



Aerospace Industry Support Initiative

an initiative of **the dtic**

# IMPACT REPORT 2023/24



**the dtic**

Department:  
Trade, Industry and Competition  
REPUBLIC OF SOUTH AFRICA



**CSIR**  
Touching lives through innovation

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The Aerospace Industry Support Initiative (AISI) is an intervention of the Department of Trade, Industry and Competition (the dtic). Created by the Advanced Manufacturing Chief Directorate, the AISI is designed to foster industrial development and competitiveness in the local South African aeronautics, defence, space and marine industries.

The initiative takes its strategic direction from government’s objectives with emphasis on the industrialisation of technology, industry transformation, and job creation.

In presenting this Impact Report for 2023/24, the AISI management extends its gratitude to the dtic, the local aerospace, defence and marine manufacturing industries, the AISI team, and its host organisation, the Council for Scientific and Industrial Research (CSIR).

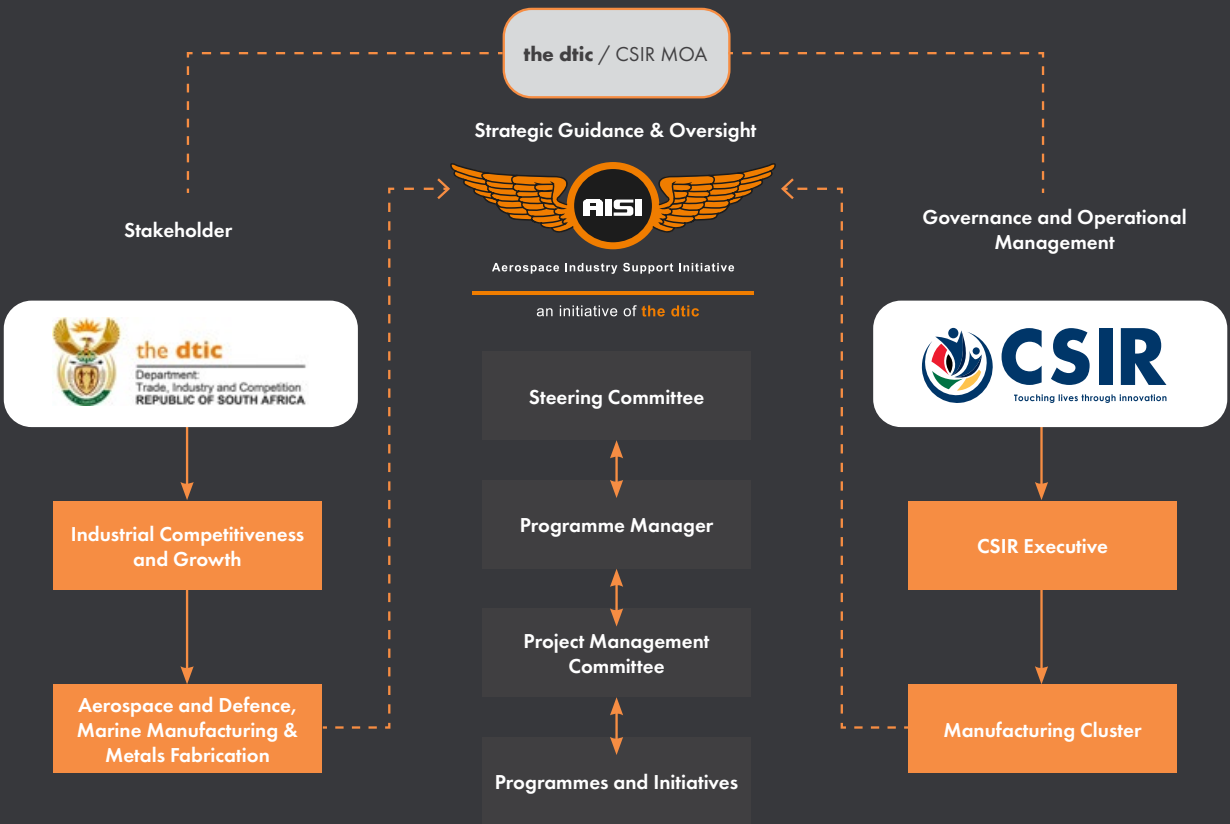
AISI VISION

To position the South African aerospace-, defence- and marine-related manufacturing industry as a global leader, in niche areas.

AISI MISSION

To enhance the global competitiveness of the South African aerospace, defence and marine manufacturing industry by:

- Developing relevant industry-focused capability and facilitate associated transfer of technology to industry;
- Identifying, supporting and promoting the interests and capabilities of the South African aerospace, defence and marine manufacturing industry;
- Implementing industrial policies in support of government strategic objectives including growth, employment, transformation and equity.



The AISI is an initiative of the dtic which is hosted and managed by the CSIR’s Manufacturing Cluster. The AISI is managed to adhere to the Public Finance Management Act (PFMA), within the CSIR’s procedural and policy framework. The AISI operating structure is shown in the figure above.

OVERVIEW OF AISI PROGRAMMES

Since 2006, the AISI has enabled the dtic to achieve the following sectoral development goals:

- Supplier and small, medium and micro enterprise (SMME) development
- Job creation and retention
- Technology development
- Industrialisation of technology
- Localisation and import substitution
- Exports promotion
- Fostering transformation in the industry with a focus on women and youth empowerment.

These goals are achieved through the implementation of programme level interventions within specific technology streams and product markets. The AISI utilises relevant tools such as technology road mapping to facilitate the development of technology strategies for respective AISI beneficiaries. This enables the AISI to identify specific interventions within its mandate to assist in improving the competitiveness of local industry.

The AISI programmes are designed to assist industry in overcoming challenges, building local capabilities and technological solutions, and enhancing global competitiveness. The five programmes that support the implementation of the AISI mandate are:

1 TECHNOLOGY-BASED SUPPLIER DEVELOPMENT

The AISI’s Technology-Based Supplier Development intervention provides enabling mechanisms to assist industry to improve productivity, implement quality management systems, optimise operations, and enhance integration into global supply chains. These interventions are implemented with a specific aim of broadening the industrial base by encouraging original equipment manufacturers (OEMs), integrators and sub-systems suppliers to work with SMMEs and lower-tier suppliers in technology programmes.

2 INDUSTRY DEVELOPMENT AND TECHNOLOGY SUPPORT

This programme focuses on advancing production innovation such as the use of advanced manufacturing and other Fourth Industrial Revolution technologies to build more durable, compact and efficient products. Access to new and existing processes, products and methods is also facilitated to ensure that beneficiaries develop products and services that enable them to exploit multiple market opportunities. Integrators and sub-system suppliers are encouraged to include SMMEs and lower-tier suppliers in their supply chains, to enable the continuous transfer of knowledge, expertise, capabilities and technologies, thereby broadening the industrial base.

3 SECTOR STRATEGIC SUPPORT INITIATIVES

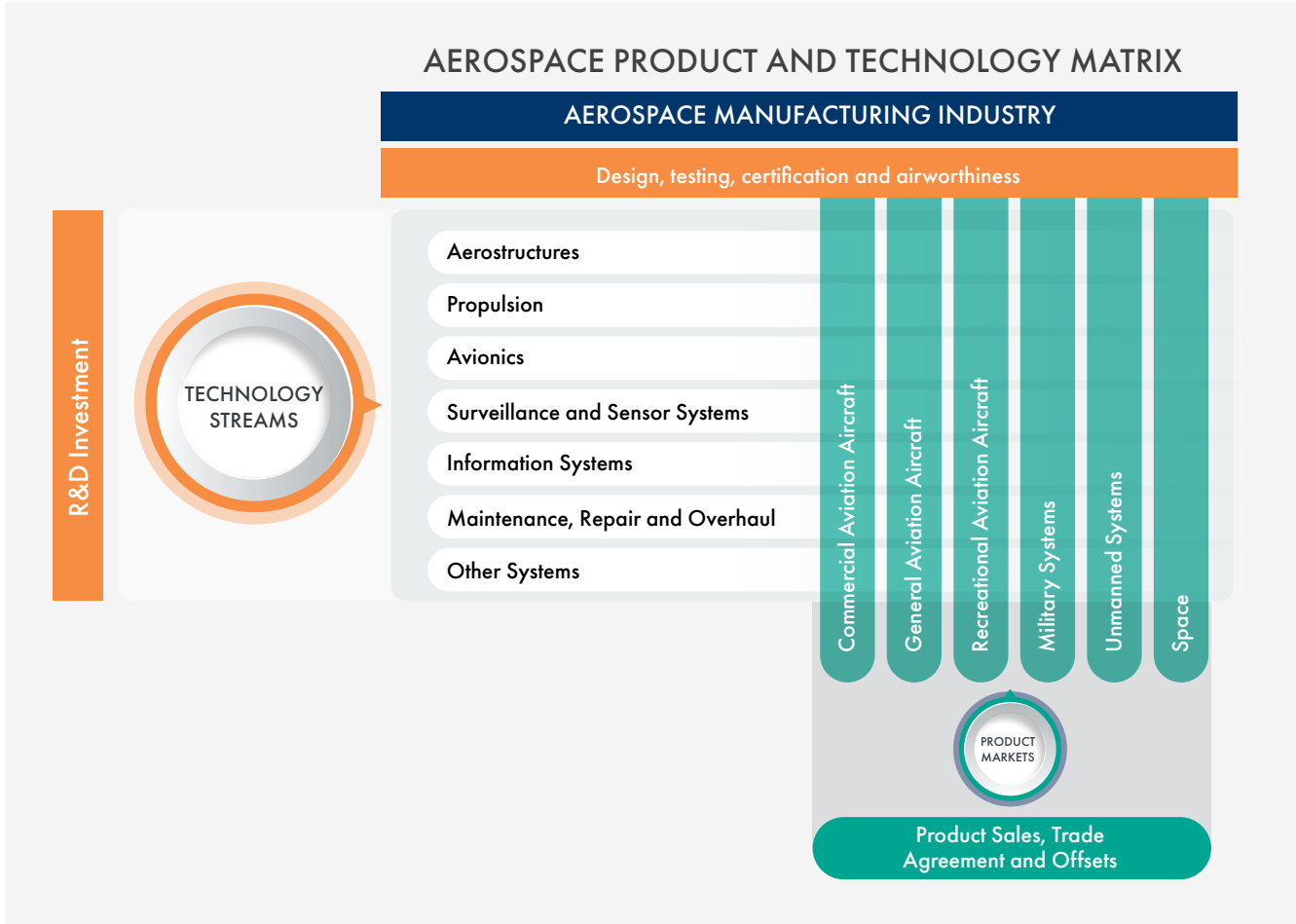
The AISI implements, oversees and contributes projects of national interest through this programme. This includes the development of the Commercial Aviation Industry Development Strategy, the hosting of the Joint Aerospace Steering Committee and contributing to the development of the Aerospace and Defence Masterplan, both at operational and strategic levels.

4 SECTOR-WIDE ACCREDITATION (INCLUDING MARINE)

This programme assists companies in the broader advanced manufacturing industries with standards and accreditation, as well as technology enhancement.

5 COORDINATION, PROMOTION AND AWARENESS

The AISI plays a pivotal role in coordinating activities and promoting awareness of the sectors and industries it represents in South Africa. A flagship event is the annual Aeronautical Society of South Africa Conference that brings together local industry players to showcase projects and associated impact achieved during the year.

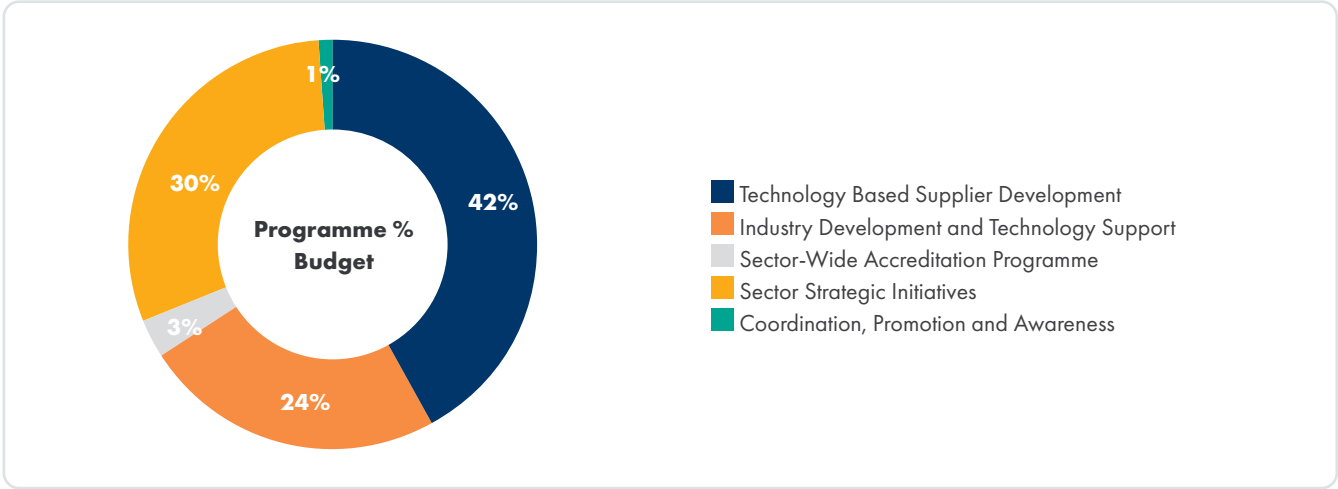


## STANDARDS AND ACCREDITATION OVERVIEW 2023/24

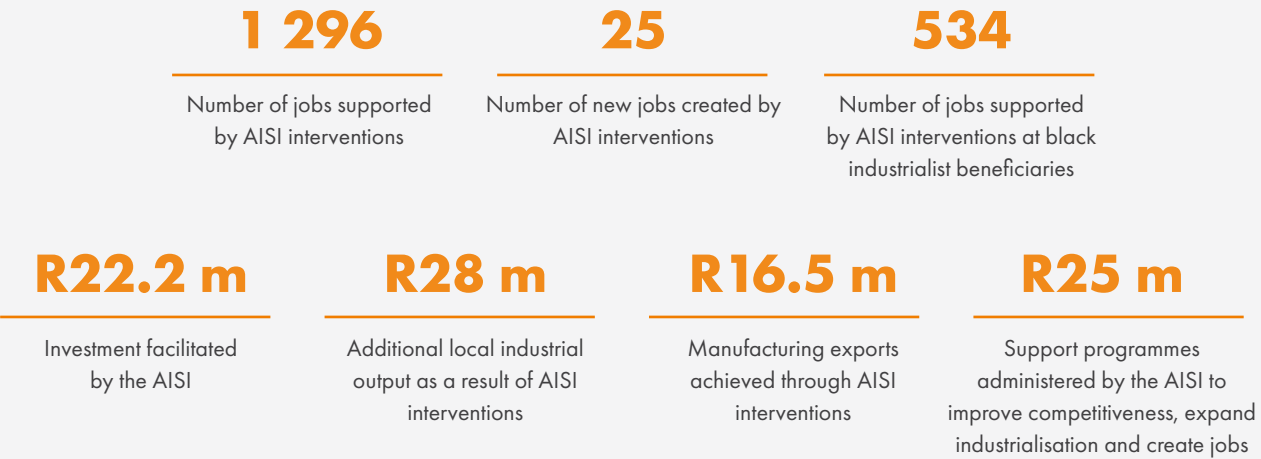
International standards ensure that the products and services one uses daily are safe, reliable, and of high quality. They also guide businesses in adopting sustainable and ethical practices, helping to create a future where purchases not only perform excellently but also safeguard our planet. In essence, standards seamlessly blend quality with conscience, enhancing everyday experiences and choices.



## BUDGET ALLOCATION BY PROGRAMME



## IMPACTS AND BENEFITS FOR 2023/24 PERIOD



## PROJECTS SUMMARY







# TECHNOLOGY BASED SUPPLIER DEVELOPMENT

*The AISI’s Technology-Based Supplier Development intervention provides enabling mechanisms to assist industry to improve productivity, implement quality management systems, optimise operations, and enhance integration into global supply chains. These interventions are implemented with a specific aim of broadening the industrial base by encouraging original equipment manufacturers (OEMs), integrators and sub-systems suppliers to work with SMMEs and lower-tier suppliers in technology programmes.*

BENEFICIARY NAME	PROJECT TITLE
Jonker Sailplanes	24m Wingspan Open Class JS5: Phase 2
Reutech Radar Systems	FMCW - Frequency Modulated Continuous Wave Short Range Radar to Detect, locate and track Humans
Reutech Radar Systems	3D Technology Establishment for the RSR 906 Surveillance Radar
Bronberg Dynamics	Development of a 12kg Minimum Take-off Weight (MTOW) Battery Powered UAV for Security Applications.
Tower 35	Stabilised Commander Sight (SCS) Development Project
Nablateg	Development of a VGA/XVGA Long Wave Infrared Thermal Imaging Core for Surveillance and Monitoring
Etion Create	ETION Autotracker Enhancement Development Project
HH Industries	Design and Integration of Additive Manufactured Parts for Turbojet Engines
SPARCX	Radar Target Classification
Metal Heart	Supplier Development of Specialised Aerospace Components with Complex Designs Project
Lambda G	Global Navigation Satellite System (GNSS) Antenna Development
Shrike Marine	Vehicle Power Management Systems Demo Set
Aditiv Solutions	Validation of a locally manufactured HYRAX metal 3D printer
Petrawell	ISO 9001 Implementation
JJ Harnessing	ISO 9001 and 45001 Implementation

# 24 METRE WINGSPAN SAILPLANE DEVELOPMENT FOR MASS PRODUCTION AND SUPPLY TO LOCAL AND INTERNATIONAL MARKETS

**Beneficiary**  
Jonker Sailplanes

**Project title**  
24m Wingspan Open Class JS5: Phase 2

**Project market**  
Local and International Gliding Enthusiasts

**Project location**  
North West

Jonker Sailplanes (JS) is a leading international supplier of sailplanes to gliding enthusiasts around the world. From their factory in Potchefstroom, North West, they design, develop and manufacture a range of sailplanes.

The AISI and the CSIR have a long history with JS that has spanned a wide range of technology development and has assisted them in establishing their reputation for technical excellence.

One of the first projects was the development of a wing-based bug wiper device that cleans unwanted bugs off the wings of a plane. This is specifically important in planes used competitively, as bugs can impact the performance of a plane. This development replaced the expensive import of a similar device.

During the 2019/20 financial period, the AISI support assisted JS with the development of probes on the pitot-static and total energy control systems. A pitot-static system is a system of pressure-sensitive instruments that is most often used in aviation to determine an aircraft's airspeed, Mach number, altitude, and altitude trend. These systems require a combination of static and dynamic pressure that was the focus of this development project. The successful completion of this project replaced an import product.



Since 2018, Jonker Sailplanes has been developing the JS5 24m wingspan sailplane that was completed during the year under review. The AISI has played an integral role in reaching this momentous step.

These are just two examples of projects that the AISI and the CSIR have supported JS with.

**The most recent, and probably the most notable project, is the design and development of the open class JS5 with a 24m wingspan that started in 2018. The design was completed in the beginning of 2022 and since then, the AISI has supported various aspects of the project.**

During the 2022/23 AISI supported the tooling process in preparation for the manufacture of the first prototype. AISI's support for the On-Track Technologies Low Vibration 2-Stroke Aircraft Engine Project (also featured in this publication) directly benefited the development of JS5' 24m wingspan plane. By the end of the financial period covered by this report, JS had successfully completed the development of the JS5 and was gearing up to participate in the World Gliding Championships taking place in August 2024 in Uvalde, Texas, USA.

At the time this publication was produced, JS was awaiting feedback on the requisite certifications on the JS5, that is the final requirement for participation in the World Gliding Championships.

The JS5 is not the only model internationally with a 24 metre wingspan, but it is the only model of its size destined for mass production and also the only one in its class in South Africa. It is important to qualify the concept of mass production. Whereas international manufacturers of sailplanes in this class will produce less than ten units on an annual basis, Jonker Sailplanes intends producing 60 units on an annual basis that will position JS as a leading international supplier of quality open class sailplanes.

In addition to flying the South African flag high for technological development, Jonker Sailplanes is an important contributor to socioeconomic development in its immediate community and the country. Skills development is a key priority at JS and the company is an active participant in First National Bank's (FNB) 1st job initiative. Young people with a technical aptitude participate in a yearlong learnership that involves on-the-job training.



# FUNCTIONAL RADAR PROTOTYPE DEVELOPED FOR TRACKING OF HUMANS

**Beneficiary**  
Reutech Radar Systems

**Project title**  
FMCW Short Range Radar to Detect, Locate and Track Humans

**Project market**  
Defence and Marine

**Project location:**  
Western Cape

Reutech Radar Systems has been involved with security for strategic and national key points, as well as commercial sites for several years. This has involved sensors and equipment from various suppliers, that have been integrated and commissioned by Reutech Radar Systems. A low-cost, short-range radar with local supply and support would be a huge benefit to the local industry. National key points have requested support, proposals and the threat posed world-wide by drones has raised the requirement even further.

Small, low-cost, short-range radars with the capabilities of detecting and tracking humans would be an ideal tool for this market. Devices that exist currently from other international manufacturers tend to be expensive and local support is not available. They are not easily customisable for particular sites or operations and original equipment manufacturer (OEM) support is typically required.

***“The genesis of this radar concept took root within the framework of the engineering intern programme at our company, a platform designed to nurture young graduates by fostering their skills and providing first-hand industry exposure,” says Claude Ramasami Engineering Domain Manager Digital & RF at Reutech Radar Systems. “Over the course of the past three years, the evolution of this radar into its current prototype stage has served as the cornerstone of experiential learning within this programme.”***

The support requested from the AISI is to take the current intern-based hardware and develop it further with various technology enhancements to make it suitable for further investigation, development and commercialisation by industrialising, qualification and licensing at a later stage.

Throughout its development, this radar concept has not only materialised into a functional prototype but has also demonstrated a compelling value proposition in terms of cost-performance dynamics, setting it apart from existing market alternatives. This differentiation has been a pivotal achievement, confirming the feasibility and potential impact of the concept.

To propel this concept further and transition it into a refined and industrialised state, the support from the AISI will be channelled strategically. The primary objective is to optimise and streamline the design, aiming to establish a foundation for low-volume production readiness.

“This initiative marks a significant stride toward concretising the vision, with the overarching aspiration of ultimately scaling up to high-volume production, envisaging a notable contribution to the manufacturing landscape in South Africa and beyond,” adds Ramasami.

The involvement of SMMEs in the development of the frequency modulated continuous wave short range radar (FMCW SRR) will bring a wealth of benefits, including diverse expertise, cost-effectiveness, enhanced supply chain management, faster development cycles, and positive impacts on the local economy. This contributes to the sustainability and continuity of the FMCW SRR development efforts.



TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



IMPORT  
REPLACEMENT

The goal for this phase of the project is to add capability to the prototype to optimise the design and add the necessary target classification and tracking, integration with a security camera and enhancement of the human machine interface (HMI) functions.

The ultimate project goal is to update the conceptual firmware and software of the radar, adding support for a feature set suitable for a standalone minimum viable product (MVP). Additionally, the project aims to initiate industrialisation for the enclosure and create a manufacturing data pack. These steps will enable the production of small runs of systems intended for demonstrations and test site deployments.

## ▶ ABOUT REUTECH RADAR SYSTEMS

Reutech Radar Systems is a division of Reutech (Pty) Ltd, a leading defence and applied electronics company in the Reunert Group. Founded in 1987, the company's radar capability has broadened significantly through the local development and manufacture of a wide range of surveillance and tracking radars for the South African National Defence Force (SANDF), foreign defence forces and the security industry.

Since its establishment, Reutech Radar Systems' local development and manufacture of radar systems for military use has broadened significantly. Today its systems include land and naval search and tracking radars for the SANDF and international clients, radar solutions for the security industry that integrate traditional technologies used for asset protection with ground surveillance radar technology and monitoring and surveillance radars for slope monitoring in the mining industry.

**Reutech Radar Systems offers the complete spectrum of capabilities applicable over a radar system's life cycle from concept to retirement. This process includes system engineering supporting requirements definition in collaboration with the client, system and subsystem specifications, qualification methodologies and system verification and validation; engineering and production to support development, manufacture and assembly, integration and testing, system qualification, installation and commissioning of systems; and logistics and support for post-delivery maintenance and support.**



Isaac Mpheng, Graduate Designer: RF & Microwave, visually inspecting processor PC board on the FMCW Short Range Radar.



Isaac taking a closer look at a solder joint for any errors and for quality control on the processor PC board on the FMCW Short Range Radar.



# SURVEILLANCE RADAR DEVELOPMENT TO IMPROVE CLUTTER REJECTION AND DETECTION PERFORMANCE

**Beneficiary**  
Reutech Radar Systems

**Project title**  
3D Technology  
Establishment for the RSR  
906 Surveillance Radar

**Project market**  
Defence and Marine

**Project location**  
Western Cape

Reutech Radar Systems’ RSR 906N naval air/sea surveillance radar is a mechanically stabilised, continuous scanning surveillance radar, optimised for the simultaneous detection of both air and surface targets. The radar is a fully coherent, low cost, lightweight, low probability of intercept (LPI) and frequency modulated continuous wave (FMCW) radar.

Marine and coastal surveillance and awareness have become increasingly important over the past five to ten years and implementing 3D capability within the RSR 906 is expected to have a significant improvement on the clutter rejection and detection performance of the radar, especially in the inshore coastal (littoral) environment.

This AISI project sought to define the technology approach; establish the design goals and measures of success for a technology proof of concept (POC); realise a multi-channel FMCW receiver; integrated the new receiver into a modified RSR906 radar for evaluation; and the eventual branding of the 3D capable RSR 906 as the RSR 936.

The digital receiver exciter (DREx) was tested on its own before being deployed in a functional laboratory model (FLM) for system-level testing. The results proved that the technology was ready to be tested in a functional rooftop model (FRM) in a real-time scenario. The DREx was integrated with a production antenna and tested against a flying drone. The results yielded very accurate height measurement capability, proving that the technology is ready for full-scale engineering development of the final product, which will be called the RSR 936.

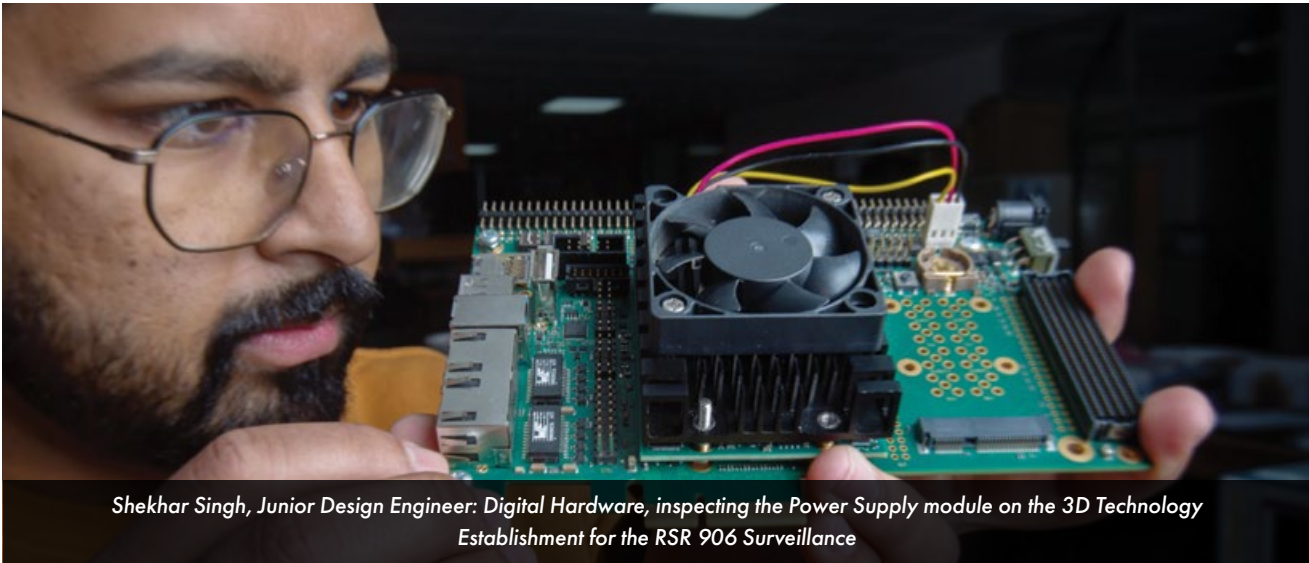
The intention is that a cost-effective 3D surveillance radar, in the same price class or better compared to major competitors, will be able to obtain a sizeable market share in the coastal surveillance radar market. In addition, this development presents opportunities for Reutech Radar Systems to supply the technology to constabulary vessels including fisheries, law enforcement, coast guard cutters, naval offshore patrol vessels, and inshore patrol vessels market.

The technology is now matured to the point that allows full scale engineering development of the production-ready DREx module for integration into the future RSR 906 Surveillance Radar.

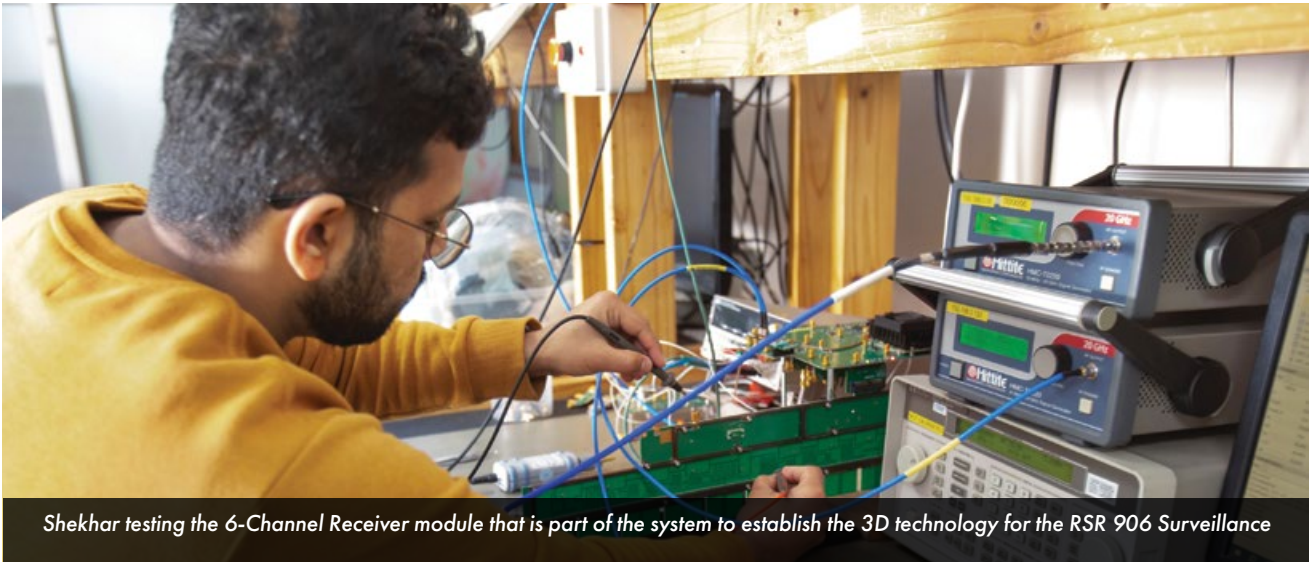
This project’s success positions Reutech Radar Systems well in the market and has resulted in an international customer contracting Reutech Radar Systems for the full-scale engineering development and delivery of the RSR 936 radar.

Finally, and just as important, this project contributed to the development of numerous Reutech Radar Systems’ engineers, as well as established strong working relationships, capabilities and technologies mastered by various small, medium and micro enterprises (SMMEs),

**“The technology that has been developed under this project would be applicable to a number of other radar systems currently under development and production at Reutech Radar Systems,” says Claude Ramasami Engineering Domain Manager Digital & RF Reutech Radar Systems “and the working relationship that has been developed with the various SMMEs should be maintained beyond this project.”**



Shekhar Singh, Junior Design Engineer: Digital Hardware, inspecting the Power Supply module on the 3D Technology Establishment for the RSR 906 Surveillance



Shekhar testing the 6-Channel Receiver module that is part of the system to establish the 3D technology for the RSR 906 Surveillance

## BENEFITS OF 3D SEARCH RADAR OVER 2D SEARCH RADAR

- Ability to provide additional information about the altitude or elevation of detected targets
- Enhanced situational awareness
- Improved target discrimination
- Accurate tracking of altitude changes
- Adaptability to varied terrain
- Detection of stealthy or low-profile targets
- Integration with modern surveillance systems
- Comprehensive threat assessment



**A Frequency Modulated Continuous Wave (FMCW) radar system is a special type of radar system that measures both distance and velocity of moving objects.**



# DESIGN AND DEVELOPMENT OF SMALL, LOW-COST UAVS TO RIVAL LARGER COMPLICATED SYSTEMS

**Beneficiary**  
Bronberg Dynamics

**Project title**  
Development of a 12kg Minimum Take-off Weight (MTOW) Battery Powered UAV for Security Applications

**Project market**  
Aerospace and Defence

**Project location**  
Gauteng

Bronberg Dynamics' unmanned aerial vehicle (UAV) for security and surveillance is a project to enhance the local capabilities in South Africa's UAV market segment that is dominated by the import market. The competitors in the market are expensive platforms and do not offer any local support as the suppliers are all outside of the country.

The project team will source local and off the shelf components and hardware that will be integrated on a newly designed UAV platform. The software design, mechanical, electrical and communication design will be done by the project team. The product will be a demonstrator of a small and rapidly-deployable UAV capable of extensive security and surveillance roles.

Bronberg Dynamics specialises in mechanical, aeronautical, and electrical engineering. Their expertise in aeronautical engineering includes aircraft and helicopter design, flutter and stability analysis, UAV design, computational fluid dynamics (CFD) analysis, wind tunnel testing, store release simulations, wind turbine design, and Pixhawk UAV control software and hardware.

UAV systems have overwhelmed the market in recent years, with many companies offering solutions in the security, surveillance, inspection, agriculture, and military sectors. The industry comprises many sectors, that includes regulatory, operating and training bodies; research and development; as well as supply and logistics.

***"Whilst the sector internationally is booming, with exponentially increasing capital throughflow and diversification of capabilities, a key factor for the sector in South Africa is the cost of production as equipment and services are produced internationally," comments Dr Gert Erasmus from Bronberg Dynamics.***

"The South African industries are not yet mature enough to maintain the necessary supply at a competitive cost and are thus unable to profit from the large international markets and industries based on the UAV sector," adds Dr Erasmus.

The international electrical component supply industry has also developed quickly in the last decade and UAV systems with electronic payloads now weigh a tenth of the weight an equivalent system would weigh years ago. This often makes it excessively expensive to operate older and larger UAV's.

The manufacture of small UAVs offers a greater market opportunity than their large counterparts that are manufactured in small quantities due to their great cost, complexity and manufacturing timelines. This often limits the scope of manufacturing processes as it is not financially viable to develop processes and moulds necessary for largescale production of larger UAVs. This is particularly relevant in the composites manufacturing sector, where experience in large volume aerospace industry manufacture is limited to international companies.

Research conducted locally with civilian and military clients by Bronberg Dynamics has revealed that a market exists for a small UAV that is able to meet a combination of requirements. These include, maximised endurance, a camera able to retrieve usable footage, easily transportable in a small personal vehicle without risk of damage, quiet



operation to limit possible detection, vertical take-off and landing capability, and the ability to withstand gusts of wind up to 25 knots and thus needing low directional volume. In addition, the payload should be easily interchangeable, with capacity for a variety of payloads.

"We believe that small, low-cost UAVs tipping the scales at no more than 15 kilograms can perform equally with the large and complicated systems available," continues Dr Erasmus, "which means that these small UAVs could vastly outnumber the large and complicated systems, making them easily replaceable and aggressively developable."

The project will open doors for smaller companies to enter the UAV services industry and expand Bronberg Dynamics' product offering. In

doing this, the skillsets of individuals within the company will improve greatly and contribute to the development of young South African engineers in the future. The transfer of technical knowledge will include, among other topics, safe battery handling and storage processes, aeronautics and flight planning, software usage and autonomous mission planning.

The AISI's support for this project will lead to the development and retention of highly skilled jobs in the sector, as well as achieve export capability for supply of smaller UAVs. The project will result in the technical development of advanced and existing technologies, as well as grow support for local SMME's to compete in global technology markets.





# DEVELOPMENT OF ADVANCED DEMONSTRATOR MODEL OF TWO-AXIS STABILISED COMMANDER SIGHT ASSEMBLY

**Beneficiary**  
Tower 35

**Project title**  
Stabilised Commander Sight Assembly Development

**Project market**  
Aerospace and Defence

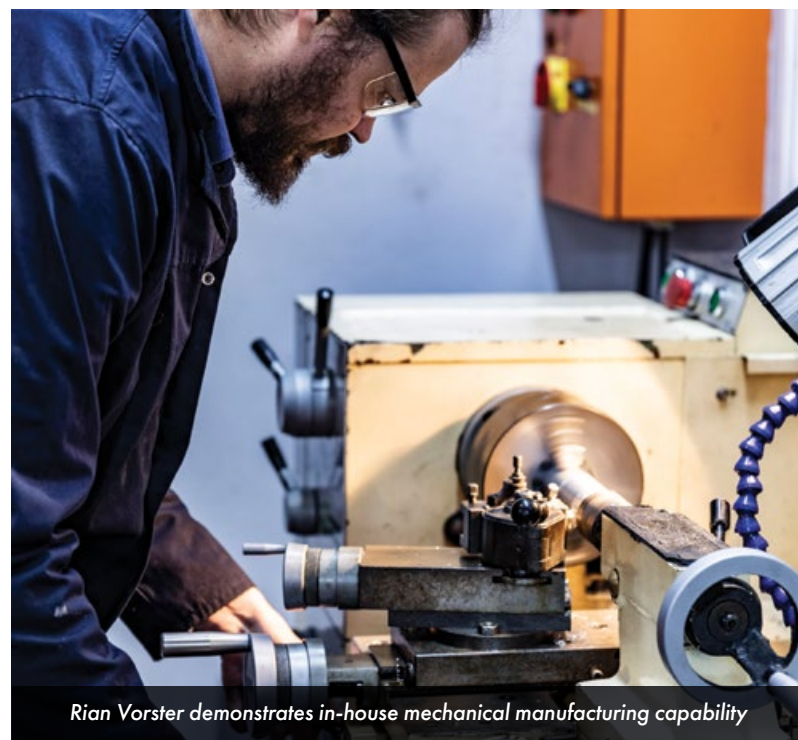
**Project location**  
Gauteng

There are multiple 2-axis Stabilised Commander Sight (SCS) platform assemblies available to local and international markets. These systems come at a great cost to the client and don't always meet their specific needs. As a result, Tower35 identified a need for a system that is cost effective, as well as being able to perform according to the requirements of such a land-based system, while being a modular/scalable system that can be tailored to client's specific needs.

Tower35 is a design bureau and original equipment manufacturer in the aerospace industry. The company specialises in stabilised platform assemblies incorporating a wide range of technologies including optronics, electronics, mechanics, digital processing, and control systems. Although Tower35 is a small enterprise, sound engineering principles are followed, backed by a strong configuration management system and change control.

**The company was approached by a local aerospace and defence company to develop a stabilised 2-axis gimbal assembly to integrate their payload for an international client as a complete surveillance and tracking system. This proposal did not come to fruition but enabled Tower35 to further look at an opportunity to develop its own 2-axis SCS Assembly.**

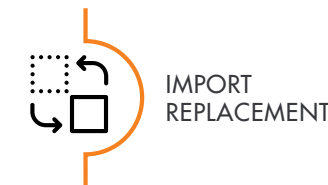
The result was the development of a demonstrator 2-axis gimbal using existing designs and hardware with new building blocks to mitigate certain risks of such a challenging design. This system was used at the African Aerospace and Defence (AAD) expo with an integrated HMI panel to demonstrate another client's auto tracker functionality.



Rian Vorster demonstrates in-house mechanical manufacturing capability



TECHNOLOGY  
DEVELOPMENT



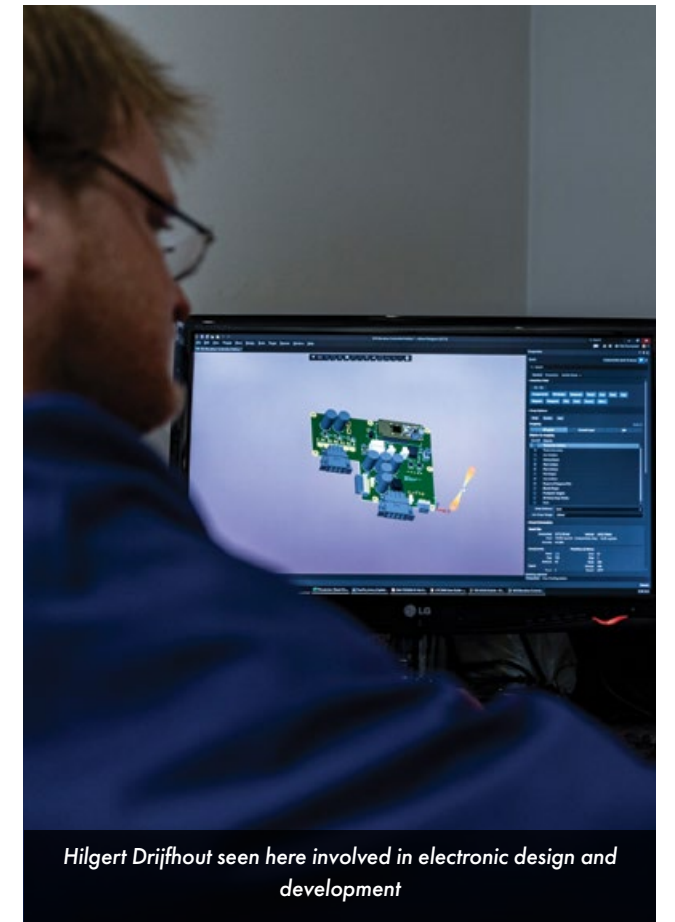
IMPORT  
REPLACEMENT



EXPORT  
POTENTIAL



Johannes Roberts demonstrates Stabilised Commander Sight integrated onto Steward platform for performance evaluation.



Hilgert Drijfhout seen here involved in electronic design and development

Tower35 approached the AISI to co-fund the development of an advanced demonstrator model of the SCS Assembly that comprised concept design, detailed mechanical and electronic design, software development, procurement and manufacturing, system build and integration, as well as an SCS field test and acceptance test procedure.

In less than a year Tower35 developed and built the SCS Assembly and completed full vehicle integration and testing as per the project scope. The system was also integrated on a vehicle mast and demonstrated to multiple military attachés present in South Africa.

The SCS Assembly offers a scalable design solution with a modular payload interface allowing a quick time to market for potential clients with specific needs. The system is price competitive in comparison to similar options available globally. Tower35 now owns the IP to a scalable gimbal assembly that can be easily adapted for many defence applications. The SCS Assembly fills a gap in the South African market due to the downscaling of the state-owned defence initiatives.

Following the successful initial development of the SCS Assembly, Tower35 aims to upgrade the payload sensors and qualify the

system in the coming year to further mature the product and expand on its market range.

"The Development of the Stabilised Commander Sight was deemed a success and Tower35 is eager to further mature the system. Multiple tests have been completed to evaluate the system's performance and the feedback from different industry experts has been highly positive," says Johannes Roberts, MD at Tower 35. "The support from the AISI and the dtic funding played a significant role in helping us achieve this milestone."

The SCS Assembly will have to go through a formal qualification process to improve on the Technology Readiness Level (TRL) of the product. This should be completed with a high-end payload solution to bring a more realistic option to the aerospace and defence market.

"Tower35 aims to integrate their 4-axis system's sensors in the SCS Assembly in the coming year to reduce the risk of failure during the qualification phase of the SCS Assembly and to provide an alternative option to future clients," concludes Roberts.



# LOCAL DEVELOPMENT OF COST COMPETITIVE THERMAL IMAGING CORE FOR GIMBALLED SENSOR PAYLOADS

**Beneficiary**  
Nablateq (Pty) Ltd

**Project title**  
Development of a VGA/  
XVGA Long Wave  
Infrared Thermal Imaging  
Core for Surveillance  
and Monitoring

**Project market**  
Aerospace and Defence

**Project location**  
Gauteng

Unmanned aerial vehicle (UAV) systems have overwhelmed the market in recent years, with many companies offering solutions across a variety of markets and sectors. The rapid uptake has caused an exponential increase of capital flow and diversification of capabilities on both the platform and payload sides. Unfortunately, this is a high-level tertiary market sector characterised by high equipment and service costs, in part since most of the products and services are produced and/or rendered from abroad.

The South African industry is dominated by local defence companies with mature gimballed sensor payloads only catering for the top tier international market with almost no local companies competing for the low or middle tier local or international market. Companies that are not mature enough to offer solutions at a competitive cost are reliant on international vendor supplied thermal imaging cores which becomes a major cost driver in their product offerings. This fact renders local companies unable to profit from the large international markets and industries based on the UAV sector.

A cost competitive thermal imaging core for gimballed sensor payloads does not exist locally and presents an opportunity for Nablateq to compete in this emerging market.

Nablateq possesses a solid track record and extensive experience in the implementation of real-world performance solutions for a diverse client base and can analyse and simulate complex engineering problems. The combined engineering experience of the human resource pool available to Nablateq not only spans several decades, but includes a diverse set of specialisations from software, hardware, algorithm development to mathematical analysis and optics design.

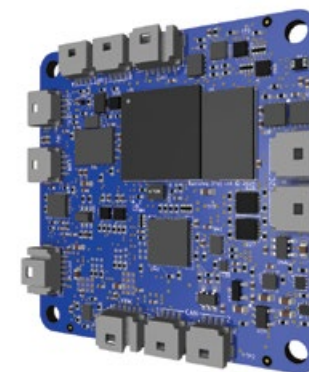
Over the past four years Nablateq has designed and built custom and bespoke remote sensing and multi spectral sensor payloads for various clients, from timelapse surveillance and monitoring internet of things (IoT) solutions to multi spectral payloads for UAVs.

"Nablateq has always tried to remain relevant to the engineering industry, both locally and internationally, and has been involved in a diverse range of high-tech and challenging engineering," says Dr Gert Erasmus, CEO of Nablateq.

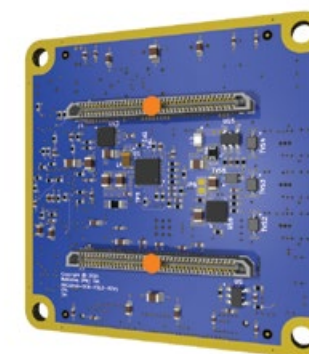
**"We have entered the international market with unique solutions for unmanned and manned aerial platforms and landward platforms providing clients with cost competitive solutions whilst providing high end operational capability," adds Dr Erasmus.**

This is achieved by developing sensors using detector technology provided by various original equipment manufacturers (OEMs) situated in the far East and embedding next generation artificial intelligence (AI) infused algorithms on low-cost hardware combined with years of experience gained by engineering resources that have worked on various missiles and electronic warfare programmes at various SOI and international defence companies over a period of 30 years.

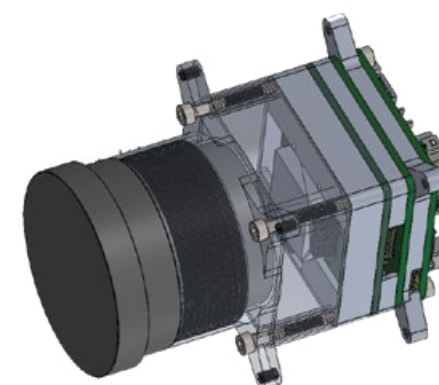
After communication with prospective civilian and military customers, it transpired that there is a need for a cost competitive thermal imaging core with a set of high-level capabilities including a size, weight and power (SWaP) footprint less than 50mm x 50mm x 20mm in size, a weight constraint of less than 150g and power consumption of less than 5W. In addition, the solution should have the ability to trigger image capture



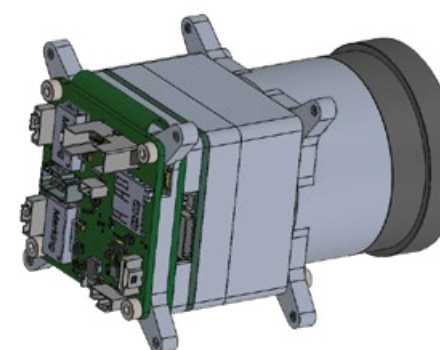
Nablateq's proprietary gimbal control processor (GCP) – a 16-layer printed circuit board responsible for gimbal stabilisation and camera frame synchronisation. It features an on-board GPS module, ethernet, CAN-bus and many auxiliary ports for integration flexibility.



Nablateq's sensor carrier board for infrared cameras. This board facilitates communication between the infrared detector and the image processor, and drives the infrared detector's thermoelectric cooler.



A model of a complete sensor stack for one of our clients. The camera lens and aluminium frame can be seen in grey, and the assembled circuit boards (detector, carrier board and image processor) can be seen in green.



A fully assembled K130 gimbal, of which we have manufactured 4, thus far. It is a complete and marketable product which has seen interest from both local and international clients.



on IEEE 1588 precision time protocol, perform DRI with deep neural networks, stream extended video graphics array (XVGA) 16-bit uncompressed video in a raw format over ethernet and annotate image data with 9-axis inertial management unit data.

The proposed thermal imaging core, the 'Proton', will be highly adaptable and performant in applications spanning from the airborne to the landward domain. The modular architecture will allow for easy interchange and enable Nablateq to construct a wide verity of different sensor payloads particular to client needs.

**Local interest was shown by the Paramount Group that has expressed an interest in five sensor payloads for evaluation under operational conditions. Bronberg Dynamics entered a strategic partnership with and designated Nablateq as the preferred supplier of autonomous gimballed sensor payloads for its UAV offerings for the local and international market.**

The technology being developed via this project will result in cost competitive product offerings by Nablateq with equal or better functionality of similar international products. This will open the market for SMMEs and enable them to enter and join the markets dominated by well establish international sensor payload companies.

"By the end of the review period the project has achieved notable gains despite challenges associated with manpower availability, hardware problems with the first revision of PCBs, as well as a global chip supply shortage on critical components. The project schedule was updated to accommodate these challenges and is due for completion during the 2024/25 project period," concludes Dr Erasmus.

# DEVELOPMENT OF VIDEO TRACKING SOLUTION ON SMALL EMBEDDED PLATFORMS

**Beneficiary**  
ETION Create

**Project title**  
ETION Autotracker Enhancement Development

**Project market**  
Defence

**Project location**  
Western Cape

Situational awareness is a key component when deploying forces in an operational environment. To improve situational awareness, video cameras are used in surveillance and targeting functions. Stabilisation of images especially in targeting applications are critical to ensuring the accuracy of positioning information and to ensure the targets are not lost due to relative movement of the platform or targets.

The goal of the project was to establish a local capability developed at ETION to introduce a video tracking solution (autotracker) that could run on small, embedded platforms or on a Linux based operating system, which is not International Traffic in Arms Regulations (ITAR) controlled and could be provided as a standalone solution without the need for extensive proprietary integrated video systems.

Video autotracking functions are built into video-based surveillance and targeting systems. It also assists with identification of objects targeted in the field of view of the video image. Whilst there are companies both locally and internationally that provide video autotracking capabilities, these companies either provide autotrackers integrated into their higher-level hardware assemblies/sub-systems (cameras and mission computers) or as licenced executable software that is dependent on an existing operating system (OS), such as Linux, being installed on the target platform.

**Locally, the companies that provide autotrackers do not provide standalone solutions, but rather as integrated functionality in their sighting systems. ETION was approached by various existing clients to investigate the feasibility of integrating an autotracking functionality on their existing display solutions.**

During this investigation it was found that the only options available were to either purchase software from a foreign company (with licence fees at approximately R 74,000 per unit installed, i.e., per display) or to purchase complete hardware solutions for resale to their clients, thus negating the original request to enhance existing products to their clients.

The project was successfully completed within the budget and timescales, resulting in a commercially viable product which was demonstrated to the AISI. Whilst the development of the basic autotracker has been an important milestone, further enhancement is required to improve its competitiveness with existing foreign sourced products.

**Integration onto even smaller embedded platforms would further facilitate integration into small form factor electro-optical sighting systems, with the smaller embedded platforms being integrated into the sight itself, instead of as an external component of the system as is current practice. This will result in an autotracking function embedded directly into small form factor sights.**



TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



LOCAL  
EXPERTISE

## ABOUT ETION CREATE

ETION Create designs, develops, and manufactures a wide range of advanced electronic and embedded solutions as well as digital products for different markets. They have a long-standing reputation for delivering excellence in the aerospace, defence, industrial, rail and cybersecurity sectors.

Their engineering expertise and insight into multi-dimensional challenges enables them to develop solutions for a wide range of applications for product companies and system integrators worldwide. With a production facility that is geared for turnkey manufacturing, they can drive innovative design engineering and product industrialisation processes across the product development lifecycle, thereby accelerating product time to market.

The company's design and development capabilities include conceptual design, software development, field programmable gate arrays (FPGA)

firmware development, high speed digital, analog and RF electronic design, computer-aided design, systems integration, engineering management, project management, systems engineering and production engineering.

Manufacturing capabilities include supply chain management, automated electronic manufacturing, product integration, reliability testing, quality management, low, medium, and high-volume production, and product support.

## EXPLANATION OF TERMS

**Auto-tracking** is the process of filming without the need for a camera operator.

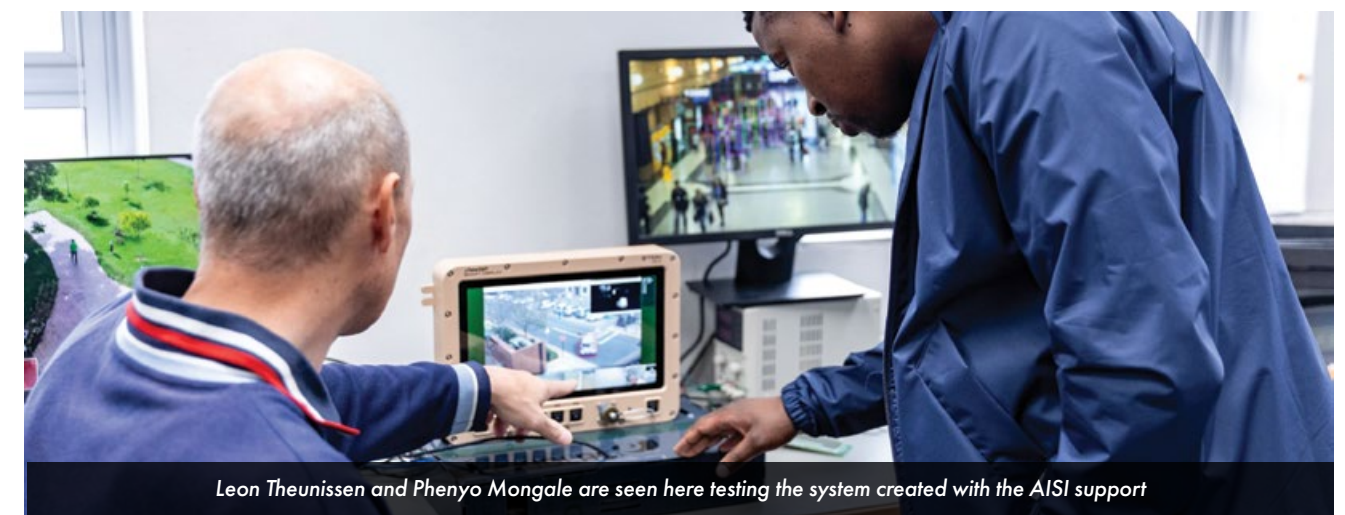
Field Programmable Gate Arrays (**FPGAs**) are integrated circuits often sold off-the-shelf. They're referred to as 'field programmable' because they provide customers the ability to reconfigure the hardware to meet specific use case requirements after the manufacturing process.



Testing of moving targets in a public area



The CheetahNav Smart Display Unit displaying its ability to track a moving target



Leon Theunissen and Pheny Mongale are seen here testing the system created with the AISI support



# ADDITIVE MANUFACTURED PARTS FOR TURBOJET ENGINES TO BOOST LOCAL AEROSPACE PRODUCTION CAPABILITIES

**Beneficiary**  
HH Industries

**Project title**  
Design And Integration of Additive Manufactured Parts for Turbojet Engines to Enhance Performance and Local Production Capabilities

**Project market**  
Aerospace

**Project location**  
Western Cape

The aerospace industry is constantly evolving, with new materials and technologies being developed to enhance performance and efficiency, while keeping costs down. In the pursuit of these advancements, there is a growing demand for high-value materials and advanced manufacturing techniques.

By focusing on aluminium and nickel-based alloys for jet propulsion applications, HH Industries aims to validate increased investment in new additive manufacturing (AM) technologies and machinery and increase confidence in the technology. Their focus is on the aerospace, mining, and tooling industries with service and product offerings customised for each area.

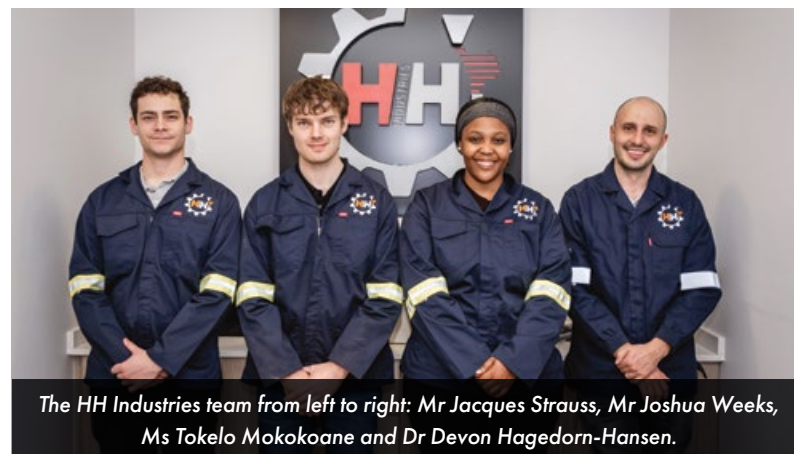
***“We recognise the need to stay ahead of the curve and it is this that motivated an investment in research, development, and commercialisation activities to extend our material and product offerings to the aerospace industry,” emphasises Dr Devon Hagedorn-Hansen, Managing Director of HH Industries.***

“The team behind this project has a deep understanding of the aerospace industry and the materials it requires, as well as a solid track record of developing and producing high-value materials for laser powder bed fusion (LPBF) additive manufacturing,” adds Hagedorn-Hansen.

With this expertise, they are well positioned to successfully address some of the challenges and gaps in the market and ultimately boost local production capability, whilst lowering costs.

The project aims to improve the performance of three turbojet models manufactured by Cape Aerospace Technologies, namely: CAT 120 TJ, CAT 250 TJ, and CAT 400 TJ. The scope of the project includes the manufacture of components such as fuel injectors, turbine stators, fuel manifolds, and turbine housings/casings.

The AISI’s support for this project is based on the project objectives of increased confidence in additive manufacturing technologies, improving the skill pools for the industry through upskilling interns and operators, and validating increased investment in new AM technologies and machinery.



The HH Industries team from left to right: Mr Jacques Strauss, Mr Joshua Weeks, Ms Tokelo Mokokoane and Dr Devon Hagedorn-Hansen.



TECHNOLOGY  
DEVELOPMENT



IMPORT  
REPLACEMENT



SUSTAINABLE  
SUPPLY CHAIN

This project will enhance the competitiveness of the aerospace industry by enabling the local production of high-performance components using AM technology, thus reducing the dependence on imports and creating a more sustainable supply chain.

***The use of AM technology will allow for the manufacture of complex geometries with reduced or no support material, part consolidation, reducing post-production processes, and ultimately improving the quality of the final product.***

By successfully completing this project, the aerospace industry will be able to validate increased investment into new AM technologies and machinery, promoting innovation and growth in the sector. This is aligned to the AISI’s goal of developing the country’s aerospace and advanced manufacturing industries.

## PROJECT BENEFITS

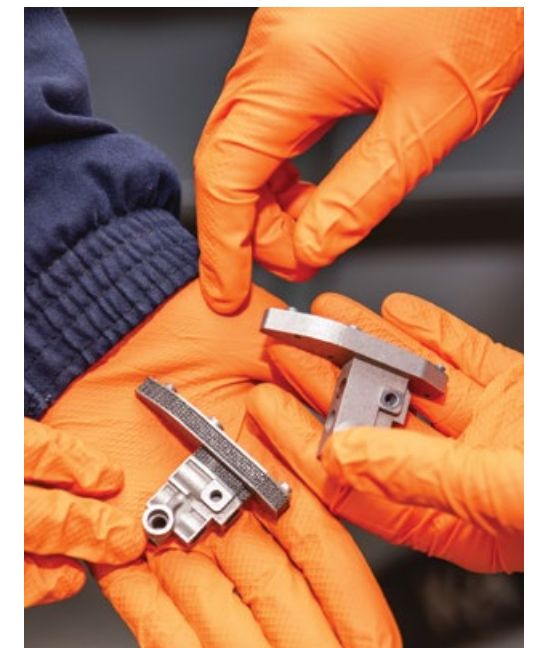
1. Improved competitiveness of HH Industries by expanding its material offering to the aerospace industry through a high-quality product portfolio.
2. Contribution to the growth of the South African aerospace industry through the successful execution of the project.
3. Development of human capital and skills, and the creation of new job opportunities for the industry through training and upskilling of interns and operators.
4. Validation of increased investment into new AM technologies and machinery.
5. Increased confidence in AM technologies and their applications in the aerospace industry.
6. Increased local production capabilities, which would lead to reduced costs and faster time-to-market.

## PROJECT PARTNERS

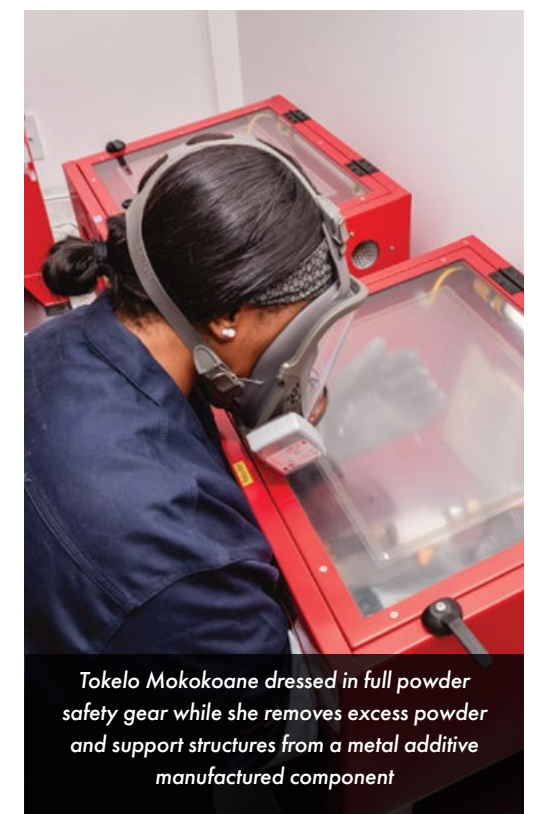
- HH Industries: Additive manufacturing service provider and project lead
- Stellenbosch University: Research and testing partner with potential students for testing and interns
- Cape Aerospace Technologies: Customer and turbojet developer
- X-Sight: Testing facility
- SmartEDM (Pty) Ltd: Wire cutting facility and service provider

## WHAT IS ADDITIVE MANUFACTURING?

Additive manufacturing, or 3D Printing, is the construction of a three-dimensional object from a computer-aided design (CAD) model or a digital 3D model. It can be done using a variety of processes in which material is deposited, joined or solidified under computer control, with the material being added together, typically layer by layer. Additive manufacturing differs from subtractive manufacturing that removes material to manufacture a part.



Additively Manufactured AlSi10Mg fuel manifolds evaluated for quality after post-processing comparing the two different design for additive manufacturing (DfAM) iterations.



Tokelo Mokokoane dressed in full powder safety gear while she removes excess powder and support structures from a metal additive manufactured component

# LOCAL DEFENCE ENVIRONMENT TO BENEFIT FROM EFFECTIVE RADAR TARGET CLASSIFICATION SOLUTION

**Beneficiary**  
SPARCX

**Project title**  
Radar Target Classification

**Project market**  
Defence

**Project location**  
Gauteng

South Africa's Border Management Authority (BMA) Act aims to strengthen border control and give the authority effective control at ports of entry and within the border law enforcement area. This is possible through technological advancements in defence and aerospace.

Radar is a valuable tool to build a complete picture of the border environment. It gathers information from 360 degrees, it can penetrate most weather conditions and it has a low latency period, which means it collects information quickly and it can monitor thousands of objects at once. Radar is also versatile and can be placed on a tower or a moving vehicle.

Current conditions favour local investment into compact radars capability and product development and related procurement programmes by the defence sector. There are spinoff opportunities in the civilian market, and there is significant potential for export to other territories. Moving towards an advanced classification model with low-scale, low-power radar solutions elevate the industry at a fraction of the typical cost, and constant improvement of the models is possible through model and data sharing.

SPARCX is a newly established, 100% black military veteran owned and managed multi-disciplinary engineering competency house focussing on the aerospace and defence (A&D) sectors. The company focuses on the total value chain of product development from requirements gathering and specification, design, (rapid) prototyping, industrialisation, commercialisation, deployment, as well as maintenance and (long term) support. It is headed up by Sujo Mulamattathil who has extensive experience across the defence sector from strategic to tactical.

**A key objective of SPARCX is to develop and commercialise special receiver and radar products. It has decided to develop the Radar Target Classification model for compact radars due to its market competitiveness and industry advancement. The project's key elements are core radar target classification model development, human capital development, effective technology transfer, knowledge transfer activities, and radar target classification technical skills transfer.**

Radar target classification is an important and challenging problem in radar applications in that the main goal is to distinguish targets by using similarities between the features of test targets and known (candidate) targets. These features are generally obtained by processing scattered signals from targets in noncooperative target recognition. However, the scattered signal from a target is highly dependent on operating frequency, polarisation and aspect angle; therefore, a designed classification method should be as independent of these parameters as possible.

Additionally, random noise makes the classification problem more complicated and reduces the accuracy rate of the methods. To minimise adverse effects of the noise an intelligent classifier containing sufficiently noise-resistant target features is needed. Decision speed is also an important criterion for a classification method and should be fast to be convenient for real-time applications.



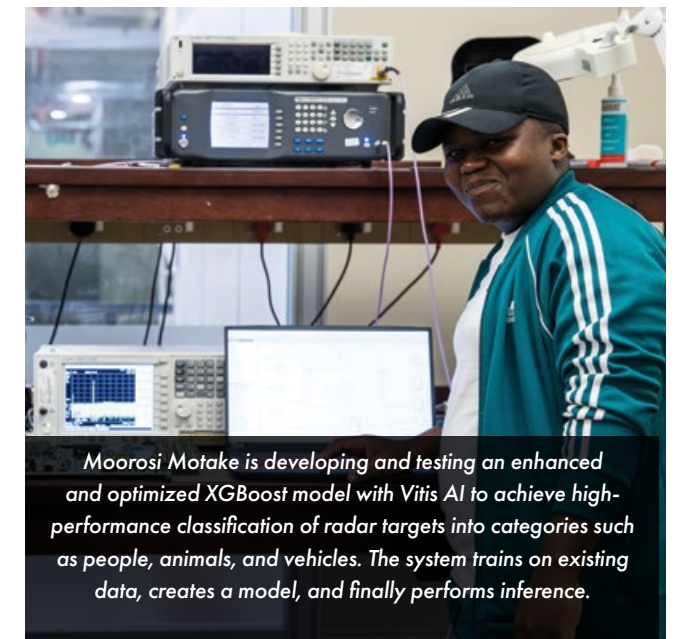
Through the AISI programme, SPARCX will fully develop its algorithm, deep learning capabilities and engineering competencies. To date, through previous AISI projects, SPARCX has appointed two electronic engineers, who have been trained by the CSIR in the field of radar and electronic warfare technologies and related fields. SPARCX intends to recruit additional electronic engineers to undergo similar training.

More recently, SPARCX has collaborated with Reutech Radar Systems that has been developing Low-Cost Radar (LCR) system over the past four years. The LCR is a TRL 5 short range Frequency Modulated Continuous Wave Radar (FMCW) and the project is currently in the prototype phase with one being evaluated and a few more being built. This radar will serve as the source of data for the classification problem being investigated by SPARCX.

Reutech Radar Systems had reached a point where the results were looking promising but did not have a chance to develop it into a product yet. Reutech Radar Systems' development had resulted in the following high-level features: 1km range, high performance surveillance with real time operation, target detection and localisation, low production cost and real time user interface.

Moorosi Motake, the Lead Design Engineer from SPARCX, embarked on a week-long training programme at Reutech Radar Systems in October 2023. The training, facilitated by Riyaadh Adams, a Senior Software Engineer at Reutech, aimed to equip Moorosi with comprehensive knowledge and skills related to the LCR system.

The training covered various aspects of LCR technology, including the theoretical underpinnings of Doppler radar, the functionalities of the



5 data points obtained from the LCR (Doppler FFT, Real data, Phase and Magnitude, Range FFT, and Target Detection), and the intricacies of connecting and tapping data from the LCR. Moorosi actively engaged with the Reutech LCR Development Team to understand the nuances of data labelling methodologies and potential classification implementations.

At the conclusion of the review period, SPARCX had successfully reviewed and completed development of radar target classification algorithms. This involved an extensive literature review, evaluating ten prominent algorithms and techniques suitable for radar target classification. The algorithms explored encompassed AdaBoost, Decision Trees, Gradient Boosting, k-Nearest Neighbours (KNN), Logistic Regression, Naive Bayes, Neural Networks, Random Forest, Support Vector Machine (SVM), and XGBoost.

The next step involved the development and testing of initial classification algorithms on desktop PC-based systems. This process allowed the team to gain valuable insights into the performance and suitability of each algorithm. Subsequently, a meticulous analysis was conducted to optimise the algorithms for enhanced accuracy, ensuring they align with the project's objectives and requirements.

The final milestone centred on the integration of the refined algorithms into a comprehensive PC-based classifier design. This holistic approach aimed to create a cohesive and efficient system that can lay the foundation for subsequent phases of the radar target classification project. The successful completion of Phase 1 sets the stage for further advancements in the development of an effective radar target classification solution.



# LOCAL SUPPLY CHAIN DEVELOPMENT TO MANUFACTURE METAL COMPONENTS FOR EXPORT MARKET

**Beneficiary**  
Metal Heart

**Project title**  
Supplier Development of Specialised Aerospace Component with Complex Designs

**Project market**  
Aerospace

**Project location**  
Gauteng

Metal Heart is an Additive Manufacturing (AM), or 3D printing, company that focuses on the industrial application of Metal Additive Manufacturing (MAM). It has manufacturing capabilities to 3D print Titanium, Aluminium, Tool Steel, Stainless Steel, Inconel and more.

The company's investment in two metal 3D printers, one for industrial applications and the other for medical grade titanium, five axis computer numerical control (CNC) machines, a wire electrical discharge machining (EDM) machine, an induction furnace, as well as a hot isostatic press positions it as a key market player in the production of advanced manufacturing techniques.

The project for which Metal Heart received support from the AISI aims to support supplier development for two main clients that require aerospace components with materials ranging between Titanium Grade 5, Tool Steel (1.2709), Stainless Steel and Inconel 718.

***"The project is unique since there is currently no other suitable method to manufacture the components identified within South Africa and worldwide there are very few, comments Gerrie Lombard from Metal Heart. "We have the potential to complete the full manufacturing supply chain in house with no elements requiring outsourcing."***

This project will address a local supply chain to manufacture components for a strong export market. The first identified client has shown interest in growing the specialised component as part of their production line. The company would like to investigate the application of AM to a component with a complex geometry that they are unable to produce with conventional methods. The prototype will be manufactured and evaluated by the client to unlock further development funding from the client.

Their client has developed rocket thrust component designs and would like to qualify the process from the initial prototypes. The processes developed will be qualified by ISO 13485 standards to enable contracted production of the components by Metal Heart as the preferred supplier.

***"Metal Heart is already manufacturing within the aerospace industry and these projects are great opportunities to expand the market footprint of Metal Heart offering Additive Manufacturing to a broader segment of the aerospace market," adds Lombard.***

To date, Metal Heart has manufactured satellite components, waveguide components and filters, brackets and other components in the aerospace industry. These projects will add space flight rocket components as well as wingtip components to their successful list of projects completed.



TECHNOLOGY  
DEVELOPMENT



SUPPLY CHAIN  
DEVELOPMENT



LOCAL MARKET  
GROWTH

## PROJECT SCOPE

The project objective was to develop and qualify the manufacturing process of specialised aerospace components identified by the clients. It aimed to secure high quality grades of feedstock materials and the development of product specifications for each of the following parts:

- Titanium Wingtip component
- Titanium Gimbal base and ring
- Titanium phoenix nozzle
- Composite 316L/Copper fuse plate
- 316L Injector
- Inconel 718 Complex Impeller Blade for the lox pump
- Inconel 718 Injector
- Tool steel injector rings
- AM Gimble Base
- AM Gimble Ring
- Injector Ring

This was followed by design review of the presented parts using AM principles, additive manufacturing of selected parts as per material specifications, post processing based on user specifications, as well as testing and validation of parts using ISO 13485

At the conclusion of the review period, the entire scope of work had been completed and the design of the components also proved that the components are production ready for further production orders of similar components. Successful operational environment tests were conducted through the client, moving closer to full flight validation and as a result moving components into full production.

"This initiative driven by the AISI will enable development of new clients and technologies within the local South African aerospace market," concludes Lombard.



Using Selective Laser Melting, parts were produced in Stainless Steel 316, Titanium (Ti6Al4V), and Inconel 718



The Rocket payload delivery system brackets manufactured from Ti6Al4V

# DEVELOPMENT OF GLOBAL NAVIGATION SATELLITE SYSTEM ANTENNAS

**Beneficiary**  
Lambda G

**Project title**  
Global Navigation  
Satellite System (GNSS)  
Antenna Development

**Project market**  
Aerospace and Defence

**Project location**  
Western Cape

South Africa has a long history in the space industry, both through government and private companies, as a contributor in terms of space engineering and / or mission support. 'New Space' activities or missions, using smaller satellites as opposed to larger traditional spacecraft, are growing exponentially both globally and on the continent and requires space components with low mass, power, and cost.

Traditional waveguide antennas are made in the UK, Europe and US and waveguide antennas and components made using additive manufacturing (AM) complement the requirements of modern small satellites. LambdaG seeks to be a global exporter/supplier of innovative lightweight antenna systems for spacecraft and defence applications. Furthermore, the space sector is vibrantly growing and LambdaG is actively participating with the provision of novel solutions through advanced manufacturing of traditional waveguide antenna assemblies and mounting hardware.

The project involves the development of a space-qualified Global Navigation Satellite System (GNSS) antenna for spacecraft. The GNSS antenna and its receiver provide navigation and timing information to a spacecraft in Low Earth Orbit (LEO).

Since the inception of the project, a requirement specification has been developed, as well as several antenna designs that satisfies these requirements.

A technical delay involving the integration of the antenna element, active electronics and a mechanical enclosure, to provide a compact assembly, has led to the strategic decision to develop two designs. The first of these is a single band design that will complement the current global positioning system (GPS) GNSS L1 receiver of our industry partner. The second is a wideband design that can receive all the GNSS bands (L1 – L5) to complement the future multiband GNSS receiver of their industry partner and other international potential clients.

**The uniqueness of the wideband design is its wideband radiating element combined with a High Impedance Surface (HIS). An HIS, a subset of metamaterials, is an artificial surface realised by printing a periodic metallic frequency selective surface on top of a grounded dielectric slab. The result is a surface providing a high surface impedance to Analog Current (AC) currents within a forbidden frequency band.**

The surface, therefore, does not support propagating surface waves and reflect electromagnetic waves (emanating from the antenna element above it) with zero phase reversal (opposite to the behaviour of a metallic surface). The final implementation and integration are now in progress followed by qualification testing.

**"As a consequence of this project, Patsa Khotso has joined LambdaG as an intern," says Dr Vernon Davids, CEO of Lambda G. "He is in the process of starting his Doctoral degree in Engineering focusing on the analysis and design of compact antennas utilising high impedance surfaces for small satellites."**



TECHNOLOGY  
DEVELOPMENT

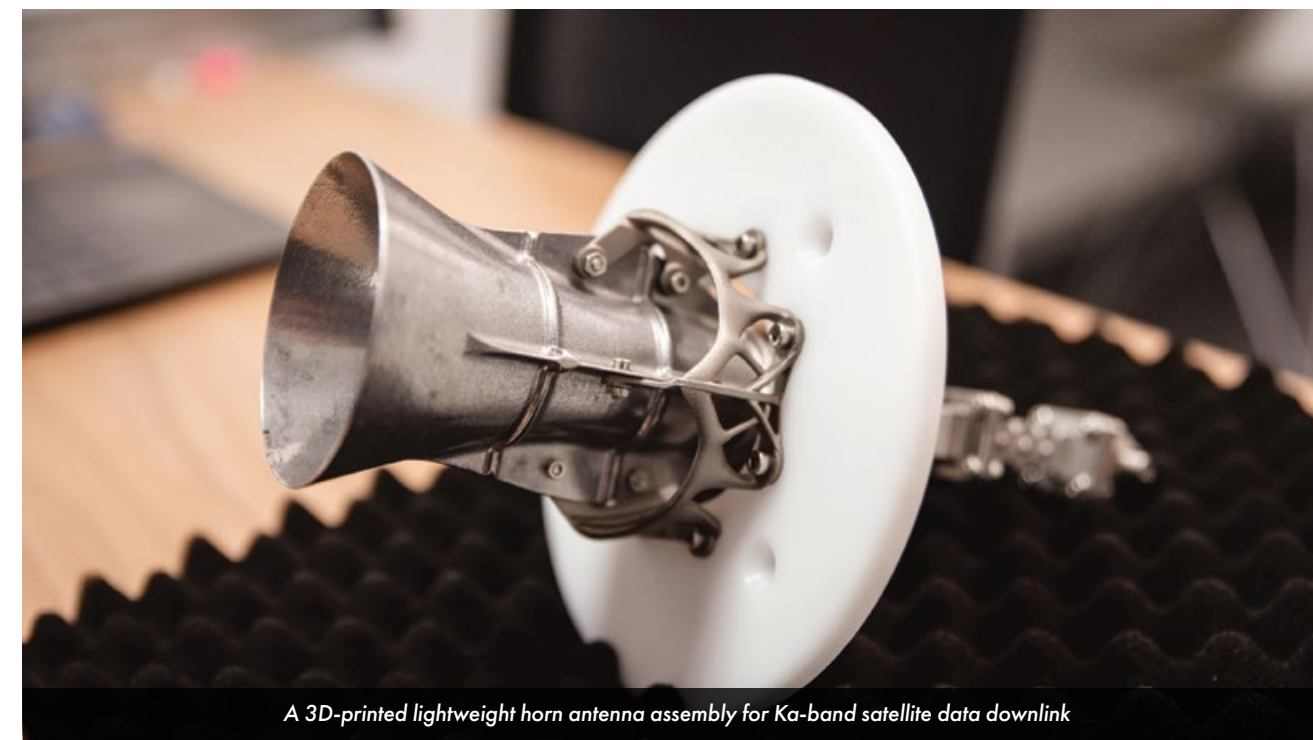


EXPORT  
POTENTIAL



SKILLS  
DEVELOPMENT

"This project aligns well with the goals of the AISI by increasing the contribution of small enterprises to the economy, improving local industry competitiveness, and enabling new suppliers to enter the supply chain, as well as to develop new technologies for the global aerospace and defence markets. Furthermore, this project increases South Africa's advanced manufacturing capabilities and global competitiveness to manufacture high-value, high performance communication components for the local and international space market," concludes Dr Davids.



A 3D-printed lightweight horn antenna assembly for Ka-band satellite data download



Seen here are Patsa Khotso, who has joined Lambda G as an intern and who is pursuing his Doctoral degree, and Dr Vernon Davids, CEO for Lambda G.



# LOCAL DEVELOPMENT OF DEFENCE VEHICLE POWER MANAGEMENT SYSTEM GARNERS EXTENSIVE INTEREST

**Beneficiary**  
Shrike Marine

**Project title**  
Vehicle Power Management System Demo Set

**Project market**  
Defence

**Project location**  
Western Cape

Modern military vehicle functions are becoming ever more complex and power-hungry, and legacy systems with conventional circuit breakers and bulky wiring are ineffective in addressing the new demands. Effective power management to support mission-critical command, control, communications, computers, intelligence, surveillance and reconnaissance domains as well as sophisticated mechanical subsystems requires platform-specific electrical systems architecture.

Shrike Marine was founded to provide specialised electronic hardware solutions and subsequently expanded to the areas of power supply and power distribution primarily for military use. The company also manufactures high quality handmade internal and external cable harnessing assemblies to military specifications for use in aviation, defence, UAV and vehicle systems.

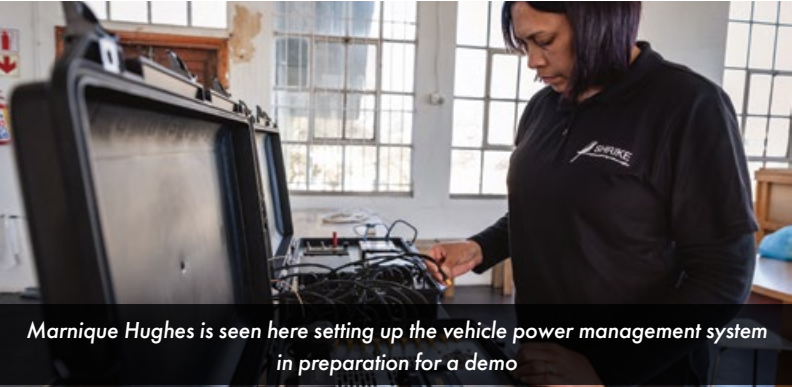
Their vehicle electrical power management system (VePMS) is specifically designed to address the particular needs of a modern war-fighting vehicle. It has the flexibility to optimise the level of integration, monitoring inputs and controlling the vehicle’s electrical power in the most cost and energy-efficient manner.

The goal of the project was to have a demo VePMS system which potential customers can view and test before procuring the system.

**“If the VePMS is approved on a working system, we can market an already approved “platform” that is a major hurdle currently as customers want to verify it prior to placing orders,” comments Rhi Guthrie Business Development Director for Shrike Marine.**  
**“Another objective was to qualify the demo system to MIL-STD 461 and MIL-STD 810.”**

The objectives of the project were met, and Shrike Marine now has a fully qualified demo VePMS system for customers to view. The demo system was demonstrated to a potential customer, ADG Mobility, in Pretoria. They are interested in the system and are currently reviewing their technical requirements for future vehicle designs.

The system was successfully launched at the International Defence Exhibition (IDEX) trade show in February 2023. The Minister of Defence took an interest in the system and was excited that it was designed and manufactured in South Africa. Shrike Marine visited the United Arab Emirates in July 2023 to demonstrate the system.



“We have already received interest from both local and international boat manufacturers, UAV manufacturers and vehicle manufacturers for the system,” says Rhi Guthrie Business Development Director for Shrike Marine. “The expected revenue to be generated from this project will contribute not just Shrike Marine’s success, but the country’s too, as well as boost export potential.”

## MORE ABOUT SHRIKE MARINE’S VEPMS SYSTEM

Shrike Marine’s vehicle electrical power management system (VePMS) is designed to address the specific needs of modern military vehicles. The system is modular, fully scalable, highly cost effective, as well as space and weight efficient. It allows fingertip control over all vehicle and fighting platform/ancillary functions and mechanical

push buttons are completely configurable to satisfy vehicle crew requirements. Information and data can be formatted and displayed as needed anywhere in the vehicle, or transmitted back to command headquarters.

User-defined states or modes of operation are fully customisable and can be triggered automatically or manually operated. Available outputs ensure upgradability and permit a single vehicle to be configured for multiple roles in one interactive, seamless system.

## WHAT IS AN MIL STANDARD?

A defense standard (often referred to as a “MIL-STD” is a document that establishes uniform engineering and technical requirements for military-unique or substantially modified commercial processes, procedures, practices, and methods.





# TECHNOLOGY ENHANCEMENT OF LOCAL METAL 3D PRINTER TO PRODUCE TITANIUM PARTS FOR AEROSPACE AND DEFENCE INDUSTRIES

**Beneficiary**  
Aditiv Solutions

**Project title**  
Validation of a Locally  
Manufactured HYRAX  
Metal 3D Parts

**Project market**  
Aerospace and Defence

**Project location**  
Gauteng

Additive Manufacturing (also known as 3D printing) is a relatively new manufacturing technology. However, it has proven to have specific advantages over conventional manufacturing processes. These advantages are mainly because, firstly, the technology allows for the manufacture of net/near-net parts with little to zero material waste. Secondly, the technology also allows for the manufacture of highly complex geometries which inter alia allows for reducing the weight of parts, increasing functionality of parts and for reducing part count.

Another advantage of additive manufacturing is the fact that it is a toolless manufacturing technology. This makes it an ideal solution for industries with relatively low manufacturing volumes, such as the aerospace and defence industries, where the manufacturing volumes do not always warrant the cost for injection moulding or casting tools.

Aditiv Solutions is a South African tech-based SMME, that currently supplies 3D printing machines and components to the aerospace and defence industries. The goal is to ensure that Aditiv Solutions becomes an industrial supplier of metal 3D printing equipment for the international (and local) aerospace and defence industries.

The HYRAX is one of the most cost-efficient metal 3D printers on the market and has applications in many sectors including automotive, mining, and power generation. However, the biggest markets for metal 3D printing are the defence, aerospace and medical industries that have stringent requirements. Aditiv Solutions aims to develop technology improvements to ensure that their machines are relevant in these industries and to increase their customer base in high-end sectors.

Although Aditiv Solutions' technology is an excellent solution for most industries there are limitations in accessing highly regulated industries such as the aerospace, defence and medical industries. These industries are the biggest consumers of metal 3D printing today and accessing these markets will substantially impact the company's market (and export) potential.

***"Through this technology improvement programme, we expect to expand our scope of supply to ensure that we can provide solutions for producing titanium components for the defence (and aerospace) industries," says Marius Vermeulen from Aditiv Solutions. "We have developed a laser-based 3D printer that can produce parts directly from powder in a range of metals such as titanium, aluminium, stainless steel and others."***



The HYRAX has an ultra-modern touch interface to ensure the systems are user friendly and easy to use



Back row (left to right): Adolf Wilhelm, Marius Vermeulen, Johan Bothma, El-Racham Botha, Fanie van Zyl  
Front row (left to right): Adderus Berg, Peet Krüger, Francois Joubert, Jurgens Taljaard

***"Our machines can produce intricate metal parts with excellent mechanical properties and they have applications in many industries, including the aerospace and defence sectors and currently, Aditiv Solutions is the only company in South Africa that produces metal 3D printing equipment," he adds.***

The project will address the following requirements to increase the relevance of HYRAX in the aerospace and defence sector:

- Long-term reliability and affordability of the technology in serial production conditions.
- Traceability of the manufacturing process for certification requirements.
- Safety requirements for working with titanium in a production environment.

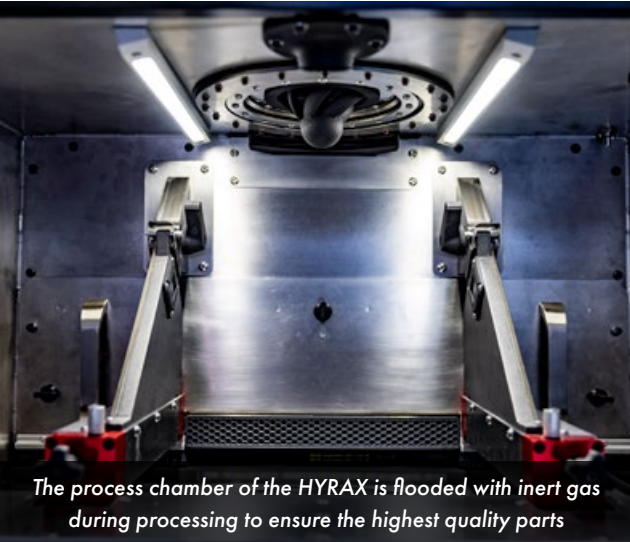
During the reporting period, progress was made in several areas. Manufacturing of the HYRAX machine for a UAE-based company progressed well and the machine was at the final stages of testing. Two teams from the customer were scheduled to visit Aditiv Solutions for machine operation training which would be followed by factory acceptance tests and sign-off. The machine is Aditiv Solutions' standard machine version, excluding the upgrades planned during this project that will be installed later this year. The project will conclude with the production and evaluation of a titanium demonstrator part.

"We pride ourselves on not just providing a manufacturing service but working closely with our customers to provide custom engineered solutions, best suited to the needs of every application and we expect that this

project will allow us to increase our footprint in the local and international aerospace and defence industries substantially," concludes Vermeulen.

The Hyrax has the following valuable features:

- Best-in-class German optical systems.
- High precision printing with layer thickness down to 30 µm.
- Variable laser spot size to allow for printing at various resolution vs speed combinations.
- Extremely easy to install and commission.
- Requires little with regards to support equipment.
- User-friendly operator interface.
- Easy to maintain.



The process chamber of the HYRAX is flooded with inert gas during processing to ensure the highest quality parts



# OVERVIEW OF ISO STANDARDS AND THEIR ROLE IN INDUSTRY



## International Organization for Standardization

The International Organization for Standardization (ISO) is an independent, non-governmental international organisation that brings global experts together to agree on the best ways of doing things. From climate change through to healthcare and artificial intelligence, their mission is to make lives easier, safer and better – for everyone, everywhere.

### » WHY ARE INTERNATIONAL STANDARDS IMPORTANT?

International standards ensure that the products and services one uses daily are safe, reliable, and of high quality. They also guide businesses in adopting sustainable and ethical practices, helping to create a future where purchases not only perform excellently, but also safeguard our planet. In essence, standards seamlessly blend quality with conscience, enhancing everyday experiences and choices.

### STANDARD APPROACH TO ISO CERTIFICATION

**PHASE 1:** Gap analysis and Assessment of the existing internal systems and documentation

**PHASE 2:** Basic awareness training for all staff

**PHASE 3:** Development of manuals

**PHASE 4:** Implementation of the ISO documentation

**PHASE 5:** Baseline risk assessment

**PHASE 6:** Internal auditor training

**PHASE 7:** Internal audit

**PHASE 8:** Clearance of internal audit findings and sustainable continual improvement

**PHASE 9:** Preparation for certification including management review



### ISO 9001

ISO 9001 is a globally recognised standard for quality management. It helps organisations of all sizes and sectors to improve their performance, meet customer expectations and demonstrate their commitment to quality. Its requirements define how to establish, implement, maintain, and continually improve a quality management system (QMS). Implementing ISO 9001 means an organisation has put in place effective processes and trained staff to deliver flawless products or services time after time. ISO 9001 is the most widely used quality management standard in the world and defines seven quality management principles including a strong customer focus and continual improvement. Business benefits include customer confidence, effective complaint resolution, process improvement, and ongoing optimisation. Regular audits and reviews encouraged by ISO 9001 enables organisations to continually refine their quality management systems, stay competitive, and achieve long-term success.



### ISO 14001

ISO 14001 is the internationally recognised standard for environmental management systems (EMS). It provides a framework for organisations to design and implement an EMS, and continually improve their environmental performance. By adhering to this standard, organisations can ensure they are taking proactive measures to minimise their environmental footprint, comply with relevant legal requirements, and achieve their environmental objectives. The framework encompasses various aspects, from resource usage and waste management to monitoring environmental performance and involving stakeholders in environmental commitments. In an age of heightened environmental consciousness and increasing global challenges such as climate change, biodiversity loss, and resource depletion, organisations have a pivotal role to play. ISO 14001 offers a structured approach for businesses to address these pressing concerns. By adopting this standard, organisations signal a commitment not only to regulatory compliance but also to ongoing environmental improvement. This proactive approach to environmental management can result in tangible benefits, such as reduced waste, energy conservation, and cost savings. Furthermore, it enhances an organisation's reputation, fosters stakeholder trust, and often constitutes a critical step for engaging in global trade and supply chains. Simply put, ISO 14001 stands as a testament to an organisation's dedication to a sustainable future, blending environmental responsibility with strategic business growth.



### ISO 45001

ISO 45001 is an international standard that specifies requirements for an occupational health and safety (OH&S) management system. It provides a framework for organisations of any size to manage risks and improve OH&S performance. The standard establishes criteria for an OH&S policy, objectives, planning, implementation, operation, auditing and review. Key elements include leadership commitment, worker participation, hazard identification and risk assessment, legal and regulatory compliance, emergency planning, incident investigation and continual improvement. It can be integrated with other ISO management system standard and utilises the Plan-Do-Check-Act methodology to systematically manage health and safety risks. Using this framework means that the OH&S system can continually improve and evolve, enhancing long-term worker health and safety performance. Adopting the standard shows employees and external stakeholders that the organisation is committed to worker health, safety and wellbeing. This boosts reputation, morale and retention. By acquiring emergency preparedness and response protocols, ISO 45001 strengthens organisational resilience against safety threats and crises.

# ISO 9001 CERTIFICATION TO BOOST EXPORT OPPORTUNITIES FOR COMPOSITE OPERATIONS SUPPLIER

**Beneficiary**  
Petrawell

**Project title**  
ISO9001  
Implementation

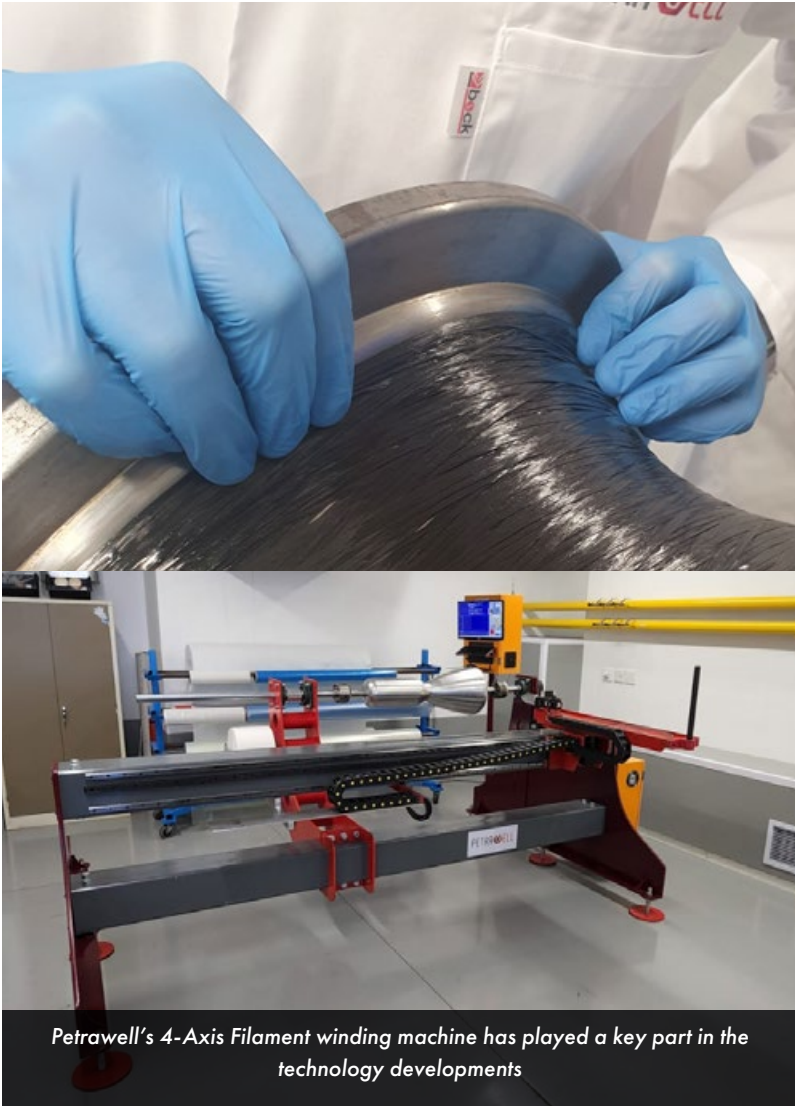
**Project market**  
Aerospace, Energy and  
Maritime

**Project location**  
Gauteng

Petrawell, a start-up enterprise that was registered in 2015, started composite operations in 2019. The company specialises in filament wound products providing solutions to the aerospace, energy, and maritime industries. To date the company successfully developed its own filament winding software and designed, manufactured, and commissioned its own computer numerically controlled (CNC) machines including filament winders and profiles cutters.

All the products manufactured by Petrawell to date have either been a first for South Africa or a first for Africa. The company has been involved in a series of exciting projects that have included, among others, a pressure vessel for a science demonstration project as part of the University of Kwa-Zulu Natal STEM programme, as well as the manufacture of a Sounding Rocket Phoenix MKII 2B R nose cone and rocket motor bulkhead.

With support from the AISI during the review period, Petrawell was able to secure ISO 9001 certification that assures potential customers due to the quality management systems in place.



Petrawell's 4-Axis Filament winding machine has played a key part in the technology developments



# CAPE TOWN BASED SUPPLIER OF CUSTOM LOOMS AND ELECTRONICS TO BENEFIT FROM ISO CERTIFICATION

**Beneficiary**  
JJ Harnessing

**Project title**  
ISO9001 and 45001  
Certification

**Project market**  
Automotive, Commercial  
and Marine

**Project location**  
Western Cape

JJ Harnessing is a contract manufacturing company that provides a range of services from prototyping to full production in the field of electronics and harnesses. They are BBBEE level 1 company and 100% black owned. Based in Cape Town, the company specialises in the automotive, commercial and marine industries with all products built according to IPC standards, as well as fully inspected and tested to ensure customer satisfaction.

ISO 9001 and ISO 14001 certifications were identified as a key business driver that would allow the company to reach new goals and grow the business. With support from the AISI, the certification process commenced during the 2022/23 reporting period and was completed during the 2023/24 period.



Construction of electronic harnesses is a complicated technical process that requires skill and knowhow



The J J Harnessing team is proud of its ISO certification achievements





# INDUSTRY DEVELOPMENT AND TECHNOLOGY SUPPORT

*This programme focuses on advancing production innovation such as the use of advanced manufacturing and other Fourth Industrial Revolution technologies to build more durable, compact and efficient products. Access to new and existing processes, products and methods is also facilitated to ensure that beneficiaries develop products and services that enable them to exploit multiple market opportunities. Integrators and sub-system suppliers are encouraged to include SMMEs and lower-tier suppliers in their supply chains, to enable the continuous transfer of knowledge, expertise, capabilities and technologies, thereby broadening the industrial base.*

BENEFICIARY NAME	PROJECT TITLE
Cybicom Atlas Defence	The development of an RPAS test platform for aerial release of sterilised False Codling Moth
Avior Labs	Industrialisation and Commercialisation of the Elevation Drone
Avior Labs	Low-Cost High Bandwidth Unmanned Aerial Vehicle (UAV) Datalink Industrialisation
AAC Space Africa	Software defined S-band telemetry/telecommand transceiver for CubeSats
Micromax	Metal Injection Proof of Concept at Micromax Project
On-Track Technologies	Low Vibration 2-Stroke Aircraft Engine Project
Petrawell	Xenon-Ion Propulsion Fuel Vessel Demonstrator
Lightweight Structures	Localisation of a Combined Advanced Composite and EPP Manufacturing Technology for Unmanned Aerial Vehicle
Wideband Receiver Solutions (WBRxs)	Technology Enhancement; from Wide Band Receiver to Wideband Transceiver Support towards
Sentian Aerospace	Unmanned Aerial Vehicle (UAV) Optimisation
Simera Sense	CubeSat Shock Test Facility

# DEVELOPMENT OF SYSTEM FOR THE RELEASE OF STERILE FALSE CODLING MOTH IN THE FRUIT INDUSTRY

**Beneficiary**  
Cybicom Atlas Defence

**Project title**  
Development of an RPAS Test Platform for Aerial Release of Sterilised False Codling Moth

**Project market**  
Sector-Wide/  
Agriculture

**Project location**  
Western Cape

Cybicom Atlas Defence (CAD) is a B-BBEE level 1 Defence Electronics company specialising in the defence, aerospace and naval industries.

CAD partnered with Bronberg Dynamics, a South African startup company in unmanned aerial vehicle (UAV) design and manufacture, to develop a remotely piloted aircraft system (RPAS) suitable for testing the aerial release of sterilised insects.

This initiative is supported and collaborated with X-Sterile Insect Technique (XSIT), a service provider to the citrus and table grape industries, assisting with the control of False Codling Moth (FCM) using sterilised insect techniques. The FCM is considered a phytosanitary pest to most of South Africa's export markets, with over 75% of SA's citrus export markets affected, and as such, poses a huge risk to South Africa's Forex earnings.

To-date, CAD has developed novel hopping and counting devices for FCM release via different platforms. The collaborators on this project sought funding for the project that aims to effectively service the agricultural industry, while minimising the risk to human life.

CAD has developed and performed extensive ground-based testing of their novel hopping technology for sterilised FCM release. This funded project is aimed to take this technology into the air with the main benefits to the citrus industry being there are currently no automated hopping, counting and logging technology for sterilised FCM aerial release.

**The hopper technology currently being used in the industry utilises an auger mechanism that damages the sterilised FCM making them less effective in fighting against the phytosanitary pest and no automated real-time counting or logging of the aerial release of the sterilised FCM. The technology, developed by CAD, will add the very necessary data element to this otherwise uncertain operation.**



Pilot taking the RPAS to the take-off and landing area



The hopping and counting device required significant rework for aerial release and integration with the RPAS. This required a re-design and repackaging of the hopping and counting mechanism into a suitable system for use with the chosen airframe.

This also meant adding a new mechanism to control and monitor the device from the ground station. Initially, a rudimentary proprietary interface that could control the system was conceived. Later it was decided to rather develop a system that uses a system standard in the form of a Micro Air Vehicle Link (MAVLink) Protocol. This would allow the Aerial FCM Dispenser to be more generic and integrate with a wider variety of future RPAS and platforms.

Thus, the agile design and development methodology was employed allowing both hardware and software engineers to work independently on different phases of the project.

"In December 2023, CAD was able to successfully demonstrate and licence the integrated FCM dispenser and RPAS platform to the South African Civil Aviation Authority (SACAA)," says Darcy Ocker, Systems Engineer for CAD "and we eagerly wait for the conclusion of this project so that we can move onto further development and proving of the systems in the air."



RPAS ready for take-off



Image of the hopper dispensing rolled oats as a simulation for the preparation of the SACAA demo. Live moths were not allowed for the demonstration



# DEVELOPMENT OF LOCAL UAV TO EXTEND SOUTH AFRICA'S MANUFACTURING CAPABILITY

**Beneficiary**  
Avior Labs

**Project title**  
Industrialisation and Commercialisation of the Elevation Drone

**Project market**  
Aerospace

**Project location**  
Gauteng

Various global companies are developing commercial solutions for fixed-wing or hybrid unmanned aerial vehicles (UAVs) and whilst the aerospace industry in South Africa is small, the country has been known to produce high-quality products for export.

Over the past several years, Avior Labs has been developing a commercial Vertical Take-Off and Landing (VTOL) drone, Elevation, that is currently in an advanced stage of development. The AISI has previously funded a highly successful project aimed at developing technology to improve the manufacturability and cost-effectiveness of the drone fuselage structure while reducing its weight and production times.

The technology utilises a hybrid construction method consisting of traditional composites combined with injected expanded polypropylene foam components. The production technology project was led by Lightweight Structures, the manufacturing partner of Avior Labs responsible for the airframe structures.

As Elevation approaches series production, several elements were identified that need to be addressed to improve the cost-effectiveness and competitiveness of the drone. These include production methods with similar goals to the one implemented on the fuselage, but also a direct follow-on to the fuselage production technology project where conformal, embedded antennas will be added to the fuselage.

***"Most of the fixed-wing and hybrid UAVs use conventional composite manufacturing techniques employing glass and carbon fibre as their main manufacturing material," says Dr Benjamin Broughton, Managing Director of Avior Labs "and these airframes have excellent aerodynamic and structural properties but are hand-manufactured, making it very labour-intensive."***

"For small production runs, the use of a conventional advanced material manufacturing technique mentioned above is suitable. Such a technique, however, becomes prohibitive for manufacturing of large volumes of products due to the costs involved and associated difficulty in reaching the required economies of scale," adds Broughton.

The internally developed manufacturing technology previously funded by the AISI entails a hybrid composite and Expanded Polypropylene (EPP) construction method and is ideal for large production runs. EPP is thus used widely in the automotive, packaging and Heating, Ventilation, and Air Conditioning (HVAC) markets due to its lightweight and structural benefits.

To be able to extend the local aerospace industry's capabilities and ever-growing demand for fixed wing and hybrid UAVs globally, it is essential for South Africa to develop and establish local capability to manufacture efficient UAV aircraft parts that are cost-efficient and allows for large-scale production runs.

Complex multifunctional parts, that include embedded antennas, while still achieving their structural properties, will further enhance the local aerospace development and manufacturing capability.

The goal of the commercialisation and industrialisation of Elevation is to establish the technologies and facilities that will allow for series production of the airframes to deliver a product at the rate demanded by the market, at a competitive price and one that meets



or exceeds all the performance specifications. The implementation of advanced technologies, such as conformal or embedded datalink antennas, are intended to transform the product into a true winner in the global market.

In the first phase towards this larger objective, Lightweight Structures in co-operation with Avior Labs completed the first intermediate objective namely: Update the Elevation fuselage manufacturing process from traditional moulded composite construction to a much more efficient hybrid EPP/composite technique. This objective was successfully completed in a AISI co-funded project concluded in August 2023.

The second phase of the project was undertaken in the 2023/24 period. In collaboration with LambdaG, a radio frequency connectivity specialist and manufacturer of various antenna solutions for aerospace applications, the project sought to replace the sub-optimal commercial off-the-shelf omnidirectional datalink antennas with conformal embedded antennas that form part of the hybrid fuselage construction technology introduced in the previous phase of the project.

During this same period, the Elevation tail construction process was improved from a time-consuming composite sandwich construction to a novel machined or injected core covered in a moulded composite shell with integral control surfaces. A similar technique will be utilised to manufacture the outer wings.

At the conclusion of the review period, the Elevation drone was in the final validation stages and the first testing with operational payloads had been scheduled. Successful completion of this stage would position the system at TRL 7. By the completion of the proposed work, the system is expected to have achieved TRL 8 or TRL 9.

Two prototypes have already been manufactured at the Lightweight Structures facility where other non-UAV products are currently in full-scale production. A third prototype is in process and is being utilised to finalise all the production elements.

"By completion of this project, it is expected that Elevation will have reached manufacturing readiness level (MRL) 8, with the initial stages of MRL 9 (low-rate production demonstration) in process," concludes Broughton.

## ▶▶ ABOUT AVIOR LABS

Avior Labs (Pty) Ltd was launched at the beginning of 2019 with the mission to apply technical and scientific innovation in developing unmanned and autonomous aerial vehicles and provide expert advice in the aeronautical industry. Although the company is relatively young and is currently classified as an Exempted Micro Enterprise (EME), two of the co-founders of the company, Dr Benjamin Broughton and Kreean Padayachee, have more than 35 years of combined experience in the military aerospace industry.

The company strives to develop innovative products to uplift and better society with emerging technologies in the aerospace sphere. Avior Labs specialises in the development and manufacture of highly efficient commercial UAVs, associated technologies, and software.

The company's goal is to connect its co-founders' and associates' mathematical, scientific and engineering knowledge with societal needs to produce products that solve everyday problems in efficient and cost-effective ways. In this context, the company's focus is on creating UAV solutions applied in the health, agricultural, built environment, security, and humanitarian domains.



# LOW-COST HIGH BANDWIDTH DATALINK DEVELOPMENT TO BENEFIT LOCAL UAV INDUSTRY

**Beneficiary**  
Avior Labs

**Project title**  
Low Cost High Bandwidth UAV Datalink Industrialisation

**Project market**  
Aerospace

**Project location**  
Gauteng

With assistance provided by the AISI, Avior Labs, in collaboration with Bovancor and Lightweight Structures, developed a Low-Cost High Bandwidth Datalink that at the conclusion of the project had achieved TRL 8, which means that the product is ready for commercial production.

The Datalink project was initiated in response to the identified gap in the market following the analysis of the off-the-shelf datalink systems that could be used to equip a fixed-wing Vertical Take-Off and Landing (VTOL) drone to meet its designed specifications.

At the outset, it became clear that outside proprietary systems that are not available for purchase, the existing datalink systems that combine both telemetry and video processing cost upward of R20 000. It is possible to purchase separate systems that allow telemetry and video processing and that are considerably more affordable; however, their integration is not only highly complex, but creates a bulky system that lacks additional Central Processing Unit (CPU) capability and runs a risk of potential interference.

The initial project sought to develop a single solution for telemetry, command communication and video streaming, and where a relatively short range is required (approximately up to 1.5 km), along with bandwidth sufficient for video streaming.

While the datalink was initially conceptualised to be integrated into drones, it is developed as an Internet of Things (IoT) device. This opened the secondary market for the datalink, which was identified to be an order of magnitude greater than the primary market it was designed to serve. In the context of South Africa, its application is particularly attractive as the IoT device can be used in security and surveillance applications in the mining, agricultural, and conservation industries to monitor perimeters and other remotely located sites.

Over the course of the project, it was discovered that the potential applications are much wider than UAVs. In fact, the IoT sector is potentially a larger market that could be serviced by the same product with no changes except for the specific software scripts needed for each individual application.

***“During this phase of the project, we successfully progressed the product up to a point where it is very close to market ready,” says Dr Benjamin Broughton from Avior Labs. “There are only two outstanding items that must still be completed before initial low-rate production can start, this being the completion of ICASA (Independent Communications Authority of South Africa) certification and the development of software components for the most typical IoT applications.”***

In summary, this project was considered highly successful and all original project goals were either achieved or exceeded.

“Avior Labs hopes that the “Pyxis WiFi HaLow Datalink and IoT Edge Computing Gateway” will be the first in a series of products. For example, a version with a LoRa link is already foreseen, which will give users the choice between long range or high bandwidth. It is further hoped that the commercial success of this product will allow Avior Labs to grow, thereby providing numerous new job opportunities.” concludes Broughton.



TECHNOLOGY  
DEVELOPMENT



SKILLS  
DEVELOPMENT



EXPORT  
POTENTIAL



Crispin McKenzie demonstrates the ground control software and software-in-the-loop-simulation (SILS) technology



The Pyxis WiFi HaLow Datalink and IoT Edge Computing Gateway, also development at Avior Labs with support from AISI



## SKILLS DEVELOPMENT APPROACH TO BENEFIT TALENTED YOUNG AERONAUTICAL ENGINEERING STUDENT

During the review period, Avior Labs hosted Crispin McKenzie, a student from Wits University who is doing an MSc in Aeronautical Engineering. He is hosted at Avior Labs and paid a stipend by the company. Crispin spends about 50% to 60% of his time on company work, and the rest of the time he works on his postgraduate research project. Avior Labs typically makes sure that his company work and research project are closely related. Besides office space, he is given access to hardware, software and other facilities that are then used for his research. Avior Labs also provides mentorship and support throughout his studies, and funds him to attend at least one local conference. In return, if Avior Labs has a position available, they will offer the student a full-time position at the end of his studies and ask that he remains with them for at least one month for each month of study that was funded. In this case, Avior Labs is definitely intent on appointing the student as a full-time engineer from January 2025. The title of his thesis is Autonomous Thermal Soaring – a fascinating project whereby in the end, we intend to demonstrate how a large (7.2m wingspan) model glider can fly a triangular circuit fully autonomously, utilising energy from the atmosphere as needed. We are hoping to use that technology eventually on our current or future drones.



# DEVELOPMENT OF ALL-IN-ONE TRANSCEIVER SOLUTION FOR USE IN BOTH CUBESATS AND GROUND STATIONS

**Beneficiary**  
AAC Space Africa

**Project title**  
Software Defined  
S-Band Telemetry/  
Telecommand  
Transceiver For CubeSats

**Project market**  
Aerospace

**Project location**  
Western Cape

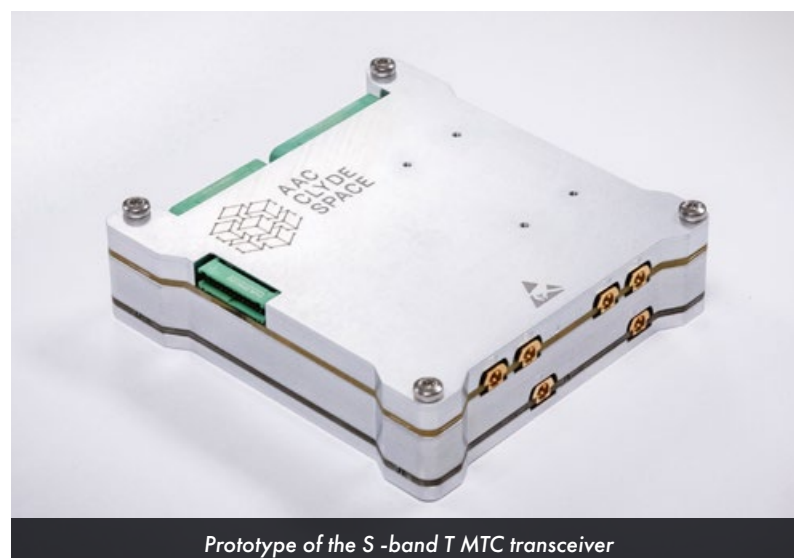
Telemetry and telecommand (TMTC) functions for CubeSats are typically executed over low (1 – 100 kbps) to medium (100 – 1000+ kbps) bitrate data radios in the very high frequency (VHF) and ultra high frequency (UHF) bands. However, these frequency bands are becoming increasingly congested, and with increased complexity of missions, high bitrates for TMTC are required. In addition, associated antennas for S-band are smaller than those for VHF and UHF, which facilitates more compact platforms.

Although the rapid pace of commercial technological development allows big strides in advancing state-of-the-art technology, it also results in shorter shelf life due to parts obsolescence of non-configurable hardware designs. The use of software defined radio (SDR) mitigates this problem and aims to provide a more future proof design. In an SDR, analogue hardware components are replaced by components implemented in software on a microprocessor. An SDR therefore provides a flexible and configurable framework that can support a variety of modulation and coding schemes through on-orbit, uploadable software instead of being fixed in hardware.

AAC Space Africa is part of AAC Clyde Space, a “New Space” group of companies that specialises in small satellite technologies and services that enable businesses, governments, and educational organisations to access high-quality, timely data from space. This data has a vast range of applications, from weather forecasting to precision farming to environmental monitoring, and is essential to improving our quality of life on Earth.

AAC Space Africa is the centre of competence for radio frequency communications within the AAC Clyde Space group. Their role is to provide and support radio communications solutions for the group’s satellite missions. The nanosatellite landscape has evolved from the provisioning of subsystems for customers who wish to build their own spacecraft, to the turnkey provisioning of complete space missions, including the operation of these missions on behalf of the customer, and the delivery of mission data to the customer.

The key to increasing the delivery of data is in rolling out and building constellations of satellites more efficiently. Components must be better manufacturable, reusable, and adaptable to different applications and standards.



Prototype of the S-band TMTC transceiver



All spacecraft use a TMTC radio frequency subsystem through which the spacecraft receives commands from the ground station and sends telemetry and mission data back down. AAC has developed a TMTC radio transceiver that is specifically designed to be used on board CubeSat satellites, but which can be used in larger satellites too. The product is designed with software defined radio at its core so that it can be adapted for different missions that are designed to varying international standards.

Although SDR solutions exist in this market, they come at a cost of large size and weight, as well as high power consumption. The proposed development aims to reduce size and power consumption by utilising large-scale silicon integration and low component count and aims to be an all-in-one transceiver solution that, with minor design changes, will be suitable for use in both CubeSats and ground stations.

**“The advantages of developing our own products are that the intellectual property and expertise will belong to a South African company and that the product will be designed with consideration of the African New Space market,” emphasises Robert van Zyl of AAC.**

“Various large international clients are currently in negotiations with our group to provide quantum advances in communications performance and flexibility necessitated by requirements for machine-to-machine automated networked communications and whilst the AISI supported project focuses specifically on high performance SDR-based TMTC radios for CubeSats, the resulting commercial products built on this flexible technology will also be used to advance technology to inter-satellite machine-to-machine automated links as the next step,” adds Van Zyl.

The project contributes directly to the industrialisation imperatives of the national and regional space strategies through capacitating AAC Space Africa and its partner to participate effectively and competitively in the national, regional and global small satellite markets.

Through the Africa Agenda 2063 (The Africa We Want), the African Union and its member states are committed to the socio-economic transformation of the continent over the next half-century through the implementation of sustainable initiatives. This implies the transition from a resource-based to a knowledge-based economy. Through the African Space Policy and Strategy, the utilisation of space to achieve this goal, is fully acknowledged.



Cynthia Daars, Production Technician, reviewing the prototype



Cynthia Daars and Carel Nel, RF Engineer, in the EPIC Production Lab



# METAL INJECTION MOULDING PROOF OF CONCEPT DEVELOPMENT FOR NON-LETHAL WEAPONS

**Beneficiary**  
Micromax

**Project title**  
Metal Injection Proof of Concept at Micromax Project

**Project market**  
Aerospace and Military

**Project location**  
Gauteng

Numerous components that are required within the military and aerospace industries cannot be manufactured locally because of the lack of certain technologies. Whereas South Africa is very capable when it comes to traditional machining, the uptake of new machining technologies has been slow.

As a manufacturer of mechanical components that operates primarily in the military and aerospace markets, Micromax, was approached by Byrna that sells self-defence launchers mainly as a non-lethal weapon for both civilian and police purposes, to supply them with metal injection moulding (MIM) components.

Micromax specialises in industries where extreme attention is made to exact detail with large implications and technological requirements to reach this level of complexity. The company operates both inside and outside the borders of South Africa, with numerous export contracts. This being said, Micromax does not have MIM technology and the technology does not exist commercially within South Africa.

“We were aware though that the CSIR has done research and experimentation for over ten years into metal injection moulding,” says Estiaan van der Merwe Contract Manager from Micromax “and through meetings and discussions held with the CSIR, they expressed interest in being involved in the process by developing the initial components with their existing equipment.”

“This project will establish whether the proposed components required by Byrna can be produced at the required quality and price,” adds van der Merwe.

Strategically, the main goal of this project is to establish MIM commercially in South Africa to enhance local manufacturing to better compete within the international manufacturing market.

**“If this project is successful in manufacturing components at the right price and quality, then Micromax should have sufficient information to invest in setting up a larger metal injection moulding process within the company that would allow us to take on a bigger product portfolio and expand our product offering to existing clients,” emphasises van der Merwe.**

Micromax has been involved with Byrna from the start when the first self-defence launcher samples were manufactured for testing about three years ago and still supplies the bulk of the complicated components used in their assembly. But, the complex machined components only make up about 50% of the parts in the assembly, with the rest being contracted out to Asian countries with the requisite MIM capabilities.

The reason why MIM is used for these parts is the cost associated with raw material machining. Whilst MIM is not as accurate as traditional machining, it can produce bulk components at a fraction of the price and speed of traditional machining. Research indicates that a large volume of products that can be manufactured using MIM are imported into the country on an annual basis.

What is crucial to the success of this project is the design and manufacturing of the moulds. It is a costly and time consuming process, but determines the accuracy and quality of the parts.



NEW  
TECHNOLOGY



EXPORT  
POTENTIAL



IMPORT  
REPLACEMENT

Micromax will provide employees to work with the CSIR using their equipment to gain hands-on experience in the process, so that this experience could eventually be transferred to Micromax. This also presents a unique opportunity for the CSIR to demonstrate the capabilities of its MIM process within an industrial context, making commercial parts for the local and export market.

By the end of the financial review period, significant progress has been made on several aspects of the project.

## WHAT IS METAL INJECTION MOULDING?

Metal injection moulding is a manufacturing process for producing complex components at high speeds and a significantly reduced cost. It is a metalworking process in which finely-powdered metal is mixed with a binder material to create a feedstock. The feedstock is then solidified and shaped to produce the final product.



Mandy N Madigoe, Senior Engineer and Technical Leader for metal injection moulding (MIM) project, preparing an Arburg MIM machine to produce green components.



Feeding of feedstock into a hopper to produce green parts at an elevated temperature.



17-4PH stainless steel feedstock that is used to produce green components



# ENGINE ENHANCEMENTS TO 2-STROKE ENGINE ON 24 METRE GLIDER ADDRESSES VIBRATION CHALLENGES

**Beneficiary**  
On-Track Technologies

**Project title**  
Low Vibration 2-Stroke Aircraft Engine Project

**Project market**  
Aerospace and Defence

**Project location**  
North West

On-Track Technologies Pty Ltd is a privately owned South African company, that designs and manufactures prototype aircraft from their main facilities based at the Potchefstroom Airfield. The company was born out of the design needs of Jonker Sailplanes, the well known sailplane manufacturing company. The company provides design services to mainly Jonker Sailplanes Pty Ltd, Milkor, M&D Flugzeugbau GmbH, SOLO Entwicklungsbetrieb GmbH, and North West University.

In 2021, On-Track Technologies was contracted by Jonker Sailplanes to resolve the vibration problem of the SOLO 2626ii 2-stroke engine selected for the JS2 glider / 24m wingspan glider in development.

There are only two EASA type certified engines suitable to be installed on self-launching sailplanes. The SOLO 2625 2-stroke engine from SOLO® Vertriebs- und Entwicklungs GmbH (Germany) and the Austro AE50R rotary engine from Austro Engine (Austria). These engines are installed in drones, as well as all the current glider manufacturers. According to Jonker Sailplanes, the SOLO engine was selected as this is a 50kW power plant compared to the 37kW from the Austro AE50R engine. The AE50R has very low vibration but will not have sufficient power for Jonker Sailplanes' 24m Open Class glider product. Jonker Sailplanes could not overcome the failures in their sailplane and engine systems due to the high vibration levels resulting from an unbalanced engine.

The project investigation found that the selected engine design was inherently poorly balanced, and the addition of balancing shafts to the design would theoretically eliminate most of the engine's vibration. A mathematical model was then constructed to quantify the vibration levels and calculate the parameters of the required balancing shafts. The values obtained from this model formed the basis for a geometrical model used to evaluate the feasibility of the modified engine in terms of geometric constraints, strength, manufacturability, and maintainability.

***"There is a market opportunity for the product that could change the gliding world as the current solution is not an acceptable product," comments AP Kotze, a Director at On Track Technologies "and we have the opportunity to retain the IP and produce and supply the modification parts to SOLO."***

Jonker Sailplanes confirmed their commitment to the engine change and confirmed orders of 24 engines per year for the JS5 24m sailplanes. Schempp Hirth, a manufacturer of gliders in Germany, also contacted the manufacturer SOLO and confirmed their interest in the upgraded engine.

On-Track Technologies signed a collaboration agreement with SOLO to protect the IP and define the working arrangements.

Throughout the project, the engine was subjected to a comprehensive array of tests, spanning various operating conditions. The industrialisation phase was implemented in parallel with the development phase to fast track and finalise all outstanding design optimisations and subsequent manufacturing processes.

The industrialisation phase also placed a strong emphasis on accurate and clinical documentation. This documentation serves as a foundation for the design and establishes



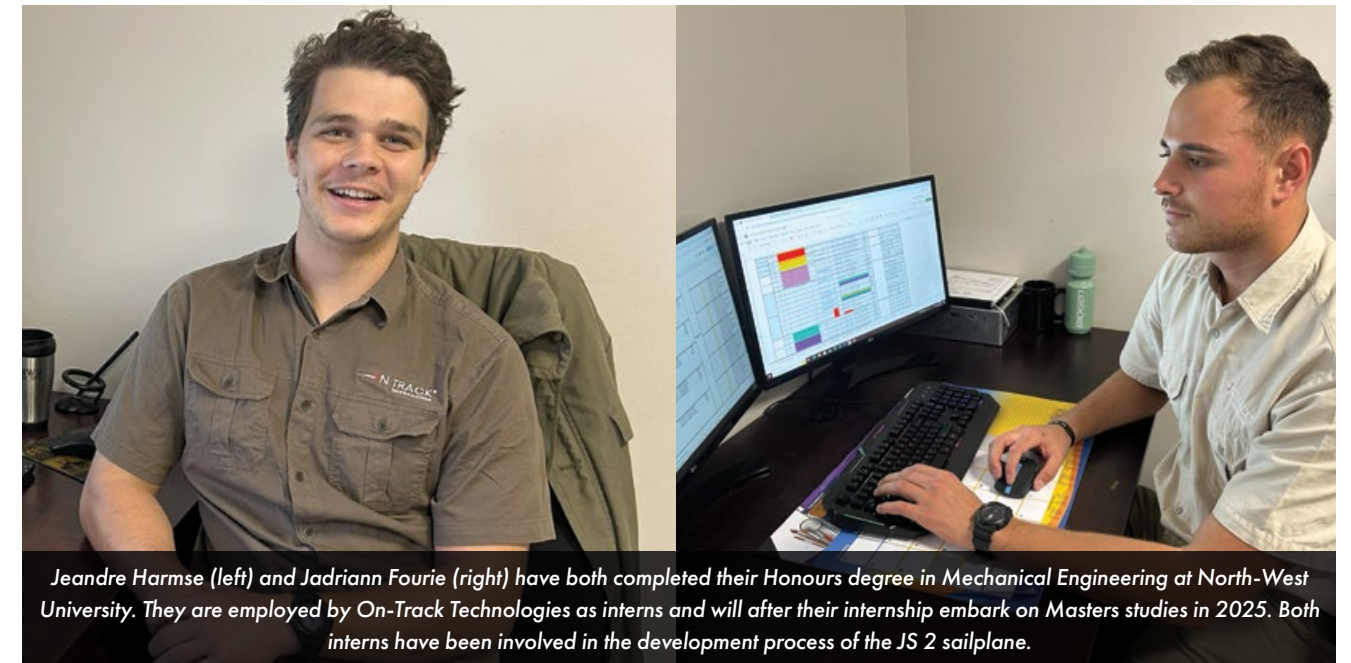
TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



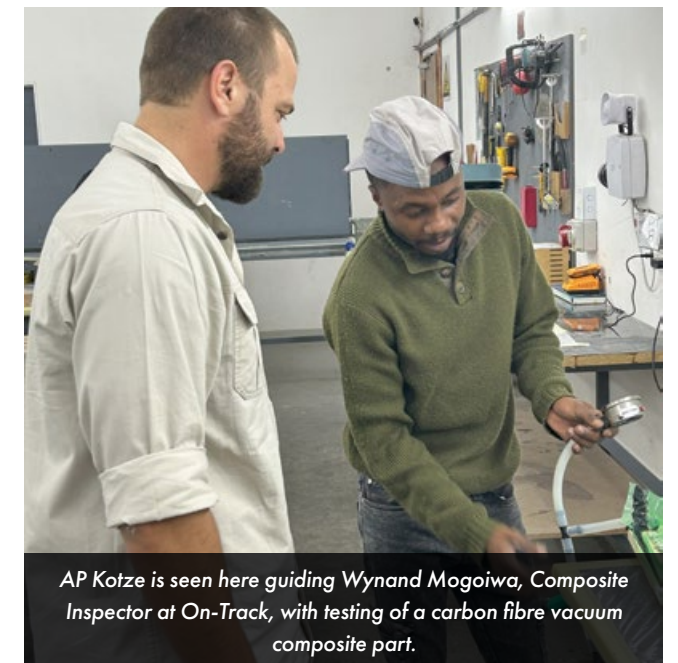
LOCAL  
GROWTH



Jeandre Harmse (left) and Jadriann Fourie (right) have both completed their Honours degree in Mechanical Engineering at North-West University. They are employed by On-Track Technologies as interns and will after their internship embark on Masters studies in 2025. Both interns have been involved in the development process of the JS 2 sailplane.



On-Track Technologies' facility is a main hub for the production of parts required by Jonker Sailplanes.



AP Kotze is seen here guiding Wynand Mogoiva, Composite Inspector at On-Track, with testing of a carbon fibre vacuum composite part.

a base that ensures no critical deviations. The objective is to ensure that no component strays beyond established standards, also futureproofing the design as any reputable manufacturer will be able to machine the components within the necessary set out tolerances.

On-Track Technologies achieved success with this project through fundamental engineering design, testing, design optimization, and documentation. The engine underwent rigorous testing in various operating

conditions, including local and Namibia flight tests, revealing excellent performance within specified parameters. By the conclusion of the project, the TRL level had increased from TRL level 4 to 8.

"We as On-Track Technologies are pleased with the outcome with the project and during the development of the product we learned a lot and this has added value to our experience and engineering team," concludes Kotze.



# APPLICATION OF LOCAL FILAMENT WINDING EXPERTISE TO DEVELOP PRESSURE VESSELS FOR USE IN AEROSPACE INDUSTRY

**Beneficiary**  
Petrawell

**Project title**  
Xenon-Ion Propulsion  
Fuel Vessel Demonstrator

**Project market**  
Aerospace

**Project location**  
Gauteng

The fast-paced world we live in has seen the emergence of satellite technology that is of importance in our day-to-day lives. More recently, there has been a proliferation of large satellite constellations. These mega-constellations provide, among other things, worldwide internet coverage. Since 2015, satellite internet providers such as Space X and OneWeb have been working on the idea of mega-constellations. OneWeb has deployed 50% of its first-generation satellites, whilst SpaceX is now the largest satellite operator in terms of number of assets with more than 6 000 Starlink satellites deployed. Gwo Wang, Kuiper and Telesat will over the next decade be joining the fray with their own satellite constellations. Whilst they will concentrate 58% of total satellite demand over the decade with an anticipated 9 900 units, these organisations will only retain 8% in manufacturing and launch value.

A Xenon storage pressure vessel with unique characteristics is needed for spacecraft, in this case, satellite propulsion. This type of tank must be high performance, lightweight, and designed to withstand severe operational loads. Additionally, the tank must be built with existing technology to minimise manufacturing cost and programme risk. Titanium-lined, carbon fibre overwrapped tanks are designed and manufactured to meet such a need. Initially the tank was mounted to the spacecraft by a series of polar bosses located on the tank centreline axis. The attachment points are designed to accommodate any dimensional fluctuations caused by pressurisation and temperature effects.

For small tanks, used in the launch of micro satellites that comprise the bulk of the emerging satellite constellations, this is not necessary as the momentum caused by launch loads are small enough to be reacted on the nozzle end. The nozzle then becomes a fixed point with any longitudinal growth in the blind end direction. Micro satellite fuel tanks are typically one litre order of magnitude, with some variation depending on design.

New vendors have emerged, ranging from dedicated smallsat access to space, to superheavy reusable launchers with various design-to-cost value propositions. With a new generation of Geosynchronous Transfer Orbit (GTO)-capable launchers expected, the market will experience a challenging transition.

Petrawell specialises in filament winding technology. This specific technology proves to be very well suited for high performance composite components that include pressure vessels, tubes, and many other applications. The company has also become a supplier to local satellite manufacturers for certain composite components on the satellite systems. The company has identified a need to establish local manufacturing capability for Xenon fuel



Attaching the Xenon tank to the hydrostatic test bench



TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



NICHE  
MANUFACTURING

tanks with specific application of ion-propulsion on satellite systems. The goal of the project for which Petrawell is receiving support from the AISI is to develop a certifiable ion propulsion fuel vessel for the domestic and international satellite market. This will be done making use of advanced manufacturing techniques coupled with exotic material applications and creative design solutions.

The project was successfully completed with deliverables over and above the original scope of the proposal and it created the opportunity for Petrawell to develop this niche manufacturing capability from a TRL level 4 to TRL level 8.

***"We believe this opportunity will be beneficial not only to Petrawell, but to the South African economy and the Sovereign capability of the country as a whole," comments Wouter Gerber, Chief Research Officer for Petrawell.***

One aspect of the project that was hugely underestimated was the manufacturing of the titanium liner for the pressure vessel. The process of hot spinning did not deliver the desired effect and this caused most of the extra activities and placed pressure on the already strained supply of titanium sheet metal for the project. Specific difficulties were experienced with the forming of the liner components. The laser welding of the liner components was also negatively affected by the poor fit of the components.

Commenting on this, Gerber said: "Although the project was completed successfully, there are significant indicators that even mature hot spinning capability will not deliver the type of product that can be industrialised at international rates. We strongly recommend further development of the methods used to form the titanium liner before venturing into commercial production."

***"Petrawell thanks the AISI and its partners for the opportunity and the excellent collaboration throughout the execution of this project," concludes Gerber.***

## OVERVIEW OF PETRAWELL'S SUPPORT FROM THE AISI

In 2021 Petrawell started to develop the relevant expertise to design, analyse, manufacture, test and deliver high performance filament wound pressure vessels. They realised that to play a meaningful role in this industry they needed to develop from a TRL4 to TRL9 level. This was achieved through collaboration with industry role players like AMT Composites for material supply and training requirements and Aerosud

for technical advice. The outcome was a composite filament wound high pressure and low-pressure vessel.

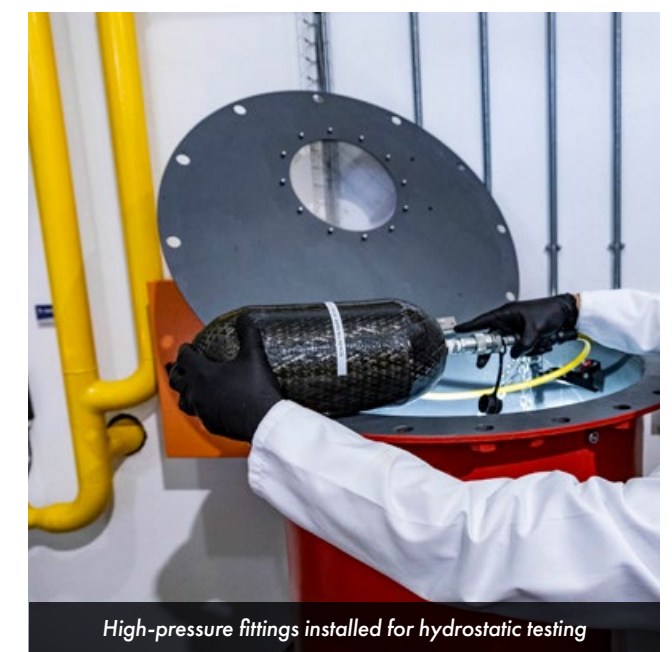
The AISI's contribution towards this project made it possible to explore more solutions than what would have been possible in terms of materials and labour. Several methodologies were designed and validated. In addition, support from the AISI has made it possible for Petrawell to run other optimisation campaigns, that include, but are not limited to, design process optimisation, material procurement process improvement, manufacturing technique improvement, and testing improvement

## WHAT IS GEOSYNCHRONOUS TRANSFER ORBIT (GTO)?

The term refers to the initial elliptical orbit of an artificial satellite destined for a circular geosynchronous orbit or geostationary orbit. The GTO altitude at its furthest point from the Earth is about 37 000 km. The satellite then moves in a circular orbit by rotating parallel to the Earth's Equator. Launch vehicles, such as those produced by Petrawell are designed based on the weight and power needed to launch a satellite into GTO. Geosynchronous = travelling in an orbit (path around an object in space) in which an object moves around the earth at the same speed as the earth turns

## WHAT IS A SATELLITE CONSTELLATION?

A satellite constellation is a group of artificial satellites working together as a system. Unlike a single satellite, a constellation can provide permanent global or near-global coverage, such that at any time everywhere on Earth at least one satellite is visible.



High-pressure fittings installed for hydrostatic testing



# CONTRIBUTION OF ADVANCED COMPOSITE TECHNOLOGY TO DEVELOPMENT OF FLAGSHIP UAV

**Beneficiary**  
Lightweight Structures

**Project title**  
Localisation of a Combined Advanced Composite and EPP Manufacturing Technology for Unmanned Aerial Vehicle (UAV) Structural Parts: Phase 1

**Project market**  
Aerospace and Defence

**Project location**  
Gauteng

The use of drones globally is continuously growing and has created the need for the development of new manufacturing processes that would enable more efficient production without jeopardising specifications.

In South Africa, the industry is small compared to some of the European and North American countries. Nonetheless, despite a relatively small size, the aerospace industry in South Africa has been known to produce high-quality products for export contributing to the country's current account and job creation. Commercial Aerospace Manufacturing Association South Africa (CAMASA) (2021) estimates that the industry comprises around 100 companies, employs over 3 000 people and generates R3.0 billion of export earnings annually.

In 2021, Avior Labs (Pty) Ltd, that is currently developing a hybrid fixed-wing UAV for commercial applications signed an agreement with Lightweight Structures to manufacture structural components of its flagship UAV. The UAV was designed to be used for surveillance, mapping, conservation, and inspection offering a greater endurance than Multirotor (MR) drones and be more affordable than international hybrid UAVs of the same class. The production of these UAVs, which is envisaged to kick off in 2024, is expected to grow from single digits per month to a few tens per month in the medium term.

Most of the fixed-wing and hybrid UAVs use conventional composite manufacturing techniques employing glass and carbon fibre as their main manufacturing material. These airframes have excellent aerodynamic and structural properties but are hand-manufactured, making it very labour-intensive. Such a technique, however, becomes prohibitive for manufacturing of a large volume of products due to the costs involved and the associated difficulty in reaching the required economies of scale.

Phase one of the project aimed to design, develop, integrate, and test a new production process for at least one prototype structural component for a medium sized fixed-wing UAV. A fuselage was selected for the development of the production process.

The new manufacturing process developed has been a success and has moved from TRL 4 to TRL 6. While not yet assessed in the operational environment, the manufacturing process



Components are manufactured from glass, Kevlar, and carbon fibre materials, utilising both traditional and advanced technologies such as the use of pre-impregnated fibres and resin-transfer manufacturing.



TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



INDUSTRY  
DEVELOPMENT

allowed a reduction of the number of parts that form part of the fuselage from 30 to 14 and a reduction in the weight of the fuselage by 20% - from 400g to 361g. These results suggest that the future commercialisation of the technology will enable the reduction in production costs and time saving, which in turn will assist in increasing the competitiveness of the local industry.

***"This development is the first phase of a three-phase development approach to develop and localise the new manufacturing techniques in South Africa," emphasises Elena Broughton, Financial Director for Lightweight Structures. "The team is in the process of kickstarting Phase 2 of the bigger initiative, which involves expanding the application of the technology to develop other UAV components, such as tails and wings that have their own unique characteristics and require further R&D."***

"Whilst the project experienced some delays due to the complexity of the part chosen for the proof of concept, phase one of the project was completed successfully. This influenced the finalisation of the structural design and the production of aluminium moulds. Despite the delays, the project enabled the establishment of new manufacturing technology in the country," concludes Broughton.

## ABOUT LIGHTWEIGHT STRUCTURES

Lightweight Structures (Pty) Ltd was formed in 2020 and previously operated as Lightweight Structures Technology (LST) CC. The company was founded in 1998 following the closure of the CSIR-Aerotek composites engineering workshop, effectively commercialising the capabilities of that facility by re-establishing it as a private entity.

Over the past 25 years, the company has consolidated itself as one of the few companies in South Africa that specialises in the manufacturing of aerospace-qualified composite products used by some of the well-known global aerospace corporations.



Lightweight Structures employs 28 individuals and holds ISO 9001:2015 certification.



The Elevation UAV airframe from Avior Labs (Pty) Ltd was chosen as a technology demonstrator to develop and implement the new manufacturing technology developed. The same technology can easily be adapted to most UAV airframes that are in the small – medium category with a maximum wingspan of around three meters.



# STANDALONE WIDEBAND TRANSCEIVER SUITABLE FOR OPERATION IN HARSH ENVIRONMENTS

**Beneficiary**  
Wideband Receiver Solutions

**Project title**  
Technology Enhancement; from WideBand Receiver to Wideband Transceiver Support Towards: Advancement of Existing Technology

**Project market**  
Aerospace and Defence

**Project location**  
Western Cape

Wideband Receiver Solutions (WBRxS) is a start-up company borne from the South African Radio Astronomy Observatory (SARAO). The company was started in January 2022 by the founding members who successfully applied to the SARAO intellectual property (IP) committee to commercialise IP developed by the founding members for the MeerKAT telescope. The core focus of the company is to develop wideband receiver solutions for the defence and aerospace industries. It builds on the experience gained in developing the receiver systems for SARAO.

Radar is used in defence applications to detect air, land, and sea threats, such as missiles, ships, aircraft and spacecraft. The rising concern of strengthening defence capabilities leads to growing procurement of defence equipment which is driving the market's growth. Moreover, the shift from traditional war fighting to electronic and cyber warfare is anticipated to generate opportunities for radar systems. With evolving electronic and cyber-attacks, the demand for next-generation radars is increasing and driving market growth.

It is expected that ground surveillance and intruder detection segments will dominate the growth in the radar market due to increasing border tensions between neighbouring countries. This will result in an increased demand for wideband radar transceivers.

Radar applications require wide bandwidths and high dynamic range to meet the resolution and probability of intercept requirements of complex modern radar systems over wide frequency ranges and at times in extreme environmental conditions. Complex heterodyne architectures makes the design of these systems complex and expensive and in unstable conditions can influence the performance of the radar, as well as contribute to shorter life spans.

The solution to many of these problems would be to digitise the transmitter and receiver signals as early as possible in the signal chain of the radar. This can be done using a high-speed analog-to-digital converter (ADC) with wide radio frequency (RF) band for the receiver channels and a high-speed digital-to-analog converter (DAC) for the transmitter channel.

Most companies provide solutions that offer only the ADC part of the solution, whilst others make use of extremely expensive RF-system-on-chip (RFSOC) technology that does provide the required channels, but not at the required bandwidth. The RFSOC solution also comes at expense of signal integrity. Recent advances in technology for ADC and DAC have resulted in new products being released that can sample up to C-band directly without the need for heterodyne RF channels. Signals from X-band and above can be digitised using a single heterodyne stage.

**"Over the last ten years our team has developed direct digitisation modules for radio astronomy applications that addresses most of these concerns," comments Sias Malan, System Engineer at Wideband Receiver Solutions. "This is due to the similarity between radio astronomy and radar applications."**

WBRxS' latest digitisation card, SP-6G4S is a 6.4 Gsps solution that provides 3 GHz of analog bandwidth and has a dynamic range of 12 bits. This digitiser can directly digitise signals up to 6.4 GHz when in single channel mode but can also be configured



TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



LOCAL  
GROWTH

to sample up to four channels simultaneously at a maximum sample rate of 1.7 Gsps with a maximum input frequency of 6.4 GHz. These specifications render the module suitable to boost the receiver capability of a radar.

The scope of the project is to supplement an existing wideband receiver chain with a wideband transmitter chain to create a wideband radar transceiver. The wideband radar transceiver will be qualified to meet defence specifications. A manufacturing data pack for the transceiver product will be established.

"The commercialisation and enhancement of this technology is of strategic importance to the South African industry and continued development in this area ensures that this capability that was developed as part of the MeerKAT and MeerKAT Extension projects is retained," adds Malan. "The technology enhancements proposed by this project can be made available to other South African industries, and this industry cross-pollination will ensure that the South African government achieves an optimal return on their ongoing investment in radio astronomy."

Following the successful completion of the project, the South African defence sectors will have a world class sub-system available for use in radar applications. This will ensure that the South African defence

sector enhances their competitiveness in the international market and enables local growth.

## WHAT DIFFERENTIATES THE WBRXS SOLUTION?

- A wideband solution allowing for up to 3 GHz instantaneous bandwidth and RF bandwidth of up to 6.4 GHz.
- A standalone solution that does not require expensive hosting infrastructure and is designed to operate as a standalone module in harsh environments.
- The module is designed to operate in environments with extreme electromagnetic compatibility (EMC) requirements and has already proven to pass MilStd 461 G for radiated emissions.
- Industry standard interfaces such as 1/10/40 and 100 GbE.

## WHAT IS HETERODYNE DETECTION?

Heterodyne detection takes place when two signals with close frequencies are mixed, the result is a signal with an intensity proportional to the product of the intensities of the two signals, and its frequency is proportional to the frequency difference between the two signals.



Renier Siebrits is setting up the sample clock reference for the transceiver board testing.



Final inspection of completed transceiver PCB by Samsunissa Fataar.



# DRONE WITH 7-METRE WINGSPAN DESIGNED FOR LONG RANGE AND LONG ENDURANCE PURPOSES

**Beneficiary**  
Sentian Aerospace

**Project title**  
Unmanned Aerial Vehicle (UAV)  
Optimisation

**Project market**  
Aerospace

**Project location**  
Gauteng



Sentian Aerospace was founded in 2015 as a drone manufacturing company by a group of four friends who had the desire to do their part in improving the world. At inception, their philosophy was, and still is, to develop low-cost aerospace solutions for sustainable, green and efficient collection of valuable data. The company designs and builds unmanned aerial vehicles (UAVs) capable of delivering highly valuable video and multispectral data to customers using their airborne platform.

"The support provided by the AISI was for the production of the Xplorer, a 7-metre wingspan drone capable of running multiple missions," says Muzi Dube, CEO and a co-founder of Sentian Aerospace. "The funding has also been utilised to grow the team to include skills other than engineering and technical to allow us to enter the market and sell the aircraft to different markets."

**The drone was designed for long range and long endurance purposes to have the necessary capability to reach beyond their customer's needs. It features vertical take-off and landing capability like a helicopter, and then transitions to fixed wing mode for long endurance flight. It is modular in design for easy transportation and storage. It can fly slowly for good data collection, but is also able to fly extremely fast for delivery. Additionally, it can stop and hover in mid-air to aid in powerline inspection and search and rescue activities.**

A large-scale drone such as this one can be used for several applications in the security, maritime research, wildlife conservation and agriculture industries.

Sentian Aerospace's long-term aim is to expand into other markets and to deliver other types of products such as unmanned ground vehicles and sea vehicles. This will expand the size of the company and reach a global market.



The final, wing optimisation phase of the project was conducted to investigate the design and fabrication of higher quality and better performing wings for the original Sentian drone. The wings were built and tested, one of the two to destruction stage. This was done to gather valuable information on the performance of the wing design, manufacturing method, materials and overall finish quality.

The team was pleased with the performance of the wings and having done an extensive amount of work on the wings ascertained that the results were good enough to suggest a change in scope on the rest of the aircraft using the available resources and to improve on the previous model. The scope change was accepted and the new aircraft was designed and fabricated.

The change in the scope of the project was to redesign the aircraft for better performance, robustness and redundancy, as well as ease

of manufacturing and lowering costs. The fuselage, control surfaces, engines and nacellas, landing gear and tail were all redesigned.

Upon conclusion of the AISI project, the craft will be subject to basic flight trials to determine real-world performance of the aircraft. The aircraft will be used as a technology demonstrator and business product demonstrator. This will then allow for the company to seek additional investment that will grow the company and lead to mass production.

"A project of this nature brings with it a range of technical challenges and without the AISI support, the company would not have been able to produce the prototype and work on some of the technical challenges," adds Dube. "We have learned some important technical lessons along the way, which will serve us well in the future."





# DEVELOPMENT OF WORLD-CLASS CUBES AT SATELLITE SHOCK TEST FACILITY

**Beneficiary**  
Simera Sense

**Project title**  
CubeSat Shock Test Facility

**Project market**  
Aerospace

**Project location**  
Western Cape

Operating from its offices in Somerset West in the Western Cape, Simera Sense is on a mission to make earth observation (EO) effortless and accessible to enable a better understanding of the earth’s past, present, and future. They believe that by making extraordinary instruments to probe the planet they can make a tangible impact on our future.

Space exploration has rapidly emerged as a forerunner in modern technological advancements and whilst one might think that ‘bigger is better’ when it comes to EO, the smaller CubeSats, often referred to as nanosatellites, have played an increasingly important role, and in the last decade the launch of CubeSats has increased more than tenfold.

Simera Sense produces end-to-end optical payload solutions for the nanosatellite EO industry with a range of products targeted at the medium to high-resolution imagery market for CubeSat, micro- and small satellites. These optical payloads are designed to conform to CubeSat form factor, measuring 100 mm x 100 mm x 100 mm (1U) to create a variety of square and rectangular sized satellite structures.

The products are intended for EO missions in low earth orbit , where they must endure harsh environmental conditions. The process of launching these payloads into orbit subjects them to intense vibration and shock forces. These conditions cause mechanical stresses and vibration encountered during launch which can potentially trigger performance failures and mission-critical malfunctions.

**According to Hano Steyn, System Engineering Lead at Simera Sense: “Conventional satellite shock testing facilities have historically catered for large satellites and there is limited access to specialised testing resources tailored to unique requirements within South Africa.”**



Conventional satellite shock testing facilities have historically catered to large satellites. In South Africa, there is limited access to specialised testing resources tailored to CubeSat requirements



**“These gaps not only elevate costs, but also introduce logistical complexities, such as the need to send optical payloads and CubeSats overseas for testing. The challenges strain project budgets and timelines, necessitating a dedicated testing facility right here in South Africa,” he adds.**

The goal of the AISI supported project is to establish a world-class CubeSat Satellite Shock Test Facility that serves as a hub for optical payloads, satellite components and CubeSat satellite testing, research, and development, contributing to the growth of the South African and regional space industry.

## PROJECT OBJECTIVES

- Create a shock test facility equipped with the latest technology and equipment to accurately simulate launch and landing conditions for CubeSat satellites.
- Ensure that the facility adheres to internationally recognised standards and specifications for shock thereby guaranteeing the reliability and validity of test results.
- Design the facility to accommodate a variety of CubeSat configurations to meet the diverse needs of CubeSat satellite developers.
- Improve the reliability of CubeSat missions by subjecting them to comprehensive shock vibration testing, reducing the risk of satellite failures during launch.
- Assist CubeSat developers in South Africa and neighbouring regions by offering cost-effective and timely shock testing services, eliminating the need for costly overseas testing facilities.
- Develop comprehensive operating procedures and documentation to ensure facility users are proficient in conducting shock tests and interpreting results.
- Establish a robust maintenance and support infrastructure to ensure the long-term reliability and availability of the shock test facility.
- Contribute to the growth and innovation of the CubeSat industry in South Africa by providing a crucial testing resource and fostering a collaborative space ecosystem.

At the conclusion of the financial period, Simera Sense had made good progress on the project that is expected to be completed by August 2024.

## WHAT IS EARTH OBSERVATION (EO)?

To better predict, adapt to and mitigate global changes and their impact on human civilisation, requires an improved understanding of the Earth’s systems such as weather, climate, oceans, land geology, natural resources, ecosystems, as well as natural and human-induced hazards.

Information remains a key component in our ability to adapt to a world with a rapidly growing population, natural resources that face constant pressure and the consequences of climate change. The information required is gathered through EO and takes many forms spanning from population, demographic, economic and environmental data to observations of planet Earth itself and the impact of human societies on the planet.



Seen here from left to right are Quiwin Daniels, Test Engineer; Ian Smith, Senior Mechanical Engineer; Timothy Seloane, Project Manager; and Hano Steyn, Lead System Engineer





# SECTOR-WIDE ACCREDITATION

*This programme assists the broader advanced manufacturing industries including marine to enhance their visibility within local and global supply chains and increase their competitiveness.*

BENEFICIARY NAME	PROJECT TITLE
Wilec	Continuous Transpose Conductors Accreditation Programme
Beake Engineering	ISO9001 and 45001 Implementation
Aumanat	Pneumatic Actuator Test Bench
Premier Mats	Manufacturing Process Improvement Project
Impala Bolt and Nut	Import Replacement of Specialised Fasteners into the Automotive Sector
Trewfit Controls	IECEX and ATEX certification of valve indicators

# DEVELOPMENT AND OPTIMISATION OF CTC MANUFACTURING PROCESSES TO ALLOW FOR ACCREDITATION BY LOCAL TRANSFORMER MANUFACTURERS

**Beneficiary**  
WILEC

**Project title**  
WILEC Continuously Transposed Conductors (CTC): Accreditation Programme Project

**Project market**  
Electrical Transformers

**Project location**  
Gauteng

Makareng Electrical Industries (MEI), that is majority owned by the Mathebula Family Trust, purchased Wilec from Actom in 2019 and continues to trade as Wilec. Wilec manufactures and supplies conductors and other associated components to the electrical manufacturing and repair industries locally and for export, mainly into East Africa, Indian ocean islands and Australia.

Wilec installed and commissioned Africa’s first continually transposed conductor (CTC) production line in January 2022. The company has subsequently sought accreditation from leading local transformer manufacturers, such as Actom Power Transformers, SGB Smit and WEG Transformers that currently import CTC from abroad. Wilec manufactures the enamelled strip and converts this into finished CTC to meet the original equipment manufacturer (OEM) requirements. The CTC is tested and validated to ensure that the customers’ specified requirements are met.

CTCs are used in large power transformers Class 2 and up. They consist of a group of rectangular copper conductors arranged in two vertical stacks. Each conductor is covered with PVF/PVA enamel to provide electrical insulation. Depending on the application and design, an adhesive epoxy layer may also be applied following enamelling.

Each strand is individually bent and transposed from the top of one stack to the adjacent stack effectively “stranding” the cables repeatedly within the stack. A similar transposition occurs on the bottom of the stack. The transpositions occur with regularity such that each conductor is shifted in its numerical position repeatedly down the entire length of the cable. This effectively leads to each conductor being the identical length when a transformer is manufactured. The bundle or stack of conductors is then covered with paper insulation in-line and spooled onto a cable drum for delivery to an end user.

Wilec aims to supply CTC locally and for export to other African countries, Australia, and other Southern hemisphere countries. This will also reduce turnaround times for transformer repairs and replacement transformers to ESKOM. The aim of the AISI supported project was to develop and optimise the CTC manufacturing processes and produce a batch that would allow for accreditation of their product by local transformer manufactures.

**“In May 2023, Wilec proudly invoiced the first two official orders for CTC manufactured in its facility,” says Howard Eldridge from Wilec. “The orders were supplied to WEG and Actom Power transformers and both companies witnessed their product being manufactured in the facility.”**

“Wilec is extremely proud of the CTC capability that it has installed as the ability to produce CTC in South Africa is of strategic importance to the country, ESKOM, and stakeholders in the transformer manufacturing industry. It supports government initiatives for growth, employment, and local industry,” concludes Eldridge.

# 100% BLACK-OWNED SMME TO BENEFIT FROM ISO CERTIFICATION

**Beneficiary**  
Beake Engineering

**Project title**  
ISO9001 and 45001 Implementation

**Project market**  
Mining and Engineering

**Project location**  
North West

Beake Engineering is a value driven organisation that enables clients to meet their business objectives through delivery of responsive mining and engineering services and products, using methods and means that demonstrate respect for the physical and social environments. Their business is built on the notion of responsiveness and the ability to respond aptly in any given context. This 100% black-owned SMME, that is B-BBEE level 1, is based in the Hartbeespoort area, with a manufacturing facility in Mogwase, Northwest.

Since 2013, they have pursued and demonstrated relevance across a variety of sectors helping clients respond to several economic, social and environmental realities that impact their bottom line and day-to-day efficacy.

During the review period, Beake Engineering received support from the AISI for the implementation of ISO 9001 and ISO 45001 international standards.



**Abrey Moagi is the Managing Director at Beake Engineering. His leadership and managerial competencies, that have been acquired over 15 years in the mining and mineral processing environment, combined with his passion for Africa’s development add tremendous value to the business.**





# DUAL STATION TEST BENCH CAPABLE OF VERIFYING THE OPERATION OF SEVERAL MODELS OF PNEUMATIC ACTUATORS

**Beneficiary**  
Aumanat

**Project title**  
Aumanat Pneumatic Actuators and Test Bench

**Project market**  
Variety of industries

**Project location**  
Kwa-Zulu Natal

Aumanat was established in 1995, as an agent for AUMA electric actuators in Kwazulu-Natal, South Africa. Subsequently many other agencies have been acquired and includes brands such as ARIS, J+J, Flli Scapin and BILCO. Over its 27 years of operation, Aumanat has made a name for itself as a result of their quality products, competitive pricing, quick response to enquiries and an excellent after-sales service, all of which are essential for a successful business.

With the implementation of local content requirement and the designation of pneumatic actuators by **the dtic**, Aumanat set about designing and manufacturing a pneumatic actuator. The localisation of this technology by Aumanat has been progressing over several years, and a series of models are ready to enter the market. Several Cam-Act pneumatic actuators have already been installed in plants across South Africa and are operating successfully.

One of the challenges of designing, manufacturing, and introducing a new product into the market is to ensure it can withstand industry demands. It also needs to meet the design specifications as detailed in the relevant European Norm (EN) standards. For this, one needs to perform endurance testing on each of the models and hence the need for an endurance test rig. With endurance testing completed, the product will be able to compete technically with imported brands.

South African State-Owned Enterprises (SOEs) are required to procure locally produced pneumatic actuators that meet specific quality requirements. Customer confidence is enhanced knowing that the product meets international standards, that endurance testing has been carried out and as a requirement, can witness their products being tested on the rig prior to it being despatched and installed.

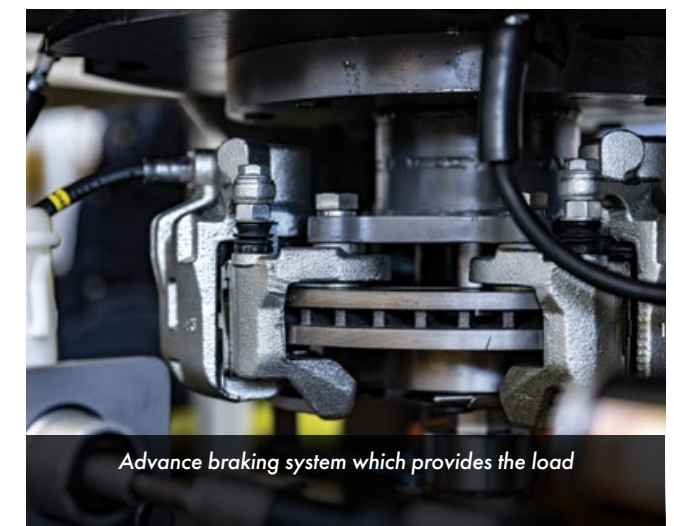
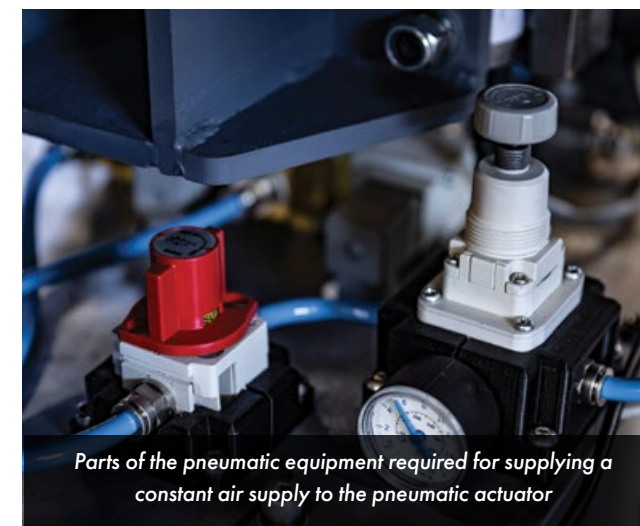
***The South African pneumatic actuator market is estimated to be around R200 million per annum, which is made up primarily of imported actuators. A locally produced actuator, meeting international standards, which can compete with imported brands, is likely to take a large share of this market.***

However, endurance testing is required to prove that the product is suitable for this market. To achieve acceptance in the market, the pneumatic actuators need to be verified at a high cycle count on a dedicated test bench.

Aumanat supply and install their range of electric, pneumatic and portable actuators into a number of industries including power generation, transmission and distribution, water and waste, mining, paper and pulp, sugar, food, petrochemical, shipping, and steel. The company possesses a basic test bench, but it has several shortcomings that need to be rectified to be able to comply to the endurance test procedure as described in EN15714-3.

This required a new test bench and during the 2022/23 financial period, Aumanat, the AISI and the CSIR joined forces to design and construct a dual station test bench capable of verifying the operation of several models of pneumatic actuators.

From the outset the project sought to achieve several important goals. The first of these is the development of a user requirement specification document, which is matched



by an acceptance test procedure document. These will be used to ensure proper specification and functionality of the deliverable. It should be noted that the test bench instrumentation should capture and record all relevant sensor and event data. The creation of a complete set of engineering drawings and relevant schematics, as well as installation, verification and training of the developed test bench at Aumanat's factory.

After completion of this project, Aumanat will be able to implement long term testing of their pneumatic actuators to gain acceptance to the market.

According to Peter Meyer, Owner for Aumanat: "The URS was successfully developed, the test bench was designed, and all the required components were procured or manufactured. This included both the mechanical and electrical requirements such as brakes and control systems as well as development of the software required to

operate the test bench. The test bench was assembled, and all the integration has been completed. The test bench is currently undergoing final testing and validation before it is shipped and commissioned at Aumanat in Pinetown."

During the development, serious consideration was carried out to ensure a functional and fit for purpose test bench is designed and manufactured whilst ensuring it is safe to operate.

To gain better acceptance in the market, the actuators need to be tested according to EN15714-3:2009, which would show that the product can handle the stresses of a real-life application. The extensive testing occurs on a test bench which simulates load to the actuator as they would be experienced in a field installation, and which exercises the actuator for many hundreds of thousands of cycles. During this testing, all relevant parameters are controlled and measured to create a record of proof.



# SYSTEM DIGITISATION IMPROVES PRODUCTION AND REDUCTION OF WASTE

**Beneficiary**  
Premier Mats

**Project title**  
Manufacturing Process Improvement Project

**Project market**  
Automotive Industry

**Project location**  
Gauteng

Premier Mats is a 100% female owned and operated SMME based in Pretoria. Since its establishment in 2013, director and founder, Madelein Marais, has grown the enterprise into a preferred supplier of custom floor mats for South Africa's commercial vehicle market that required a functional, affordable, safe, hardworking and value adding product.

*"We found ourselves faced with various challenges during the very dedicated, time consuming and personalised production processes," comments Marais, "This prompted us to apply for support from the CSIR's AISI programme as we had realised by implementing a digital, fully integrated Manufacturing Execution System(MES), we could improve production and reduce waste."*

By integrating digitised templates with the Computer Numerical Control (CNC) router and bar-coded (QR) job cards, a system was successfully implemented that resulted in productivity and Quality Management System (QMS) improvements.

This system replaced a paper-based one, and a key benefit realised, is the ability to identify any defects and where the defect originated from in the process, to allow for the problem to be addressed. A camera-based system with the capacity to conduct visual quality assurance checks further added to Premier Mats' goal to produce an excellent quality product each time.

After completion and implementation of the project, Marais expressed her gratitude for the support her company has received from the CSIR and AISI as follows: "We are very appreciative and feel honoured to have been selected for this prestigious project by the AISI and CSIR team."



Lerato Mokano is seen here operating the MES system



TECHNOLOGY  
DEVELOPMENT



100% FEMALE  
OWNED SMME



QUALITY  
MANAGEMENT  
IMPROVEMENTS

*"Since the implementation of the new MES system, we have seen a significant improvement in controlled QMS, timesaving in production processes and reduction in waste that results in positive financial savings. This in turn makes us more competitive in the current market and able to be in a better position to meet market demands," concludes Marais.*

## WHAT IS CNC MACHINING?

CNC machining is an automated machining process that uses computer numeral control technology to shape an object or a part by removing material from a workpiece until the desired shape is achieved. It works by converting a digital model of a part into a sequence of computer instructions that control the actions of the machining tools to achieve the desired output.

CNC machining equipment works on a variety of parts, such as metals, metal alloys, wood, stone, and more. The size of machine tools can vary based on the specific part that requires manufacturing. Since it is computer-controlled, CNC machining can deliver superior levels of versatility, efficiency, and precision relative to other common manufacturing methods. This makes it a popular manufacturing choice for a vast range of industries and applications.



Johannah Msiza presenting a finished product (Hino 300)



From front to the back: Lerato Mokano, Madelein Marais, Violet Mamonyane, Maria Madisha, Johannah Msiza, Lizelle Henning



# LOCAL PRODUCTION OF AUTOMOTIVE FASTENERS REPLACES EXPENSIVE IMPORTED TOOLING

**Beneficiary**  
Impala Bolt & Nut (Pty) Ltd

**Project title**  
Import Replacement of Specialised Fasteners into the Automotive Sector

**Project market**  
Automotive Industry

**Project location**  
Gauteng

Impala Bolt & Nut (Pty) Ltd was established in 1988 and has grown into one of the premier manufacturers and suppliers of standard and specialised fasteners for industrial applications in South Africa. As the only fastener manufacturer in South Africa that is certified to the required Automotive Quality Management System, IATF 16949, they have significant opportunity to manufacture and supply fasteners into the automotive sector.

The automotive sector in South Africa generally imports fasteners, because until recently there has not been a viable supplier, certified to the necessary quality standards. The Government and the dtic are encouraging and incentivising automotive original equipment manufacturers (OEM's) to purchase locally. To do so, it is necessary to first manufacture samples for approval prior to receiving purchase orders to supply mass production. This process is extremely time consuming and financially straining as the cost of tooling is significant and sometimes prohibitive.

In 2023, Impala Bolt & Nut embarked on a project to expand its in-house capability and capacity to produce tooling for the manufacture of fasteners to be used in the automotive sector in South Africa, and possibly for export. The main drive of the project was to develop local expertise and employ and train permanent staff instead of importing tooling from Taiwan.

In addition, there is a need to invest in specialised testing equipment to ensure 100% compliance with customer requirements. Analysis and testing of fasteners are currently carried out manually using microscope and shadowgraph, however it is possible to automate with optical sorters. The testing is to ensure conformance of dimensions and the thread profile.

The project that has been supported by the AISI sought to develop local expertise, employment and training of permanent staff to facilitate local production of tooling instead of importing.



SKILLS  
DEVELOPMENT



TECHNOLOGY  
DEVELOPMENT



IMPORT  
REPLACEMENT

*"We have invested in additional plant and machinery to supplement existing facilities and appointed a highly respected industry expert to train existing and new staff, ensuring development of complex skills and cross training between different machines and processes, to ensure capacity based on customer and product specific requirements," comments Derek Cohen, Managing Director at Impala Bolt & Nut.*

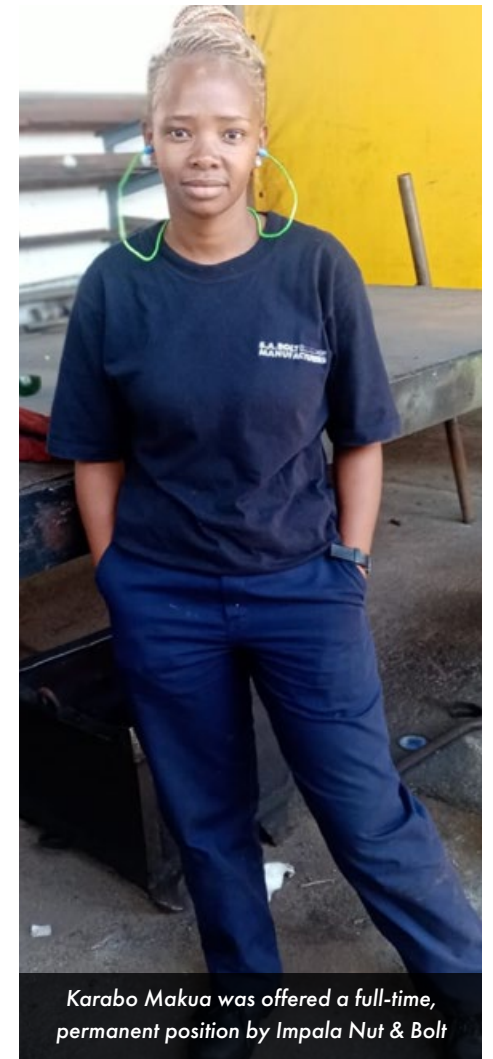
At the conclusion of the review period, final approval of samples from some customers was still pending, whilst others had been provisionally approved. Other new parts had been awarded, based on their ability to produce tooling in-house and to manufacture final parts.

## ➤ AISI SUPPORT FACILITATES SKILLS DEVELOPMENT

With the aid of AISI, Impala Nut & Bolt was able to upgrade its toolroom, creating an environment conducive to advanced training and development. This upgrade enabled the company to employ two Fitter and Turner interns, who have benefited from the enhanced facility and training programme. The structured 18-month in-service training program has equipped these interns with critical hands-on experience and technical knowledge.

Both interns successfully passed their trade tests, demonstrating the high level of competence and proficiency they achieved during their training. This milestone is a testament to the effectiveness of the support and resources provided by the AISI.

Impala Nut & Bolt has been able to offer a full-time, permanent position to one of the interns, Karabo Makua. Karabo, a 34-year-old female who was previously unemployed, has shown exceptional dedication and skill throughout her training. Her journey is particularly inspiring, as she completed her studies through Alpha Technical Training and has now secured stable employment, paving the way for a promising career in the industry.





# INTERNATIONAL CERTIFICATION TO BOOST EXPORT OPPORTUNITIES

**Beneficiary**  
TrewFit Controls

**Project title**  
IECEX and ATEX  
Certification of Valve  
Indicators

**Project market**  
Valve and Automation  
Industries

**Project location**  
Gauteng

TrewFit Controls designs and produces a range of products for the valve and automation industry. Its core products revolve around the monitoring and controlling of valves used in mining, manufacturing, food and beverage production processes. The products range from commodity items to high end value add and many are industry firsts. The company operates six computer numerically controlled (CNC) machine centres for component manufacture. In addition, TrewFit Controls has a strong information technology backbone and the latest design and computer aided manufacturing software.

The multi-billion local and international valve and automation industry presents numerous opportunities for companies like TrewFit Controls, that exports products to Europe, North America, Australasia and Asia, with various distributors and offices.

"We are registered patent holders for several products and take pride in the fact that products manufactured by the company are the result of the companies own research and development," comments Adrian Penning, Managing Director of TrewFit Controls. "The company has gained its knowledge from sound participation in the markets in which its products are deployed."

TrewFit Controls' product range includes valve positioners, valve position indicators, Piezo Pilot Valves, severe service proximity switches, mounting accessories for various valves and actuators, as well as custom manufacturing of engineering work requiring precision cnc CNC milling and precision CNC turning.

**"Foreign certifications would greatly increase our export market into Europe, Asia, Australia, and the Americas and whilst we currently export to these markets, we are excluded from projects that require these certifications," emphasises Penning.**

The anticipated opportunities that would arise from increased business would mean that TrewFit controls would need to increase its skilled, semi-skilled and unskilled staff requirements that responds directly to a key AISI goal of providing employment opportunities. The fact that more staff would need to be trained in the use of CNC machinery, programming, setting, operating and machine tending would also boost skills development and employment.

There would also be work for second tier local suppliers as the company uses injection moulded parts, high pressure aluminium die casting components, electronic assemblies, packaging materials, tooling, chemicals, and numerous other parts.

The main motivation for seeking support from the AISI is to expand local and international markets where the requirement for specific certifications is key. It is for this reason that support for IECEX and ATEX certifications was sought.

"The certification process was a big learning curve for our company as we had to implement a complete quality management system, as well as changes to the product so that they conform to the specifications," says Penning

Not only was the process extensive, it was intensive too, but a valuable exercise as the results speak for themselves. TrewFit Controls has experienced good growth in local and international sales, provided employment for seven more staff members and exposed staff to an extensive amount of training.



CERTIFICATION



EXPORT  
POTENTIAL



SAFETY  
CONTROLS

**"We are very grateful to the dtic, the AISI and all parties involved that afforded us this opportunity to expand our business. A key lesson we have learned is that we have a really good product that is able to compete on the international stage and that many of our staff realised their own abilities and potential. It has been a worthwhile and fruitful experience all round for our company," concludes Penning.**

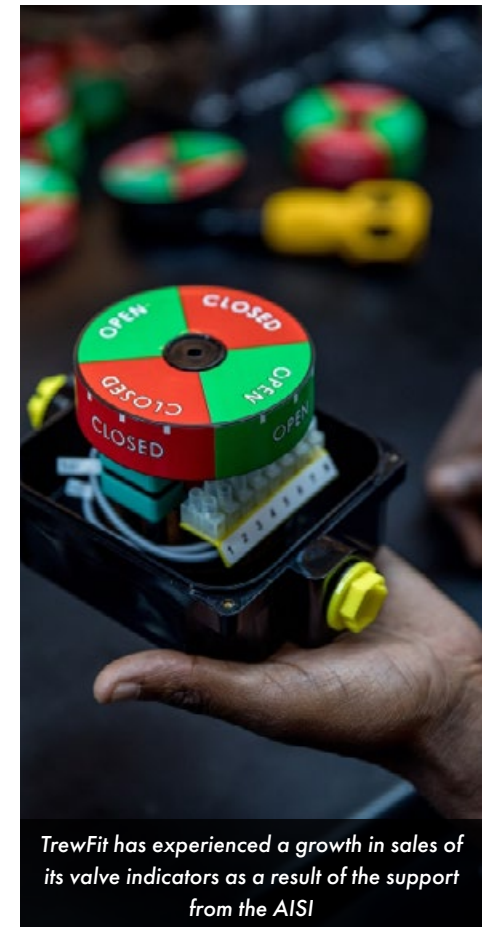
## IECEX AND ATEX CERTIFICATIONS EXPLAINED

Certification by the International Electrotechnical Commission for Explosive Atmospheres (IECEX) means that all products produced have undergone a monitoring process to ensure that they meet minimum safety requirements. This process will determine if the products can be used in hazardous or potentially explosive locations.

Being IECEX certified allows the products and equipment to be traded across countries without having to be re-tested and re-certified for every country. As different countries adhere to different safety standards, products from one country must be re-tested in another country to abide by its guidelines for use in hazardous areas. Therefore, IECEX acts as a common set of safety standards amongst participating countries certification which helps to reduce testing and certification costs for manufacturers. Participating countries in the IECEX Scheme include most countries in Europe, Canada, Australia, Russia, China, United States and South Africa.

The main difference between ATEX and IECEX is that ATEX certification only applies for countries in the EU while IECEX certification is accepted globally. Hence, the IECEX certification is more widely recognised and accepted compared to ATEX certification. Another key difference between ATEX and IECEX certifications is that ATEX is law-driven, while IECEX is standards-driven. The manufacturer is accountable for the entire ATEX certification process for products. On the other hand, the responsibility lies with the external certification party to ensure that the necessary products are IECEX certified.

Furthermore, ATEX certification can be based on an IECEX test report, but an ATEX documentation may not necessarily support an IECEX certificate. Therefore, it has become a common industry requirement for products to contain both ATEX and IECEX certificates.



**TrewFit has experienced a growth in sales of its valve indicators as a result of the support from the AISI**



**Precision in the production of products for the valve and automation industry is critical to safe working practices in hazardous environments**





# SECTOR-WIDE ACCREDITATION PROGRAMME: MARINE

*The AISI implements, oversees and contributes projects of national interest through this programme. This includes the development of the Commercial Aviation Industry Development Strategy, the hosting of the Joint Aerospace Steering Committee and contributing to the development of the Aerospace and Defence Masterplan, both at operational and strategic levels.*

BENEFICIARY NAME	PROJECT TITLE
Jokwa Marine	IACS Uwild certification
Symbytech	Argonót – Development of an Underwater UAV
HopYacht	Building Production Capacity for Export Sales
Sonhar Projects	Banksman, Slinger and Rigger Certifications
Surcotech	Thermal Spray Certification
Channel Marine and Trading	NDT Training and Certification
Carbontech	ABS approved carbon fibre pipe repair schemes
Prostar Paints	Implementation of ISO 17025 and Type Approval of Paint and Facilities
Ibis Manufacturing	Rubber Pilot Step Ladder Manufacturing Process
KND Design	High Density Polyethylene (HDPE) Boat Project
Rizik Link	IACS Welding Certifications

# CERTIFICATION IN UNDERWATER INSPECTIONS IN LIEU OF DRY-DOCKING BOOSTS OPPORTUNITIES FOR LOCAL MARITIME SUPPLIER

**Beneficiary**  
Jokwa Marine

**Project title**  
IACS Uwild certification

**Project market**  
Maritime Industry

**Project location**  
Western Cape

From its operations base situated in Saldanha Bay in the Western Cape, Jokwa Marine renders a range of commercial diving and marine support services that includes bunkering, shipbroking, vessel agency, tug and barge operations, ship-to-ship fuel and bulk cargo transfer, ship servicing, and relative maritime services.

The diverse experience of its managers and executive directors spans commercial diving, marine operations, health, safety and environment (HSE), information technology, and business management, making it a unique company of choice in Saldanha. Jokwa Marine is well-positioned to render its services nationally and to the rest of SADC and Economic Community of West African States (ECOWAS) Countries.

Large vessels are required to be inspected thoroughly every year, as well as have a secondary inspection every three or five years by a classification society to remain certified to be in operation. The goal of having certified vessels versus suspended or non-certified vessels is to protect owners, employees, insurers and the companies who depend on the ships getting to their destinations. These classification societies know that credibility is their main source of business and they have no commercial interest in any side of the shipping industry.

*“The hull of the ship is crucial to maintain to get the longest life cycle out of the ship, but it is a difficult process,” says Enrico Adams, CEO of Jokwa Marine. “In the past, dry-docking was performed to ensure thorough inspection of the hull, but the process is extremely time consuming and expensive to perform. Classification societies then began allowing Underwater Inspections in lieu of Dry Docking (UWILD).”*



*“With the support provided by the AISI, members of the Jokwa Marine team were able to undergo training and certification for UWILD inspections. Having achieved these certifications places Jokwa Marine in the position to offer UWILD inspections and therefore expands their already impressive service offering in the marine environment.” Enrico Adams, CEO Jokwa Marine*

During the UWILD inspection process, operators are looking for defects, scratches, discolourations, dents and any other imperfections. All information should be recorded in an underwater inspection report. A UWILD inspection will comprise a detailed review of the hull, paint, fouling, hatch covers, ports, anchors, propellers, blades, shafts, hubs, seals, stern bearings, rudder bearings, sea suctions and valves, as well as shell plating.

## DRY DOCKING EXPLAINED

Dry docking is a complicated, expensive, and time-consuming process. It involves taking the vessel to a designated facility, having it lifted from the water to allow access to the parts of the ship that are typically submerged underwater, and placed in the dry dock for maintenance, repairs, inspections, and other related activities. This process can range from a few days, to several weeks, or even months, depending on the scope of maintenance and repairs required.

Once out of the water, keel blocks are set into position, and lines are used to support the boat. This transition from the water to setting the vessel on the blocks is the most dangerous part of the process. If not supported properly, the vessel can tip, potentially causing extensive and costly damage, and even injury to workers.

Prior to dry docking, the ship must also be prepared by the crew, which involves removing equipment, cargo, and stores to reduce weight and ensure the safety of personnel and the ship during the process. Once maintenance and repairs are completed, the ship must go through testing and certification to ensure compliance with safety regulations and class society requirements. This can involve sea trials, testing of equipment, and certification checks.



# DEVELOPMENT OF UNDERWATER ROBOTIC VEHICLE FOR CLEANING OF SHIP HULLS APPROACHES TESTING PHASE

**Beneficiary**  
Symbytech

**Project title**  
Argonót – Development of an Underwater UAV

**Project market**  
Marine

**Project location**  
Western Cape

Biofouling is a significant problem for all vessel owners and operators. It increases the drag on a vessel that negatively impacts fuel consumption and places increased strain on the drive system. This results in higher operating costs and environmental impacts caused by the greenhouse gas emissions (GHG). What's more, invasive species transported on a vessel's hull increases the risk to our marine food security.

Symbytech is an innovative technology solution provider in the asset integrity sector and since 2018 has been designing a sustainable solution, known as Argonót.

***“Argonót is an unmanned robotic vehicle that is being developed to support the maritime industry in the reduction of invasive species distribution, reduction of GHG, improving on asset integrity, enabling the benefit of fuel savings and improved corporate responsibility in reaching the United Nations Sustainable Development Goals,” emphasises Grant Du Toit, Founder of Symbytech.***

The strategic nature of the project is to take a first-time technology for South Africa and turn it into a product that can be used in services for both national and international use. To enhance Argonót's technologies, SymbyTech partnered with various service providers in the areas of software development, mechanical and electronics engineering, as well as members in and out of the marine sector to test and trial Argonót.

“From day one, the main objective has been to develop a product that meets strict global standards (BIMCO / Glofouling / IMO) and attains the approval of the respective authorities such as the International Association of Classification Societies (IACS),” adds Du Toit.

The integration of electronics on the vehicle has seen extensive progress and has involved a combination of custom designed and off-the-shelf parts. Symbytech partnered with a company that supplies open-source software for the mechanical control system software.

Most of the mechanical work has been produced using aluminium and fittings are stainless steel. Metal sheet work has been produced through a combination of bending, as well as laser and high-pressured water cutting. A lathe has been used for any round or tubular work and enclosures have been produced with CNC milling.

Argonót's system electronics have been undertaken in collaboration with the University of Stellenbosch and several control boards have been created. The first of these comprises four channels for control purposes, the second is the power distribution unit that enables data gathering, and the third is the communications board that handles communications protocols and can cater for different logic levels.

Open-source software, that has been supplied by a US based company, has been integrated with Symbytech's own software development. This process is in its final stages, but an important win has been the successful joystick control. Once the prototype is ready for testing, it will first undergo a series of 'dry tests' before final wet testing that is subject to the availability of a suitable vessel.



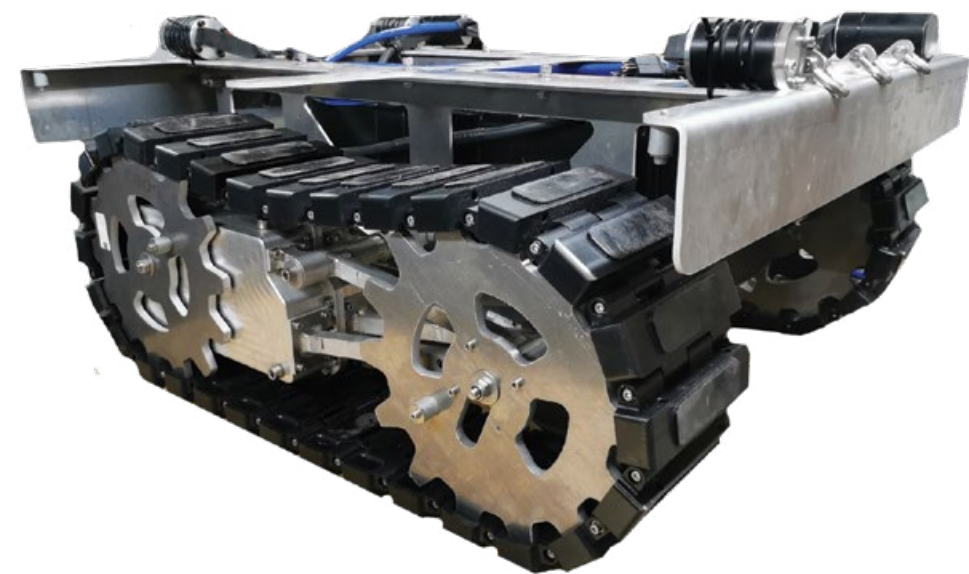
TECHNOLOGY  
DEVELOPMENT



EXPORT  
POTENTIAL



SKILLS  
DEVELOPMENT



***“Argonót will serve as a new competitor within the sectors it services and through the support provided by the AISI marine programme we have been able to focus on product development that will ultimately assist in providing access to local and international markets,” adds Du Toit.***

“The successful outcome of this project will further enable South Africa's maritime, renewable energy, shipping and oil & gas sectors through attracting a larger audience for services such as hull cleaning and underwater inspections providing a much-needed boost to economy and with the support that has been provided by the AISI, this is within reach,” concludes Du Toit.



# PRODUCTION UPGRADE FOR LOCALLY PRODUCED CATAMARANS TO BOOST EXPORT OPPORTUNITIES

**Beneficiary**  
HopYacht

**Project title**  
Building Production Capacity for Export Sales

**Project market**  
Marine Industry

**Project location**  
Western Cape

Whilst the growth in yacht sales has been steady for many years, the COVID 19 pandemic initiated a large spike in demand that has continued. There has also been an increase in demand for catamarans, due to the space and stability they offer. The traditional yacht builders have responded to this demand with larger catamaran designs.

However, research has revealed that there are no suitable yachts for couples with young children, which represent over 20% of the market. The HopYacht 30, manufactured by HopYacht (PTY) Ltd., is perfect for retired couples that need a comfortable, easy to sail catamaran that is all on one level. Currently, if a couple would like to purchase or charter a boat, they only have the options of larger vessels that are difficult to handle with just two people and cabin sizes are still small and cramped.

The HopYacht 30 is a unique catamaran. It is 100% electric, with no fossil fuels on board. The yacht is equipped with two 14,8 kWh lithium ferro phosphate batteries (from Balancell – a South African company), two E-Propulsion Evo 6 – 6.0 kW pod drives and four 400 W Sunpower Maxeon 3 solar panels harness energy from the sun to recharge the batteries.

This craft has just one sail, which makes sailing more accessible to less experienced sailors and just makes sailing easy. It can easily be sailed single handed and even the most experienced sailors see the benefit of having a boat that you can just board and sail. The twin electric motors make docking easy and since most sailors consider docking the most stressful part of a voyage, this is a significant advantage.

The greatest challenge identified is to ensure that production can keep up with demand and deliver the quality required on time and at the right cost. The priority is the outer hull moulds and the main aft cockpit moulds. Moving to production moulds for these elements will have the greatest impact on improving quality and build time. The existing inner hull moulds and smaller moulds will still be used and HopYacht will allocate a percentage of each sale towards the mould fund to replace these moulds within the next three years.

HopYacht partners with Cormorant Marine as their build partner for the HopYacht 30. The company employs 24 people, who would benefit from this upskilling opportunity.



AISI support contributed to the development of moulds for the outer hull on the HopYacht 30.



SKILLS  
DEVELOPMENT



EXPORT  
POTENTIAL



PRODUCTION  
ENHANCEMENT

The project is on track with the workplan fully completed, the initial design phase nearing completion and construction of the new moulds has commenced. The design phase has created the opportunity to not only improve the production quality of the moulds but also to make improvements to the overall design of the vessel.

The project involved taking accurate measurements off the vessels currently in production and comparing these to the initial technical drawings created for the prototype. During the project it was noted that the existing mould for the aft cockpit coach rood mould had deteriorated faster than expected so it was agreed that the production mould for this section would now be the first mould to be constructed rather than the external hull moulds. Construction of this mould has already commenced.

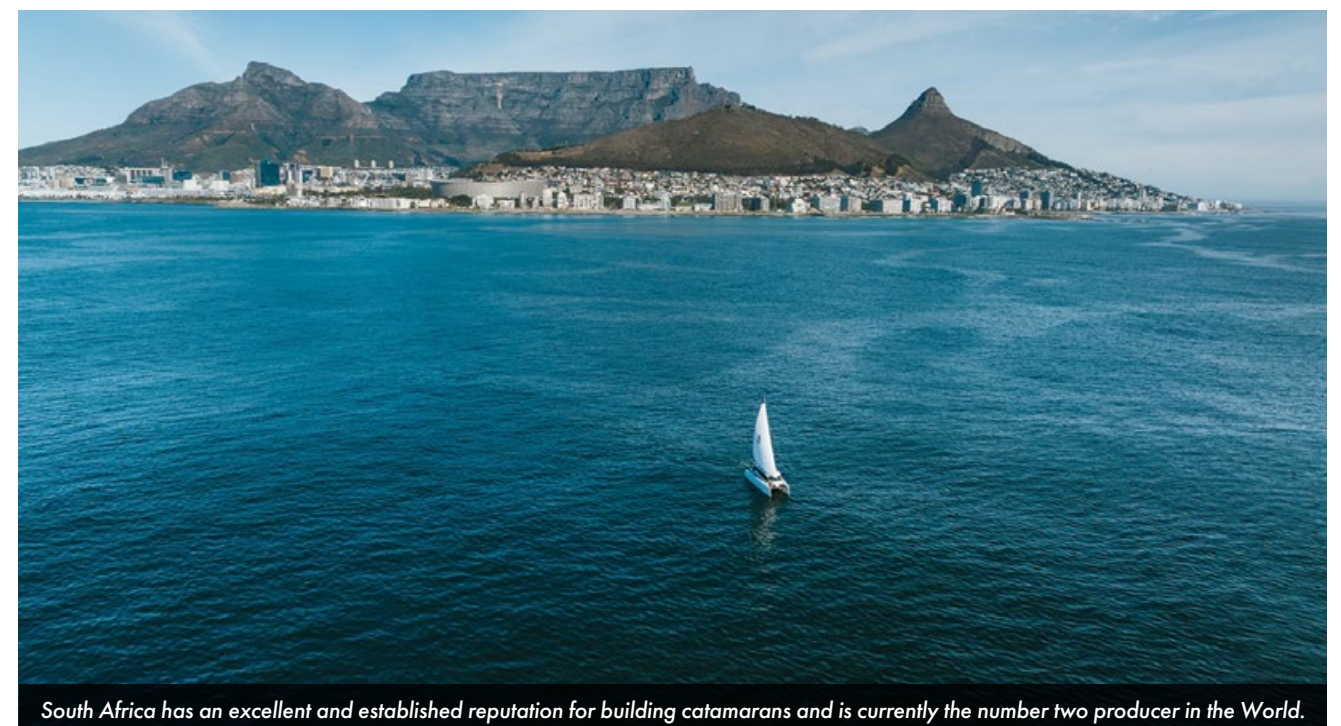
***“The project had a very positive impact on the team with new skills being developed and team members motivated to see that the new production moulds will enable them to focus on production improvement rather than spending so much time on repairs, emphasises Mary-Clare Tomes, Co-founder of HopYacht. “Overall it has lifted the professionalism and approach of everyone involved in the building of the HopYacht 30s.”***



Asenathi Sodinga

The AISI funding has allowed HopYacht's build partner, Cormorant Marine, to take on a full-time intern. Asenathi Sodinga has proved to be a great asset to the team and they hope to convert the internship to a full time position in the company. The creation of the position in the design intern has brought a new dynamic to the build team, with every measurement being tracked and recorded. The level of professionalism and pride in the quality of work being done has increased. From a management perspective, it is allowing for the streamlining of production processes as there is standardisation of all the elements of the vessel.

The aim of this project is to design and create a set of production moulds that ensures consistency and quality of the build process, reduces build time, and increases the number of HopYacht 30s that can be built each year. The project will minimise the finishing work required as each component is produced. Well-designed production moulds will speed up production by a minimum of three weeks shaved off the current 18 week build period.



South Africa has an excellent and established reputation for building catamarans and is currently the number two producer in the World.



# SLINGER AND RIGGER CERTIFICATION OPENS OPPORTUNITIES FOR LOCAL MARINE SERVICES SUPPLIER IN OIL AND GAS INDUSTRY

**Beneficiary**  
Sonhar Projects

**Project title**  
Banksman, Slinger and Rigger Certifications

**Project market**  
Marine

**Project location**  
Eastern Cape

Sonhar Projects, trading as Ocean Engineering, has been providing marine services to various shipping clients along the Eastern Cape shoreline for more than 18 years. Their tenure in this environment has earned them a good reputation and they have grown to become a well-known and respected name in the shipping industry.

The marine industry is changing rapidly and with this comes a requirement for upgraded service offerings, as well as specific certifications to meet the varying needs of clients. This has resulted in Ocean Engineering pursuing the following certifications: International Association of Classification Societies (IACS) approved welding procedures by Lloyds Register, LMI and LME certification by the Engineering Council of South Africa, Marine Engineering Diploma by Lloyds Maritime Academy, and Naval Architecture Diploma by Lloyds Maritime Academy.

**“We noticed a gap emerging in the market for Banksman/Slinger and Rigger qualifications as our Rigger certification did not meet the oil and gas industry safety standard requirements,” comments Duwyn Ferreira Mechanical Supervisor at Ocean Engineering. “We realised that securing the qualification would open a new market for Ocean Engineering in the oil and gas industry, as well as promote growth and employment.”**

Offshore Africa Training Centre (OATC), based in Cape Town, an accredited service provider in South Africa that offers Offshore Petroleum Industry Training Organisation (OPITO) courses delivered the Banksman/Slinger and Rigger training to four members of staff from Ocean Engineering. The course covers the principles of banking a crane using hand and radio signals, correct slinging of different types of loads, and safety precautions to be taken whilst working with cranes.

The course was a mix of theoretical and practical sessions, during which learners were required to demonstrate their level of knowledge and understanding of the training programme content.

The first step in the training process involves attendance at the training required and thereafter completion of an exam/test. This is followed by a series of requirements, involving a pre-determined number of lifts that must be recorded and documented in preparation for the next level of assessment that involves an exam. At the conclusion of the review period, the team from Ocean engineering had concluded the initial training and were involved in the next assessment phase.

The training is primarily aimed at riggers, but is also useful for supervisors who encounter lifting and handling problems during their day to day activities. The course is designed to alleviate everyday mechanical handling problems. At the end of this course, the personnel can perform and conduct safe rigging and slinging activities and understand the safety requirements of the industry.

In 2023, South Africa’s oil and gas industry was valued at and estimated USD 8.2 billion. The marine haulage aspect of the industry offers massive potential for local suppliers with the requisite and accredited skills and knowledge.



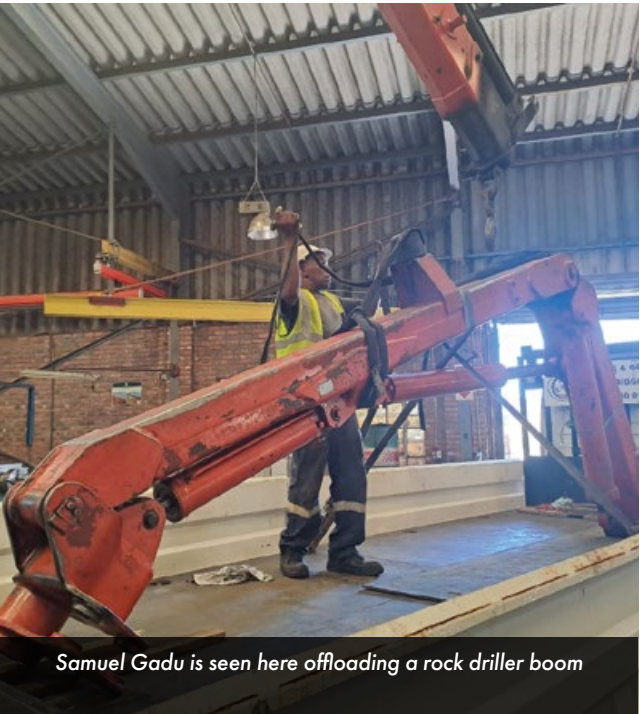
STANDARDS AND ACCREDITATION



SKILLS DEVELOPMENT



OPPORTUNITY IN OIL AND GAS



Samuel Gadu is seen here offloading a rock driller boom



Sinethemba Royi involved in dredging pump repairs



After completion of the first step of the banksman/slinger and rigger certification, learners are required to complete a series of predetermined tasks before writing an exam



**“By being able to deliver knowledge and develop competence of rigging principles, hazards and risks, whilst also providing the opportunity to develop required skills for rigging and slinging, we are making a positive contribution to South African marine companies operating both locally and internationally,” concludes Ferreira.**



## IACS CERTIFICATION FOR THERMAL SPRAYING IN MARINE ENVIRONMENT TO GROW COMPANY AND BOOST OFFERING

**Beneficiary**  
Surcotec

**Project title**  
Thermal Spray Certification

**Project market**  
Marine

**Project location**  
Western Cape



*Thermal spraying refers to a process that applies a coating – most often a metal alloy, carbide or ceramic (that may vary in thickness) onto a substrate through the projection of a molten stream of the material. Invented in the early 1900s, thermal spraying was a very simple process and generally used to perform very basic mechanical repairs. Over the last century, the technology has undergone rapid growth and development, and today, thermal spraying has become a very powerful tool, finding a wide range of applications in virtually every industry.*

Surcotec is an engineering company situated in South Africa's Western Cape Province that provides customers with thermal spray coatings, specialised welding services and coatings for specific applications.

Since its establishment in 2000, the company has offered extensive maintenance and repair on industrial components that have been damaged by wear and corrosion, and that can be repaired through either thermal spraying or plasma transferred arc cladding. Thermal sprayed coatings deliver some of the most cost-effective options to restore components and extend the life of components.

With support provided by the AISI, Surcotec has been capacitated to develop thermal metal spray procedure qualifications in line with the requirements as stipulated by the International Association of Classification Societies (IACS).

IACS is dedicated to safe ships and clean seas and makes a unique contribution to maritime safety and regulation through technical support, compliance verification and research and development. More than 90% of the world's cargo carrying tonnage is covered by the classification design, construction and through-life compliance rules and standards set by IACS.

Their goal is to secure marine industry class approval and to become a verified Mode II workshop and once approved, will have access to a much wider group of marine clients including international vessels. Increased business will increase the workload and therefore create more jobs and also allow Surcotec to obtain the latest thermal spraying technologies.

The potential impact of growth on employees will be realised with staff having access to training opportunities that were out of reach before the intervention. It will also allow for growth in the company that could lead to certain employees taking up more senior positions.

**IACS** International Association of Classification Societies

## CERTIFICATION IN NON-DESTRUCTIVE TESTING BOOSTS PRODUCTIVITY OF MARINE-BASED SERVICE PROVIDER

**Beneficiary**  
Channel Marine and Trading

**Project title**  
NDT Training and Certification

**Project market**  
Marine

**Project location**  
Kwa-Zulu Natal

Channel Marine and Trading (Pty) Ltd is a Durban based company that specialises in multi-disciplinary engineering and construction projects and processes. It provides marine repairs and maintenance, artisan skills training and assessment, as well as fabrication and maintenance solutions to its customers.

The AISI provided support for five employees to undergo non-destructive testing (NDT) training and certification to meet the requirements of ISO 9712.

NDT refers to the testing of material and components without inhibiting its further usefulness. Applied scientific principles such as electromagnetic induction, magnetism, capillary action, mechanical vibration, and electromagnetic waves are utilised to identify and characterise discontinuities within tested samples or areas of interest.

Crian Dickson, Managing Director for Channel Marine and Trading, explains the importance of NDT training and certification: "The ISO 9712 accredited technicians are capacitated to verify the quality of our welds internally prior to a third party NDT company carrying out any official testing that, according to the relevant construction codes, must conduct final tests."

"This approach of carrying out our own NDT prior to the third party testing has reduced standing time of production staff as we are able to rectify any weld discontinuities that may be encountered during our internal test. We have noticed that the level of quality has increased, as there are more employees on the floor that understand the fundamentals and requirements of inspection and testing."

"We employed the services of an outsourced Technical/Quality assurance/Quality control Manager who played an extremely important and valuable role in guiding young school leavers through a steep learning curve to PCN Bindt International certification level," adds Dickson. "The learners were put through their paces on a few vessels and learned a great deal on the different fields of NDT."

Channel Marine and Trading's short term goal is to grow the company and sustain its existence. In the long term, they aim to make an impact on the marine economy and establish themselves as a leading supplier of ship repairs and building, as well as general engineering and training needs in the marine space.

"With the funding support we have received from the AISI, we have not only been able to boost Channel Marine and Trading's position in the marine environment, but we have also been able to capacitate young people with skills and knowledge that will serve them well in the future," concludes Dickson.



*Ultrasonic Thickness Measurement (UTM) performed on suspected corroded areas of hull ensuring that the minimum thickness of the material has not been reached*

**IACS** International Association of Classification Societies



## COMPOSITE REPAIR SOLUTIONS FOR LEAK REPAIR, PIPE ENCAPSULATION, CONTAINMENT AND REINFORCEMENT ON RANGE OF COMPLEX CURVED SURFACES

**Beneficiary**  
Carbontech

**Project title**  
ABS Composite Repair Type Approval

**Project market**  
Marine

**Project location**  
Gauteng

Through combining chemistry, engineering and global expertise, Carbontech provides a range of advanced composite technologies for the emergency repair of critical assets.

The qualified engineers employed by Carbontech possess extensive knowledge and experience in composite rehabilitation systems. Their products are designed and engineered to restore pipeline systems to their original design parameters and allows for the piping systems to operate at maximum allowable operating pressure without the need to shut down the plant, unit, or system. Their range of composite repair solutions provide leak repair, pipe encapsulation, and the containment and reinforcement of both flat, irregular, and complex curved surfaces.

A composite wrap is more than just a high-tech product. It is a complete pipe repair and structural reinforcement solution for companies in the oil and gas, petrochemical, chemical, transmission pipelines and potable water industries.

With their eyes set firmly on the marine industry, Carbontech approached the AISI for support to secure the required certification in the highly-regulated marine environment. Clients in the marine industry specify either DNV, ABS, Lloyds or BV certification.

**The goal of this project is to meet all the requirements of the American Bureau of Shipping (ABS) certification of carbon fibre repairs for five products. The Revowrap 185, Revowrap 110, and Revowrap 80 with carbon fabric, as well as Revowrap 80 with glass fabric and leak arresting Spitze HP Clamp all form part of the scope of certification to allow Carbontech to perform these repairs in the marine industry where the ABS certification is recognised.**

Applications where these repairs can be used include internal corrosion, external corrosion, mechanical damage, and weld anomalies.

"We are currently still in the certification stage, after which the product can be utilised for offshore installations and rehabilitation. This will then afford us the opportunity to secure and generate revenues from the marine industry directly to drive increased product usage and funding to appoint personnel for internships for our composite resins in our designated laboratory," concludes Coumbias.



## IMPLEMENTATION PROCESS OF KEY CERTIFICATION AND APPROVALS BY LOCAL MANUFACTURER OF ANTI-FOULING MARINE PAINT

**Beneficiary**  
Prostar Paints

**Project title**  
Prostar Paints Type approval and Mode II approval for anti-fouling paint

**Project market**  
Marine

**Project location**  
Kwa-Zulu Natal

Prostar Paints is a major manufacturer of paint products with operations in Durban, Cape Town, Johannesburg and the port of Richards Bay supplying the Southern and East African market. Prostar's commitment to environmentally friendly products and quality integrity have been at the heart of their success.

Their ongoing commitment to continually evolve, manoeuvre and set industry highs for quality, performance and value is dependent on being responsive to changing technologies. To improve their products and streamline their processes, they approached the AISI for support to secure certification.

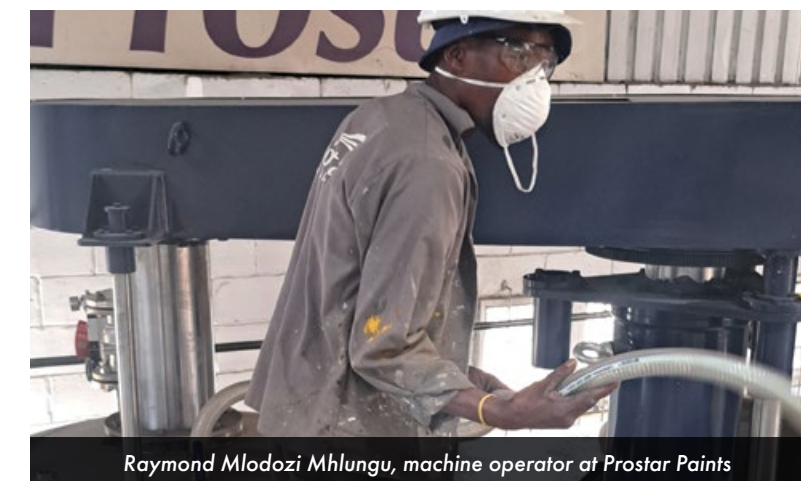
Prostar Paints sought support from two certifications namely for 1) ISO 17025 certification and 2) IACS certification of their anti-fouling paint. ISO 17025 certification allows them to operate as a laboratory and perform rigorous and documented quality testing on their paints.

This certification was started by updating their procedures, by training staff to follow the procedures, correct storage of documents ,etc. This project is temporarily delayed as the ISO 17025 standard prescribes testing and laboratory equipment to be available at Prostar Paints and they are in the process of acquiring these high value items from Germany.

Certification of marine certified paints requires both for the paint itself to be certified (Type Approval) but the production or manufacturing facility also needs to prove that the paint supplied is consistently of the required quality and specifications (Mode II approval). Both certifications need to be performed by a class society and in this case it was performed by Bureau Veritas (BV).

Type approval entails checking the content of the paints and having it tested by a certified, independent Laboratory. This process needs to be audited, witnessed and signed off by BV. The test results are also sent to the BV Paris office for verification. International standards dictate that harmful chemicals are not allowed to be used during the manufacture of the paints and this is just one of the aspects that is scrutinised during the type approval process.

The Mode II certification ensures that each batch of paint that is manufactured is at the required standard and specification. In addition, all aspects of the production process are documented and traceable. This certification too was audited by BV. The above two certifications now ensures that the Prostar Paints certified anti-fouling OceanStar paints can be supplied to marine customers that are themselves bound by very specific requirements.



Raymond Mlodozi Mhlungu, machine operator at Prostar Paints





# DESIGN AND DEVELOPMENT OF PILOT RUBBER LADDER FOR LOCAL AND INTERNATIONAL MARINE CUSTOMERS

**Beneficiary**  
IBIS Manufacturing

**Project title**  
Rubber Pilot Step Ladder Manufacturing Process

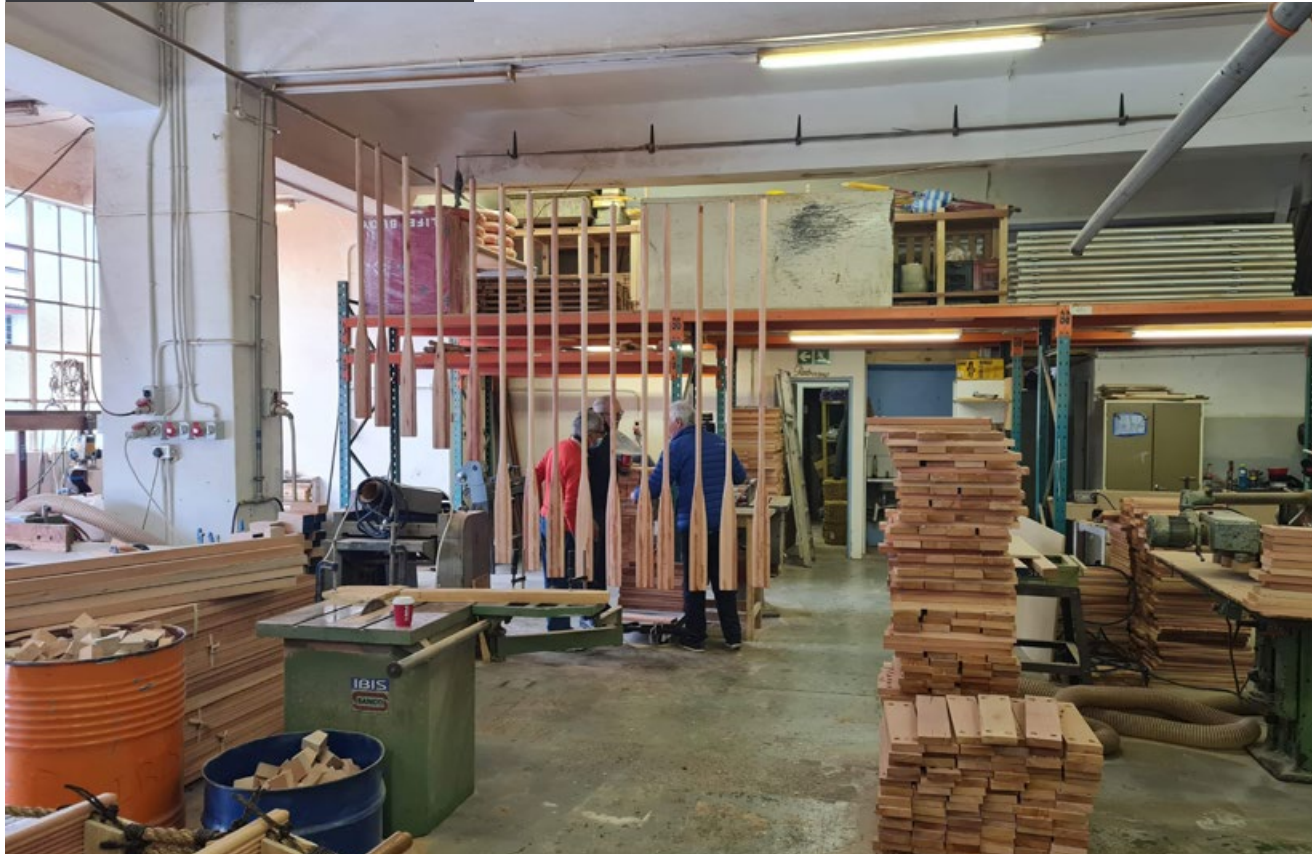
**Project market**  
Marine

**Project location**  
Western Cape

From its factory in Woodstock, Cape Town, IBIS Manufacturing produces a range of marine safety products and one of the highest value products in their product offering is their marine pilot ladders. IBIS has developed a cost-effective manufacturing method and highly functional product that has resulted in a reputation for quality over the past few years in the local marine market.

The goals of the project for which IBIS sought support from the AISI include taking a developed product through the industrialisation process to address the barriers to entry of the export market; aligning the already developed product with international product expectations; and to unlock unforeseen and indirect value from the development of this product.

*The result was the development of the IBIS Sure Step that uses a composite material development approach, where a key component is used rubber tyres. In addition, the project focused on developing a more time efficient approach in the production of pilot ladders.*



From its factory in Woodstock, Cape Town, IBIS Manufacturing has established a reputation for the production of quality products for use in the marine industry.



TECHNOLOGY  
DEVELOPMENT



NEW  
MANUFACTURING  
PROCESS



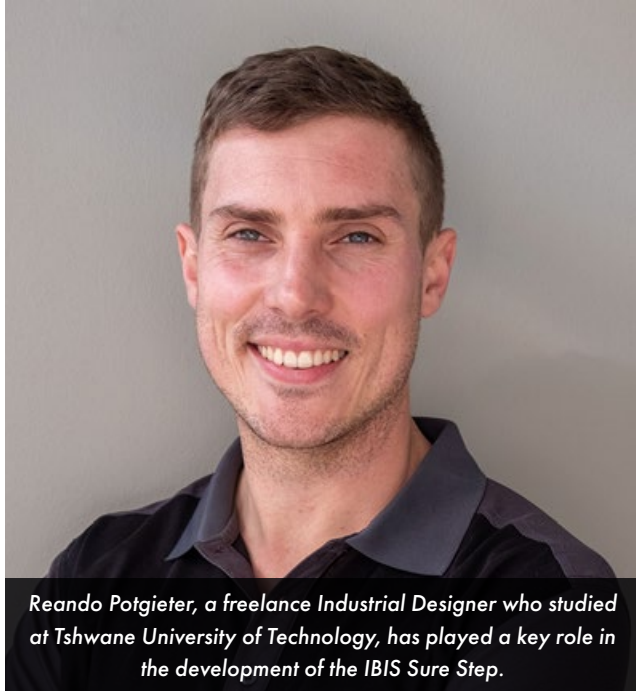
EXPORT  
POTENTIAL

The key challenges that exist in unlocking export markets have been key factors in the design of the IBIS Sure Step. The first of these is production volume/output to supply local and international markets. However, production processes of the newly developed IBIS Sure Step will enable a good market footprint in the marine pilot ladder market locally and internationally.

The prohibitive product weight and dimensions of its predecessor have been addressed and the IBIS Sure Step weighs less than half and is comparable in dry-weight to the existing hardwood treads. As wooden steps get used onboard vessels the wood naturally absorbs moisture making it heavier, whereas the rubber and glass fibre used in the Sure Step won't.

The Sure Step addresses the haphazard and expensive wood supply issue in South Africa by being able to make all the steps with recycled car tyres. Component shipping is also made easy as the treads are an all-in-one casting, which means there is no need to ship the treads and poppets individually. The use of manila rope is a must as it is a durable, yet biodegradable. The import price on manila ropes can be cut by up to 70% if IBIS has the capital and production volume to import the rope directly.

To produce the earmarked quantity of 3000 units per month IBIS needs to produce 142 steps a day. This goal raises three important questions. What is the minimum mould cycle time? (60min). How many moulds do we need? (3-6 moulds on a 24h shift to produce 142 steps a day). How will the raw materials affect mould cycle time? (Further development on the moulding resin is under way to shorten the mould cycle time. The goal is to reduce the cycle time by 50% as the product and production matures)



Reando Potgieter, a freelance Industrial Designer who studied at Tshwane University of Technology, has played a key role in the development of the IBIS Sure Step.

According to Reando Potgieter from IBIS Manufacturing: "The product weight was reduced by more than half from the original product and is now comparable to wooden treads. The demoulding time was improved by around 50% from 8 min to 4 min and the cost to produce the product, is comparable, if not cheaper, than the cost to produce the wooden product." The Sure Step still needs to undergo Bureau Veritas certification to be sold internationally. In addition, high volume production runs need to be achieved to optimise cycle time and the import of glass fibre mesh and manila rope needs to be internalised within IBIS to cut production costs.

*"The casting process of this product is labour intensive in nature, as is the finishing and assembly of the pilot ladders and with an export production target of 3000 units per month, an estimated 30 - 50 new jobs will be created," adds Potgieter. "Without the AISI support, IBIS would never have been able to industrialise the original product concept and it has resulted in a product that holds good underlying economics, which in turn should result in increased export ability."*



Whilst conventional pilot ladders make use of the tread and four poppets as separate components, a simplified assembly process has been developed that means the Sure Step is integrated into one single component. The product is also designed to make use of aluminium crimps for tying the treads in place as opposed to older ladders that would be tied together using twine.



# DESIGN OF HDPE BOAT PLATFORM THAT PRIORITISES SAFETY AND RELIABILITY

**Beneficiary**  
KND Design

**Project title**  
High Density Polyethylene (HDPE) Boat Project

**Project market**  
Marine

**Project location**  
Western Cape

KND Naval Design is a naval architectural practice based in Cape Town. The company was founded in 1984 and their prime focus was to become a world-class research and development facility, both locally and internationally. Having successfully achieved this, it continues to be a driving force in the business.

The company approached AISI to support the development of a boat platform using high density polyethylene (HDPE) that prioritises safety and reliability.

According to Kobus Potgieter, CEO for KND: "Whilst the primary objective of the project is to design an HDPE boat platform that prioritises safety and reliability, the boat design will incorporate features and structural elements to ensure stability, buoyancy, and resistance to harsh weather conditions."

Boats are used for transportation and fishing activities in many African communities. This requires craft able to manage load capacity, maneuverability, fuel efficiency and ease of operation. Equally important is the need for maintenance-free operation and resistance to corrosion, rot, and marine growth.

**"Although certification is excluded from this application, the objective of the project at a later stage is to ensure that the HDPE boat design meets international safety and regulatory standards," adds Potgieter "as the boat will undergo rigorous testing and examination to achieve certification and therefore validating its compliance with industry standards in due course."**

The project aims to promote sustainability by leveraging the recyclability of HDPE material. This includes consideration for the entire lifecycle of the boat, from manufacturing to eventual decommissioning and recycling. Skills transfer and empowerment of local manufacturers are important objective of the project to facilitate the growth of local industries by providing training and support in boat manufacturing techniques. This empowerment will foster economic development and create employment opportunities within the region.

At the conclusion of the review period, the HDPE boat project had successfully navigated through its construction design phase with significant milestones achieved. This involved intricate processes such as creating CNC toolpaths, generating all necessary assembly construction drawings, compiling a welding schedule drawing, and assembling the technical construction file required to meet Conformité Européenne requirements.

"The successful completion of these objectives marks a critical step in the project's progression, indicating a thorough approach to the design and preparatory work necessary for the actual construction of the boat," concludes Potgieter.



A CE mark is a symbol that must be affixed to many products before they can be sold on the European market. The mark indicates that a product:

- Fulfills the requirements of relevant European product directives
- Meets all the requirements of the relevant recognised European harmonised performance and safety standards
- Is fit for its purpose and will not endanger lives or property



TECHNOLOGY DEVELOPMENT



SKILLS TRANSFER



EXPORT POTENTIAL

## BENEFITS OF HDPE IN A MARINE ENVIRONMENT



## THE NAVAL DESIGN SPIRAL PROCESS

The design spiral process used in naval architecture is a methodical approach to ship design that iteratively refines and improves the vessel's design through various stages.



### Concept Phase

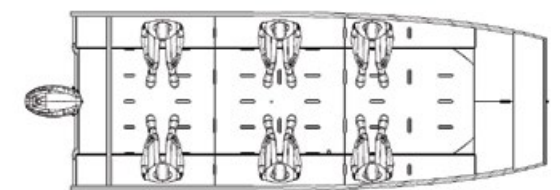
- Idea Generation
- Feasibility Study
- Concept Design

### Preliminary Design Phase

- Detailed Design Development
- Design Analysis and Optimisation
- Regulatory Compliance Check

### Construction Phase

- Final Design and Specifications
- Construction
- Trials and Delivery



# IACS WELDING CERTIFICATION TO BOOST OFFERING TO MARINE MARKET



**Beneficiary**  
Rizik Link

**Project title**  
IACS Welding Certification

**Project market**  
Marine

**Project location**  
Western Cape

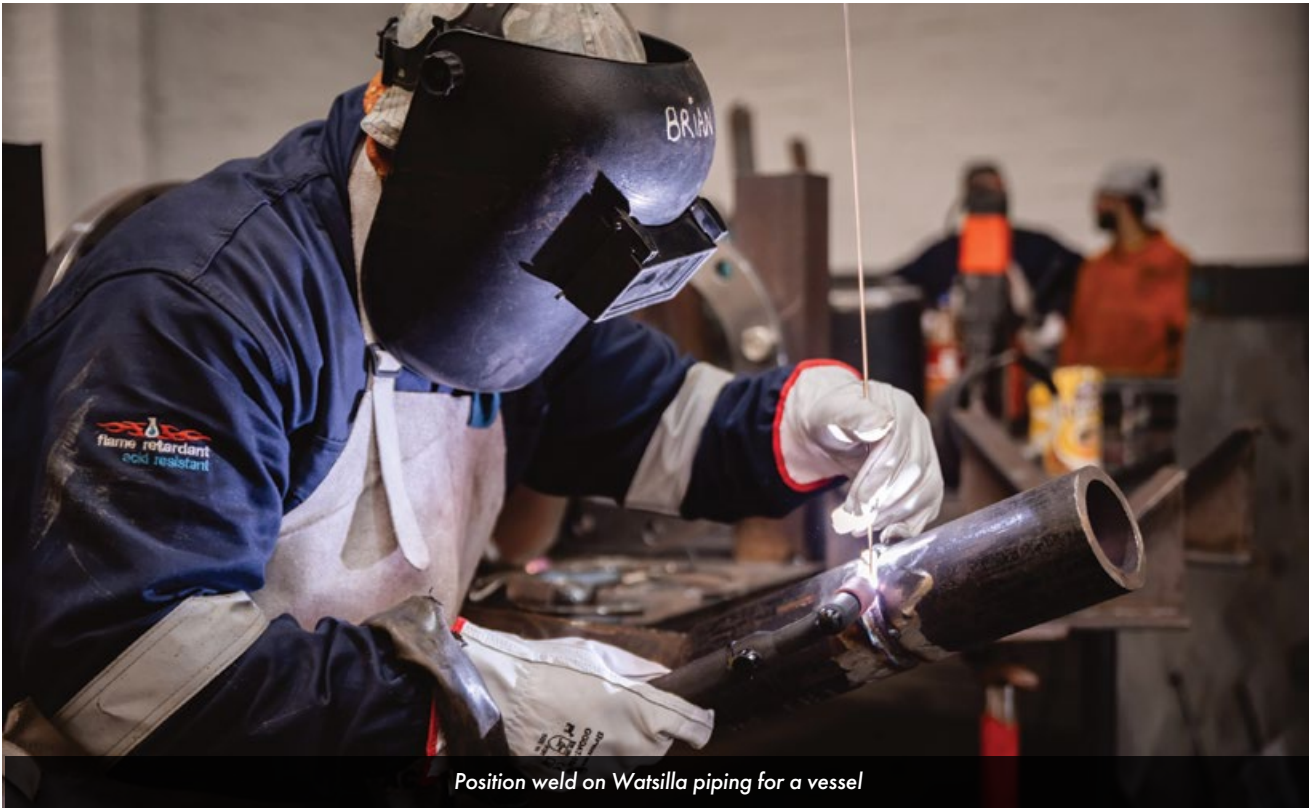
The International Association of Classification Societies (IACS) is dedicated to safe ships and clean seas. The organisation makes a unique contribution to maritime safety and regulation through technical support, compliance verification and research and development. More than 90% of the world’s cargo carrying tonnage is covered by the classification design, construction and through-life compliance rules and standards set by the eleven Member Societies of IACS.

*During the review period, the AISI supported Rizik Link, a maritime and general engineering company that is proficient in specialised welding services, steel fabrication and piping, to gain IACS Welding Certification.*

» THE CERTIFICATION PROCESS INVOLVED THE FOLLOWING KEY STEPS:

- Development of welding procedure specification, procedure qualification record and welder performance qualification documentation by welding engineer
- Review of all documentation
- Procurement of requisite material and welding machines
- Pre-test skills assessment
- Attendance at workshop for review of test coupons and material certification, consumables and consumable certification, welding machine set up and positive identification of welders.
- Supervision and witness of welding of test coupon/s for PQR’s.
- Presentation of familiarisation session to welding supervisors regarding IACS 47, IACSW28, IACS W32 and BV class requirements for ship building and repair
- Visual inspection of completed test coupons prior to destructive / non-destructive testing
- Radiography and non-destructive testing
- Attendance at laboratory for witness of required test coupon destructive and/or non-destructive tests.
- Endorsement of WPS and PQR documentation.
- Collation of final documentation and issue.

*All planned work went off very well and was done as per schedule. On completion of the welding, the plates were visually inspected and handed over for MPI testing and thereafter delivered to RITC in Cape Town for radiography. After passing all radiography successfully, the test plates were couriered to VML*



Position weld on Watsilla piping for a vessel

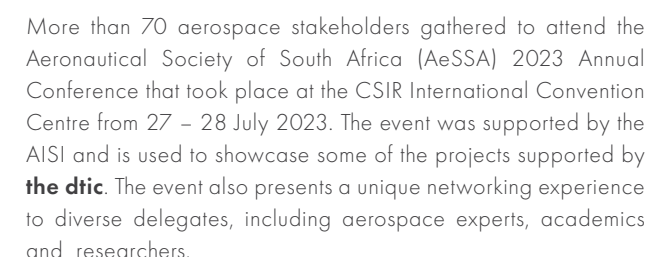


Members of the Rizik Link workforce who have benefited from the certification as a result of skills development





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Preceding the event, AeSSA hosted a Young Professional Network (YPN) event on Wednesday, 26 July 2023. The event gave the youth an opportunity to connect and share their academic experiences in relation to the aerospace industry. A session on personal mastery, presented by the Mindspa Institute provided young professionals with knowledge on how to develop a reputable professional brand.

The two-day conference offered delegates the opportunity to learn from fellow innovators and network with industry stakeholders, where all participants contributed to the discussion on aerospace

innovation and its growth on the continent. Presenters outlined advances, trends, academic research, challenges and solutions that can, for example, combat crime or gather data for precision agriculture and other aerospace applications. Some of the topics covered included application of additive manufacturing in aerospace components, small gas turbines for propulsion, sounding rocket developments as well as material and surface treatment processes.

An article about a near-vibrationless engine project written by the On-Track Technologies team was featured on the Engineering News website on 25 August and was also published on the Defence Web on 29 November 2023. These articles highlighted the impact made by young professionals on projects Supported by the AISI.

<https://www.defenceweb.co.za/aerospace/aerospace-aerospace/aisi-provides-opportunities-for-young-engineers/>

<https://www.engineeringnews.co.za/article/utilization-and-development-of-youth-in-ontrack-technologies-aisi-supported-projects-2023-08-25>

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**Aerospace Industry Support Initiative**

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