PIONEERS

SPACE INNOVATION IN THE CAPE

DRIVING THE FUTURE OF SPACE INNOVATION

Stellenbosch University excels in academics and satellite technology.

Optic innovation shoots for the stars in SA.

The World's First Agriculture-Focused Satellite Constellation

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NewSpace Systems
A multinational leader in spacecraft components, exporting to over 33 countries.

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LEADING SPACE TECH ORGANISATIONS

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Opinion Editorial

HOW THE SPACE ECONOMY CAN LIFT GROWTH

By Wrenelle Stander, Wesgro CEO

South Africa's strategic location and booming tech scene, especially in the Western Cape, sets the stage for it to soar in the global space economy.

- With strategic partnerships and support, space innovation can lead South Africa to new heights.
- Heightened emphasis on STEM education not only boosts our space efforts, but also fuels innovation in healthcare, finance, and other crucial fields.
- Major developments in countries like the U.S., China, and Luxembourg demonstrate that space isn't just about far-off missions—it's an engine for economic growth.

To rev up the economic growth engines and tackle the intertwined challenges of poverty, inequality, and unemployment, South Africa needs every sector to operate at its peak performance. The space sector, in particular, is brimming with potential, offering substantial economic, technological, and societal gains.

In recent times, the space economy has shifted away from being dominated by superpowers. Many countries are reaping significant returns on their investments in space-related projects. South Africa is strategically placed to have a greater impact in this rapidly evolving sector, thanks in part to its geographic location in the Southern Hemisphere, offering a unique vantage point for space observation, satellite tracking, and launching. With its clear skies, the country is ideal for astronomical observations and radio astronomy, backed by growing tech hubs, particularly in the Western Cape. Realising this promise, however, requires increased strategic investment, robust public-private partnerships, international cooperation, and targeted support for education to build a sustainable talent pool.

Partnerships and skills development are fundamental for advancing the local space sector and, consequently, strengthening the economy. Pumping more resources into Science, Technology, Engineering, and Mathematics (STEM) education across all levels will, for the most part, ensure a steady supply of much-needed skills. This will support not just the space economy but also other vital sectors of the economy, such as healthcare and finance. Research regularly shows that countries with strong STEM human capital are competitive, productive, and achieve high economic growth.

Investing in the space economy offers many benefits for our economy and daily life. Satellite technology, for instance, plays a crucial role in communication, weather forecasting, disaster management, and environmental monitoring. Given the challenges of climate change, such as droughts and severe weather, these capabilities have become more important than ever. Improved satellite connectivity can bring internet access to remote and underserved areas, helping to bridge the digital divide. Greater connectivity can also boost access to education and skills, which in turn can increase employment opportunities.

Advancements in space technology often result in innovations that improve life here on Earth. Research for space missions has driven progress in medical devices, materials science, and renewable energy technologies. Developing a strong space economy can stimulate growth in these areas, diversifying and strengthening our economy. These efforts are critical for creating more jobs and alleviating poverty.

A Global Opportunity

The space sector holds immense significance. A recent report by the World Economic Forum and McKinsey predicts that the global space economy will expand from $630 billion in 2023 to $1.8 trillion by 2035. This growth includes vital services like satellites and launchers, as well as applications where space technology aids businesses across various industries. Key growth drivers highlighted in the report include the need for better satellite connectivity, increased demand for positioning and navigation services on mobile phones, and a rising demand for AI and machine learning-powered insights.

Similarly, a 2023 report by Deloitte offers a compelling look at the space economy. Recently, the challenges of manufacturing, launching, and operating satellites and other space-based assets have significantly decreased. Satellites are now smaller and cheaper to produce and operate. Reusable rockets have drastically reduced launch costs. Digital and advanced technologies are opening up satellite data access and new business opportunities to more players than ever before. The report, however, notes remaining uncertainties and challenges, emphasising the need for a pragmatic and collaborative approach to achieve steady growth toward a self-sustaining space sector.

The Western Cape is making significant progress in advancing the space sector, with strong support from both public and private sector partners, all focused on achieving sustainable growth. Recently, NASA and the South African National Space Agency (SANSA) met with the Western Cape Education Department and Wesgro during their visit to the new Deep Space Station scheduled to launch in 2025 in Matjiesfontein, a rural town near Cape Town. This project, led by SANSA with NASA's support, aims to promote deep space exploration and improve communication with satellites, probes, rockets, and planets.

Discussions included expanding education programmes to uplift surrounding areas and cultivate domestic space-related professionals. Collaborative efforts such as these could pave the way for a comprehensive school space programme, designed to groom future space scientists and tackle national skills shortages through a focus on STEM subjects. Offering scholarships, internships, and encouraging collaborations with international space agencies will provide valuable training and experience.

Looking ahead, a clear and supportive regulatory framework is crucial for the local space sector to hit new heights. Targeted policies promoting innovation, protecting intellectual property, and maintaining ethical standards will benefit both public and private entities. Initiatives like space incubators and accelerators can give startups and SMMEs a leg up, cultivating a dynamic space ecosystem. Establishing and maintaining state-of-the-art facilities, such as launch sites, research labs, and data analysis centres, is crucial to support a range of activities from satellite development to space tourism, enhancing South Africa's global competitiveness.

Learning from Global Leaders

Countries like the U.S., China, and India have demonstrated how prioritising the space sector can spur economic growth and innovation. The U.S., through NASA and partnerships with private firms like SpaceX and Blue Origin, has cultivated a multi-billion-dollar industry that generates jobs, drives technological breakthroughs, and promotes international cooperation. China's ambitious space programme has accelerated technological advancements, contributing significantly to its economic expansion and global reputation. India's cost-effective missions have showcased its technological prowess, attracting global investments and forming international alliances.

Luxembourg provides a compelling example for smaller nations. Despite its size, the country has established itself as a major player in the space sector by creating a favourable regulatory environment and offering financial incentives for space companies. This strategic focus has attracted numerous space-related businesses, positioning Luxembourg as a global hub for space mining and satellite communications. The space sector's contribution to Luxembourg's GDP ranks among the highest ratios in Europe.

We can take a page from these countries by increasing public investment, encouraging private sector participation, and strengthening international partnerships.

Wesgro, as the official agency promoting tourism, trade, and investment in Cape Town and the Western Cape, champions collaboration and innovation to drive inclusive and sustainable economic growth across our region. With this ethos guiding us, we are preparing to launch a study to assess the local economic impact of the space sector. Our aim is to identify investment opportunities and areas where growth can be accelerated. With strategic support, South Africa's broader space economy holds significant potential for success, creating jobs and positioning the country as a key global player. The foundational elements are already in place—it's time to capitalise on this potential and lift our economy to new horizons.

ASTROFICA
TECHNOLOGIES

FROM INTERNS TO INNOVATORS

Astrofica Technologies' stellar path to nurturing tomorrow's space talent, driving growth and innovation in the sector.

In 2006, Jessie Ndaba, CEO and co-founder of Astrofica Technologies, began her journey with an internship at the SumbandilaSat programme. This experience with South Africa's first government-backed, locally manufactured Earth observation satellite sparked a passion that has since become her lifelong mission: to nurture young talent and advance South Africa's space sector. Today, this passion continues to drive her efforts at Astrofica.

In 2020, the company hosted 29 interns from various provinces. "Sixty percent of them found permanent positions in the space sector and now live in the Western Cape," Ndaba proudly shares. Astrofica collaborates with the South African Agency for Science and Technology Advancement (SAASTA) to increase public engagement with science, engineering, and technology. Through outreach programmes in schools, they aim to inspire the next generation of space experts.

Founded in 2017 and fully operational by 2018, Astrofica is a fully black-owned satellite technology solutions provider specialising in the assembly, integration, and testing (AIT) of satellite systems. The company aims to cultivate a talent pipeline for South Africa's growing space sector, recognising the critical need for skills development to drive the nation's economy in the modern era.

Astrofica's commitment to education extends to curriculum development. "We are developing the Aerospace and Space Curriculum with Dr. Alan Nelson at the University of Cape Town and Mr. Davis Silman from the Department of Basic Education," says Ndaba. "My dream is to reach the most remote parts of the country, helping students develop applications for their communities using space data."

A recent report from Innovate UK, Britain's national innovation agency, highlighted Africa's potential as a hub for competitive space technology, with Kenya, Rwanda, and South Africa leading the way. South Africa's design capabilities, especially in startup companies, were rated world-class. These startups produce sophisticated mission-specific components for global satellite manufacturers.

Meaningful impact

Ndaba, an electrical satellite engineer, affirms South Africa's steady progression towards prominence in the global space sector. However, she highlights a pressing concern echoed by industry leaders and stakeholders alike: the imperative for robust skills development. This issue holds personal significance for Ndaba, who, alongside Khalid Manjoo, a fellow intern from the SumbandilaSat programme, co-founded Astrofica. The company's evolution mirrors their journey from interns to industry leaders. Their shared dedication to space science and its potential for driving socio-economic progress across Africa laid the groundwork for Astrofica, which aspires to make a meaningful impact not only in South Africa but also across the continent.

"Both Khalid and I met during a Space Internship Programme sponsored by the Department of Science and Technology, run by Stellenbosch University and SunSpace & Information Systems," Ndaba recounts. "After the internship, we joined SunSpace as assembly, integration, and testing (AIT) engineers, later moving to Space Commercial Services. We started Astrofica to use space technology in various sectors, but space continued to be our focus."

Fast-forward to 2024, Astrofica has established itself as a high-tech company utilising space data to generate valuable business information. They specialise in building and testing satellite systems (upstream) and developing customised applications for global clientele using satellite data (downstream). In a broad scope, upstream opportunities include rocket launch and component manufacturing, while downstream applications cover Earth observation and support services in investment, insurance, and skills training.

"We offer spectrum monitoring, satellite design and assembly, integration and testing, and the development of space applications and products," Ndaba explains. Astrofica's dual upstream and downstream divisions allow the company to offer comprehensive solutions. Operating from the Western Cape, they benefit from proximity to key stakeholders and a strategic location in Somerset West.

Learn more about **Astrofica's** story on the Pioneers Podcast.

The glue of the space sector

Astrofica's team, supplemented by contractors as needed, brings over 500 years of combined experience in the space industry. This extensive expertise enables them to deliver high-quality, cost-effective solutions, from exploring system requirements to managing commercial operations.

"A lot of people ask why we focus on both upstream and downstream. We had to venture into downstream to understand the practical benefits of what we do in space, not just build satellites for fun. Khalid calls it Astrostream," says Ndaba.

Astrofica is one of the few companies offering comprehensive upstream and downstream services, effectively acting as the glue of the space sector. They collaborate with local suppliers for components and work with other companies to develop space applications that meet end-user needs.

Addressing the challenges in the local space sector, Ndaba notes that most issues arise upstream. "To market our solutions, we need space heritage to prove reliability. This requires funding for technology demonstrations," she explains. Space heritage refers to the proven reliability of technologies used in previous space missions, crucial for gaining trust for future missions. Despite these challenges, there are significant opportunities downstream. Space technology can provide accurate data crucial for decision-makers in areas like food security, energy, and water management, all essential for sustaining economies.

Astrofica's value proposition lies not only in its technical competencies but also in its unique business methodology. The company sees itself as an enabler for government and industry ventures, aiming to advance space science and technology across Africa. They continuously seek opportunities to collaborate with like-minded organisations to develop key skills in the space sector, propelling South Africa and the broader continent to new heights.

Ndaba's vision for Astrofica is clear: to serve as a catalyst for growth and innovation. By inspiring the next wave of space professionals and leveraging space technology, the company aims to propel socio-economic development in South Africa and across the continent.

> *"My dream is to reach the most remote parts of the country, helping students develop applications for their communities using space data."*

SOUTH AFRICA'S RISE IN THE GLOBAL SPACE INDUSTRY

Cubecom: Redefining High-Speed Communication Systems in Orbit.

In recent years, there has been a notable rise in the global appeal of space products made in South Africa. But what exactly is fuelling this surge? According to Mariechen Du Plessis, the Head of Marketing at CUBECOM®, a leading satellite sub-systems provider based in Stellenbosch, it's a combination of quality, affordability, and agility.

"The global space industry is taking notice of the quality products emerging from South Africa," Du Plessis says. And it's not just about cost; it's about quality too.

Du Plessis highlights that production expenses, including labour costs, are notably lower in South Africa compared to Europe or the U.S., the leaders of space exploration and science. This translates to more competitive pricing for South African products, a boon amplified by the favourable exchange rates. Importers abroad appreciate competitive pricing and are enticed by faster lead times and the ability to do cost effective custom development if needed, Du Plessis points out.

"At Cubecom, we are producing products that rival those of first-world countries in excellence, but at a more competitive price point," Du Plessis explains. "Our ability to deliver reliable products with speed and quality has attracted attention worldwide."

Cubecom specialises in designing, developing, and manufacturing communication systems for satellites.

As the Space Technology division of Etse Electronics, a company under the Alphawave Group portfolio with roots tracing back to 1997, Cubecom has been a dedicated player in the commercial new space industry since 2015.

Cubecom is focused on developing high data rate communication systems tailored for various satellite applications at Low Earth Orbit including earth observation, synthetic aperture radar, as well as geo-location monitoring. These systems integrate seamlessly with the latest imaging sensor technology, such as hyperspectral or multi-spectral cameras, and is particularly well suited for data-intensive missions that require super-fast downlink speeds and accuracy.

"We offer end-to-end solutions tailored to the unique mission requirements of our customers," Du Plessis elaborates. "Whether it's for nanosatellite applications, microsatellites or constellation missions, our mission is to provide reliable, cutting-edge communication technology, that helps you get more data down, faster. Our fastest high data rate transmitter can send up to 180 GB in a single down pass, that is unheard of in the current New Space Landscape."

Agility

The company's agility, facilitated by its compact team, is a significant advantage. "Being small allows us to innovate rapidly," Du Plessis says. "We are constantly developing new products to meet the evolving demands of the industry." While the company's client base is primarily in Europe, they are currently expanding into Asian and the American markets with opportunities to do more business in Africa on the horizon. "South Africa's reputation for engineering excellence has opened doors internationally and the global markets are taking note," Du Plessis points out. Over the years, Cubecom has significantly expanded its product portfolio, reflecting its commitment to innovation and advancement. The company has experienced substantial growth, with a remarkable 89% increase in revenue over the past year alone. This growth is further evidenced by a surge in orders from space institutes across the globe, highlighting the demand for high-quality South African technology.

Traditionally, space companies stuck to local suppliers. However, the landscape is changing. "Developing countries like South Africa and India are producing quality, affordable products," Du Plessis notes. This shift has opened doors for collaborations across borders, driving a more inclusive global space community.

Transition

Reflecting on the evolution of South Africa's space industry, Du Plessis highlights its roots in the early 2000s. "The transition from military to commercial applications, coupled with a growing interest in space exploration, laid the foundation for our industry's growth," she explains.

From left to right: Chief Technical Officer, Sampie Booysen, and QA Specialist, Justin Jacobs. Photographer: Genevieve de Wet

One of the pioneers in this transformation was Sunspace, a company born out of the SUNSAT satellite programme at Stellenbosch University. SUNSAT, South Africa's first satellite, symbolised the country's entry into the global space arena. The momentum continued, fuelled by a burgeoning interest in space among the younger generation and catalysed by notable figures like Mark Shuttleworth, South Africa's first space traveller. "The excitement surrounding space permeated universities," Du Plessis says.

> *These systems integrate seamlessly with the latest imaging sensor technology.*

"The excitement around space, coupled with commercial opportunities, fuelled our industry's expansion," Du Plessis reflects. Today, companies like Cubecom are continuing that legacy of innovation.

The Western Cape, particularly the stretch between Stellenbosch and Somerset West, has emerged as the epicentre of South Africa's space sector. Close proximity to talent pools and supply chains encourages collaboration and innovation.

Indeed, collaboration, not competition, defines the local ethos. "Unlike elsewhere, our space companies foster camaraderie and the spirit of ubuntu," Du Plessis observes. "We work closely with peers and suppliers, ensuring seamless integration of products and enhancing customer experience."

"At Cubecom, we work closely with other local companies like Simera Sense and Dragonfly Aerospace whose products relate directly to ours, and support the efforts of other big players like Cubespace and New Space. Our shared goal is to propel South Africa's space industry to new heights," she says.

Cubecom's success mirrors the growth of South Africa's space industry, marked by more commercial involvement and innovation.

For more information about Cubecom, visit cubecom.space.

CUBESPACE

ROCKETING TO PROMINENCE IN GLOBAL SATELLITE INDUSTRY

From Stellenbosch labs to the stars: how Cubespace is propelling South Africa to the forefront of satellite innovation.

In the vastness of space exploration, South Africa often flies under the radar as a major contributor. However, according to Mike-Alec Kearney, CEO of CubeSpace, a satellite components manufacturer born out of Stellenbosch University's research labs, that perception is rapidly changing.

CubeSpace specialises in crafting satellite components deployed worldwide. Currently headquartered in Techno Park, a technology-focused science park nestled in Stellenbosch, the company represents South Africa's rising presence in the global satellite industry.

"South Africa is now synonymous with top-notch space technology," Kearney proudly declares. "At conferences, when South Africa is mentioned, heads nod in recognition of our contributions." He recalls a time when South Africa's contributions to space technology were underrated, burdened by a stigma of inferiority. "But now," he asserts, "we have changed those misconceptions and are solidifying our position as [major players] in space tech."

"If you mention South Africa at conferences now, the immediate response is, 'Oh yes, they produce incredible space technology'." CubeSpace, leveraging technology incubated at Stellenbosch University, has etched its mark globally, supplying components utilised in NASA satellites and lunar rovers. As the premier US government agency for air and space science and technology, NASA leads the charge in global space exploration. Its efforts not only fuel innovation but also drive technological progress and economic development on a global level.

Leader in satellite innovation

CubeSpace has emerged as a key player in advancing space exploration through its significant contributions to groundbreaking missions. Notably, the company has spearheaded the development of control systems for the United Arab Emirates' (UAE) lunar rover, a remarkable feat in space exploration. Presently, CubeSpace is actively engaged in crafting control systems for three more lunar rovers. These endeavours exemplify the company's commitment to pushing the boundaries of space exploration, with aspirations extending to lunar and Martian colonisation.

Throughout its decade-long journey, CubeSpace has produced over 5,000 components, including 300 intricate control systems, positioning itself as a leader in satellite innovation. "Control systems are the backbone of satellite operations," Kearney explains. "They ensure precise manoeuvrability crucial for many applications."

Although CubeSpace doesn't conduct satellite launches itself, its 55-member team locally designs, manufactures, and assembles components, making significant contributions to groundbreaking missions such as the UAE lunar rover. Kearney traces the origins of CubeSpace back to 2014 when it emerged as a spinoff from Stellenbosch University. The company's foundation lies in research conducted at the university, forming the basis for the development of its component designs.

With a diverse clientele spanning Europe, the US, and beyond, Kearney envisions CubeSpace as the premier manufacturer of satellite control systems globally. "Our vision is clear," Kearney emphasises. "We aim to be the global standard for satellite control systems, catering to satellites of all sizes."

Poised for strong growth

The satellite sector has experienced substantial growth, witnessing a significant increase in space launches over the past decade. According to a recent report by the World Economic Forum, and multinational consultancy McKinsey & Company, advancements in space-enabled technologies such as communications, positioning, navigation, timing, and Earth observation services have the potential to propel the global space economy to $1.8 trillion by 2035, up from $630 billion in 2023. Kearney highlights that South Africa's space technology sector is positioned for significant

growth, poised to emerge as a major player on the global stage. He attributes CubeSpace's success to its organic growth trajectory, cultivated within the ecosystem of Stellenbosch University, encouraging efficiency and cost-effectiveness since its inception.

"Unlike our counterparts in Europe and the US, we have bootstrapped our way up, prioritising efficiency and cost-effectiveness from day one," he explains. CubeSpace's commitment extends beyond commercijal success, actively engaging in initiatives addressing terrestrial challenges. From space debris mitigation to smart agriculture and climate monitoring, the company leverages its expertise for societal benefit.

Operating from the Western Cape offers CubeSpace strategic advantages, including proximity to a robust supply chain and academic talent pool. Kearney points to the region's unique appeal, blending industrial infrastructure with natural beauty and modern amenities: "It's a perfect balance," he says, "where talent thrives amidst scenic landscapes and state-of-the-art facilities." Indeed, Stellenbosch's blend of industry and academia nurtures an ideal ecosystem for innovation.

Kearney envisions CubeSpace as the premier manufacturer of satellite control systems globally.

In a bid to boost local talent further, CubeSpace sponsors bursaries for Master's students, investing in the next generation of space technologists. The company recently announced a significant milestone, securing its inaugural venture capital funding of R47 million from the University Technology Fund and co-investor Savant Venture Fund. This infusion of venture funding is earmarked to fuel the company's global expansion initiatives and support the development of components tailored for larger satellites. Notably, Stellenbosch University retains a stake in the company, alongside its original founders and the newly acquired investors.

As CubeSpace looks to the future, it aims to set up international offices to improve logistical efficiency. Kearney stresses the importance of streamlining logistics and believes that establishing international offices will lead to smoother operations. Such bold steps are imperative for South Africa to excel on the global space stage.

For more information about Cubespace, visit [cubespace.co.za.](cubespace.co.za)

DRAGONFLY AEROSPACE: REFINING EARTH'S VIEW FROM ABOVE

Leading the way in precision imaging for informed decision-making and global impact.

In 2020, Dragonfly Aerospace took flight with a simple yet impactful objective: to equip decision-makers with precise, accessible data to inform their choices. Bryan Dean, the Group CEO and Co-Founder of Dragonfly, encapsulates their mission succinctly: "Our goal and our vision we see is using this technology to improve lives on earth."

Specialising in compact, high-performance imaging payloads and satellites, Dragonfly Aerospace is at the forefront of creating large imaging constellations. These constellations offer persistent views of Earth across various spectrums, providing invaluable business intelligence and ultimately enhancing lives worldwide.

Dragonfly's story runs deeper than mere innovation; it's steeped in a rich heritage of aerospace excellence. With roots tracing back 25 years to the pioneering days of South Africa's first microsatellite, SUNSAT, launched in 1999, Dragonfly inherits a legacy of ingenuity and perseverance. Team members, seasoned veterans in the field, have contributed to every microsatellite mission since, embodying a commitment to excellence that permeates the company culture.

Led by Dean and four engineer co-founders, the Stellenbosch-based company rapidly expanded to 100 employees.

With 50 cameras and one satellite sold to date, Dragonfly Aerospace boasts a revenue of $20 million, poised for further growth in tandem with the burgeoning space economy.

Africa's rapidly expanding space industry is on track to soar to $22.64 billion by 2026, up from $19.49 billion in 2021, according to insights from Space in Africa, a top analytics and consulting firm specialising in the African space and satellite sector. With South Africa and Egypt edging closer to joining the league of spacefaring nations, it's clear that the continent's impact on space exploration is gaining momentum. Dragonfly Aerospace stands out as a significant player. The company primarily caters to customers in Europe, but it also serves clients across the globe, including the USA, South America, and the Far East, encompassing Japan and Singapore.

> *These constellations offer persistent views of Earth across various spectrums*

Go-to experts

Dean's journey to founding Dragonfly is a tale of dedication and vision. With experience garnered from prestigious entities like Airbus in the UK and consultancy Space Commercial Services, Dean's expertise laid the foundation for Dragonfly's success. For Dean, the company's focus on imaging is not just a strategy but a passion—a heritage cultivated over years of dedication to the craft.

Dean articulates Dragonfly's vision with clarity and passion: "Our purpose is clear. We want to be the go-to experts in imaging, from the cameras to the satellites. It's about delivering the best results, every time." Dean emphasises the importance of synergy between camera and satellite, ensuring optimal conditions for capturing breathtaking images. But it doesn't stop there. Seamless data transmission back to Earth and ground servers is paramount, completing the cycle of their imaging prowess. "It doesn't help making this advanced camera and then having a satellite that can't give it the correct conditions to take good pictures. And also you need to have good data transmission back to earth," Dean explains.

The heart of Dragonfly Aerospace's mission beats within their groundbreaking satellites. Their flagship, EOS SAT-1, spearheads the world's first agriculture-focused satellite constellation. Equipped with cutting-edge DragonEye imagers, EOS SAT-1 captures panoramic and multispectral imagery, empowering farmers worldwide with precise data for sustainable practices. From water management to soil quality assessment, the satellite revolutionises agricultural practices, boosting sustainability and productivity. Dean elaborates: "Our satellites act as Earth's health monitors, capturing vital data for informed decision-making." From aiding harvest monitoring to detecting soil moisture levels, EOS SAT-1 empowers farmers to adopt sustainable agricultural practices. Securing a launch license wasn't easy. The state had concerns about the potential liabilities they would have to cover for a commercial company. "The national treasury was a bit worried," Dean admits. "But statistics show that the likelihood of an issue is very low." After addressing these concerns, the license was finally granted.

Looking ahead

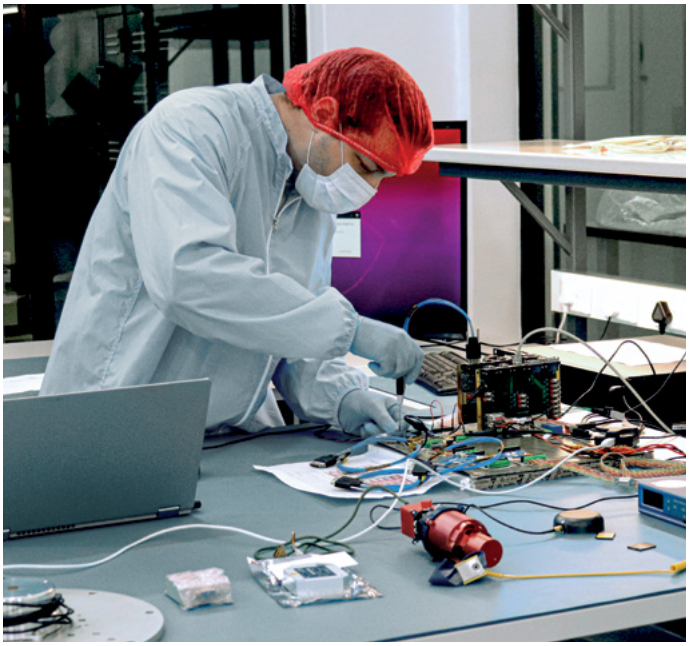
Beyond Earth observation, Dragonfly has also ventured into space exploration, contributing to NASA missions and lunar exploration efforts. Operating from the Western Cape, they benefit from a thriving local space ecosystem and close proximity to educational institutions and key material producers.

Despite facing challenges like the lack of government space projects, Dean sees resilience as a defining trait of South African space companies. "The industry would definitely grow more with government projects and grants, which we have received practically zero of for a long time," he remarks. "But our resilience is also our strength. Without government safety nets, we are forced to be agile and competitive on the global stage."

Dean emphasises how this agility sets South African space companies apart. "We have to fight hard for every piece of revenue," he says. "But it's made us tough and agile. We are probably one of the only truly commercial space industries in the world because we have no government support. It sounds negative, but it's made us stronger."

Looking ahead, Dragonfly Aerospace aims to expand its business globally, with plans to establish a European office. Dean envisions a future where Dragonfly's expertise extends beyond Earth, into lunar, asteroidal and Martian exploration. Dean reflects on the company's name with a smile. "Dragonflies possess unmatched vision and agility in the animal kingdom," he says. "It's a perfect comparison for our imaging company."

As humanity ventures further into space, Dragonfly Aerospace stands ready, drawing inspiration from its namesake, the dragonfly, symbolising agility, vision, and a relentless pursuit of innovation.



LAMBDA G
Applied Electromagnetics

THE VISION AND DRIVE OF LAMBDAG

Cultivating engineering talent: the launchpad for South Africa's space sector success.

South Africa's space sector holds huge potential, but unlocking it requires a dedicated effort to develop engineering talent within the country, says Vernon Davids, founder and CEO of LambdaG. This start-up, established in 2018, specialises in designing and manufacturing innovative radio frequency (RF) components for aerospace and defence applications.

RF components are crucial for space exploration, satellite communication, navigation, surveillance, and defence. They form the backbone of reliable communication links, facilitate data collection, monitor the space environment, and ensure mission success and safety. Without robust RF components, spacecraft would struggle to transmit data, navigate accurately, or communicate effectively, significantly limiting the scope and capabilities of space exploration and defence operations.LambdaG, a black-owned small, medium-sized, and microenterprise (SMME), has been incubated by NewSpace Systems, a Somerset West-based multinational spacecraft components manufacturer. LambdaG's products, available through NewSpace Systems, include specialised antenna systems for small satellites.

Davids highlights LambdaG's role in diversifying South Africa's technology sector more broadly. "Most of the South African technology sector lacks diversity at ownership and management levels. LambdaG aims to change that," he says. He emphasises LambdaG's commitment to employing graduates from diverse backgrounds eager to learn about the aerospace and defence industry and calls for targeted funding for space startups to drive growth and skills development.

"LambdaG strives to enhance the local knowledge-based economy while also earning foreign currency. Our product offerings require critical skills that are currently in short supply. It is my vision to establish a well-organised training programme for interns and trainees, specifically for young RF and antenna engineers," Davids explains.

In a recent interview with ITWeb, a Johannesburg-based business and technology media company, Debbie Mavis, director at the UK satellite operator Avanti Communications, raised the importance of educating youth about satellite technology as a gateway to STEM (science, technology, engineering, and mathematics) careers. She pointed out that satellite development requires proficiency in engineering, physics, data science, and software—skills that are in high demand. Mavis emphasised the importance of offering training programmes and certifications as viable alternatives to traditional higher education.

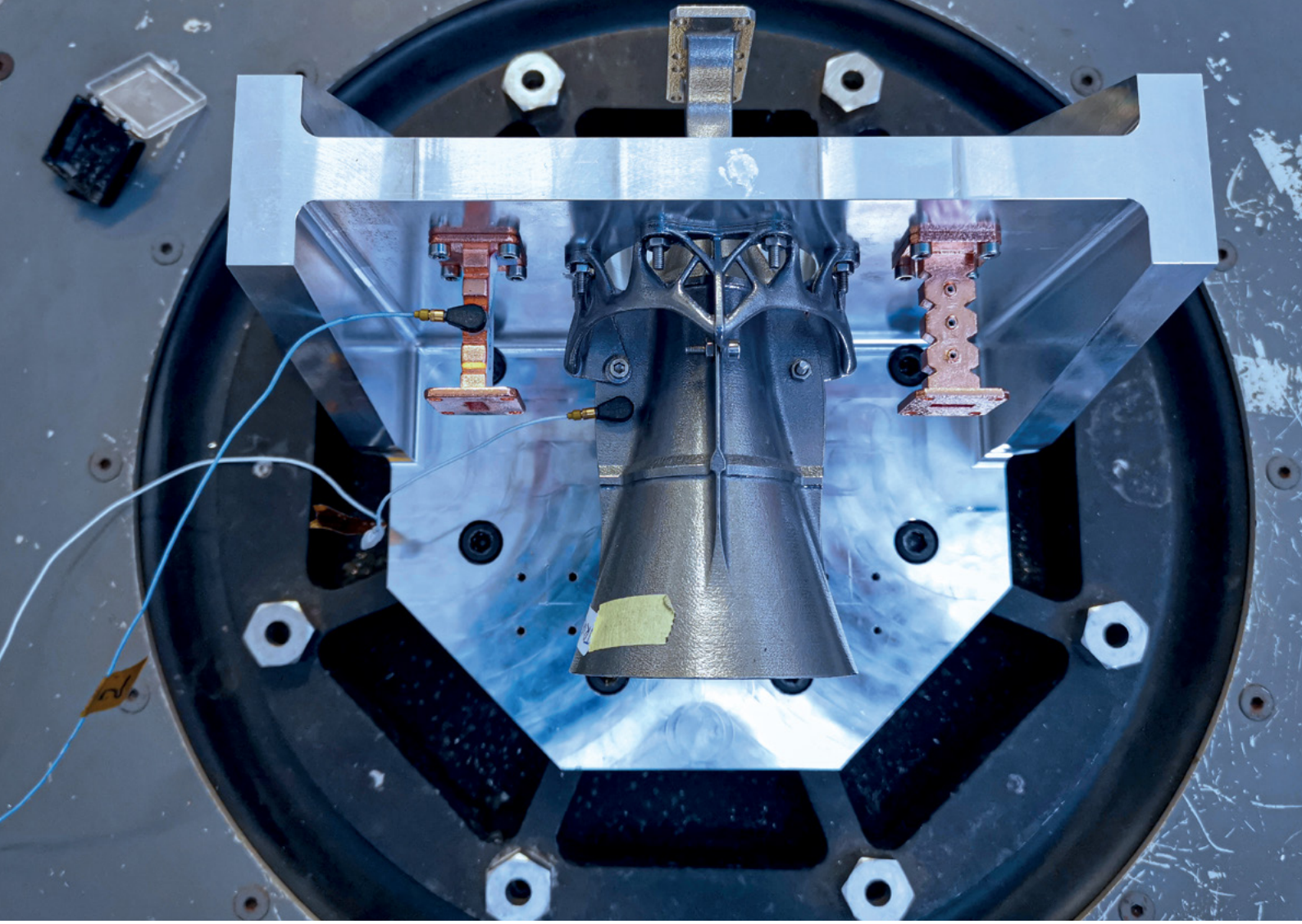
A Personal Mission

Davids credits his journey into engineering to the strong foundation provided by supportive and excellent maths and science teachers during his school days, which ultimately led him to pursue engineering at the Cape Peninsula University of Technology (CPUT). This educational background laid the groundwork for establishing LambdaG.

For Davids, skills development is a deeply personal mission. "Having grown up with limited resources and being previously disadvantaged, I want LambdaG to engage in public initiatives that encourage the youth to pursue STEM careers. We aim to financially assist deserving youth in acquiring tertiary education with a focus on engineering," he says.

LambdaG is poised to contribute significantly to the growing space industry in the Western Cape, boosting South Africa's technological competitiveness. The company focuses on developing and manufacturing innovative antenna systems for satellites and defence platforms, such as unmanned aerial vehicles and rockets. These niche applications leverage years of experience and expertise, embracing advances in material science and modern manufacturing techniques like additive manufacturing, commonly known as 3D printing.

Cape Town and the Western Cape offer significant advantages as a business location for LambdaG. Davids reflects on his experiences: "As a young RF engineer, I performed testing at the Houwteq (a former satellite development facility) in Grabouw and was similarly inspired by the ambitious startups in Technopark, Stellenbosch. The Western Cape feels like our Silicon Valley. Being born, raised, and educated here, it was



natural to start my business in the Western Cape, a region I love for its Fynbos, mountain ranges, and oceans."

Innovative Solutions

LambdaG's innovations have been showcased at numerous international expos and trade shows, leading to technical discussions with potential clients and partners. The company has presented advances at local and international research conferences, such as showcasing 3D-printed RF component prototypes at the World 3D-print Summit & Expo in Saudi Arabia in 2019.

The company, supported by the Department of Trade, Industry and Competition (DTIC) through the Aerospace Industry Support Initiative (AISI), was founded with a clear and ambitious technology roadmap. This support enabled the development of two satellite antenna products. The first being an additive manufactured lightweight Ka-band horn antenna assembly enabling high data-rate downlinks and uplinks from low earth orbit. The second, a Global Navigation Satellite System (GNSS) antenna for spacecraft navigation.

> *LambdaG's commitment to employing graduates from diverse backgrounds.*

"Our innovations lead to products that are optimally designed in terms of size, weight, and cost for our clients," says Davids. The company's expertise in space-qualified antennas and defence communications underpins its offerings, which include RF consulting services like antenna design, testing, and performance analysis.

Davids acknowledges the challenges facing the space sector, such as logistical bottlenecks and load-shedding disruptions. Despite these hurdles, LambdaG remains focused on its short- to medium-term plans, which include developing complementary antennas for its satellite industry partner, NewSpace Systems and providing consulting services to the defence industry. "Our long-term goal is to enhance local manufacturing and testing facilities for aerospace antennas," he says, stressing the importance of ongoing innovation.
The name LambdaG reflects the core of the company's work and the technical precision central to antenna engineering. "In our field, we work in wavelengths. Antenna sizes are measured in wavelengths, and the wavelength is measured in Lambda.

When an electromagnetic wave travels through a different medium than air, the wavelength is described as Lambda G," Davids explains. 'LambdaG' signifies the company's commitment to skills development, advanced engineering, and innovation.

NEWSPACE SYSTEMS

BUILDING THE FUTURE: NEWSPACE SYSTEMS AND THE PROMISE OF SOUTH AFRICA'S SPACE ECONOMY

How NewSpace overcame initial challenges to become a global leader in space technology.

Creating a thriving space sector that boosts sustainable socio-economic growth needs solid backing from both financial institutions and the government, says James Barrington-Brown, the founder and CEO of NewSpace Systems. This multinational company, based in Somerset West, specialises in manufacturing spacecraft components and subsystems. It stands as a prime example of the space sector's promise when it receives adequate backing.

Reflecting on the early days of NewSpace Systems, founded in 2013 after he relocated from the UK, Barrington-Brown highlights the financial challenges they faced. "Many often don't recognise the value of the space sector," he explains. The misconception that space is only about astronauts and rockets, which are seen as risky and expensive, often deters banks and investors. However, the benefits of the space economy extend far beyond these traditional views.

> *NewSpace Systems remains committed to preserving the human touch in production*

The "space economy" encompasses any goods and services produced for use in space and the ground infrastructure that supports it. This even includes more future looking technologies such as lunar transportation or asteroid mining, as highlighted by the Harvard Business Review. Much more importantly, space technology drives growth and efficiency across various sectors. The European Space Agency has noted the deployment of new space infrastructure benefiting industries like meteorology, energy, telecommunications, insurance, transport, maritime, aviation, and urban development. For example, satellite images help farmers keep tabs on crops, businesses gauge their environmental impact, and governments track CO2 emissions, aiding climate action and food production, among other advantages.

Barrington-Brown points out that financial institutions often overlook how everyday applications of space technology can benefit society. "Taking pictures for mapping townships or providing communications to rural communities are very practical uses of space technology," he says. Despite these advantages, NewSpace Systems struggled initially to find local investors who understood and supported the space sector's potential.

"Local investors were either uninterested or unsuitable, lacking access to markets, technological skills, or supply chain partnerships," he explains. In the end, they looked overseas, finding funding initially through a German investor, and ultimately from the USA.

Growth

Government support, or the lack thereof, also posed challenges. "There is very little awareness of the societal benefits of space technologies outside of the team at the National Space Agency (SANSA), and consequently virtually no national space programme," Barrington-Brown notes. Nevertheless, NewSpace Systems has grown significantly, now employing around 120 staff and achieving a turnover of over R220 million in the past year. The company supports 14 space agencies globally and delivers to blue-chip clients including renowned industry giants like Airbus.

NewSpace's growth has been fuelled by both internal capabilities and investor engagement. The company designs and manufactures a range of components and sub-systems, primarily in guidance, navigation and control applications, from its local facilities. Boasting over three decades of collective industry experience, NewSpace Systems has expanded its reach with branches across North America, Europe, and Oceania.

The journey began in 2011 when Barrington-Brown visited South Africa and saw immense opportunities for space-related projects. "I moved to South Africa from the UK with an idea and two suitcases," he recalls fondly. Bringing intellectual property from his previous company, he started NewSpace Systems with South African and European shareholders. Today, the company exports to over 33 countries across six continents, solidifying its position as Africa's largest exporter of spacecraft-utilised hardware.
NewSpace's product range includes flight-proven off-the-shelf products such as reaction wheels, sun sensors, GPS receivers, antennas, magnetometers, magnetorquer rods and will soon be adding RF communication products.
The company supports major commercial spacecraft manufacturers, including several blue-chip companies and constellations of 500 satellites or more.

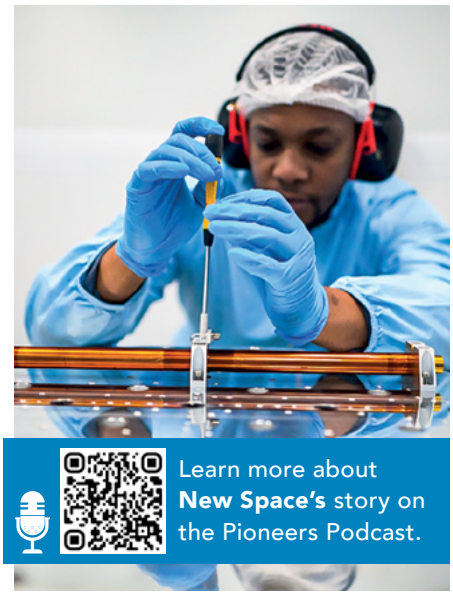
To date, their products have been utilised on over 2000 spacecraft, which equates to around 20% of the total number of satellites currently active in orbit.
"We handle the entire lifecycle, from design to industrialisation, build and test, and shipping our products worldwide," Barrington-Brown says. With 35 years of experience as an electronic engineer in the space business, he highlights the importance of "space heritage," building products with a sound reputation and a focus on reliability, given the high stakes of space missions. "Having been around for 10 years, we [NewSpace Systems] have seen significant growth due to our established track record," he says. This experience makes it difficult for newcomers to compete.

Human touch and inspiration
Despite increasing automation, NewSpace Systems remains committed to preserving the human touch in production, with a focus on precision and customisation. "Certain applications require automation for quality, but not necessarily for cost savings in the African context," Barrington-Brown explains. The company continually invests in enhancing its workforce's skills, understanding that space manufacturing demands attention to detail and quality control.

Operating from South Africa, particularly the Western Cape, offers several advantages. "The availability of skilled labour added to the cost of living being much lower than in the countries we sell to," Barrington-Brown points out. This cost-effectiveness, combined with local high-tech support and skilled artisans, makes the Western Cape an excellent hub. "The Western Cape is the most beautiful place on the planet," Barrington-Brown enthuses.
The proximity of high-tech companies supporting the space sector is a key advantage. "Building space equipment requires support from precision engineering and machining companies, and we have a wealth of skilled artisans here," he adds.

Excellent local universities like CPUT, UCT, UWC, and Stellenbosch also contribute to a strong talent pool. "Our engineers are so good that countries like the Netherlands are trying to poach them," says Barrington-Brown, emphasising the combination of skills and cost-effectiveness that make South Africa an ideal base for NewSpace Systems.
Barrington-Brown also highlights the inspirational value of space projects. He shares a favourite story: "Imagine a mom working on equipment destined for Mars, telling her child, 'I built a sensor for a spacecraft going into deep space.' This inspires kids to work harder at their studies, dreaming of becoming astronauts one day." This inspiration is crucial for building a skilled workforce and a sustainable space ecosystem.

With strong support from key stakeholders, including financial institutions and government, South Africa's space economy can soar to new heights, fuelling innovation and sparking inspiration for the next generation of scientists and engineers.



Learn more about **New Space's** story on the Pioneers Podcast.

HOW SANSA IS PROPELLING SOUTH AFRICA'S SPACE AGENDA FORWARD

The value proposition of South Africa's space sector: a strategic asset for economic growth and disaster mitigation.

In South Africa, where fiscal pressures are immense, articulating the value proposition of the space sector can be challenging. However, its potential to drive economic growth and mitigate disaster risks is substantial. Jon Ward, the executive overseeing the space science programme at the South African National Space Agency (SANSA), emphasises the sector's significant contributions to socioeconomic development.

"We can create products and services for the government and the public, helping to manage risks such as climate change and resource protection," says Ward. "Take the recent floods in the Western Cape and KwaZulu-Natal, for instance. The space sector, through Earth Intelligence, can minimise the damage from such extreme events by providing detailed early warning systems, reducing the need for costly disaster recovery."
Ward points out that disaster mitigation can reduce risks to communities and save money otherwise spent on disaster relief. In addition, many skills developed within the space sector, such as engineering and applied maths, are transferable to other critical areas of the economy, addressing skill deficits and supporting the growth of the knowledge economy.
SANSA is pivotal in driving the knowledge economy, promoting innovation, and enhancing industrial competitiveness.
By leveraging space science and technology, the organisation develops applications for geospatial services, telecommunications, timing, and positioning.

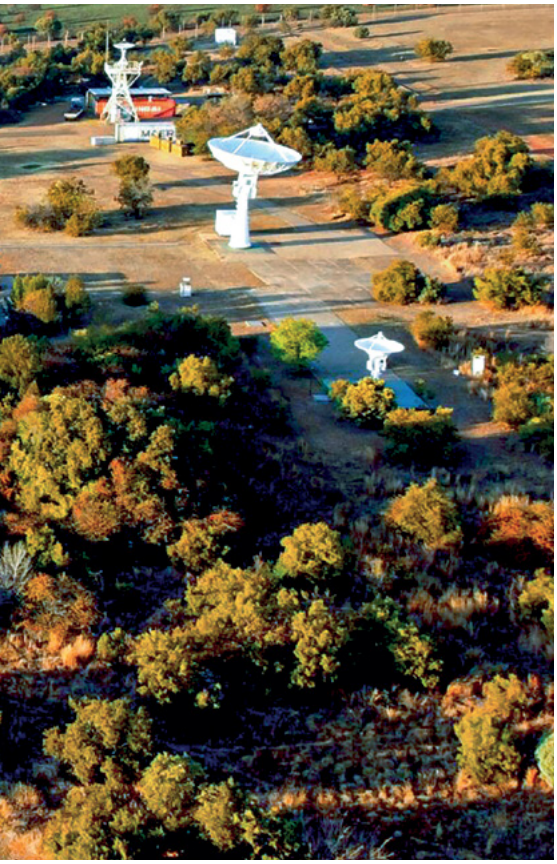
A brief history of SANSA

SANSA's official history is relatively recent, established under the South African National Space Agency Act of 2008 and officially launched on December 9, 2010. However, its roots extend far back, predating the global space race of the 1950s. As early as 1841, a Magnetic Observatory operated at the University of Cape Town. This observatory became part of an international network in 1932 and was relocated to the Hermanus Magnetic Observatory (HMO) in 1940 due to interference from an electric railway system in Cape Town. The Satellite Remote Sensing Centre in Hartebeesthoek was established by the Council for Scientific and Industrial Research (CSIR) in 1976 and later became the Satellite Applications Centre.

The 2008 Act aimed to consolidate South Africa's space activities under one agency, leading to the formation of SANSA. Its mission is to harness space for humanity's benefit through research and human capital development. SANSA promotes space utilisation, encourages research, advances scientific engineering, and supports industrial development in space technologies.

SANSA's work spans Earth Observation, Space Science, Engineering, and Operations. They collect, process, archive, and distribute satellite data to aid policy-making, economic growth, and sustainable development. This data supports resource and disaster management, food security, national security, and more. SANSA also offers cutting-edge facilities for space weather monitoring, launch support, and data downloads, strengthening the local space sector. Their efforts align with national and global strategies, promoting significant socioeconomic benefits.

SANSA's head office in Pretoria oversees operations and hosts the Earth Observation and Space Engineering programmes.



Learn more about **SANSA's** story on the Pioneers Podcast.

Its mission is to harness space for humanity's benefit through research and human capital development.

The Space Operations programme (formerly the Satellite Application Centre) is located in Hartebeesthoek, and the Space Science programme in Hermanus, in the Western Cape.

The Space Weather Centre in Hermanus, launched in 2010 and upgraded to a 24/7 operation centre in 2022, has provided critical updates and warnings for African stakeholders during periods of increased solar activity, encompassing various phenomena originating from the Sun, including solar flares, sunspots, and coronal mass ejections (CMEs). These solar events can exert considerable influence on space weather conditions, telecommunications infrastructure, satellite operations, and terrestrial power grids.

SANSA is expanding its operations in the Western Cape with the acquisition of the Houwteq Satellite Assembly, Integration and Testing (AIT) facility in Grabouw as well as the establishment of a Deep Space Network facility at Matjiesfontein in the Karoo District.

Research and human capital development

At the Hermanus facility, a key focus area is space science research and operational services, says Ward. "We have a strong research cohort that is internationally recognised. We generate new knowledge through publishing papers and recruiting and training postgraduate students. While we are not a degree-awarding institution, we collaborate with universities nationwide, and our researchers provide supervision." SANSA offers an external bursary programme targeting specific skills in physics, space science, space weather, applied maths, and engineering disciplines. This programme not only develops skills for SANSA but also benefits the broader sector.

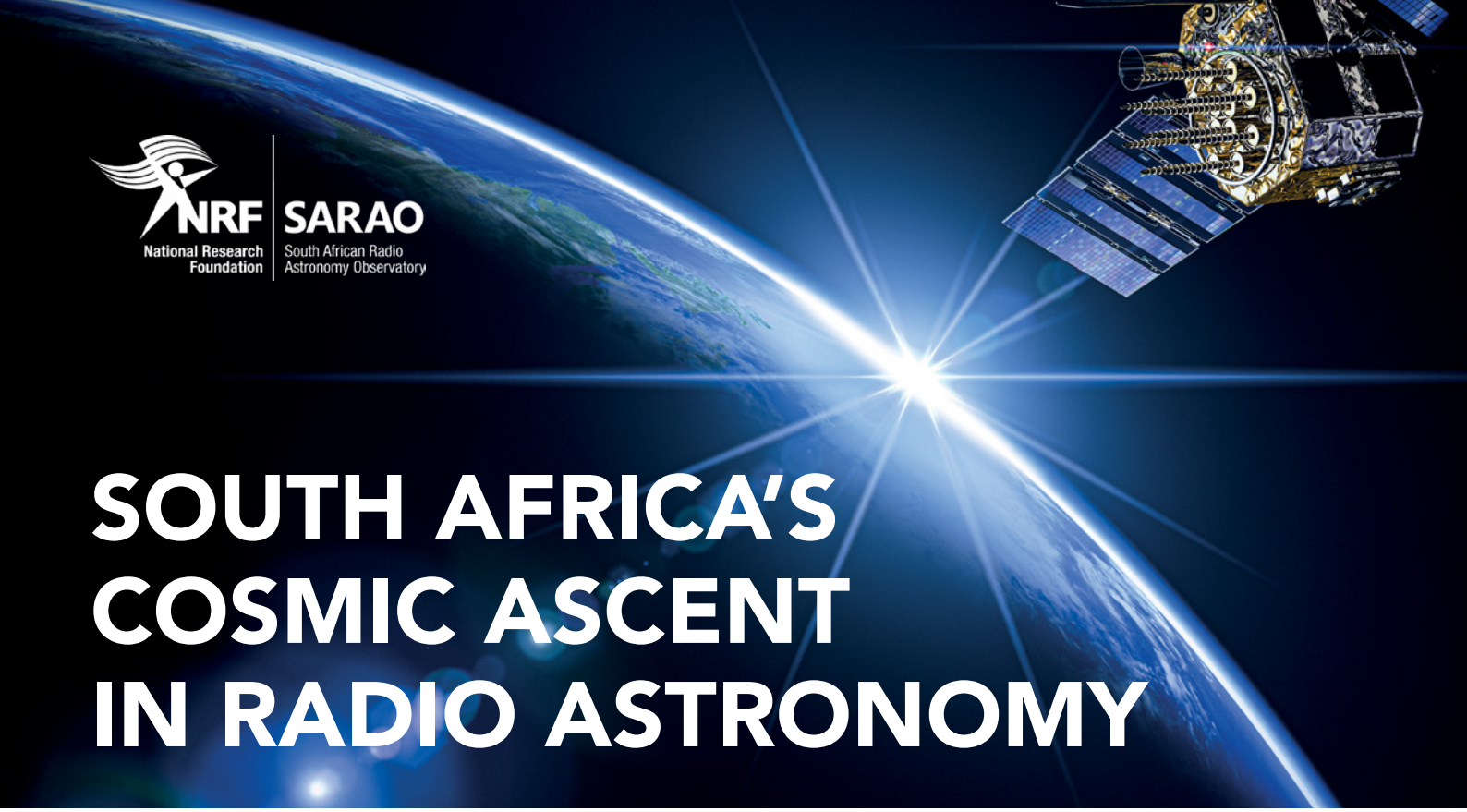
Targeted human capital development and strategic collaboration with universities play a crucial role. "We are in discussions with industry stakeholders to create incubator programmes for key skills development. While we produce bright engineers and scientists, we cannot employ all of them. By training these young professionals, we prepare them for various sectors," Ward adds. He highlights the potential for growth in the Western Cape's space ecosystem, stressing the need for better assembly, integration, and testing facilities.

"We are limited in building larger satellites and subsystems. By providing the necessary infrastructure, we can enable the industry to construct more sophisticated satellites," he states. This investment in infrastructure is crucial for the sector's advancement.

Developing indigenous launch capabilities is also critical. "Since 1993, we have been set back in developing our own launch capability," Ward explains. In the early 1990s, amid political tensions, South Africa faced international pressure to denuclearise, impacting its space launch capabilities. "Launch is one of the most expensive parts of a space mission. While companies like SpaceX have reduced costs, it remains prohibitively expensive. Indigenous launch capabilities would offer more opportunities," says Ward.

Ward is optimistic about the sector's future, emphasising the importance of continuous investment and collaboration to fully harness the potential of space technology for South Africa's technological advancements and the creation of a resilient and diversified economy.

For more information about SANSA, visit sansa.org.za.



SOUTH AFRICA'S COSMIC ASCENT IN RADIO ASTRONOMY

Key international partnerships, like the SKA project with SARAO's Cape Town hub at its core, propel South Africa to the forefront of radio astronomy research — unlocking the mysteries of the universe while sparking innovation and growth.

South Africa is establishing itself as a global leader in radio astronomy, thanks to key international collaborations like the Square Kilometre Array (SKA) project. Adrian Tiplady, Deputy Managing Director of the South African Radio Astronomy Observatory (SARAO), explains how these initiatives are setting new standards and offering numerous benefits. "SARAO's mission is to be a catalyst for radio astronomy and technology advancement in South Africa, Africa, and globally," says Tiplady. "We aim to establish South Africa as a global leader in radio astronomy by successfully hosting and participating in the design and construction of next-generation astronomical facilities, such as South Africa's own MeerKAT telescope and the international SKA facility."

Radio astronomy is more than just a scientific endeavour; it plays a crucial role in technological innovation, education, infrastructure development, and economic growth. It contributes significantly to our understanding of space, aiding in the exploration of celestial bodies and the search for extraterrestrial life. The insights gained from radio astronomy can inform space missions and create new economic opportunities in space-related industries.

Industries such as telecommunications, satellite communication, and navigation systems benefit from radio frequency analysis and interference mitigation techniques developed through radio astronomy. Tiplady notes the growing appreciation of radio astronomy's impact on socio-economic development, driven in part by South Africa's involvement in the SKA project. Established in 2017 as a national facility of the National Research Foundation, SARAO encompasses all national radio astronomy telescopes and programmes. It spearheads South Africa's strategic investments in radio astronomy, including participation in the SKA project and the construction and operation of the South African MeerKAT radio telescope. Located just outside Carnarvon in the Northern Cape, MeerKAT serves as a precursor to the SKA, but is a premier astronomical facility in its own right enabling ground-breaking scientific discovery by the global astronomy community.

Unparalleled observational capabilities

The SKA, spanning sites in South Africa and Australia with its headquarters based in the UK, is set to address fundamental questions in astrophysics. Offering unrivalled observational prowess, it will surpass the image resolution of the Hubble Space Telescope by a factor of 50 and stand as the world's largest radio telescope array upon its slated completion in 2028 or 2029. The telescope will perform precise tests of Einstein's theories and search for extraterrestrial life by detecting faint radio signals from cosmic sources billions of light-years away, including those from the early universe.

One of the SKA's main goals is to trace the full history of hydrogen, the most abundant element in the universe. Tiplady highlights the significant socio-economic benefits of the SKA and MeerKAT projects on local communities and the country at large. "The development of the SKA and MeerKAT has had a substantial economic and social impact on surrounding communities and the national GDP," he says.

"This project contributes to the development of a knowledge economy in South Africa, developing critical STEM skills in individuals at high school, graduate, and postgraduate levels."

Collaboration is a cornerstone of the SKA project, with SARAO playing a leading role. "From world-leading scientists and engineers to technological innovations focused on radio astronomy, SARAO manages some of the best sites globally, legislatively protected for astronomy research," says Tiplady. "We collaborate with renowned organisations like Oxford, LOFAR, UCT, UWC, Stellenbosch University, and the Max Planck Institute. SARAO is already contracted to deliver key products and services for the SKA project."

The SKA's design has engaged 500 engineers from 100 institutions spanning 20 countries, while its scientific development boasts contributions from over 1,000 scientists across 40 nations. Although the SKA and MeerKAT are situated in the Northern Cape, SARAO and SKA Observatory's headquarters, along with the SKA Data Centre, call Cape Town home. Specifically, they are located in Observatory, renowned nationally as a hub for optical and infrared astronomy, merely six kilometres from the Cape Town CBD. The data centre is primed to manage the vast data stream generated by the SKA telescope, a development valued at more than R1 billion.

"Cape Town's central location provides SKA investors and stakeholders, including international scientists and engineers, access to scientific data through undersea cable landing points," Tiplady explains.

Challenges and opportunities

SARAO's efforts have transformed radio astronomy in South Africa and beyond. "Nearly 300 academic articles have been published using data from MeerKAT, and our work has been profiled by major outlets – from the scientific journal Nature, to media outlets such as the New York Times. Numerous PhD and Master's degrees have been completed using data from MeerKAT," Tiplady highlights. The organisation also played a pivotal role during the COVID-19 pandemic, coordinating the National Ventilator Project using methods developed during the design and development of the **MeerKAT telescope.**

SARAO's Human Capital Development Programme collaborates with South African academic institutions to build capacity and establish a diverse research community able to exploit scientific data from MeerKAT and the future SKA, Tiplady says.

Despite notable achievements, the sector grapples with significant challenges, particularly the impact of satellite constellations on astronomy. Tiplady warns that "the advent of mega constellations poses a major future risk if not mitigated through appropriate regulatory and technical solutions." Starlink, developed by the private spaceflight company SpaceX, aims to provide low-cost internet to remote locations. However, the presence of such satellite constellations can interfere with both optical and radio astronomical observations. This has prompted efforts to minimise their effects.

Stakeholders are actively exploring technical solutions, regulations, and best practices to ensure the coexistence of satellite mega-constellations and scientific research both in space and on Earth. According to Tiplady, collaboration between space agencies, commercial entities, and the scientific community will be crucial in addressing these challenges.

SARAO's efforts have transformed radio astronomy in South Africa and beyond.

Tiplady also highlights exciting opportunities in the space technology sector, including the development and deployment of distributed compute infrastructures and passive radar systems. Distributed compute infrastructures entail interconnected computers sharing processing power, enhancing the efficiency of handling vast datasets and intricate computations. This technology supports advanced scientific endeavours, facilitating the analysis of astronomical data and simulation of space phenomena. Passive radar systems represent another innovative stride. Unlike traditional radar, they utilise existing signals like radio or TV broadcasts to detect objects, minimising radio frequency interference. This technology finds application in tracking satellites and space debris without adding to environmental interference.

These advancements drive scientific research and bolster national projects, benefiting from sophisticated skills and technologies developed through cutting-edge astronomical facilities. Leveraging these innovations, the space technology sector can significantly contribute to global scientific and practical pursuits. South Africa's investment in radio astronomy, led by SARAO and through both the MeerKAT and future SKA project, not only advances scientific frontiers but also fuels socio-economic progress, positioning the nation as a premier global authority in the field.

SIMERA SENSE

SIMERA SENSE SHOOTS FOR THE STARS

Exploring the galaxy of economic opportunities with optical payloads and earth observation cameras.

The global space sector is rocketing toward growth, and for South African companies, that means a galaxy of new economic opportunities, according to Thys Cronje, Chief Commercial Officer at Simera Sense, headquartered in Somerset West. Simera Sense, established in 2018, is quickly making its mark globally as a leading developer of optical payloads for nano, micro, and small satellites. But what exactly are optical payloads? They are cameras, specially designed for the satellites and the space environment to take detailed pictures of the Earth. "Our focus is 100% on the export market. Globally, we are leading the pack in cameras for smaller satellites," Cronje notes, emphasising the doors swinging wide open in the space industry. Technological advancements and the commercialisation of space, increasingly driven by private interests, have led to investments in space exploration, satellite deployment, space tourism, and more.

There is a surge in demand for satellite-based services such as communication, navigation, Earth observation, and remote sensing, catering to sectors like telecommunications, agriculture, defence and intelligence, and disaster management. Furthermore, emerging markets, particularly in Asia and Africa, are increasingly recognising the potential benefits of space technology and investing in their space programmes. This is creating new opportunities for companies to export space products and services to these regions.

"Our cameras stand out in this industry due to their unique form factor, performance and cost-benefits. We are constantly pushing the boundaries to enhance resolution—spatial, spectral, and radiometric," Cronje explains. Simera Sense boasts in-house resources and infrastructure for designing, building, verifying, and calibrating world-class optical payloads. Their goal is to make Earth observation effortless and accessible, providing insights into our planet's past, present, and future through extraordinary instruments.

'Off-the-shelf'

Their suite of high-resolution, 'off-the-shelf' cameras serves a diverse clientele across various industries. Earth observation cameras play a pivotal role in agriculture, forestry, urban planning, and natural resource management. For instance, by monitoring crop health and soil moisture levels, these cameras optimise agricultural practices, leading to higher yields and efficient water usage. Moreover, they contribute to environmental monitoring and climate change studies, aiding policymakers in making informed decisions.

Cronje highlights that Simera Sense collaborates with partners worldwide to expand its footprint and technology adoption. "We work with major satellite manufacturers, operators, research institutes, and space agencies. Our technologies assist in Earth monitoring and daily decision-making across industries like agriculture, mining, urban planning, intelligence, and environmental management."

At Simera Sense, they are embracing the 'newspace' ethos, which shifts away from traditional government-led space ventures towards more commercially driven initiatives. Cronje asserts: "We are breaking down traditional barriers in Earth observation from space, aiming to enhance the accuracy of smaller cameras and optimise their cost-effectiveness." Operating from the Western Cape provides an ideal ecosystem for scaling production and staying competitive on a global scale. Earlier this year, Simera Sense secured €13.5 million in its first growth investment round, with joint funding from NewSpace Capital and Knife Capital. This investment will support expanding production capacity, establishing new sites in Europe, growing product development teams, and enhancing customer service in Europe.This strategic move is poised to propel the company's growth in the Earth observation data and services market, which, according to Knife Capital, is forecasted to increase from a valuation of $12.55 billion in 2024 to $20.73 billion by 2029.

Simera Sense is also spearheading innovation with onboard data processing embedded in camera control electronics. This pioneering step has the potential to transform satellite imaging by analysing the data on the satellite to decrease the time from image capture to where social-economic and environmental decisions are made.

> *"We are breaking down traditional barriers in Earth observation from space, aiming to enhance the accuracy of smaller cameras and optimise their cost-effectiveness."*

Expansion

Operating from the Western Cape has been a significant advantage for Simera Sense, leveraging over 40 years of satellite and Earth observation instrument production history. The region's precision engineering expertise and facilities contribute to expanding production capacity and addressing global market needs, Cronje emphasises.

While Simera Sense has a global outlook, it remains committed to nurturing the local satellite industry by investing in people and infrastructure. Through partnerships with academia, they are training the next generation of space engineers and providing access to cutting-edge facilities. Their successful internship programme offers students hands-on experience, with many transitioning to full-time positions post-graduation.

"The Western Cape has a vibrant space economy, and we will always focus on working with our partners to grow it even further. The space sector is such a collaborative industry that we will always take hands and work with our industry partners. This includes working with academia to train the next generation of space engineers and upscaling our local supply chain," Cronje explains.
In the coming years, Simera Sense is gearing up to expand its development team, aiming to double its current size of nearly 50 members. This strategic expansion is focused on strengthening production capabilities within South Africa, paving the way for increased employment opportunities. With this growth trajectory, Cronje envisions South Africa emerging as a prominent provider of satellite components on the global stage, a testament to Simera Sense's commitment to pushing the boundaries of possibility in the space industry.

For more information about Simera Sense, visit www.simera-sense.com.

GROWING STARS: FROM WINE COUNTRY TO THE FINAL FRONTIER

Stellenbosch University is leading South Africa's charge in space technology, blending academic excellence with pioneering satellite innovation.

Stellenbosch University (SU), nestled in the stunning Western Cape winelands, is a key player in South Africa's expanding space technology sector. The institution, which i s surrounded by vineyards and mountains, has become a leader in space research and innovation, significantly influencing the nation's major achievements in the field and promoting the growth of prominent space technology enterprises in the region.

Since its founding in 1918, SU has developed into a major centre for interdisciplinary research and real-world application. The university's Department of Electrical and Electronic Engineering is especially notable because it has played a key role in the development of nanosatellites—tiny spacecraft no larger than a shoebox but packed with scientific capability. These small satellites perform various missions, including Earth observation, climate monitoring, and telecommunications.

For decades, SU has been leading South Africa's space endeavours. The building of SumbandilaSat, the country's first government-backed Earth observation satellite, was a significant milestone in 2009. This milestone not only demonstrated SU's technological prowess, but it also represented a huge step forward in South Africa's space exploration objectives. SumbandilaSat highlighted the value of space technology in everyday life by providing critical data for urban planning, agriculture, and disaster management.

SU's involvement in space efforts goes much beyond the SumbandilaSat project. Since the 1980s, the university has been actively involved in a variety of initiatives at Houwteq, an assembly, integration, and testing facility in Grabouw—approximately 65 km southeast of Cape Town, along the N2 highway.

Houwteq has played an influential role as a hub for these activities, bolstering SU's position in expanding South Africa's participation in the global space community. In recent years, the emphasis has been on small satellites, demonstrating the university's continued dedication to this field.

Roots in the Microsatellite Industry

The South African small satellite industry traces its roots back to the SUNSAT academic programme, which started in the early 1990s at SU. This advanced programme, developed by graduate students of the Department of Electrical and Electronic Engineering, aimed to build capacity in space mission design and construction. Africa's first domestically developed satellite emerged from this initiative, featuring a high-performance Earth observation camera.

A significant outcome of this programme was the formation of SunSpace and Information Systems (Pty) Ltd. in March 2000, an associate company of SU that aimed to commercialise satellite technology developed at the university. Over the past three decades, SU has conducted substantial research, particularly focusing on control systems for satellites. Professor Herman Steyn, who recently retired from SU's Department of Electrical and Electronic Engineering, was instrumental in developing extensive space programmes. His leadership was instrumental in initiatives such as the SUNSAT satellite programme and the establishment of SunSpace, which constructed satellites for global clients and contributed to the SumbandilaSat project. Steyn highlights that these efforts have

spurred the growth of several new commercial space enterprises in the Western Cape, many of which were founded by former SunSpace personnel. Many of these companies provide vital components to global clients, further enriching the region's space value chain.

Steyn underscores the university's focus on research and postgraduate training in satellite engineering. SU offers specialised courses and degrees in aerospace engineering and satellite design, equipping students with the skills needed to thrive in the competitive space industry. The institution also provides short courses in satellite engineering and mission design for industry professionals, primarily in the Western Cape.

Diverse and Inclusive Talent Development

SU boasts impressive facilities, including a satellite ground station (for communicating with satellites), a thermal vacuum tank (to simulate the harsh conditions of space), an anechoic chamber (to test radio equipment without interference), and a GPS simulator (to mimic satellite navigation). These resources make the university an ideal project coordinator for satellite missions with local space companies, says Steyn. SU's space lab encourages participation from students with diverse backgrounds, and the university has seen a substantial increase in diversity since the early days of the SUNSAT programme.

> *SU is passionate about fuelling the next generation of space explorers.*

SU has a track record of successful collaborations with both national and international institutions. Within the Western Cape, SU has supported the Cape Peninsula University of Technology (CPUT) with their CubeSat activities. These customised nanosatellites are used for Earth observation, safety at sea, pollution and weather monitoring, and communication between secluded areas and the 'outside' world.

Steyn notes the success of Western Cape commercial space component suppliers internationally, with many space missions currently flying South African-developed components. However, he also highlights that the local government-sponsored satellite sector has not grown as expected since SumbandilaSat. Efforts to fund new satellite missions often stall at the planning phase, with current national funding supporting only a few staff at the South African National Space Agency (SANSA) and related institutions.

To realise the full potential of South Africa's space sector, Steyn emphasises the need for increased funding and collaboration. SU continues to partner with government agencies and private enterprises, leveraging its research capabilities for national development through collaborations with SANSA and industry leaders.

The university is passionate about fuelling the next generation of space explorers. Through its comprehensive education programmes, students gain key skills to excel in the global space sector. Offering specialised courses, targeted degrees, and state-of-the-art equipment, SU serves as a launchpad to success for aspiring space professionals. Professor Willem Jordaan, who heads the satellite research programme at SU, stresses the critical importance of developing human capacity in this field. The Electronic Systems Laboratory (ESL) at SU has been leading the way in satellite development in South Africa since the late 1990s. Their main focus is on training satellite engineers to excel internationally.

Jordaan points out that SU is currently upgrading its facilities to expand its operations. Current facilities include electronic laboratory space, a satellite ground station and air-bearing platforms. These are essential for testing and developing systems that determine and control a satellite's orientation and movement in space (known as attitude determination and control systems or ADCS) and for simulating conditions of weightlessness to conduct experiments.

Professor Riaan Wolhuter from the Signal Processing Group (DSP Group) at SU's Electrical and Electronic Engineering department explains the institution's holistic approach to research and talent development. The division's focus extends beyond space to telecommunications for various applications, including agricultural data collection, bio-telemetry, mobile services congestion prediction, and contributions to the Square Kilometre Array (SKA) project. This broad focus enhances the university's reputation and attracts high-tech investment to the Western Cape.

A Legacy of Excellence

Wolhuter emphasises that the training provided to students enables them to contribute to diverse areas such as water, power, and sanitation infrastructure, which are crucial for regional growth and development. SU's commitment to high-level professional engineering education not only enhances its reputation but also makes the Western Cape an attractive destination for high-tech investment, he adds.

SU's legacy of academic excellence extends far beyond the vineyards of the Western Cape. The institution continues to inspire and innovate, making significant contributions to the global space sector and advancing technology for a better future.

For more information about SU, visit www.sun.ac.za.

UNIVERSITY of the WESTERN CAPE

BUILDING A UNIVERSE OF TALENT: HOW UWC IS SHAPING SOUTH AFRICA'S FUTURE IN SCIENCE AND SPACE

Early science education is key to South Africa's space ambitions.

To position South Africa as a prominent centre for science and space exploration, there needs to be a focused initiative to improve education at the foundational and primary school levels, particularly in critical subjects like mathematics (maths) and science. Ed Elson, Associate Professor of Astrophysics at the University of the Western Cape's (UWC) Department of Physics & Astronomy, emphasises the necessity, stating: "Foundation phase and primary school teachers require significant support." Drawing comparisons with countries like China, Elson stresses the importance of investing in teachers. "China's government invested heavily in teacher education and resources, and the results speak for themselves. In South Africa, we haven't matched this level of investment," Elson explains, underlining the need to empower teachers to nurture future scientists and astronomers. Elson advocates for increased support for teachers, including financial incentives and access to better training and resources.

This will empower them to effectively ignite a passion for science in young minds. "If we allocate more resources to support teachers and more individuals in pursuing teaching diplomas and degrees, we will see substantial benefits," Elson says. Subjects such as maths and science are vital for South Africa's economic development and the cultivation of future scientists. These disciplines lay the foundation for critical thinking, problem-solving, and technical expertise, which are indispensable in fields such as engineering, technology, scientific research, and space science. Enhanced proficiency in these subjects can spur innovation, increase productivity, and elevate South Africa's global competitiveness, Elson notes.

Despite ongoing educational reforms and increased focus on STEM (Science, Technology, Engineering, and Mathematics), South Africa faces challenges in improving participation and performance in these subjects. Many students struggle due to inadequate resources, poorly trained teachers, and unsupportive learning environments, especially in underprivileged communities.

Breaking the Myth Around Astronomy

Astronomy, often perceived as a field for the exceptionally gifted, should be accessible to anyone passionate about science. Elson makes a clear statement: "We must dispel the myth that astronomy and astrophysics are only for super smart people. There is a lot of support available, and organisations like the South African Radio Astronomy Observatory (SARAO) and the National Research Foundation offer financial assistance to

students. While our country faces many pressing issues, promoting scientific endeavours is crucial for our development as a knowledge-based economy."

Located in Bellville, a bustling urban centre in Cape Town, UWC has become a significant player in the global astronomy ecosystem. "We aim to produce well-rounded astronomers whose skills are applicable beyond astronomy," says Elson. Graduates often enter the private sector, equipped with big data, analytical, and problem-solving skills, which enable them to adapt to different work situations as critical thinkers.

UWC places a strong emphasis on developing academic and presentation skills, teaching students to conduct impactful research and write scientific papers. "We attract students from diverse backgrounds, including the disenfranchised and marginalised sectors of society, and aim to give them the opportunity to pursue science careers," Elson states. SARAO has been a consistent supporter, relying on universities like UWC for skilled graduates to work on projects such as MeerKAT, which is described below.

Interest in astronomy in South Africa has surged recently, largely due to the MeerKAT radio telescope and the forthcoming Square Kilometre Array (SKA) project. MeerKAT, one of the country's largest scientific endeavours since the advent of democracy, features 64 observational dishes. These dishes are crucial for detecting and analysing radio waves from various cosmic sources, enhancing our understanding of the universe. MeerKAT also serves as a precursor to the SKA, set to become the world's most powerful radio telescope when completed around 2028 or 2029. "These projects have placed South Africa on the global scientific map," Elson says. "They allow us to attract and collaborate with international experts, boosting research and knowledge development." MeerKAT's unique combination of sensitivity and resolution enables detailed studies of the universe, making significant contributions to both South African and international science.

Elson highlights that it is now possible to build a fulfilling career as a professional astronomer, a prospect that wasn't always viable in South Africa. Landmark projects like MeerKAT and the Southern African Large Telescope (SALT) have significantly altered the landscape.

Located at the South African Astronomical Observatory (SAAO) field station near Sutherland in the Northern Cape, about 400 km from Cape Town, SALT is funded by a consortium of international partners from South Africa, the United States, Poland, India, and the United Kingdom. The telescope has been fully operational since 2011, realising its potential as Africa's Giant Eye on the Universe.

"Institutions such as UWC have created new positions for astronomers, allowing people like me to train the next generation of South African scientists. It's crucial to transfer expertise from one generation to the next," Elson states.

Sustaining High Standards in Space Science

> *Through this initiative, the school is calling on corporates across SA to join them and invest in the youth of the country.*

Emeritus Professor Ramesh Bharuthram, from UWC's Department of Physics & Astronomy, describes how space science research has evolved at the institution. In 2008, UWC had one astronomer. By 2015, it was rated as the third strongest astronomy team in Africa, with a staff complement of six academics. "Because of the SKA, we had about 16 post-doctoral fellows from around the world," Bharuthram says. "We had international experts from institutions like Oxford University collaborating with our scholars."

South Africa's strides in space science are largely credited to its commitment to high standards. Bharuthram highlights this, noting: "Many of our doctoral students go on to post-doctoral positions at leading centres worldwide." He shares the story of a doctoral student who landed a post-doctoral role at NASA, the United States agency responsible for the nation's space programme and aerospace research, and now teaches in that country. "As the SKA develops, we aim to attract graduates from across the globe to contribute to African projects," he adds.

UWC's space science research focuses on Near-Earth Space Physics and Astronomy and Astrophysics. The former studies phenomena within our solar system, relevant to understanding Space Weather, while the latter delves into deep space, discovering new galaxies and studying their dynamics. The research conducted at UWC is of high international standing, with collaborations with South African National Space Agency (SANSA), SARAO and global partners.

"The quality of research at UWC is of the highest standard," Bharuthram emphasises. "We publish in journals of high international standing." He stresses the importance of problem-solving skills, critical thinking, versatility, and adaptability, which are crucial in any discipline, to produce the quality of graduate needed in the world of work.

The Road Ahead

South Africa's journey to becoming a centre for science and space starts with investing in primary education, particularly in maths and science, and supporting educators. Spearheaded by initiatives such as MeerKAT and SKA and bolstered by educational institutions like UWC in the Western Cape, South Africa is set to make substantial strides in global science and technology. By nurturing young talent and breaking down barriers, the country can lead in science, promoting innovation and growth, says Bharuthram.

Q&A

PRECISION BEYOND EARTH: ENGINEERING THE FUTURE OF SPACE TECHNOLOGY

Executive Engineering (PTY) Ltd Leads with Precision and Innovation in the Western Cape.

The space economy is rapidly emerging as a key driver of economic growth, with engineering playing a pivotal role at its heart. From satellite communications and Earth observation to space tourism and asteroid mining, the potential applications are extensive. Engineers are instrumental in developing the technologies that will unlock these opportunities, paving the way for new markets and industries. The scope of engineering in the space sector is vast, covering many specialisations. Aerospace engineers design vehicles capable of enduring the harsh conditions of space travel, while mechanical engineers create the intricate machinery that drives these vehicles forward.

Electrical engineers develop sophisticated electronic systems crucial for navigation, communication, and data collection. Materials engineers continuously innovate to find materials that can withstand the extreme conditions of space. Each specialisation contributes unique skills and knowledge critically important to the success of space exploration.

Executive Engineering (PTY) Ltd, based in the Western Cape and established in 1994, aims to position itself as a leader in manufacturing for space technology. As part of a group of privately owned businesses, Executive Engineering has earned a reputation for precision engineering and machining, vital aspects of space technology that ensure components meet the exact standards required for space missions. Precision engineering and machining are foundational to mission success, ensuring every component, no matter how small, meets the stringent requirements for operation in space. As space technology develops, these disciplines will only grow in importance, driving innovation and enabling deeper exploration of the cosmos.

Executive Engineering's advanced technical capabilities enable the company to manufacture complex components while consistently meeting strict quality and customer requirements.

Beyond space technology, the company serves major clients in industries such as petrochemicals, railways, medical, automotive, wine, canning, agriculture, marine, general engineering, and industrial sectors.

In a recent Q&A session with Jurie Swart, a manager at Executive Engineering, he elaborated on the company's mission and goals:

Q: Can you provide an overview of your organisation's mission in South Africa, particularly in the Western Cape region?

A: Our mission is to deliver precision-manufactured components promptly and cost-effectively across a wide range of industries.

Q: What advantages does Cape Town and the Western Cape region offer as a business location for your enterprise?

A: The diversity of industries in and around Cape Town is a significant advantage for us. With sectors like agriculture, marine, food processing, transport, medical, and aerospace, it provides an ideal starting point in the supply chain. This diversity ensures steady business throughout the year, accommodating seasonal demands from various sectors.

Q: What specific challenges or needs does your organisation address in the South African space technology sector?

A: Space technology demands state-of-the-art precision with zero margin for error, as repairs are impossible in space. This is where our expertise in machining and measuring components to ISO (International Organisation for Standardisation) standards proves invaluable.

Q: How does your approach differ from conventional methods? What advantages do you offer stakeholders, including students, educators, and researchers?

A: Staying at the forefront of new innovations and technologies in measuring and machining equipment sets us apart in the market.

Q: What challenges and opportunities lie ahead for the space technology sector?

A: While there are challenges, the sector presents boundless opportunities. South African engineers are renowned for their innovative prowess, and the sector continues to create numerous job opportunities, promising further growth.

Q: What are your future plans to expand the influence of your space technology solutions within South Africa?

A: We aim to establish ourselves as one of the leading manufacturers for space technology, expanding our reach and impact in the market.

Executive Engineering (PTY) Ltd plays a crucial role in the growing space economy by mastering the art of precision engineering. They manufacture components to exact standards, ensuring not only the success of space missions but also driving innovation across various industries.

Q&A

ENGINEERING EXCELLENCE: RORA ENGINEERING'S JOURNEY FROM LATHE TO LEADING PLAYER

Mastering basic tools to advanced expertise, how Rora Engineering is shaping South Africa's space future with precision and innovation.

From humble beginnings with just a lathe and a milling machine, Strand-based Rora Engineering has grown into one of South Africa's top engineering companies. Specialising in aluminium machining, Rora also boasts the capability to work with a variety of materials, including stainless steel, mild steel, plastics, and non-ferrous metals.

To appreciate the origins of Rora Engineering, it helps to know about the tools that started it all. A lathe is a versatile machine tool that rotates a workpiece on its axis to perform various operations, such as cutting, sanding, and drilling. This is fundamental in creating precise cylindrical parts. On the other hand, a milling machine removes material from a workpiece by feeding it against a rotating cutter, which is essential for creating complex shapes and surfaces. These machines are the backbone of many engineering processes and were critical in establishing Rora's initial capabilities.

Rora Engineering is committed to manufacturing a wide range of engineering products for the mechanical engineering divisions of their clients. Adhering strictly to International Organisation for Standardisation (ISO) standards, which are crucial for ensuring quality, safety, efficiency, and interoperability in engineering and space sectors, the company emphasises producing quality products. Each employee plays a critical role in achieving these goals, and Rora ensures that customer requirements and satisfaction are consistently met or exceeded.

Eugene Rossow, CEO of Rora Engineering, sheds light on the company's mission and goals.

Q: Could you offer an overview of your organisation's mission within South Africa, with a focus on the Western Cape region?

A: Rora Engineering aims to be the leading engineering company in the Western Cape and South Africa, dedicated to delivering the highest quality and service.

Q: What attributes make Cape Town and the Western Cape region particularly advantageous as a business location for your enterprise?

A: Johannesburg and northern regions cater more to the mining and construction industries with large machinery. In contrast, the Western Cape offers significant advantages for aerospace, space, radar, marine, and industrial sectors.

Q: What specific challenges does your organisation face?

A: We frequently encounter challenges with the availability of certain material grades, surface finishings, and qualified personnel. Elevating new personnel to our standards and maintaining high outsourcing standards are ongoing challenges. Consistency and quality from different suppliers remain the biggest challenges in South Africa's space technology sector.

Q: How does your solution distinguish itself from conventional approaches? What unique features or advantages does it offer to stakeholders?

A: We bring extensive machining and manufacturing expertise tailored to our clients' specifications. Our commitment to quality, reliability, service, and transparency sets us apart in the industry.

Pioneering Precision and Sustainability

Engineering is a bedrock of the space sector value chain. Precision in manufacturing components is critical for the reliability and success of space missions. Rora Engineering's dedication to ISO standards and continuous improvement ensures that the products they deliver meet the high demands of the space sector. Their focus on quality not only enhances customer satisfaction but also contributes to the advancement of the space value chain in South Africa.
By adhering to strict quality objectives and environmental considerations, Rora Engineering aims to become the preferred supplier of engineering products. Their ongoing efforts to minimise environmental impact and enhance processes reflect their commitment to sustainability and excellence.

In the fast-changing world of space technology, Rora Engineering plays a crucial role. They bring the expertise and precision needed for space missions to thrive, solidifying their position as a key player in the sector.

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