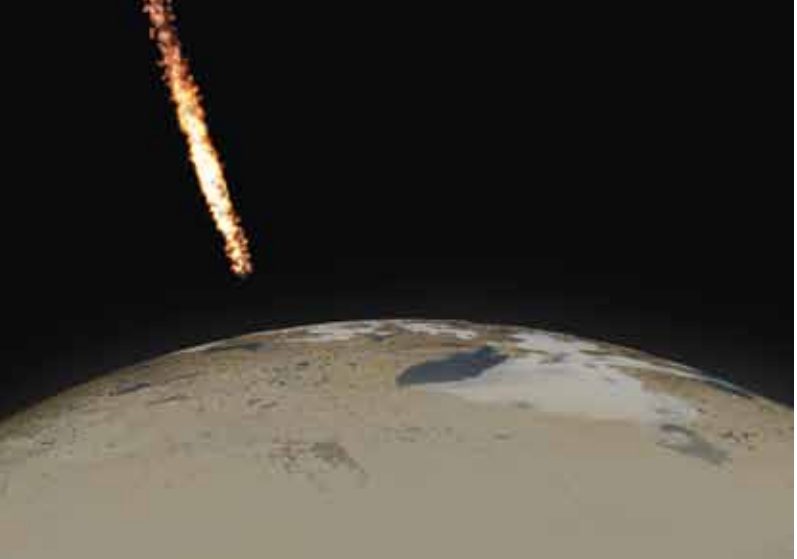
Apple has 200-million iTunes user accounts and while Amazon isn't quite as big, people in North America and Europe trust the Amazon brand and buy music, books and a range of other products from the company.

Moreover, in Europe and a number of other markets, Apple has succeeded in stopping distribution of the Samsung Galaxy because of alleged copyright infringements.

Samsung – like the Amazon tablet – runs Android's software but the problem for this system is that there is an amazing amount of junk software being developed for Android since developers are unlikely to get paid for the software they develop as users won't spend money buying basic applications.

With the iPad, good software can easily be found, from Keynote (for writing and presentations), Garageband (for writing music) Flipboard and iPlayer to play music.

Amazon, however, might change all that as it is building its own applications store and developers hope that this will mean they can earn some income from Amazon for the software they produce.



'Dead' satellite will fall to Earth in October

A 'dead' satellite is expected to fall to Earth though NASA says that it is unlikely to hit anyone. The agency says that the 20-year-old satellite will fall to Earth sometime in October and could land anywhere between Juneau in Alaska and the tip of South America.

The six-ton satellite will burn-up on re-entry and about 550kg of material will drop from the sky – which would give someone a pretty nasty bump on the head if they were unlucky enough to be in its path.

NASA says that there is a 1-in-3 200 chance that it might hit someone.

The Upper Atmosphere Research Satellite (UARS) ran out of fuel in 2005. This satellite is far smaller than the 135-ton Russian space station Mir, which fell to Earth in 2001 or the 100-ton Skylab that fell in 1979. Mir landed in the Pacific Ocean and Skylab hit the Indian Ocean and parts of a sparsely-populated area of Western Australia.

NASA says that as two-thirds of the Earth's surface area is water, the chances of space debris falling into the sea are high.

The UARS was used to measure chemicals in the air and was launched in 1991 before NASA's more recent rule that the chance of a satellite hitting anyone when it returns to Earth must be more than one-in-ten-thousand. In terms of the new rule, satellites must be capable of adjusting their orbit to meet this commitment when they are due to run out of fuel.

NASA says that it usually tries to put 'dead' satellites into a 'graveyard orbit' or steer them to a position where they will definitely land in the sea on re-entry. However, there was just not enough fuel left in the UARS to steer it to a safer orbit.

The 1-in-3 200 odds of being struck pertain to all of the almost 7-billion people living on Earth but the actual odds of a person being struck by falling debris are, according to NASA, 1-in-21-trillion.

Jonanthan McDowell, an astrophysicist at Harvard University who tracks objects in orbit, says that this is the third time this year that space debris of more than five tons has re-entered the atmosphere and fallen to Earth.

Emergency eCall system fitted to Europe's cars from 2015

All cars sold in the European Union from 2015 onwards will have an automatic emergency call system installed in them in case of an accident. The system could save hundreds of lives each year.

The eCall system will be fitted to new models of cars and light vehicles and will automatically alert Europe's emergency number 112 in the case of a serious accident according to the European Commission, which will urge member states to ensure that mobile phone operators upgrade their services so that the eCalls can immediately be routed to emergency workers.

Often the first few minutes after an accident are critical for the survival of people injured in car crashes and the eCall service will alert emergency workers even if the driver or passengers have been left unconscious or unable to make a call.

The technology is expected to add about $140 to the cost of each new car and preliminary studies have shown that it can speed up the arrival of emergency workers on the scene by 40% in urban areas and by about 50% in the more remote countryside.

Moves to develop and implement eCall have taken several years to achieve and it will be operational throughout the European bloc as well as in Croatia, Iceland, Norway and Switzerland. Britain and France have both failed to sign up for the system.

It is estimated that the system will save up to 2 500 lives a year and will significantly reduce the long-term effects of injuries sustained in a car crash. It will also help to relieve traffic congestion on highways.

However, the answering points services used by mobile network operators will have to be modernised to make sure the system works properly. eCall services are expected to cost about 4,5-billon Euros a year to run.

Africa constricted by lack of infrastructure

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.

At the same time, the Africa Development Bank (ADB) says the continent will have to spend at least $93-billion on improving basic infrastructure over the same timespan.

Gigaba says the $38-billion is needed to take care of current infrastructure deficits and to create a base for greater regional trade and investment on the continent. At the moment, the level of intra-continental trade is at a paltry 10% while the balance of trade is with partners in Europe, Asia and the Americas.

According to Gigaba, African countries need to improve energy capacity and transportation networks, and increase investment in agricultural, mining and manufacturing initiatives.

He says Africa is still being plundered by foreign countries that are scrambling for resources and this is compounded by the lack of an efficient transport infrastructure that prevents some countries from getting the full benefits of the resources they own.

Unless Africa invests billions in infrastructure every year, its economic growth will be stilted. Moreover, Gigaba says, China has already identified Africa as a target for increased investment though this is primarily for resources and raw materials.

He says the time is ripe to create greater economic integration, develop regional hubs to increase the flow of goods between different countries and integrate regional economies into shared economic planning.

Transport Minister Sibusiso Ndebele says it is imperative that Africa starts to exploit and use its own resources for the economic future of the continent as a whole.

Referring to the lack of an efficient transportation system in Africa, Ndebele concedes that private equity investments – probably with foreign rather than local partners – are fundamental as they would provide huge economic and social benefits to the continent and to individual countries.

Currently, six of the world's ten fastest-growing countries are in Africa mainly because of its rich resources. Referring to South Africa specifically, Trade and Industry Minister, Rob Davies points out that the country lost a million jobs last year and that there is no sign these are to be replaced in the immediate future.

He says that while government is planning significant investments and initiatives to improve the job market and reduce unemployment, the reality is that about 25% of the working population is currently without a job.

He says that African countries must focus more on promoting greater industrial activity and improving production levels locally because exporting materials to other countries simply means that Africa will continue to be plundered for its wealth.

The ADB says that its estimate of $93-billion a year is in addition to the $45-billion annually that African countries are spending on capital investments and maintenance projects.

In a report entitled 'Telling Africa's Development Story', the ADB claims that inefficiencies in implementing infrastructure projects are costing the continent about $17-billion a year. These include poor technical and management skills, ineffective management of costs and a lack of institutional, legal and regulatory frameworks to encourage private-public partnerships.

According to the report, Africa's inadequate infrastructure means that about 60% of its population does not have access to electricity while almost 70% of the rural population has no access to roads.

In terms of agriculture, the ADB report says that 95% of this market does not have proper access to irrigation, placing additional and unnecessary strains on Africa's ability to produce enough food to feed its

people. The report says that Africa's economic growth is constrained by at least two percentage points each year because of a lack of basic infrastructure, and this reduces the productivity of its people by at least 40% annually.

The report points out that Africa's energy sub-sector records the largest comparative deficit when compared with other emerging countries around the world. Economic activity in 2007 was affected by power outages with at least 30 African countries recording more than 11 major outages that year.

This was prior to South Africa's own energy woes in 2008 when Eskom was forced to introduce load-shedding and reduce the supply of energy to the mining and industrial sectors.

According to the report, the investment in information and communications technology (ICT) resulted in the Top Five African countries being ranked between 66th and 109th in the world rankings, based on the International Telecommunications Union's ICT Development Index.

The Seychelles, ranked 66th is the top African performer in this index, followed by Mauritius in 72nd spot and South Africa at 92. Botswana is ranked at 109 and Cape Verde at 102.

The ADB's report points out that in sub-Saharan Africa only 3% of the population has access to fixed-line telephony compared with 19% in Latin America and the Caribbean and 16% in the Middle East.

It says that the $21-billion invested in mobile phone technology in Africa between 2007 and 2009 resulted in it faring slightly better than other emerging markets. In Africa, about 40% of people have access to mobile phone technology compared with 33% in South Asia. It remains well behind Latin America and the Caribbean at 80% and East Asia at 53%.

The bank says that the rail network in Africa is the least-developed sector compared with other emerging countries, pointing out that African countries have done little to maintain or develop the network since Africa's colonial period. Moreover, the pattern is much the same when it comes to ports, logistics and trade, and the bank says that this illustrates how African countries have 'missed out on many opportunities'.

For instance, the ADB estimates that if Africa's share of world exports had remained constant since the mid-1970s its export revenues would be about ten times larger than they currently are. It blames the poor infrastructure throughout the continent for its failure to improve – or even sustain – export volumes.

Infrastructure gaps account for 40% of transport costs for coastal countries on the continent and for more than 60% for landlocked countries. Moreover, barriers in the transportation sector include:

- High transaction costs in ports.
- Outdated, low-capacity port facilities.
- A shortage of regional transportation hubs, particularly in the ports sector.
- Anti-competitive behaviour of privately-owned transport operators.

It says that in Chad, for instance, prices of imports are between 1,3 and 1,8 times higher than the cost of the product at its origin. Export prices in Europe are about 1,7 times higher than the production cost of timber and 2,8 times higher for coffee.

The ADB concedes that public sources of funding, coupled with international aid initiatives, will not be sufficient to close the funding gaps for African countries and, as a result, governments will have to explore private sources through the creation of infrastructure bonds, sovereign wealth funds and commodity-linked bonds.

Show and tell at Denel

by Peter Middleton

Denel Dynamics, SA's high-tech developer of missile and unmanned aerial vehicles (UAVs) for the SANDF and, increasingly, for BRICS and developing world markets, held a 'show and tell' day on 15 July to unveil its perspectives on the future of conflict and the proposed solutions it envisages to meet our defence needs.

Denel Dynamics, the company with its competitive, indigenous, precision weapons and UAV design and development capability, serves a number of strategic objectives for South Africa. It satisfies the unique missile, precision weapon and UAV requirements of the SANDF and enables the export of these products to customers and countries with similar technological requirements. Denel Dynamics acts as a locomotive for stimulating the wider high-technology industry and skills-base of the country.

CEO, Jan Wessels, explained that there were well-defined expectations between Denel Dynamics and the SANDF, the DoD and Armscor for short-to-medium term and medium-to-long product requirements. He also pointed to the political collaboration and support that the company enjoyed with most of the BRICS and G20 nations and with other developing countries pursuing an indigenous precision weapons capability.

He described the company as subscribing to the 'RSA Incorporated' partnership concept. South Africa, he explained, was a relatively small 'guerrilla force' in this highly competitive business, and would best succeed when industry and research establishments collaborated towards a common goal. He said that Denel Dynamics was committed to spreading potential participation as widely as possible across South Africa.

Deon Olivier presented the company's air-to-air defence solutions and its flagship development, the A-Darter missile, an infrared (IR) seeker missile being developed in partnership with Brazil. He explained that A-Darter was moving towards the qualification and full clearance envelope the Gripen fighter had already achieved.

Olivier pointed in several directions for the future: lighter, cheaper and shorter range versions of the A-Darter in the 15-20 km range for lighter fighters and the A-Darter ultra-light for armed UAVs (UCAVs), helicopters and ground attack use. Also mooted, though, was the development of a long-range multi-role, multi-mode 6th generation B-Darter missile with radar and IR seeker technology and ramrod propulsion to achieve a 100km range.

Erick Huysamer presented Denel Dynamics' air-defence solutions for naval and ground-based defence applications. He showed a map identifying the key purposes of these missiles: area defence and convoy protection, peacekeeping and extraction; blockading and airspace control at major events like the FIFA World Cup. Key development focus areas included: range extension (2-40 km) all weather performance; GPS navigational systems, and application development for offshore patrol vessels.

For land based systems, Huysamer said that mobility and stealth were two key requirements. He cited a vehicle-mounted ground-based launcher that enabled quick and mobile deployment.

Mokopa, a general missile in the 10km, 50kg range with a cost effective, fixed laser seeker head or a stabilised imaging IR with fire and forget capability, is being installed into Denel's next generation UAV, the Seeker 400.

With the Giraffe radar capable of supporting up to four vertical launchers, he said that each launcher could engage four targets simultaneously with a salvo of two missiles per target. The system, he explained, used standard ISO interfaces and a radio-freqency (RF) link for easy integration, it was transportable by air, sea and land and supported Umkhonto IR missiles as well as other extended range missiles.

Further enabling technologies currently being incorporated into these systems were: compact radar seeker technologies; differential GPS solutions; dual pulse rocket motors and spread spectrum bidirectional communication links.

Denel Dynamics' Ground attack solution was presented by head of the weapons group, Coenie Loock. Highlights included:

- Raptor, the strategic, high precision, long range missile, which recently concluded a highly successful 75km test for a foreign customer. Loock said that the miss distance was 15cm with new seeker and less than 6,5m in fire and forget mode. He said that the weapon was mature, in production and constantly being upgraded.
- Umbani, a tactical, general purpose missile due to be in series production for a major export client within 12 months. Two weapons recently released from a Hawk 25km from the target achieved miss distances well within specification.

Loock said that the Small Guided Missile (SGM) was a concept currently being defined for asymmetric warfare, i.e., conflicts involving highly-mobile small guerrilla-type armies, pirates or bandits. SGMs were seen, he said, as ideal for use in the urban environment, where threats were often surrounded by a civilian population. Its widespread use was to protect shipping lanes and to deal with fast enemy patrol boats. These small (50kg) missiles would have a programmable kill range: 1,0m with no warhead; 10m with a fully exploding head and no lethal effect beyond 30m.

Denel Dynamics' range and vision for surface target guided missiles was presented by Petrus Mentz. Central to his message was the test firing of a guided missile from a Cessna Caravan AC-208B combat aircraft. He explained that the use of sophisticated weapons on unsophisticated platforms was fast becoming a global trend and that South Africa had to create weapons that were sophisticated and cost effective coupled to an unsophisticated platform.

The Mokopa and Ingwe missiles, with 10km and 5,0km ranges respectively, were displayed as South Africa's current surface guided missile solution. He said that future developments for both of these were planned, with a view to making them smaller, lighter, stealthier and more cost effective. Future strike platforms included armoured cars, light and naval helicopters, UAVs, offshore patrol vessels (OPVs) and light fixed wing aircraft.

The laser-guided Ingwe system, Mentz outlined, was already integrated onto the MI24, and was to be engineered to be less expensive and more suitable for a wider range of platforms. He said that for our own systems in future, the Ingwe precision strike platform was a cost effective solution for other light attack helicopters and that we were also integrating Mokopa onto Lynx helicopters.

He added that Mokopa was also an option for Denel's next generation UAV, the Seeker 400. On the whole, he said, we were looking at cost effective solutions: Mokopa as a general missile in the 10km, 50kg range with a cost effective, fixed laser seeker head or a stabilised imaging IR with fire and forget capability; and Ingwe, which would have a multipurpose penetrator by later this year with precision capability for small volume

Typical Giraffe surveillance radar (top) suitable for the proposed ground-based air defence launcher system.

Awarenet aims to have a high altitude airship equipped with solar panels that can operate for six to 12 months and be capable of detecting and monitoring at individual human level anywhere in South Africa.

targets. In the future, he said, South Africa would be working on a stealthier, lighter Ingwe missile with better performance.

'Unmanned and armed surveillance solutions' was the title of Jonathan Fouché's presentation on UAVs. He began by presenting some insights gleaned from the Paris air show. "While we fully acknowledge that UAVs are not the end all solution, they are an increasingly useful part of the inventory of all modern defence forces. We see increasing numbers in use: from big systems to tiny bat-like camera carriers – and acquisition costs are decreasing all the time," said Fouché.

Because no crews were on-board, he said, UAVs were good for high risk, high persistence and endurance exercises (10-40 hours). He said that the French army, based on lessons learned from operational exercises, was emphasising that UAVs increased the protection of soldiers and 80% of missions area aimed at protecting soldiers by providing them with information and situational awareness.

Denel's Skua was also routinely used as a drone for testing missiles. "Skua has been used in the A-Darter development and during the integration of Umkhonto missiles onto the SAN corvettes," he said.

Fouché explained that the UAV's main role was to gather information, and surveillance of all kinds to enhance situational awareness and enable decision making; something the Seeker II had been doing very successfully for over a decade. He said that it was a well integrated system, easy to use and suitable for harsh environments. He added that it had already gone through several upgrades and that we were currently looking at quieter and more powerful engines, better endurance and enhanced payloads including laser target designation capabilities. There was, he said, a need for bigger systems that could stay out longer. Systems that could gather even more information using multiple sensors working simultaneously.

Hence the new Seeker 400 originally conceived as an airframe upgrade for the Seeker II but now developed into a completely new and modern UAV system with a range of enhanced communication features. Seeker 400, he said, was a typical medium altitude long endurance (MALE) UAV. With 16-hour endurance and a 250km range, it could monitor two payloads simultaneously. The emergence of compact satellite communications technology allowed for easy upgrading into high altitude long endurance (HALE) systems, he added.

Ideal for surveillance in low conflict and full scale warfare Seeker 400, said Fouché, was also well suited to convoy and patrol protection at sea and on land and some systems could deal with time sensitive targets or ambush situations. He said that the company envisaged increased growth for border safeguarding, securing fishing rights, preventing smuggling and rhino poaching, anti-piracy in Mozambique and Somali channels. We could also act against pirates with small missiles or use the guidance system to deliver an emergency pack onto a sinking yacht during a search and rescue operation.

Skua, Denel Dynamic's high-speed target drone, is designed to simulate high-speed attack aircraft during land, sea and air combat training exercises and weapon development.

Fouché said that the Seeker 400 was now under full development for a launch client: "We have the building blocks; capable people and technology to put in place very sophisticated UAV solutions for South Africa.

But we are a small systems house and we rely on the broader South African engineering community, Carl Zeiss Optronics, for example, to support us in putting systems together," he said.

Gerrit Viljoen presented a view of future conflict and the defence solutions that might be required.

He said that military operations were likely to be characterised by:

- Rapid deployment over strategic distances.
- Deployment into areas with poor transport infrastructure.
- Deployment of relatively small forces across large areas of operation.
- Unexpected contacts outside of those planned and supported.
- Contacts at close ranges.
- Engagements in and around built-up areas.
- The need to limit collateral casualties or damage.

The nature of such operations would require fire support that was: prompt, flexible, sustained and precise. Viljoen identified three key uses for technology: to see and identify, i.e., to do persistent surveillance over large areas of interest; high fidelity and layered protection against all airborne threats, i.e., protecting anything from a single vehicle to the whole of South Africa; and precision fire-power technologies with tunable effects, i.e., capable of operating in a civilian environment with minimum risk of collateral damage.

In addition, equipment needed to be affordable, have a low logistical footprint and all weather, day/night, 24/7 operational capability.

UAVs were ideal for the surveillance task but, in addition, Viljoen said, there was Awarenet, a proposed national collaboration by the South African radar interest group (SARIG). The dream, he outlined, was to have a high altitude airship equipped with solar panels that could stay up for six to 12 months. With a vast array of sensors, the idea was to be able to detect and monitor individual humans, large mammals, suspicious vehicles, poachers, etc. It aimed to be able to detect the difference between a rural villager and an armed terrorist, he said.

From space, it would be possible to use satellite observations to monitor agriculture, climate change, military movements, and much more – and if we developed a satellite launch capability, we would also be able to sell that service to launch the satellites of other nations.

On the active protection side, Viljoen cited a demonstration in the US last year of an active protection missile, a small 3,2kg missile that could intercept and deflect incoming enemy missiles. Mongoose 1 (20m), Mongoose 3 (300m), the C-RAM guided 35mm shell (2-3km), and the local area protection system (LAPS) (6-8km) systems were Denel Dynamics' versions of active protection. Umkhonto Mk 1 (12-15km) and Mk 2 (30-60km) were the chosen solutions for short range (SHORADS) and medium range (MRADS) air defence.

What was needed, he said, were systems that could shoot down mortars and artillery fire in large numbers. Using the guided gun shell approach, a 35mm guided shell system could successfully shoot down 60 threats a minute with greater than 90% reliability.

Meeting the need for weapons for urban environments and tuneable effects, Viljoen listed several ongoing developments: a 4,0kg FSIM infantry support missile; the Ingwe III new generation anti-tank missile; a range of guided artillery and mortar shells (76/105/120/155 mm); and the small guided missile (SGM) with a programmable warhead. He highlighted the guided artillery solution, which he showed deployed as quickly as a conventional mortar, but guided directly to a target with a 10m circular error using GPS and inertial guidance.

Viljoen said that technology was an important cost-effective force-multiplier for the future and that Denel Dynamics was a technology partner that could provide innovative solutions to operational requirements and that stood ready to assist its clients to achieve their goals with tailor-made solutions.

Some 'whey' to go for food packaging industry

The whey protein – a by-product in cheese production – is being used to make a form of plastic for food packaging. The WheyLayer project, funded by the European Commission, is the brainchild of research company IRIS, which discovered it could replace synthetic petroleum-based polymers with the whey protein.

The whey protein plastic has similar oxygen-blocking properties to traditional food packaging but is cheaper to make, easier to recycle and seems to be even better when used with foods.

Scientists say the biggest advantage is that the whey protein can be removed with enzymes and then reused. The manufacturing process keeps about 40% of the whey protein that is currently discarded by European cheese factories.

As part of the project, the scientists are also using the whey proteins to replace synthetic oxygen barrier layers for use in the cosmetics industry. They have found that preliminary experiments on the oxygen permeation properties of the whey protein prove that it provides an excellent oxygen barrier.

The researchers say that common synthetic polyolefin films such as PE and PP block moisture but have to be coated or laminated with synthetic polymers such as Ethylene Vinyl Alcohol Polymer (EVOH) or Polyvinylidene chloride (PVDC) to provide an effective barrier. The resulting polymeric structures are effective in minimising oxygen, water vapour and odour permeation but are difficult to recycle. The team says that the whey protein offers a number of special advantages, primarily that it is discarded into landfill sites by cheese producers and has no commercial value to them at all.

Fourteen companies from seven European Union countries are working on the WheyLayer project to develop a sustainable packaging material from this unwanted by-product. Positive properties of the packaging material will include its anti-microbial and anti-oxidative properties on the film and researchers say that it will be possible to obtain particularly pure protein isolates from sweet or sour whey by chemically modifying the formulation.

NASA scientist guilty of espionage

A scientist employed at NASA has admitted that he tried to sell top secret information to an undercover FBI agent who was posing as an Israeli spy.

Stewart Nozette, who has been fired by the space agency, tried to provide information on satellites, early-warning systems and ways of retaliating against large scale attacks on communications systems.

He has been sentenced to 13 years in prison after the US Department of Justice and Nozette's lawyers reached a plea agreement.

Nozette, who has been in jail for the past two years, will be credited with the time he's spent behind bars.

Just before his arrest in 2009, Nozette told the undercover agent that the cost of developing the different systems cost the US government between $200-million and $1-billion and suggested that the agent pay him about one percent of the development costs in return for the information.

At the time of his arrest, Nozette had high-level security clearance having worked on a number of science and space projects at NASA, the energy department and the National Space Council.

Nozette could have had the death penalty imposed against him for all four counts of espionage that he faced but the deal with the justice department ensures that he will remain in jail for 13 years instead.

He has a doctorate in planetary sciences from MIT and was primarily known as a defence technologist who had worked on the missile defence shield project, the 'Strategic Defence Initiative', formulated under former US President, Ronald Reagan.

Nozette also helped to prove the existence of water on the Moon. Because of the highly classified information he has been exposed to, Nozette has had special communications restrictions placed on him while in jail.

Galaxies used as lenses to explore the universe

Astronomers use galaxies as lenses to explore distant parts of the universe, providing them with a precise tool to measure the size and age of the universe and how rapidly it is expanding.

The measurements determine a value for Hubble's constant, which indicates the size of the universe and confirms its age as 13,75-billion years old, within 170-million years. It also measures the strength of dark energy, responsible for accelerating the expansion of the universe.

Now, a team of astronomers is using gravitational lensing to measure the distances light has travelled from a bright, active galaxy to the Earth along different paths. By understanding the time it takes to travel along each path, and the effective speeds involved, a researcher can infer not just how far away the galaxy is but also the overall scale of the universe.

According to Phil Marshall of the Kavli Institute for Particle Astrophysics and Cosmology it is often difficult to distinguish if a bright light is far away or if it's a dimmer source lying much closer. The gravitational lens circumvents this problem by providing a number of clues to the distant light.

For instance, when a large, nearby object such as a galaxy blocks a distant object such as another galaxy, the light can detour around the blockage in up to four different routes thus quadrupling the amount of information that scientists receive.

Marshall says that gravitational lensing can measure the ebb and flow of light from four distinct paths. He says that while researchers do not know when the light left its source, they can compare its arrival times.

He likens this process to four cars taking four different routes between places and arriving at different times.

Marshall says that traffic density in cities is much like the mass density in a lens galaxy and by using gravitational lens equations to account for variables such as distance and density it is possible to get a better idea of when the light left the background galaxy and how far it has travelled.

Magnetic stimulation stops people from telling lies

Sending a magnetic pulse to a particular part of the brain stops people from being able to tell a lie, according to a study undertaken by Estonian researchers.

The act of deception is believed to be as old as civilisation itself and probably began soon after human beings started communicating with each other. But as more people were telling lies, more wanted to know what the truth was and modern technologies have been developed to try and force people to do so.

These technologies include the widely discredited polygraph and extend to the use of powerful drugs. However, the latest study suggests that brain interference can solve the problem and prevent people from being able to lie.

Two researchers, Inga Karton and Talis Bachmann worked with 16 volunteers who submitted themselves to transcranial magnetic stimulation, which stimulates some parts of the brain but not others.

Transcranial magnetic and electric stimulation is being used to study complex aspects of human nature such as morality and learning patterns that can impact on conditions such as autism or stuttering. The stimulation temporarily interferes with the affected area, causing it to behave differently.

In the study, volunteers had their dorsolateral prefrontal cortex stimulated. This part of the brain is thought to be involved in decision-making, complex thought and deception.

Like most of the brain it has a right and left side, which are responsible for different tasks. The volunteers were shown a series of coloured disks, and told they could tell the truth or lie about the colours. Half were stimulated on the left and the rest on the right.

The volunteers who had the left part of the brain stimulated lied more often while the ones who had the right side stimulated were more likely to tell the truth. The experiment was then repeated using a different part of the brain and that had no effect on any of the volunteers. The researchers concluded that the spontaneous choice to lie more or less can be influenced directly by brain stimulation. Further studies, using more volunteers and a larger range of tests, are planned for the future.

I wonder if it would be successful on some of our youth league members.

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CROWN PUBLICATIONS

Inter-breeding between humans and Neanderthals

Inter-breeding between modern humans and Neanderthals and Denisovans occurred in Africa as well as in Europe and Asia according to a study published in the *Procedures of the National Science Academy* (PNAS).

The authors of this paper argue that inter-breeding was more likely in Africa as fossil records show that a variety of transitional forms existed with remnants of both archaic and modern features.

The inter-breeding seems to have occurred over a wide geographic area extending from Morocco to South Africa and took place between 200 and 35 kya (thousands of years ago).

However, the authors note that conclusive evidence could only be drawn from ancient DNA samples and many areas of the continent are not conducive to DNA preservation.

In the absence of conclusive DNA evidence, the authors present a statistical argument. They suggest that DNA that has come from a population that's otherwise reproductively isolated should have certain properties. In terms of DNA sequence changes it should appear to be more distant from other human variants than those variants are to each other.

And it should only be present in a limited sub-set of human populations, the descendants of the one where the inter-breeding took place.

The authors concede that the evidence isn't conclusive but these sorts of patterns are unlikely to occur by chance and rare variants may end up being common in a population because they resulted in a favourable mutation.

The research was done on two groups of the oldest and most diverse populations in Africa comprising hunter-gatherers and an agricultural group from West Africa. They examined the genetic diversity in these populations to estimate population dynamics, which showed a large recent expansion of the human population.

What was unexpected was the divergence time that pre-dates the origin of modern humans based on fossil data. In other words, it appears that two populations had split before modern humans existed as a distinct group and the probability of this being explained by chance is just two percent.

The scientists have identified a single area of Chromosome 4 as likely to be the product of DNA that has come from a population that is reproductively isolated. The inter-breeding in this population is thought to have occurred about 35 000 years ago.

Carbon dioxide used to make natural limestone

A team of Icelandic and American scientists have come up with a plan to pump carbon dioxide into a deep hole on the fringes of a steaming volcano to chemically dispose of the greenhouse gas that is blamed for causing the bulk of the world's global warming.

The CarbFix experiment will use the features of the basalt rocks that cover about 90% of Iceland. Basalt is highly reactive and when combined with calcium and a carbon dioxide solution it forms limestone, which is harmless.

However, the scientists are sceptical about whether the experiment will provide a means of safely disposing of carbon dioxide. They say that the main goal of the experiment is to assist students to look for alternative solutions to the greenhouse gas problems facing the world.

The experiments are being sponsored by a Reykjavik electricity company and various American and Icelandic universities. Columbia University's Wallace Broecker says that whether we solve the problem of disposing of carbon dioxide in the next 50 years or in the 50 years after that is irrelevant as we still have to store it.

The advantage of the CarbFix experiment is that it holds the promise of transforming large amounts of carbon dioxide into limestone. Reykjavik Energy operates a huge geothermal power plant on the fringes of a volcano that last erupted about 2000 years ago.

A collection of about 30 wells draws steam laden with carbon dioxide and hydrogen sulphide from the volcano and CarbFix separates the two gases. Carbon dioxide is piped to an injection well about three kilometres away where it is combined with water and pumped back into the ground.

This carbonated water or 'seltzer' is pumped to a depth of 500 metres at which point the carbon dioxide bubbles start to dissolve, forming carbonic acid. The acid is extremely corrosive. It attacks the basalt rocks, which are porous, eventually filling in areas of the rock with the acid water which reacts with calcium in the basalt to form calcium carbonate or limestone.

The CarbFix team have applied for patents on their system in both Iceland and America.

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 personal 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 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 or 011 487 9042
In addition you gain CPD credits, for when you are required to re-register.

Bacteria can remove soluble uranium from water

Tiny filaments that grow on the surface of bacteria could be used to remove uranium from contaminated water. Uranium mining and atomic weapons tested during the Cold War era have led to contamination of sediments and groundwater through toxic soluble uranium.

Now a team of American scientists from the Michigan State University has identified a Geobacter that produces tiny protein filaments or nano-wires that remove dissolved uranium from water and precipitate it outside the cell.

The filaments effectively alter the soluble form of uranium into a less-soluble form that can easily be removed from sediments. The reaction is a by-product of the bacteria's normal metabolism, which generates energy by altering the chemistry of other metals such as iron.

Dr Gemma Reguera and her team at Michigan have found a way to purify the nano-wires in the natural population of Geobacter and to genetically increase their concentration. The amount of solid uranium deposited around the cell is directly proportional to the number of filaments it has. The individual filaments are about four nanometres across but they create a network that is many times the size of the cell itself.

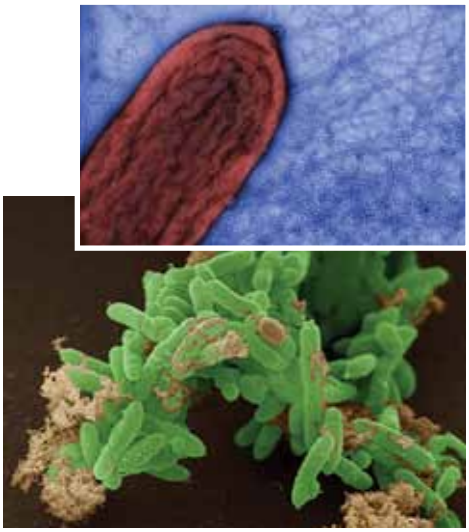
The network creates a surface area that is available for converting the uranium but keeps it at a safe distance from the cell. The harmful uranium is deposited outside the bacterial cell and the bacterium is not harmed or poisoned. The Geobacter grow faster and recover more quickly in uranium-contaminated water than any other species.

The use of this type of technology may have special application in South Africa where acid mine drainage is threatening the country's water supplies and experts are warning that attempts to control acid mine drainage are already reaching environmentally critical levels under Johannesburg.

A panel of experts told Parliament's water and environmental affairs committee that acid mine drainage will begin overflowing into Johannesburg in early 2013 if rainfall is normal but if there is a wet summer next year, it could start flowing by November 2012.

The experts warn that the Western Basin is already decanting and emergency action should begin within two months to halt the overflow and draw the drainage down to an environmentally critical level.

They say that there is more time for construction of water treatment plants in the Eastern Basin because it is filling up more slowly than the Central Basin. Central government is currently preparing a budget to deal with emergency measures to halt the mine drainage.



Cheating Dutch scientist sacked

A Dutch social psychologist who fabricated data for some of his studies has been sacked by Tilburg University. Diederik Stapel, who heads the university's Institute for Behavioural Economic Research, admitted he used faked data.

Stapel had worked at the university in southern Netherlands since 2006. He was known as a prolific researcher and a successful fundraiser and his studies appeared to offer new insight into the workings of the human mind. For instance, a paper published in April this year showed that people are more likely to stereotype or discriminate in messy environments.

University Rector, Phillip Eijlander, says that he was first contacted in August this year by junior researchers working in Stapel's facility who alleged that his conduct was fraudulent. Stapel admitted that there was "something strange" in his papers and then confessed that the data had been faked. In a statement released by the University it says that Stapel had "committed a serious breach of scientific integrity by using fictitious data in his publications".

As a result, the University has now asked Willem Levelt, a psycholinguist and former president of the Royal Netherlands Academy of Arts and Science, to lead a panel that will investigate the extent of the alleged fraud.

This committee will compile a report on its findings by the end of October and the university will publish the findings internally and externally before announcing what further measures will be taken.

Eijlander has confirmed that all 'tainted papers' will immediately be retracted. In early September, Stapel produced a contentious paper that attracted newspaper headlines around the world when he claimed that people who think about eating meat behave in a more boorish way and are less social.

The announcement raised some eyebrows as the study had not yet been written, let alone published. Roosvonk, psychologist at Radboud University Nijmegen and a collaborator on this study, says that she believes it is also based on fabricated data.

PneuDrive Challenge road show visits Tshwane University of Technology

The PneuDrive Challenge road show team, headed by Rene Rose of SEW Eurodrive and Brian Abbott of Festo, delivered an overview of the competition on Friday 2nd September at the Tshwane University of Technology (TUT). Interest from Professor Johan Benade and some TUT students was generated after one of the students visited the competition's website – www.pneudrive.co.za – thereby reinforcing the value of creating a web space for the competition.

Professor Benade quickly saw the value of this competition on his students' learning experience and arranged for more than 30 committed and enthusiastic mechatronic and mechanical engineering students to attend the presentation. There is no doubt that by getting his students to engage in the design competition, Benade has created an environment for learning that will help students bring together engineering theory, the latest technology in drive engineering and pneumatics and business reality.

Although TUT students have less than six weeks to achieve what some students may have been designing for about six months now, they are confident that a strong entry will come out of this group. In fact, the questions that were being asked by students clearly indicated that some extensive thinking had already taken place and that there was a strong belief in the potential of someone in the group to design a winning entry. If the TUT students manage to combine their enthusiasm with a creative and accurate design, there is a good chance that they may win a trip to the SEW Eurodrive and Festo head offices in Germany and R100,000.00 worth of equipment for their university.

During the visit Rene Rose explained that two international judges, Tobias Nittel from SEW Eurodrive, and Andreas Keller from Festo would be part of the judging panel. She also mentioned that "besides sticking to the rules of the competition, judges will focus on elements such as creativity, business acumen and technical accuracy".

Brian Abbott demonstrated a range of pneumatic components in the Festo Expotainer and the interest shown by TUT students clearly illustrated the importance of combining engineering theory with what happens on a production line. Abbott emphasised to students that there were a wide range of components and possible design applications when integrating Festo and SEW Eurodrive products, and that the competition was "not just about re-inventing the wheel of existing production designs, but about trying to come up with a design that is unique and creative".

For further information please contact Rene Rose on +2711 248 7000.

Jute turns to a golden fibre

Jute, a vegetable fibre that can be used to make sacks and packaging materials, is returning to favour in many markets and for the first time since the 1980s jute sales exceeded a billion dollars for Bangladesh, one of the largest natural producers of the fibre.

In the 1980s packaging manufacturers switched to synthetic materials like polythene and other plastics and sales of jute steadily declined. However, jute is bio-degradeable and has become the preferred alternative to synthetic bags for the packaging industry. Sales of jute in Bangladesh have brought much-needed foreign income to the impoverished country. Jute is the second most important natural fibre after cotton in terms of its cultivation and usage and the major growers are in eastern India, China, Burma and Bangladesh.

According to Mohammad Asaduzzaman, a scientist at the Bangladesh Jute Research Institute in Dhaka, the mechanical processing and chemical treating of jute allows it to be used to make carpets, bags, textiles and insulation materials.

At the moment there are about five million farmers involved in jute plant cultivation.

Once the plants are harvested, they are bundled together, immersed in water and left to rot. The fibres are then stripped from the plant, dried and sent to mills for processing. Interestingly, the government of Bangladesh has made it compulsory for jute bags to be used for all packaging of food grains.

Jute is extremely versatile and strong and, in applications such as geo-textiles, is used for soil erosion control or is laid underneath tarred roads to create greater durability and prevent the build-up of moisture beneath the road surface.

Jute is also being used to make grades of paper and pulp and Bangladesh scientists are working on a project to blend jute with cotton to produce a denim fabric.

By harvesting it earlier than the usual period of 120 days, the fabric is softer and can be chemically modified and bleached. However, special machines are needed to blend the jute and cotton and, to date; none of these machines is available commercially.

Call to moderate electricity prices

The South African Energy Intensive User Group (EIUG) has called for greater price moderation by Eskom and the National Electricity Regulator of South Africa (NERSA). It says that high electricity prices are affecting the country's competitiveness and are undermining its ability to beneficiate minerals.

It says that a number of refineries and smelters have been forced to close down. The EIUG, whose members consume about 44% of the country's electrical energy, is to undertake a study that is aimed at assessing the state of energy-intensive firms and their prospects. It has called on NERSA to audit the 19,8% rise in Eskom's primary energy costs for the financial year that ended in March.

Eskom says its primary energy costs have risen to 16 cents per kilowatt hour and are likely to rise at rates that are well above inflation next year. Moreover, it says, coal-related inflation could be between 12% and 15% over the next few years. This is because Eskom needs to secure supplies and improve the quality of coal it uses.

Eskom says its total costs rose to 32,8 c/kWh in 2011 equivalent to R38,8-billion. The costs include a government-imposed environmental levy of 2c/kWh.

The EIUG has warned that energy costs could double to about 100 c/kWh in the medium term and says that these price hikes are too high and will have negative consequences for businesses and their ability to compete in international markets.

It says that the average Eskom price in 2011/12 will be about 50 c/kWh and the average tariff will probably settle at about 75 cents by 2016. NERSA last year approved increases of 25% a year for the three years from 2010 to 2013.

Mike Rossouw, chairman of the EIUG, says that a co-ordinated regulatory policy and investment effort are required to moderate the price increases as these could lead to 'de-industrialisation'.

The EIUG members include large mining groups such as Anglo American, BHP Billiton and Xstrata along with steel manufacturers and chemical, paper and pulp producers.

Nord Stream pipeline to supply Germany with energy

A new pipeline that pumps natural gas under the Baltic Sea from Russia to Germany has been opened by the Russian Prime Minister Vladimir Putin. Known as the Nord Stream pipeline, it reduces Russia's dependence on the existing Ukrainian pipeline, which was shut down during gas disputes between Russia and the Ukraine.

Consumers in Germany will use the gas, which runs down a twin pipeline that cost $12,5-billion to build and traverses 1 224km from Vyborg in north-west Russia to Sassnitz in north-east Germany. It will be capable of pumping 55-billion cubic metres of gas a year once the second pipeline is running.

Nord Stream gives Russia's gas company Gazprom sufficient capacity to boost future supplies to Western Europe. The amount of gas, according to Putin, is equivalent to the output of 11 nuclear plants.

At the moment about 80% of Russia's gas exports flow through the Ukrainian pipelines. Russia is planning to build another pipeline, known as the South Stream, which will run from southern Russia to Bulgaria under the Black Sea and will pump another 63-billion cubic metres of gas to central and southern Europe each year. Some analysts say, however, that the South Stream is a 'bluff design' being used to put pressure on the Ukraine to reduce its prices.

Russia's huge gas resources will lead to a further pipeline being built along a 3 900km stretch known as Nabucco. It will carry 31-billion cubic metres of gas from the Caspian and the Middle East westwards to Turkey, Romania, Bulgaria, Hungary and Austria.

Ukraine has been fighting hard to reduce the price it pays for gas under the contract it has with Gazprom, which was signed by Yulia Tymoshenko, the then Prime Minister. Ms Tymoshenko is currently on trial in Kiev, accused of exceeding her authority by signing the gas-pumping deal at a price that was economically damaging for the Ukraine.

The country's current Prime Minister, Viktor Yanukovich says that the country will launch an international legal challenge to Gazprom's pricing model if Kiev is unable to secure lower prices.

The threat that Russia will shift significant export volumes of gas to the Nord Stream – thus depriving Ukraine of transit fees for carrying Russian gas – could prevent the legal action. Moreover, European gas buyers want Gazprom to modify the terms of its long-term supply agreements with them to reflect the lower cost of spot prices in Europe and this might be achieved by cutting the transit fees paid to the Ukraine. Gazprom's chief executive, Alexei Miller, says that the Ukraine has "got on a train to a dead end" in its pursuit of lower prices.

Renewable energy meets 21% of Germany's power needs

Germany, which has already announced plans to close down a number of its nuclear plants, says that renewable energy supplied almost 21% of the country's total energy needs in the first six months of this year.

According to the Association of Energy and Water Industries (BDEW), wind, biomass, solar and hydro power plants generated 57 TWh. It says that solar photovoltaic systems on rooftops of homes, farms and factories generated about 3,5% of the national supply, exceeding that of hydro-electric power's 3,3%.

Wind turbines produced about 7,5% of the country's energy needs while biomass plants contributed about 5,6%. By comparison, the BDEW says that 57 TWh is sufficient to provide about 40% of California's electricity consumption in the first half of the year.

In a separate development, SolarWorld has announced plans to close its existing manufacturing plants in the United States and in Germany and will transfer production from these facilities to its newer plant in Oregon.

The announcement comes at a time when Solon has also closed its manufacturing operation in the US and two other companies, Solyndra and Evergreen Solar went into bankruptcy in August.

SolarWorld says consolidation of its plants will allow it to better compete in the global market and manage price reductions as China and India typically, increase solar production to meet rising international demand.

There has been a 70% decrease in solar panel prices over the past two years according to Arno Harris, chief executive of Recurrent Energy. He points out that Solyndra's technology was compelling when solar modules costs $3,25/W but that the technology could not prove itself when the costs dropped to $1/W.

Harris says that while this may place additional pressures on manufacturers, the reality is that the less that solar power costs, the more attractive it becomes for those who are using conventional power supplies.

He says that utility-scale solar power can now be delivered in California at prices below $100/MWh, less than most peak generators, even those running on natural gas.

Finance is key to renewable energy

Finance and funding mechanisms will be the key to supporting green, low-emission and climate resilient development according to the United Nations Development Programme's director of environmental finance, Dr Yannick Glemarec.

He says there are three challenges that must be overcome for developing economies such as those in Africa. These are:

- Access to innovative sources of funding for climate change.
- Creation of synergies between developmental and climate finance.
- The use of public finance for climate change projects.

He says in many developing countries, food security is already a problem that is exacerbated by energy shortages and a lack of access to clean water and proper sanitation.

Glemarec says that climate change will pose health challenges for the people of Africa particularly as more pests start to migrate to warmer climates and the incidence of waterborne diseases keeps rising.

He suggests that Africa formulate binding public policies while encouraging greater levels of private finance for green projects. It also needs to invest in its infrastructure development, formulate regulations that will attract independent power producers and focus efforts on using green energy such as hydro and solar technologies.

According to data from UNEP's Division of Technology, Industry and Economics, global investment in renewable power and fuels reached a new record in 2010, which saw investments reach $211-billion last year, up by 32% compared with 2009.

A document entitled 'Global Trends in Renewable Investment 2010: An analysis of Trends and Issues in Financing of Renewable Energy' says that there is strong evidence of a shift to renewable energy in developing countries.

New investments in renewable energy by third-party investors reached $143-billion but almost $71-billion of that was in developing countries and $72-billion in developed countries.

Predictably perhaps, China led the investment drive with $48,9-billion going into new investments and it seems to be dominating the financing of large wind farms. However, investments in renewable energy increased by 104% to $5-billion in the Middle East and Africa region and was up by $13,1-billion in South and Central America.

The report says that the price of photovoltaic modules per MW has fallen by 60% since July 2008 while wind turbine prices have dropped by 18% per megawatt.

Uganda's reliance on charcoal pushes up prices

Charcoal prices in Kampala almost doubled in August with a single sack of quality charcoal now costing Sh70 000 ($24,80) at the Nateete Market, primarily because trees that are suitable for making charcoal are becoming more and more scarce, according to Richard Kisakye, a charcoal trader at the market.

He says that charcoal burners (or small-scale manufacturers) are trying to find sources where trees are abundant and free because farmers are charging them for felling the trees and making the charcoal, pushing up prices.

He says that charcoal burners who were working in the cattle corridor districts of Nakasongola have been forced to pay land owners for felling trees, as many farmers there are trying to establish plantations.

Kisakye says that because the sites for 'free trees' are further away from the cities, traders are charging more for the product in order to cover the fuel and transportation costs of getting their product to market.

He predicts that prices of charcoal in Kampala are likely to rise to between Sh80 000 ($28,42) and Sh90 000 ($31,97) before the end of the year.

About a decade ago most of the charcoal sold in Kampala came from Luwero and Nakasongola, but charcoal burners are now travelling to Masindi to fell suitable trees.

Moses Kawere, a resident in Bweyogerere says that the prices of commodities will have to go up as people rely on charcoal because the electricity supplies are erratic and far too expensive for most people to afford.

John Diisi, an expert in Geographical Information Systems says that the Ugandan government is not doing enough to control rampant felling of trees for charcoal.

The Uganda Bureau of Statistics says that about 90% of Uganda's population relies on wood fuel with the urban population using charcoal and the rural population relying on firewood that they can carry to their homes.

Diisi has called for the urgent formation of an inter-ministerial committee of experts to work on methods of producing sustainable biomass energy, possibly using charcoal as a feedstock.

Legislation sets energy management pace

The need for companies to comply with legislation is driving the demand for energy saving from top management down. Two months after the international release of the Energy Management Standard, ISO 50 001, Energy Cybernetics in conjunction with DQS launched the first ISO 50 001 course in Port Elizabeth.

Held in August this year, the course highlighted a number of interesting points: The responsibility for energy efficiency within organisations seems to be scattered throughout various departments. Delegates from automotive industries in the region who attended ranged from environmental managers experienced in ISO 14 001 to plant engineers and energy department personnel who held the portfolio of implementing energy efficiency and sustainable development practices. A common misconception was that energy managers filled a temporary position that would no longer be required once savings had been achieved. The reality, however, is that ISO 50 001 requires documentation, continuous training and management in the same manner as financial accounting systems.

Energy management forces companies to look at how much energy they use, where they use it, what drives the high usage areas and equipment, who and what within the organisation influences energy use, and which areas and systems warrant further investigation. To equip your organisation with the knowledge to start implementation of ISO 50 001, attend the next Energy Management System Implementation course at Emperors Palace, Gauteng, from 24 to 25 October 2011.

For bookings logon to www.energycyberneticstraining.com or call Christina on 018 294 7174.

Delegates at the first ISO 50 001 course held in Port Elizabeth in August this year.

DSTv Eutelsat Star Awards place science and technology on Africa's education agenda

On Monday 12 September at Vilamoura, Sandton Sun, Johannesburg, MultiChoice Africa and Eutelsat, in collaboration with Mindset Learn, saw the first DStv Eutelsat Star Awards draw to an exciting end at a gala dinner presided over by the Minister of Science and Technology, Mrs Naledi Pandor.

At the event, the Minister encouraged TV channels and stakeholders to engage with officials of the department to see how, where and when they could enhance the participation of youth in marginalised parts of this country and those in our fellow African states in various science and technology initiatives.

Out of over 800 entries from across the continent, the final judging panel reviewed 12 finalists' entries, which included Chukwuka Ekweani (Nigeria), Sandile Dube (Swaziland), Kidanemarriam Belew (Ethiopia), Vitumbiko Chingwere (Malawi), Rebecca Nalwanga (Uganda) and Oluwaseyi Oloyede (Nigeria) and commented on the extremely high level of these entries.

The final judging panel comprised Judging Chairman, Professor George Smoot, Nobel Prize laureate and Astrophysicist; Dr Phethiwe Matutu, Chief Director Department of Science and Technology; Lauren Beukes, novelist and winner of the 2011 Arthur C Clarke Award for her novel Zoo City; Nadi Albino, Chief of Education UNICEF and Professor Amadi Ihunwo, Head Morphological Anatomy, Faculty of Health Sciences at the University of the Witwatersrand. All agreed that talent among Africa's students abounds.

Overall judging panel with the President of MultiChoice Africa.

Prof. George Smoot, receiving a complimentary gift from SAIEE members, Shamendran Pillay and Gerard Petrick.

Minister Naledi Pandor and Nobel laureate, Prof. George Smoot.

JHB START UP

The first Startup Weekend to be held in Johannesburg took place on 29 July at Microsoft's head offices in Bryanston. The event attracted 39 people, all of whom committed to working the entire weekend in an attempt to create a start-up.

A total of five teams was formed; each working on projects ranging from budget travel to trading OTC shares. The event attracted many local sponsors as well as regular international sponsors who provided attendees with web hosting, breakfast and access to Venture Capitalists. Everyone who participated in the event thoroughly enjoyed seeing that it is possible to create something in a weekend.

Regulating the measurement and verification industry

The Council for Measurement and Verification Professionals of South Africa (CMVPSA) is a Section 21 company established as a Chapter of the SAEE to regulate M&V practitioners (individuals) in the industry. CMVPSA will operate in the same manner as which professionals within the legal, medical, and accounting professions, for example, are regulated.

The development of Regulations and Standards to claim energy efficiency tax incentives was set in motion in 2009 when the then Minister of Finance, Trevor Manual, announced that there would be tax incentives for companies that could demonstrate energy savings. This necessitated the establishment of the CMVPSA. Following Manual's announcement, the South African Bureau of Standards (SABS) was tasked by government to develop a South African Technical Standard (SATS) for the energy efficiency tax incentive programme. This has been completed and is available from SABS – SATS 50 010. The SATS is expected to be converted to a full South African National Standard (SANAS) during the course of 2011.

The South African National Accreditation System (SANAS) was tasked with developing an accreditation process for M&V bodies. This fulfils the requirement of assessing the capability of Measurement and Verification (M&V) companies. The mechanism is in place and SANAS is ready to accept applications from companies wishing to become accredited. SANAS provides full information and guidelines for accreditation on its website. SANAS will accredit M&V bodies using the SATS 50 010 as basis as well as M&V-specific requirements, such as having access to appropriately skilled and qualified human resources.

It is imperative that there is a mechanism that ensures that both individuals as well as companies are held responsible for their actions in the event of malpractice. SANAS will deal with companies while CMVPSA will deal with individuals.

With the SATS and SANAS systems in operation, all that is outstanding is the publication of the Regulation, which will allow companies to claim tax on their energy efficiency savings. This regulation is expected to be published toward the end of 2011.

Individuals wishing to verify measurements for energy efficiency tax incentives and ISO 50 001 certification must register as professional M&V practitioners with the CMVPSA.

Students studying at a tertiary institution may apply to the Council to become Student Associate Members free of charge. Associate membership is available to persons interested in M&V who want to gain more knowledge on the topic for a minimal annual fee. Full membership implies that you are registered as an M&V professional with the CMVPSA, providing that your educational and experiential requirements are fulfilled.

For further information or to register with the CMVPSA in any of these categories, logon to www.cmvpsa.org.za, or contact Izelle Bosman by telephone on 018 297 5908.

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 1st Concentrated Solar Thermal Power Conference and Exhibition to take place in Johannesburg on the 7th and 8th 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.

PV solar and wind energy for professionals

A one day training course that introduces the concept of Photovoltaics (PV) and presents standalone PV system configurations and their design, installation, commissioning and maintenance, as well as the principal components of such systems. How wind power can be integrated here as well as the regulatory compliance aspects are also discussed. The course is presented by Lapp Group, and is 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 1 October 2011 at the Lapp Building in Modderfontein, Gauteng.

For further information or to make a booking for either of these courses, contact Johannah on 086 167 7652 or email dieter@solarcon.co.za.

SAEE scoops international award

The Southern African Association for Energy Efficiency (SAEE), one of 70 chapters of the Association of Energy Engineers (AEE), has been presented with the International Best Overall Chapter Performance Award by the US-based AEE. President of the SAEE, Prof LJ Grobler was elated at the news.

The AEE has an international membership of over 14 000 professionals in 83 countries and provides information and networking opportunities in the fields of energy engineering and energy management, renewable and alternative energy, power generation, energy services, sustainability, and related areas. Globally, the AEE is known for its widely recognised energy certification programmes, which role the SAEE facilitates through its affiliated trainer, the Energy Training Foundation.

The SAEE provides various platforms for education and awareness creation in energy engineering and related industries at a time when this country is experiencing energy supply constraints coupled with generation cost increases that could hinder economic development. In addition, a council has been established to uphold the stature of Certificated Measurement and Verification Professionals. Almost 25% of the CMVPs in this country have already registered with the Council for Measurement and Verification Professionals of Southern Africa (CMVPSA) and have agreed to abide by the high standards expected of them.

For more information on the SAEE contact Danielle Badenhorst on 018 293 1499; email info@saee.org.za, or visit www.saee.org.za online.

SAIEE visit to ACTOM

On Wednesday the 31st of August, members of the SAIEE were welcomed by ACTOM, formerly Alstom, for a tour of its plant and a light lunch in Germiston. SAIEE Fellow and Council member, Hermann Broschk, organised the visit.

ACTOM (Pty) Ltd is the largest manufacturer and distributor of electrical equipment in Southern Africa, employing approximately 6000 people. The B-BBEE company has 33 operating units, 27 production facilities and 28 distribution centres throughout South Africa. ACTOM is extensively involved in the production and manufacturing of power equipment, power conversion, high and low voltage equipment, medium voltage and protection equipment, transformers and electrical products.

The SAIEE members in attendance were invited to the boardroom and given a brief history of the company by Jack Rowan, Managing Director of the Transmission & Distribution Division at ACTOM. Everyone received a set of earplugs prior to being guided through the large factory to get a glimpse of the inner workings of the plant.

During the tour, ACTOM shed some light on its Apprenticeship programme, something which seems to have fallen by the wayside in most large corporations today. The group's training centre is responsible for training electrical and mechanical apprentices. A range of short courses has recently been introduced for group tradesmen and outsiders to provide these experienced but unqualified tradesmen with the opportunity to acquire the official qualifications they need.

The tour, which involved visiting each department and seeing numerous employees plying their trade and manufacturing the wide array of products offered by the company, was an experience enjoyed by all who marvelled at the complexity and efficiency of the workplace. The impressive two-hour tour was concluded with the SAIEE members discussing the day's events over a light lunch and beverages in the boardroom.

On behalf of the SAIEE, past President Pierre Ballot thanked ACTOM for the tour.

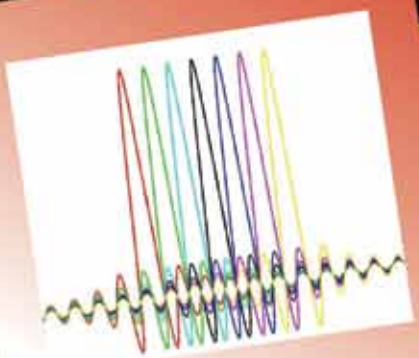
Photos courtesy of Apex Multimedia.

TELECOMMUNICATIONS RESEARCH GROUP

POWER LINE COMMUNICATIONS:
University of Johannesburg

Our Research Interests

Powerline Communications
Digital Communications
Coding Techniques
Information Theory
Video Communications
Networks



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