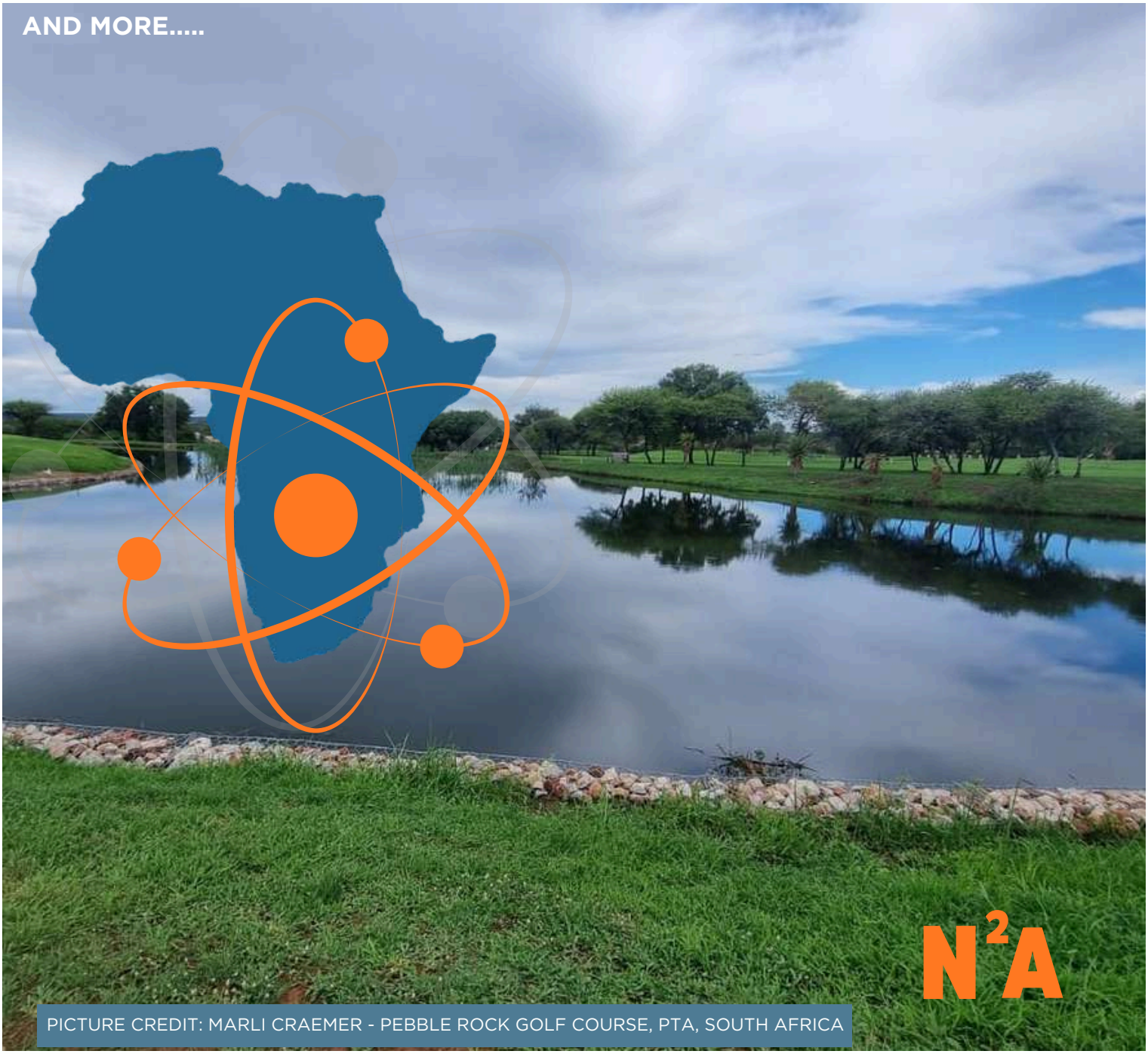
NUCLEAR NETWORK AFRICA

THE WORLD OF NUCLEAR

SYSTEMS INTERACT WITH SYSTEMS
PROF ANTHONY LANGE

I MUST GO DOWN TO THE SEAS AGAIN, IN A NUCLEAR-POWERED SHIP
DR STUART BALLANTYNE

AND MORE.....



PICTURE CREDIT: MARLI CRAEMER - PEBBLE ROCK GOLF COURSE, PTA, SOUTH AFRICA

JANUARY 2025 | ISSUE 006/25

VIEW PREVIOUS EDITIONS ON: WWW.STRATEKGLOBAL.COM

N²A HIGHLIGHTS

PICTURE CREDIT: STRATEK GLOBAL - ORYX ARCHITECT DESIGN

JANUARY 2025 | ISSUE 006/25

FROM THE EDITOR

Welcome to the first edition of Nuclear Network Africa (N^2A) for 2025! As we embark on this new year, it is impossible to ignore the mounting urgency surrounding the global energy conversation.

The dawn of 2025 brings with it renewed hope and heightened ambition for achieving a greener, more sustainable future. At the centre of this dialogue stands nuclear power. A technology poised to redefine our approach to energy generation and climate action.

Nuclear energy's potential to deliver reliable, low-carbon power has never been more relevant. Across Africa, nations are recognizing the opportunity to harness this technology not only as a means to meet growing energy demands but also to spearhead economic development and technological innovation. With the rise of small modular reactors (SMRs) and advancements in nuclear safety and waste management, the case for nuclear power has become more compelling than ever.

In this issue, we explore securing energy independence, and fostering industrial growth across the continent. From insights into groundbreaking projects to expert commentary on policy and infrastructure development, N^2A continues to bring you the stories that matter most in shaping Africa's nuclear narrative.

As we step into a pivotal year for energy transformation, we invite you to join the conversation, share your perspectives, and engage with a community that believes in the power of nuclear to illuminate a brighter future for Africa and the world.

Here's to an energizing start to 2025!

Warm regards,

Heather Veldhuis

HEATHER VELDHUIS
EDITOR

TO SEE THE LIGHT, LOOK IN THE NON-OBVIOUS PLACES

DR PALI LEHOHLA

Statistics, like all other fields of human endeavour, is complex and often times is a preserve for a few who dare to dream. Yet according to H.G. Wells (1866 - 1946), in his book Mankind in the Making, says, “Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write."

It has taken only seventy years from the death of Wells to realize that the tools of prediction into the future have become really sophisticated, particularly, for example, in estimated arrival times in the field of mobility, and the simulation of rate of movement and volumes in traffic flows. These can be estimated and deployed ordinarily by anyone. However, there are preconditions. These new tools are so practical and efficient that indeed humanity is forced to think statistically.

Abraham Wald

Aircrew of No. 16 Squadron SAAF and No. 227 Squadron RAF sitting in front of a Bristol Beaufighter at Biferno, Italy, prior to taking off to attack a German headquarters building in Dubrovnik, Yugoslavia, 14 August 1944.

Helmut Spinner of the Karlsruhe Institute opined that the technological constraints have all been removed for societies to function in the era of information technology, but two constraints remain. These are; basic freedoms and literacy.

For society to function as Wells opines, the basic freedoms and literacy have to be enhanced, for statistical thinking to be available in the brains and minds of everyone. The ubiquitous nature of COVID 19 and the availability of social media, enabled everyone to have opinions about those numbers.

Numerology was unleashed like a tidal wave across the world. The quality of knowledge and debate in the public discourse, including amongst scientists, was greatly diminished and together with that much of the trust, especially in vaccines, is now being questioned.

The science of observation often requires long spans of time. But with electronic non-intrusive sensors, observations are made all the time, and complex algorithms are created. Socrates on democracy, like Spinner, correctly argues that without raising the levels of education of a society, democracy cannot work. **CONTINUED ON PG5**

CONT.... FROM PG 4

Voting is a lottery of merchant politicians who turn the voting uneducated populace into currency of votes, or merchandise, and units of exchange. So, without Spinner's condition of overall literacy in the public, the assertion of Wells, of statistical thinking, can be a sad pipe dream. Yet it is a necessary condition for interacting with artificial intelligence tools. So, educating the masses for management of public life and for thriving, is a critical condition for democracy.

Policy space requires evidence. Against a plethora of methods and sources of data, how does a policymaker make up her mind on which data she or he is to trust. Not only does the policy-maker have to make a choice with massive implications, but has to make such choice fast enough to address an existential risk of multiple moving targets. The stakes can be high in terms of life and limb, but also for livelihoods.

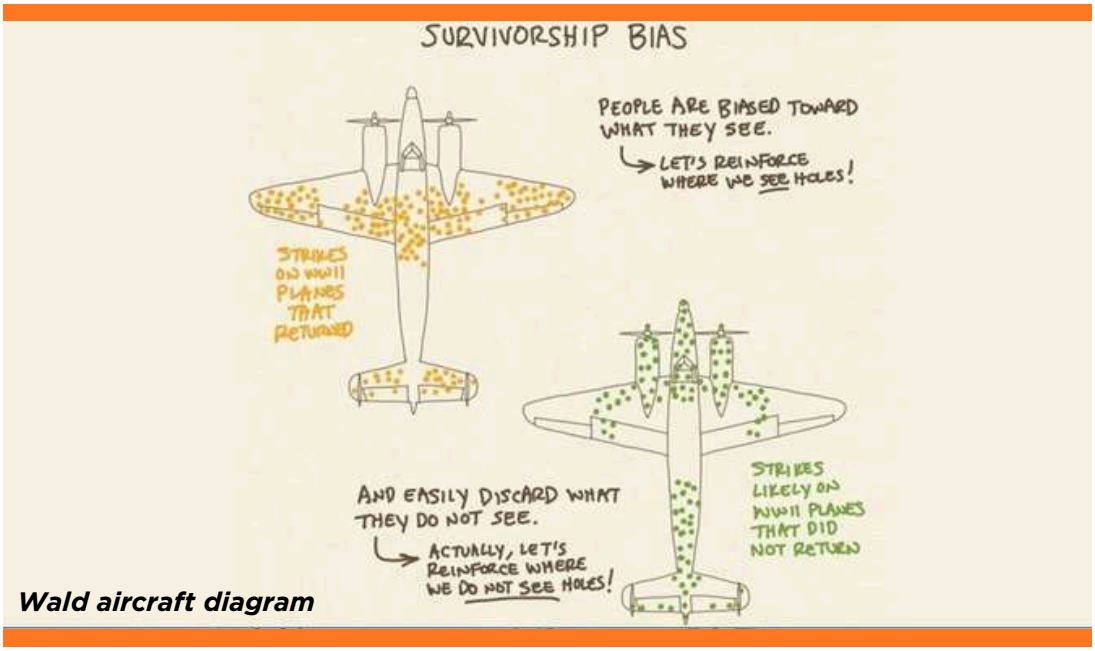
Decisions are about choices within a finite time, and some decisions cannot be reversed, because they cost in real-life terms.

A classical case, often quoted amongst statisticians, is the wartime application of the assessment of war planes, and decisions made about their protection. But before we get into Wald statistics and survivor bias, let us tell a story of Moolana. Moolana's colleague sees him frantically going up and down searching.

The friend finally asks, 'Moolana, you seem to be searching for something.' Moolana answers, 'yes, I am searching for my coin.' The colleague asks, 'where did you lose it?' Moolana says, 'I do not know where I lost it, because if I did I would have gone there to find it.' The friend asks, 'if you do not know, then why are you looking for it here where you are looking for it?' Moolana says, 'this is where there is light.'

A great deal remains unknown, as we look for things only where there is light. This constitutes a serious learning bias, especially in artificial intelligence systems. What we know is; we know because we searched for it, from what we know, which is where there is light.

During World War II it was observed that the 'planes of allied forces that survived, were riddled with bullet holes on the wings. Given that this was the case, the scientists concluded that the wings should be reinforced to withstand the bullets. It was not until Wald was invited to the discussion that the decision was turned around. Wald observed that what the scientists concluded was driven by 'survivor bias.' He in fact said that the reinforcements should be added where there were no bullet holes, which were on the areas that covered the engine and the cockpit. This intervention reduced the loss of 'planes that were never recovered for inspection.



Wald aircraft diagram

CONTINUED ON PG6

CONT.... FROM PG 5

Wald Statistics was born on interpreting Moolana's problem of managing where there is light. The war 'planes that were never observed because they did not survive, were confirmed to have been attacked on the engines and the cockpit. Subsequently reinforcements were added on the engine and the cockpit, which greatly improved the survival of aircraft. Wald had brought attention to the 'observation of the unobserved,' through noting that aircraft survived despite having bullet holes.
It is in encouraging entrepreneurship in our daily lives, especially, that the mistake is made of noting the traits of those who survived, instead of those who did not survive.

Dr Pali Lehohla is a Professor of Practice at the University of Johannesburg, a Research Associate at Oxford University, a board member of the Institute for Economic Justice at the University of the Witwatersrand, and a distinguished Alumnus of the University of Ghana. He is the former Statistician-General of South Africa.

NUCLEAR POWER ON MARS

Nuclear energy is operating even outside of our planet. In the past, Mars expeditions depended on solar panels to provide the electricity to keep the missions going. However, issues like dust build-up, no sunlight at night, and the season of the year, have a huge impact on the exploration process overall.
Massive Martian dust storms can completely block the sun's light for days, which happened with the Opportunity and Spirit Rovers some years ago.

So when the much larger Perseverance Mars Rover was built, it was decided to run it on a nuclear power source, which used radioactive plutonium. Perseverance nicknamed 'Percy,' also carried its own helicopter, which made a record number of flights.

By going nuclear, the scientists could be certain that the advanced Perseverance rover would keep going for years, no matter what the Martian weather did.

Sea-Fever

I must go down to the seas again, to the lonely sea and the sky,
And all I ask is a tall ship and a star to steer her by;
And the wheel's kick and the wind's song and the white sail's shaking,
And a grey mist on the sea's face, and a grey dawn breaking.

John Masefield 1878-1967

Dr Stuart Ballantyne is a Naval Architect who studied Naval Architecture in Glasgow, and is a Fellow of the Royal Institution of Naval Architects. He holds a Doctorate in Science from Strathclyde University

He has real sea experience, and was a Deck Officer in the Merchant Navy for seven years, in both passenger and cargo ships
Dr Ballantyne started the Sea Transport Corporation in 1976, which has sold ship designs into 47 countries, owns and operates three commercial vessels, and has built two ports.

He is the Winner of ten International Awards for services to the marine industry, including five Environmental Awards. He has published three books, with all proceeds going to the Seamen's Mission. He is also the recipient of the Vellum Award for Bravery, of the Royal Humane Society.

CONTINUED ON PG 09

CONT.... FROM PG 08

I MUST GO DOWN TO THE SEAS AGAIN IN A NUCLEAR-POWERED SHIP.

DR STUART BALLANTYNE

There are forever wars going on somewhere. Where indeed are the world's Peacekeepers? Well, the UN has peacekeepers in 11 sites, yes mainly in the Middle East – why does that not surprise you?

It may come as a surprise that the South Pacific nation of Fiji has been supplying peacekeeping forces for more than four decades. Fiji has sent more troops and police, per capita, to serve UN peacekeeping operations, than any other country in the world.

It may also be surprising to learn that the present Prime Minister of Fiji, Major General (rtd) Sitiveni Rabuka was a peacekeeping soldier leading the Fijian contingent of UNIFIL in Lebanon, from June 1980 to July 1981. He served another two years of leadership in the Sinai in the mid 80's.

In September 2023, during the United Nations General Assembly debate in New York, Rabuka promoted the Ocean of Peace concept. For sure, the South Pacific has had its share of disputes, the Solomons and New Caledonia being recent examples. A peacekeeping presence within the region is certainly a positive aspect, and Rabuka has the track record in driving this.

But how is this to take shape?
At present, Fiji is committing to a 73m Ocean of Peace vessel, capable of regional disaster response. It will have an amphibious beach-landing capability, like the latest United States Marine Corps (USMC) vessels.

At present, when southwest Pacific islands are struck by cyclones or tsunamis, the affected area has to wait for Australia or New Zealand to select a vessel, and equip it for the task, sometimes taking up to three weeks to arrive at the disaster site.

The Sedov visited Cape Town in April 2013, a full 77 years after she last visited Cape Town in 1936. She now serves as a training ship for the Russian Navy, based in Murmansk, and the City of Murmansk is responsible for her management and maintenance.

CONTINUED ON PG 10

CONT.... FROM PG 09

The proposed Fiji-based vessel can cater for up to 750 people in distress, and can reach most neighbouring nations within two days.

For regional peacekeeping duties, this vessel has good accommodation and meeting rooms, providing an ideal neutral zone for parties to discuss and resolve differences, before they become irreconcilable. For context, the Bougainville crisis (1988-1998) was ended after a meeting of opposing sides, on the visiting Christian mission ship "Doulos" at Bougainville wharf. The highest cost component in running a ship these days, is fuel. This is both the limiting criterion financially and operationally.

Another retired soldier, Dwight D Eisenhower, addressed the UN General Assembly on December 8th, 1953, with his "Atoms for Peace" speech, resulting in the US designing and building the nuclear passenger cargo ship, the "Savannah". This ship could circumnavigate the globe a dozen times at an impressive speed of 20 knots, using only 20 kg of uranium, the volume equivalent of a single house brick.

Like computer technology, nuclear propulsion has become miniaturised, safer and more highly efficient, in the last seven decades.

Fiji's number one blockage against its prosperity is the $1billion of imported diesel fuel. This is the same for most Pacific islands. Even in emergency response, having a solid electricity supply is always a prime requirement for first responders. Alongside a home port for 365 nights a year, with the vessel's power system connected to the grid, this system could reduce the local fuel consumption by 5.26 million litres per annum, along with a corresponding reduction in emissions.

Imagine, if you will, just over 500 years ago, being Ferdinand Magellan on his diminutive 27m "La Trinidad" designed for neither speed nor comfort, after battling the strong winds and treacherous currents of the Magellan Strait, at the foot of South America, you emerge to suddenly find your little ship in this Great Ocean where the sea was calm. This would inspire you, as it did Magellan, to call it the Peaceful or Pacific Ocean!

Now the Pacific peacekeeper Rabuka is heading a bold initiative, by proposing a nuclear-powered vessel, three times the size of Magellan's La Trinidad, with an unlimited range. This proposal for serving the Pacific region, in several different ways, will leave him a substantial legacy.

In Rabuka's soldierly style, knowing the mission capability limitations caused by fuel, and also knowing that most military casualties are caused while "defending the supply lines", he has opened dialogue with producers of marine micro modular reactors (MMRS) which will allow this flexible Ocean of Peace vessel to respond rapidly in the whole region for 10 years, without refuelling, and with zero emissions.

SYSTEMS INTERACT WITH SYSTEMS

PROF ANTHONY LANGE

We have a Water Crisis, and it is beginning to hit South Africa hard.

Whilst everyone in South Africa was having panic attacks and suffering from the load shedding, what was and is quietly manifesting is a whole lot of other system failures vital to the health of the South African economy. This is something very unobtrusive, and stealthy that almost nobody is noticing. This is primarily the degradation of our water systems, which are probably more important than electricity.
These massive national networks are like our bodies. We have a nervous system, blood circulating pipelines, interconnected with a digestive, waste and endocrinological system, amongst others, which are all interconnected, and which have to work seamlessly together to allow us to live. If any part of the system starts to fail, we get sick and die.

It is the same with South Africa. We are running out of water, which together with our sewerage systems failures, are making the water situation even worse.
It is a vicious cycle. To show this interdependency, and the vicious feedback cycles, let's start with water. If we have less water, we need to restrict farming and agricultural use, and also the use of drinking water. So, we make less food, and at the same time have to restrict power generation as there is less water for their operations. Then let's go to our sewerage plants, which leak and pollute our rivers and dams, hence polluting water. We have less power which is needed to keep the purification plants and water supply plants running, so there is a knock-on effect. Our coal-power plants consume water. So do our industrial plants and mines. Hence every part of the economy is stressed, due to this lack of water.

We all know already what power shortages do. Less electricity to keep chickens cool, cows being milked, wheat being milled, so there is less bread, milk and eggs. Couple this with less wheat, less water for cattle, the effect is a positive feedback nightmare.
Everything slows down or is throttled. Think about all the hospitality and sailing clubs going out of business on the Vaal Dam due to low rainfall.

As this water shortage gets worse, as has happened before, drastic measures are needed to put plans in place to keep our power plants going on the Highveld. In the past this included making some rivers flow backwards, to get water to the coal plants.
So, what is the solution?There are numerous steps, and what needs to be done is that cool and sensible heads must persist, and practical decisions must be made, so as to minimise the negative scenarios which are happening.

Confounding this problem is a lack of money, or the misappropriation of funds. Lack of knowledgeable people making the right decisions at the right level makes this worse. For example, right now, with the Vaal Dam at less than 30% full, Johannesburg is unable to pay its debts and is fighting Eskom, and there is not a word about water restrictions which are needed right now. Drastic action needs to be taken now, but often this is too late. This is not an exaggeration.

CONTINUED ON PG 12

THE VAAL DAM OVERFLOWS, SOME SLUICE GATES WERE OPENED, FEBRUARY 2010

CONT.... FROM PG 11

But the interactions within this huge feedback system, are what is literally keeping us alive. This is all incredibly complex. What certainly does not help, are the various planning and IRP plans which use highly inappropriate maths and stats, that I suspect the planners don't fully understand, and which they then misuse, and which then results in inadequate function in the real world. We need to have frank and effective talks with experts who can really help to make optimal decisions. Optimal decision-making is rare, and sometimes some good technology can help to minimise problems, and prioritise goals.

Prof Tony Lange is a distinguished academic and industry leader with extensive experience in the fields of engineering and technology. He serves as a Professor of Engineering in the School of Electrical and Information Engineering at University of the Witwatersrand, where he contributes to cutting-edge research, and the development of future engineering professionals.

In addition to his academic role, Prof Lange is the Managing Partner and Founder of Optin, a dynamic enterprise at the forefront of innovation and solutions in engineering and technology. His expertise and leadership have established him as a respected voice in both academic and industrial spheres, making him a valuable contributor to the discussions shaping the future of nuclear energy and engineering in Africa.

LOCAL SKILLS FOR NUCLEAR PROJECTS ARE HERE NOW

DR DAVID MILNE

In some quarters there is a mistaken belief that South Africa lacks the necessary professional expertise to undertake the management of major nuclear projects. The relevant professional engineering skills are, and have been, available in South Africa for many years.

Fundamental to the successful execution of a nuclear project, at the onset of the project, is to create an Owner Team to be staffed by professional engineers. This Owner Team would not undertake the detailed execution of the project but instead would have overall responsibility for its management. The composition of this team would include a professional person for each engineering and project management discipline.

The detailed execution of the project would be assigned to a competent South African Engineering, Procurement, Construction Management (EPCM) contractor, to be appointed by the Owner Team, and to which it would report.

All contractors engaged at the project site, including the EPCM contractor, would be obliged to conform to stringent project management precepts, mandated by the relevant authorities, well beforehand. Each contractor would be required to summarise and report its progress in such a manner as to establish its compliance to the project's budget and schedule. It would be the Owner Team's task to monitor this compliance. Well established upfront project criteria would allow corrective action to be taken while there still is time to do so, when issues crop up during construction. Recognition of unfavourable deviations at a late stage of the project invariably results in a *fait accompli*, as there is insufficient remaining time to take any corrective action. So you do not want the owners of the project to keep changing their mind about the project.

At one time it was believed that accounting information could be depended upon to forecast the final cost of a project.

This is a fallacy. If, say, the approved project budget is $100 million and the contracts placed and expenditure to date total, say, $40 million, it does not mean that the final project cost would remain at the sanctioned $100 million. To determine what the final project cost will be, it is necessary to use engineering principles to establish the efficiency of the EPCM contractor's utilisation of project funds. This efficiency factor is then used to predict the final cost, if nothing changes and the conduct of the contractors continues on the same path.

The Eskom Environmental Manager of the nuclear site near Jeffreys Bay, explaining a technical point to Antoinette Slabbert, in the site office.

The water's edge place where the planned new large nuclear plant will have its water inlets and outlets.

CONTINUED ON PG 14

CONT.... FROM PG 13

Exclusive reliance upon accounting information is certain to ensure a cost overrun, and this usually only becomes known at a late stage in the project's lifespan, when there is little, if anything, that can be done to redress the situation.

Similarly, with the project schedule. Presupposing that eighteen months of a sanctioned project of four years have elapsed, it cannot be assumed that the project will be completed in the remaining thirty months. As with the analysis of project costs, it is essential that engineering principles be applied. In turn, the calculated efficiency factor is then used to predict the final completion date.

Equally, reliance upon a calendar is certain to ensure a schedule overrun, and this fact usually only becomes known at a late stage.

Artisan skills for South Africa.

Certain critical nuclear reactor work would involve foreign nationals, but most of the construction work would be undertaken by competent South African companies. Their activities would be coordinated and controlled by the overall EPCM contractor.

The project labour force would be predominantly South African. All construction materials would be sourced from South Africa. So it is false to project an image that all nuclear project money would flow out of the country.

The construction phase needs many skilled artisans. Perhaps the most critical artisan skill required would be the availability of coded welders. In simple terms, coded welders are highly skilled individuals who can read an engineering drawing and who have been certified to work with special materials, to a very high standard. But many other skilled artisan functions are also required.

To make up the required number of artisans the EPCM contractor would be tasked with recruiting suitable candidates and with their professional training. After qualifying for a nuclear project, such skilled artisans would be available to benefit the entire economy.

South Africa has all the skills required to develop any nuclear build. We now need the industrial and government confidence to start.

The Environmental Manager of the nuclear site near Jeffreys Bay, points to the position where the new large 2400MW nuclear plant is planned to be built.

Dr David Milne is a professional engineer He has a PhD in chemical engineering, from the University of the Witwatersrand.

For over thirty years he has been involved in the management of large projects in the mining, process, and industrial sectors in South Africa and in China. He was a founding director, and is now a Fellow, of the Southern African Project Controls Institute. He is also a Member of Project Management SA, and of the American Association of Cost Engineers.

N²A VOLUNTARY CONTRIBUTOR PROGRAM

The N²A Voluntary Contributor Program aims to empower aspiring and passionate young people to voice their pro-nuclear sentiments through creative expression. This initiative provides a platform for contributors to showcase their skills while fostering positive thinking about nuclear power's role in shaping their lives and securing sustainable energy for future generations. By participating, these young people contribute to a broader narrative that highlights nuclear energy's benefits and its potential to positively impact communities and the environment.

To Join our Voluntary Contributors Team and join the voice for the N²A future, submit your list of skills and a motivation to:

heather@stratekglobal.com

NUCLEAR NETWORK AFRICA

THE WORLD OF NUCLEAR

Any person who has influence and a role to play in representing any Nuclear-Related Developments to advance nuclear power in Africa. or in any international entity, which can contribute to the development of Africa's nuclear energy capability is encouraged to be part of this great journey.

Any company, ranging in capability from a nut and bolt to the most sophisticated piece of equipment, should join the journey now.

N²A is published by Stratek Global (Pty) Ltd.

www.stratekglobal.com

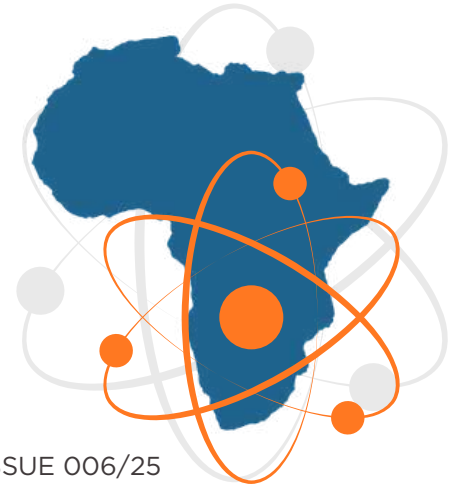
Editor: Heather Veldhuis

Email: heather@stratekglobal.com

Cell: +27 (0)83 625 0316

Submit your article or topic for consideration in our next N²A edition.

heather@stratekglobal.com



Rachel has been involved with Stratek Global and our nuclear projects for over 10 years. She handles sales and marketing functions related to conferences, meetings, brochures and publications like N²A