IMPACT REPORT

Aerospace Industry Support Initiative

2013/2014

AISI

Aerospace Industry Support Initiative

an initiative of the dti

the dti
Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

An initiative of the Department of Trade and Industry, managed and hosted by the CSIR


GLOBAL

AISI Vision

To position the South African aerospace and defence-related industry as a global leader, in niche areas, whilst ensuring effective interdepartmental participation and collaboration.

AISI Mission

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

- Developing relevant industry-focused human resources and facilitate associated R&D and transfer of technology to industry;
- Providing a platform for facilitating partnerships and collaboration amongst government, industry and academia, locally and internationally;
- Identifying, developing, supporting and promoting the interests and capabilities of the South African Aerospace and Defence Industry;
- Accelerating the achievement of government strategic objectives, including growth, employment and equity.

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Executive Impact Summary

The Integrated **dti** Aerospace Programme (IDAP) is the optimised aerospace industry support mechanism of the Department of Trade and Industry **(the dti)**. IDAP consists of two aerospace initiatives, namely the Aerospace Industry Support Initiative (AISI) and the National Aerospace Centre (NAC).

IDAP aims to improve the competitiveness of the local aerospace and defence industry through focused programmes and interventions in two integrated themes, namely the 'Industrialisation theme' and the 'Skills Development theme'. The CSIR hosts and manages the AISI, which is responsible for the industrialisation theme of IDAP. It utilises its national expertise and infrastructure to benefit local industry. The University of the Witwatersrand hosts and manages the NAC.

IDAP Value Proposition

The value proposition of IDAP in relation to additional players in the aerospace sector is illustrated in Figure 1. IDAP assists industry in the commercialisation of technologies and products. Through this, IDAP assists industry to verify that technologies and products are technically feasible and thus commercially viable.

The diagram below gives an indication of the national infrastructure and expertise IDAP utilises to benefit the local industry. It utilises its national expertise and infrastructure to benefit local industry.

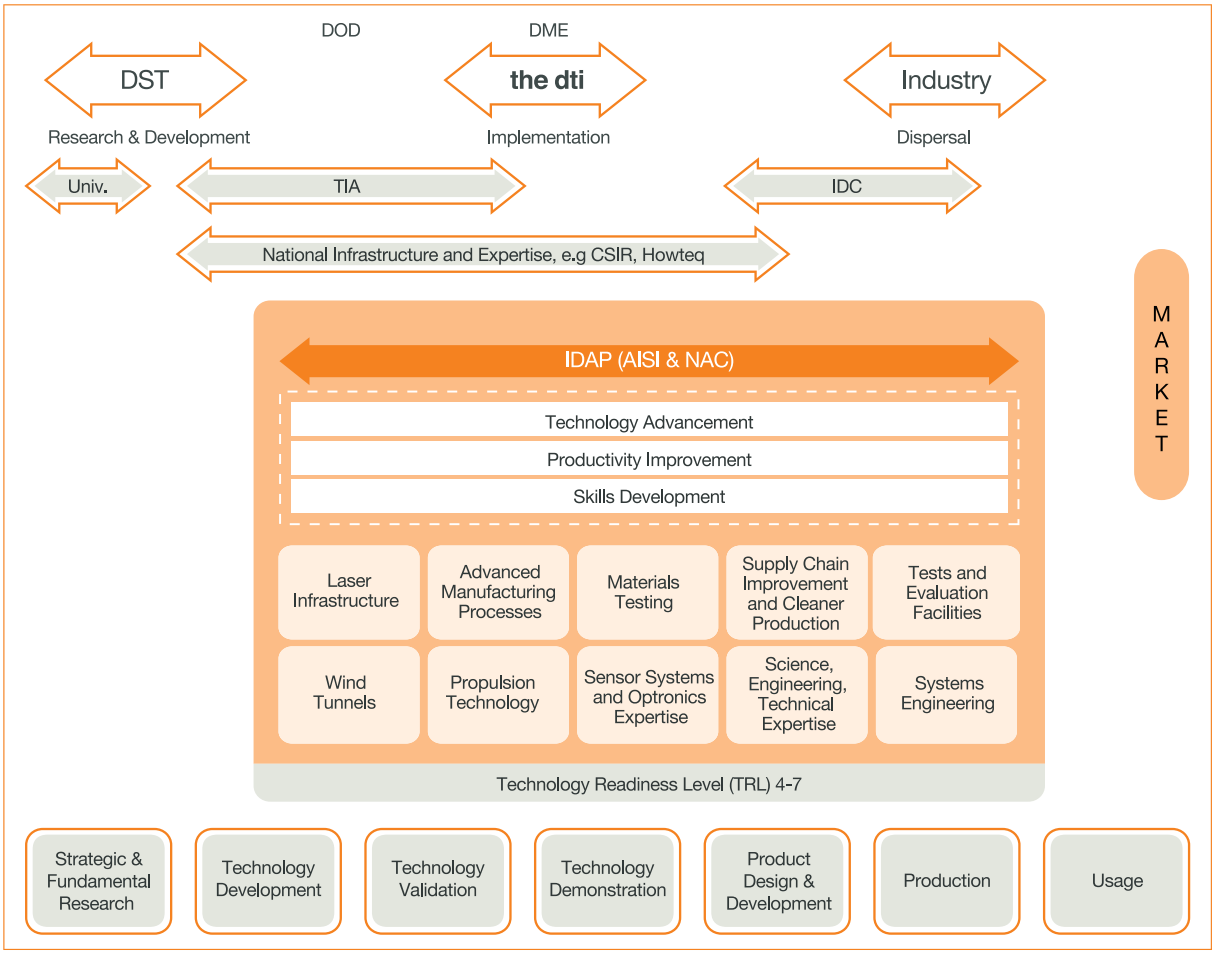


Figure 1: IDAP Value Proposition

The remainder of this document is focused on the AISI fulfilling its mandate mainly under the industrialisation theme of IDAP.

The AISI achieves impact in industry through focused programme-level interventions benefiting industry. The programmes are designed to assist industry in overcoming challenges faced by industry, and in doing so, ensuring that industry becomes more competitive. The programmes aim to improve the industrialisation processes and introduce technologies into industry, which will ultimately add to its overall competitiveness. This will result in the participation of industry players in the industry, which under normal circumstances would not have been able to participate in the aerospace economy.

Underlying all of the AISI's programmes is the recognition that SMME development and B-BBEE/transformation-focused projects, aiming for the industrialisation of technologies, are a prerequisite for the programmes to be successful in supporting the national imperatives.

The AISI will therefore ensure that there is a proactive cross-cutting approach to support SMME development and B-BBEE/transformation promotion across its programmes, with the aim of supporting the industrialisation of technology to improve the competitiveness of the local industry.

The AISI's six operating programmes during 2013/2014 were:

1. Industry Development and Technology Support
2. Sector Strategic Support Initiatives
3. Supplier Development
4. Industry Focused Skills Development
5. Special Projects
6. Coordination, Promotion and Awareness

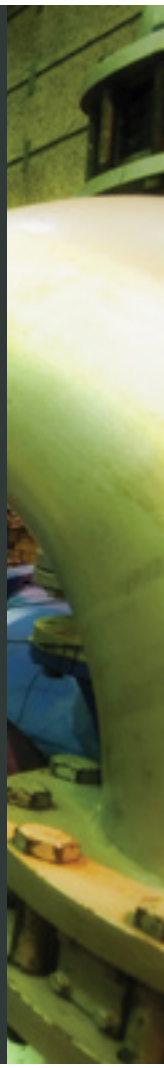
[1]

R12,5 million Industry Support Investment

24 Number of Projects Undertaken

[2] **100** Number of organisations benefiting from AISI projects

49 Number of SMMEs benefiting from AISI projects



1 Impact information derived from data submitted by benefiting organisations

2 Numbers based on organisations benefiting from AISI support; some organisations have been supported for more than one project

Summary of Organisations Benefiting from AISI Support

The below maps the geographic location of organisations benefiting from the AISI's value offering.

Organisation Name	Location
Adept Airmotive	
Advanced Material Technology	
Aerospace Maritime and Defence Association	
Aerosud	
Aerotechnic	
Agricultural Research Council	
Albetron Precision Engineering	
ANDT Centre	
Applied Services	
Aquajet Profiles	
Avex	
Bohler Thyssen Welding SA	
Cape Aerospace Technologies	
Cape Peninsula University of Technology	
Cassidian Optronics SA	
City of Joburg	
Cliff'sway Engineering	
CMI	
Collaborative Xchange	
Commercial Aviation Association of South Africa	
Competition Commission of South Africa	
Compumach Engineering	
Contactserve	
CSIR	
Daliff Precision Engineering	
Denel Aerostructures	
Denel Aviation	
Denel Dynamics	
Department of Defence	
Department of International Relations and Cooperation	
Department of Public Enterprises	
Department of Science and Technology	
Department of Trade and Industry	
Department of Transport	
DK Mokoena Attorneys	
EezeeCAD	
EliteTech UPVC Windows	
Eskom	
Gofer Engineering	
Heliocentric Technologies ZA	
Heyns Laboratories	
HFB Engineering	

Organisation Name	Location
Independent Communications Authority of South Africa	
Industrial Development Corporation	
ISCAR South Africa	
iThemba LABS	
Jack Pack Trading	
Knowles Husain Lindsay Attorneys	
M Square Precision Manufacturing	
Maizey	
MARCOM Aeronautics and Space	
Megapack	
National Treasury	
Nelson Mandela Metropolitan University	
NJR Steel	
Northern Bolt and Tool	
Paramount Advanced Technologies	
PPG Coatings South Africa	
Revolavia	
Rheinmetall Denel Munition	
Rosslyn Sandblasting and Engineering	
Rost Precision Engineering	
SAAB Grintek Defence	
Safety First	
Safomar Industrial Brands	
Simera Technology Group	
Sondor Industries	
South African Civic Aviation Authority	
South African National Space Agency	
Stellenbosch University	
Stemela and Lubbe Inc.	
Technology Innovation Agency	
Tellumat	
Tiffy Safety	
TI-TaMed	
Tony Beverley Agencies	
TP Agencies	
University of Cape Town	
University of Pretoria	
University of South Africa	
University of the Witwatersrand	
Vestcast	
Wesco	
West Engineering	

According to the Aerospace Sector Development Plan (ASDP), the aerospace market segmentation is intended to serve as a reference framework and is aligned with international market data available. The model is well suited to graphically represent and interpret the local spending patterns and focus areas. It is designed to address three common sector perspectives, namely:

- Military and civil aerospace
- Aerospace product-centric view of the sector
- Technology stream-centric view of the sector

Utilising the market segmentation framework of the ASDP, the AISI investments in strategic sectors, as defined in the ASDP, are mapped in the diagram below. As a result of the AISI being an initiative of **the dti**, and **the dti's** role in creating a fair regulatory environment for South African industry, an additional technology stream has been added, namely 'Policy and Strategy'.

According to the ASDP, South Africa has one significant product stream, namely aeronautics services. AISI investment over the past financial period reflects this capability with noteworthy investment in this product stream. AISI investments in industry are defined in three categories:

- Technology Advancement Support: This entails industrialisation support to industry
- Competitiveness Improvement Support: This is achieved through interventions that improve the efficiency and effectiveness of the local industry
- AISI Organisational Support: Through the creation of enabling mechanisms, the AISI assisted industry through the creation of platforms to improve its operating environment.

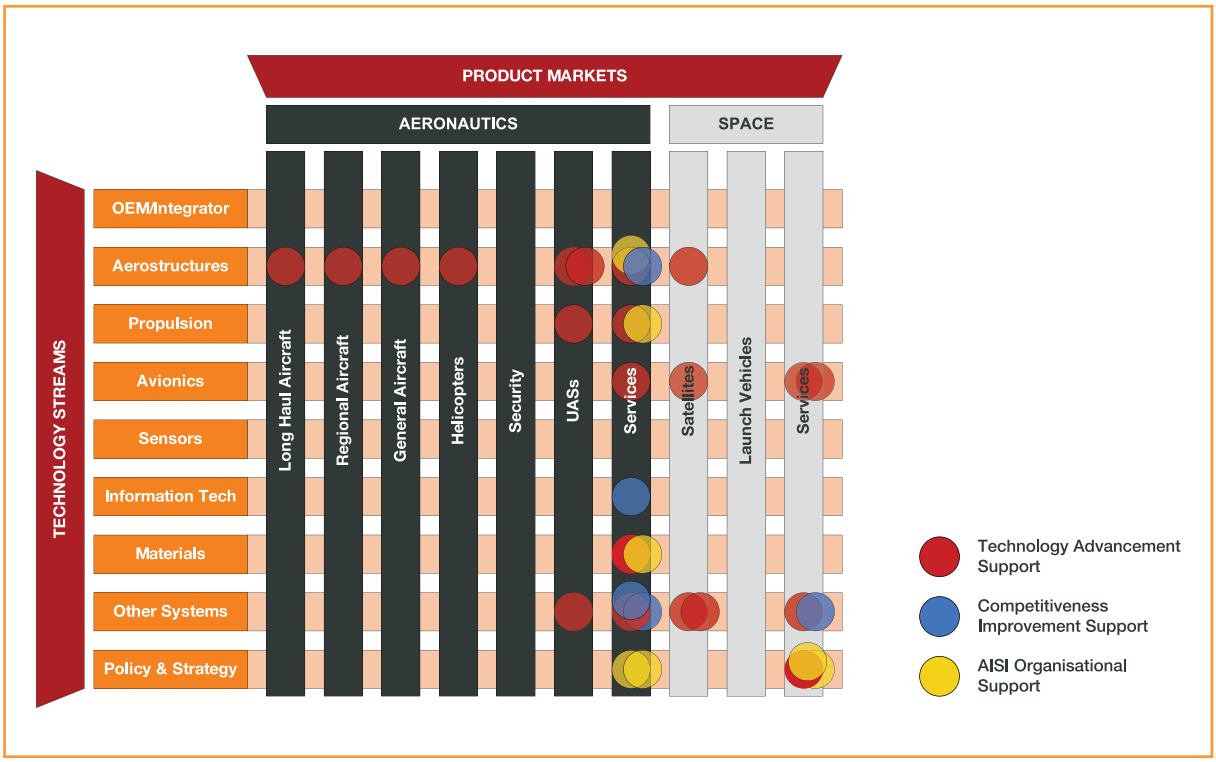


Figure 2: AISI investment areas 2013/2014 according to the ASDP Product and Technology Matrix

The figure highlights two main technology streams in which the AISI has invested through technology advancement support during 2013/2014, namely aerostructures and other systems. This is building on already existing local capability and has cross-cutting application possibilities across numerous product markets. This ensures broader market possibilities for local industry.

Industry Development and Technology Support

The aim of industry development and technology support is to improve the competitiveness of the local industry through the industrialisation of technologies. This will add to the product offerings of the benefiting organisation, which in turn increases its competitiveness.

Organisations are encouraged to include industry partners when undertaking industrialisation projects under this programme, and more specifically, integrators are required to include small, medium and micro enterprises (SMMEs) to ensure technology transfer and the growth of the industry supplier base. This programme is the main focus of the AISI's interventions and accounted for 32% of investment during the financial period.

Programme Focus	Technology Advancement Support
Predominant Product Market	Aeronautics, Defence, Space, Materials, Manufacturing
Industry Support Investment	R 4 million
% AISI Investment of Budget	32%
Number of Projects Undertaken	10
Number of Organisations Involved	29
SMME Involved	10
RESULTING IMPACT ON INDUSTRY	
Development of New Technologies	5
Manufacturing Processes	2 processes supported to improve competiveness within the Aerospace Manufacturing Industry
Business Opportunity	1 SMME Established
Efficiency and Profitability	11 organisations benefited from Laser Based Manufacturing Solutions
Collaboration with Academia and Research Councils	3 Universities and 2 research councils collaborated with industry
Industry Access to National Experts and Facilities	15 Organisations directly benefiting
Project aligned to national programmes	2 Projects aligned with the requirements of the South African National Space Agency (SANSA)

Testimonial

The Micro Gas Turbine Development Project enabled like-minded people with a passion to enhance the Aerospace Industry in South Africa to collaborate and deliver a prototype within 12 months. This project enabled me, and my colleague, to start a company in the Aerospace Industry in 2013, namely Cape Aerospace Technologies. With the support from the AISI we could deliver a micro gas turbine within the first 12 months of operation, namely the CAT 200 KS.

- David Krige, MD, Cape Aerospace Technolgies

Sector Strategic Support Initiatives

The Joint Aerospace Steering Committee (JASC) was established to provide strategic guidance and positioning to the local aerospace and defence industry. The focus of Programme 2 is firstly the hosting of the JASC and its secretariat, and secondly, the hosting and implementation of JASC flagship projects. These projects are technology advancement projects with the specific aim of addressing technology gaps in strategic areas, as identified by the JASC and its subcommittees.

Programme Focus	Technology Advancement Support
Predominant Technology Stream	Avionics
Predominant Product Market	UASs and Services
Industry Support Investment	R 2 million
% AISI Investment of Budget	16%
Number of Projects Undertaken	2
Number of Organisations Involved	14
RESULTING IMPACT ON INDUSTRY	
Development of New Technologies	1
Student Involvement	2
Job Retention	4
SMME Involvement	1
Collaboration with Academia and Research Councils	Future collaboration with 1 University and Research Council
Project aligned to national programmes	Alignment to national UAV activities

Supplier Development

Supplier development aims to ensure that the supplier base participating in the economy is broadened.

It provides enabling mechanisms to assist industry to improve their competitiveness, productiveness and quality management systems.

Programme Focus	Competitiveness Improvement Support
Predominant Technology Stream	Services
Predominant Product Market	Standards, Accreditation, Quality Management Systems
Industry Support Investment	R 2 million
% AISI Investment of Budget	16%
Number of Projects Undertaken	5
Number of Organisations Involved	41
SMME Involved	39
RESULTING IMPACT ON INDUSTRY	
Cost Savings and Reductions	• Cost saving at one SMME of R 160 000.00 per annum • Reduction in scrap metal from 10% to 6% at one SMME
Efficiency and Profitability	Full supply chain visibility through web-based procurement portal utilised by 35 suppliers and 1 OEM
Standards and Accreditation	Implementation of AS/EN 9100 (Airbus standards and requirements) at two SMMES

Testimonial

The support of the AISI has enabled Daliff to implement a global best practice system in the Airbus GRAMS, which is now opening very significant business opportunities for Daliff to manufacture locally and supply to the OEMs. Since implementing GRAMS, we have become an approved supplier to two additional global OEMs and are in discussion with a further two to whom we have already quoted.

- Rowland Chute, Chairman, Daliff Precision Engineering

Industry Focused Skills Development

The focus of the AISI's interventions in industry focused skills development is firmly on utilising industry knowledge and technology to improve the human capital in the aerospace industry.

It also addresses **the dti's** strategic objective to "create a fair regulatory environment" by focusing projects on space regulations.

Programme Focus	AISI Organisational Support
Predominant Technology Stream	Policy and strategy support and services product stream
Predominant Focus	Materials and Manufacturing Testing and Analysis Space Regulation
Industry Support Investment	R 1 million
% AISI Investment of Budget	7%
Number of Projects Undertaken	2
Number of Organisations Involved	14
RESULTING IMPACT ON INDUSTRY	
Capacity Development	3 Internship placements; 17 Trainees in Air, Space and Telecommunications Law
Scarce Skills Development	• Air, Space and Telecommunications Law • Materials and Manufacturing Testing and Analysis
Transformation	• 82% of Trainees PDIs • 100% of Interns PDIs
Exposure to National and International Experts	2
Alignment to National Councils and Programmes	• South African Council for Space Affairs • Titanium Centre of Competence
Project aligned to National Policies	South African context for Space Law

Special Projects

As part of the duties of the CSIR as the host of the AISI, it is obliged to make national facilities and expertise, housed at the CSIR, available to industry. Special projects endeavour to do just this by granting industry access to infrastructure and expertise, which they would not have had access to otherwise.

Programme Focus	Technology Advancement Support
Predominant Technology Stream	Aero structures
Predominant Knowledge Stream	Aerodynamics Management Systems
Industry Support Investment	R 0.5 million
% AISI Investment of Budget	3%
Number of Projects Undertaken	1
Number of Organisations Involved	2
Previously Disadvantaged Institutions Involved	1
RESULTING IMPACT ON INDUSTRY	
Collaboration	1 Research Council and 1 University
Scarce Skills Development	• Aero-derivative applications • Experimental and Computational Aerodynamics
Exposure to National Facilities	Aerospace Infrastructure (Wind tunnels)
Knowledge Transfer	Transfer of processes and methodology from industry to academia

Testimonial

The Aerospace Industry Support Initiative has helped the aerodynamics department of Nelson Mandela Metropolitan University (NMMU) racing in many ways over the past year. We were able to get results through simulation and wind tunnel testing in order to determine how effective our design was. This wouldn't have been possible without the willing and eager help we received from the team at CSIR. Without their help we wouldn't have been able to show that we are working on optimising our design before manufacture. We at NMMU racing are extremely grateful.

- Anga Hackula, NMMU student

Programme 1 Projects

1. LABAMA Support Project
2. Ultra High Cycle Fatigue Testing Machine
3. Hyperspectral Sensor Upgrade
4. Small Gas Turbine Technology Improvement
5. Aerodynamic Investigation of a Rhomboid Wing UAS
6. Higher Level of Mode S Technology Development
7. Radiation Screening Services for Satellites
8. Laser Shock Peening

Industry Development and Technology Support

Industry Development and Technology Support focuses on advancing the involvement of industry in sectors relating to advanced manufacturing in aerospace and defence.

Industry is encouraged to industrialise technologies to the advancement of South African niche capability and value proposition.

- Partnerships are established between organisations to achieve this goal
- Access to national infrastructure and expertise is facilitated
- Specific emphasis is placed on drawing innovative processes, products and methods into industry. Industrialising technology from universities and institutions, and building on historical investments in research and development from other sources such as the DST
- Enhancing industry competitiveness by ensuring appropriate technology transfer interventions
- Utilisation of the IDAP Thematic networks to support this technology development and transfer
- Original equipment manufacturers (OEMs) are encouraged to include SMMEs as well as lower tier suppliers, to ensure the continuous transfer of knowledge, expertise, capability and technology, and in doing so, broaden the industrialisation base.

LABAMA Support Project

Due to its unparalleled ability to stimulate innovation and to combine high levels of productivity and quality, laser technology has become a key technology for global competitiveness and is widely implemented in leading manufacturing industries around the world. In order for the South African manufacturing Industry to maintain competitiveness, it is imperative that it has access to the same level of laser-based manufacturing that its global competitors enjoy. Laser technology, however, is both capital intensive and unconventional, which poses a significant entry barrier to local companies and, in particular, SMMEs.

Over the last decade the CSIR established a comprehensive suite of laser-based manufacturing platforms consisting of state-of-the-art equipment, complemented by engineering expertise. These platforms are unique in the South African context and are ideally positioned to reduce the entry barriers to local manufacturing concerns and, in particular, the aerospace community where quality and innovation are particularly important.

The goal of this project was to enhance the competitiveness of local companies involved in aerospace manufacture by providing access to laser-based manufacturing techniques. In the context of this project, local companies were assisted in developing several innovative products that would not have been possible without access to laser-based manufacturing techniques.

Objectives

The LABAMA project was launched to identify potential projects that can be supported and developed within the Aerospace industry. The specific objectives are to:

- Identify specific companies where its support to the aerospace industry is an enabler to improve them in the short, medium and long term.
- Collaborate with the aerospace industry to develop high impact interventions. In particular, identify and pursue opportunities to enable localisation of suppliers and import replacement.
- Provide the necessary support to the OEMs, 2nd and 3rd tier suppliers once the issues have been identified, so they can benefit from laser-based manufacturing solutions.
- Work with Higher Education Institutions (HEIs) and other agencies to ensure that there is Human Capital Development (HCD) so that there is skilled labour available to the aerospace industry for the successful and sustainable implementation of these developed technologies.
- Support SMMEs.

Laser Based Manufacturing (LABAMA) is a key driver of innovation because it enables the manufacturing of components and products, which would be impossible with conventional techniques

11 organisations benefited from national infrastructure at the CSIR

Marcom Aeronautics & Space (Pty) Ltd

Marcom Aeronautics & Space (Pty) Ltd requested the development of a laser welding process for use during the assembling of a prototype fuel manifold. The laser process was selected because of the requirement for a high integrity low distortion process. This company is involved in the satellite launch industry and this particular development forms part of their liquid rocket engine development.

In addition, the CSIR is conducting development on the potential of laser assisted cold spraying (LACS) to be used as a production method for the copper alloy nozzles that form part of the booster engine of the rocket. A LACS system was assembled and commissioned. Copper was successfully deposited on both aluminium and copper substrates.

Rheinmetall Denel Munition

Rheinmetall Denel Munition (Pty) Ltd requested assistance with the development of a new generation bulkhead to be incorporated in a rocket motor. This bulkhead is intended to activate a second booster motor. The development involved precision 3D laser cutting followed by a low heat input laser welding process. Four prototypes were produced at the CSIR. The prototypes are currently being evaluated. The evaluation of the prototypes which included both NDT as well as a "bench fire" was completed successfully.

Denel Aviation

Denel Aviation requested a feasibility study on the dissimilar laser welding of an aluminium shell. This required the weld joining of aluminium LM24 and AA6082 onto each other, which were of different thickness as well. The process was proven to be feasible and a sample of a shell was successfully welded (Figure 1).

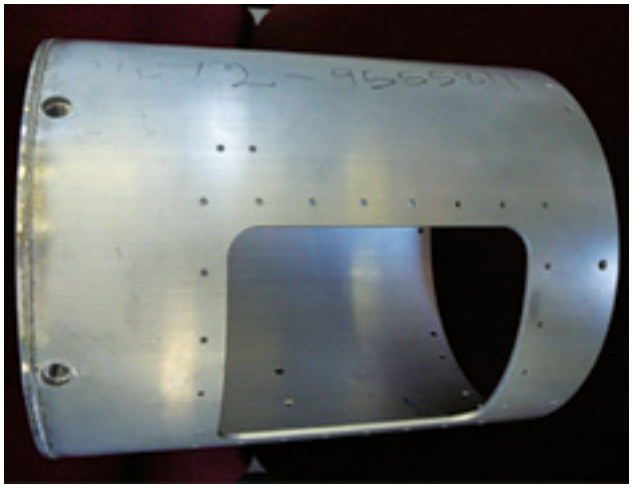


Figure 1: Example of a shell that was autogenously laser welded

The LABAMA project was implemented to enhance the competitiveness of the South African aerospace manufacturing industry by improving productivity and enabling innovation through the provision of affordable access to state-of-the-art laser technology.

Adept Airmotive

Adept Airmotive requested the autogenous laser welding of a steel gear onto a carburised axle, which was done successfully (Figure 2) and has since also been repeated on request. Due to the carburisation of the axle, precision needs to be executed in terms of weld positioning, together with low heat input, in order to prevent centreline cracking from occurring.

The CSIR also assisted Adept Airmotive with the recovery of two high value aluminium cylinder heads. These heads are cast and the functional surfaces are machined onto the castings afterwards. Normally, if machining errors occur at this stage, the casting has to be scrapped since conventional weld repair processes, such as TIG welding, introduce too much distortion because of the high heat input. Laser welding on the other hand is ideally suited to this repair process because of the much lower and highly localised heat input.

In the first instance a tool path was programmed incorrectly. A weld preparation was machined with a geometry that was suitable for laser metal deposition welding.

Secondly, a hole was bored oversized. An aluminium sleeve was machined and it was welded in position with a deep penetration key-hole weld. Because of the thin wall, a pulsed laser welding process was developed which further reduced the heat input while it maintained the required penetration.

M Square Precision Manufacturing

M Square Precision Manufacturing requested the autogenous laser welding of an aluminium AA6082-T6 TCU enclosure for BAE Systems. The enclosure was assembled by the customer and delivered for laser welding. This is the second request for the laser welding of such an enclosure from BAE and both times the enclosure was welded without any distortion.

Figure 2: Laser beam welding of gear assembly

Albetron Precision Engineering

Albetron Precision Engineering requested the laser cladding of hydraulic pistons (44mm OD and 38mm ID) (Figure 3) for landing gear. This process required the cladding of a more corrosion and wear resistant material onto the outside of the piston (0.5mm thick layer). The process is intended to replace the previously used hard chrome process which proved to be unsatisfactory because of problems with flaking. Four pistons were evaluated.

Figure 3: A steel piston supplied for laser cladding, and half-way cladded

Cassidian Optronics SA Pty (Ltd)

Cassidian developed a compact high performance air-to-water heat exchanger. The unit forms part of the thermal management system of an airborne surveillance camera. It is mounted in close proximity to sensitive, high value electronics. In particular the service environment of this unit demands a high level of resistance to vibration induced fatigue. In addition, the sensitivity of the electronics to moisture demanded that all water to air interfaces had to be leak tight. In order to ensure this, these interfaces were specified to be He leak tight. Because of these service conditions, it was decided to manufacture the heat exchanger from AA 6082 T6. Due to the small size, only vacuum brazing and laser welding were considered to be viable for the assembling process. The CSIR was tasked to develop a laser welding process for the assembling of the heat exchanger. Each heat exchanger requires 16 welds of which 4 have to be He tight. 6 different welding procedures with the associated jigging had to be developed. To date, 5 prototypes and 10 production units have been delivered.

Figure 4: Laser welded heat exchanger assembly

Saab Grintek Defence

The components are used in Saab Grintek Defence's High Speed Directed Launcher. In layman's terms, it is a very fast gimbal. The "housing" part houses the recoil mechanism and the shaft with the spline on it is connected to a gear. The gear thus turns the recoil mechanism as well as the given payload, which is connected to the recoil mechanism. The shaft-housing interface made use of two ''flats" to carry the torque over but this was not sufficient and thus we had to have them welded up for extra strength. The housing is made from aluminium 7075-T6 and the shaft aluminium 6082-T6. Both these alloys are crack sensitive with AA 7075 considered to be unweldable with conventional techniques. The material combination together with the requirement of high strength and low distortion indicates a laser welding process.

Figure 5: Laser welding of stainless steel gimbal beams

Rost Engineering

Rost Engineering requested the laser welding of 304L stainless steel beams (Figure 5). Rost is subcontracted by Cassidian to manufacture the beams. This process required the fusion joining (seam welding) of two mirror-imaged beams by means of a butt joint. These individual beams are machined from forged pieces of 304L stainless steel, they are largely hollow structures and have to be welded together to form one side of the final part. The two sides (two sets of beams welded together) are joined by two aluminium bridges and then final machined to form a gimbal. The gimbal is used to mount an airborne surveillance camera. The reason why the beams are manufactured in this way is to save weight without sacrificing stiffness. Minimal distortion of the component is a pre-requisite and is therefore an excellent application for laser welding. To date, 552 of these units have been laser welded for Rost Engineering.

Denel Dynamics

Denel Dynamics needed to manufacture a high pressure gas cylinder to supply pressure to a gas servo which is used for the deployment of control fins on a missile. The gas cylinder consists of a gas reservoir and a valve unit. The design specification requires that the gas cylinder retains its structural integrity and remains leak tight. Three welding processes had to be developed by the CSIR to assist Denel Dynamics.

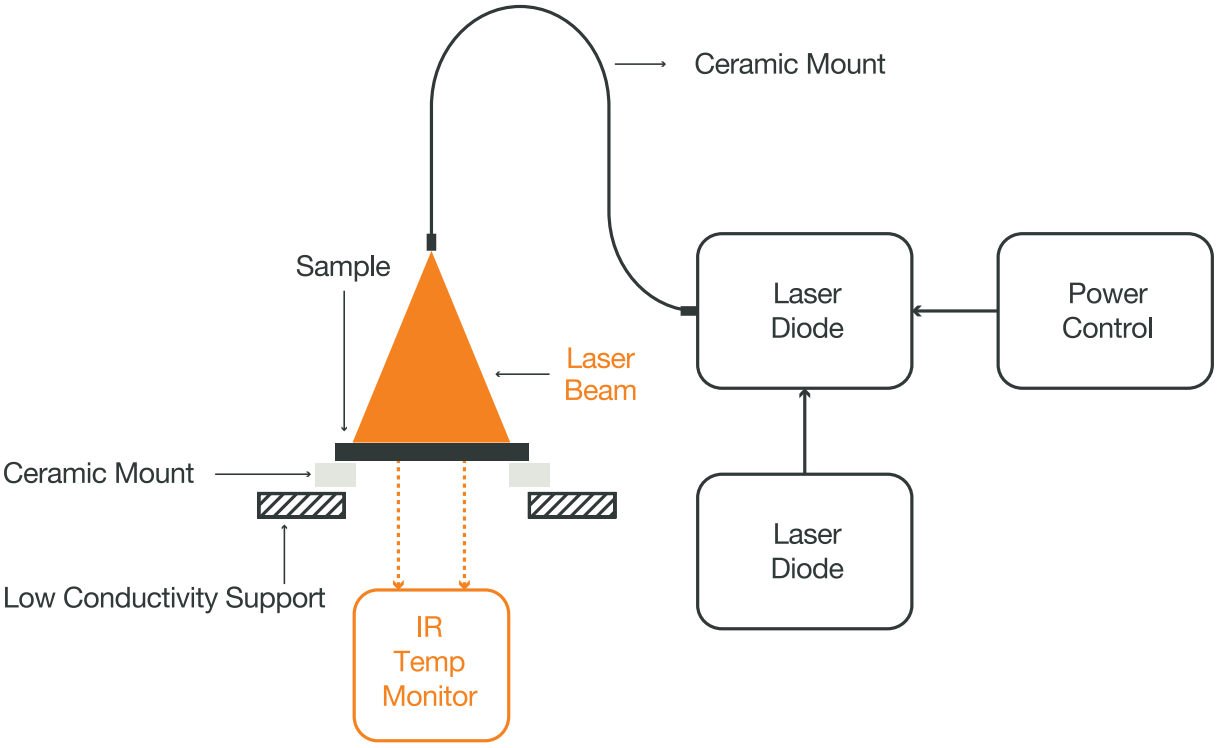


Figure 6: Experimental setup to evaluate laser heating for CFRTP materials

Aerosud ITC

A feasibility study was completed for Aerosud on the use of laser diode preheating on their newly developed Composites Fibre Reinforced Thermo Plastics (CFRTP) press that the Aerosud Innovation and Technology Centre developed. This CFRTP process is an innovative process developed by Aerosud. Aerosud has already been contracted to manufacture wing clips for the Airbus A350 aircraft using this new technology.

Aerosud approached the CSIR with the request to evaluate whether using IR laser diodes can be more efficiently used as the source of the preheating required for the CFRTP materials. An extensive feasibility study was done, with a detailed report covering the findings of the investigation. Existing equipment was used and experimental setups done on solar coating development work, as well as laser sources used in the additive manufacturing development projects

The findings of the investigation indicate that the present approach used by Aerosud in the CFRTP processing facility is energy efficient, and if the techno-economic aspects are considered, IR lamp technology is the technology of choice. However, laser technology with the ability to provide tailored heating effects, might be considered if a non–uniform heating solution is required.

It was proposed that if Aerosud wants to take this investigation further, a detailed specification be drafted to ensure that the advantages that laser technology presents is exploited to the fullest.

Conclusions

Several projects have been undertaken in collaboration with companies that are active in the Aerospace Industry. In five instances, the projects yielded components that are now incorporated into innovative high technology commercial products. In all instances, the financial support received from AISI support made an invaluable contribution towards lessening the risk and financial burden that is typical of development projects of this nature. The future focus will be on the development and dissemination of Laser Additive Manufacturing (LAM) technology while more applications in laser welding and laser metal deposition will be identified.

Fatigue is a progressive and localised structural damage that occurs when a material is subjected to cyclic loading.

Ultra High Cycle Fatigue Testing Machine

The main impact achieved via the AISI/**the dti** funding is that it has allowed for the development of this new product from initial concept to final design manufacture and testing.

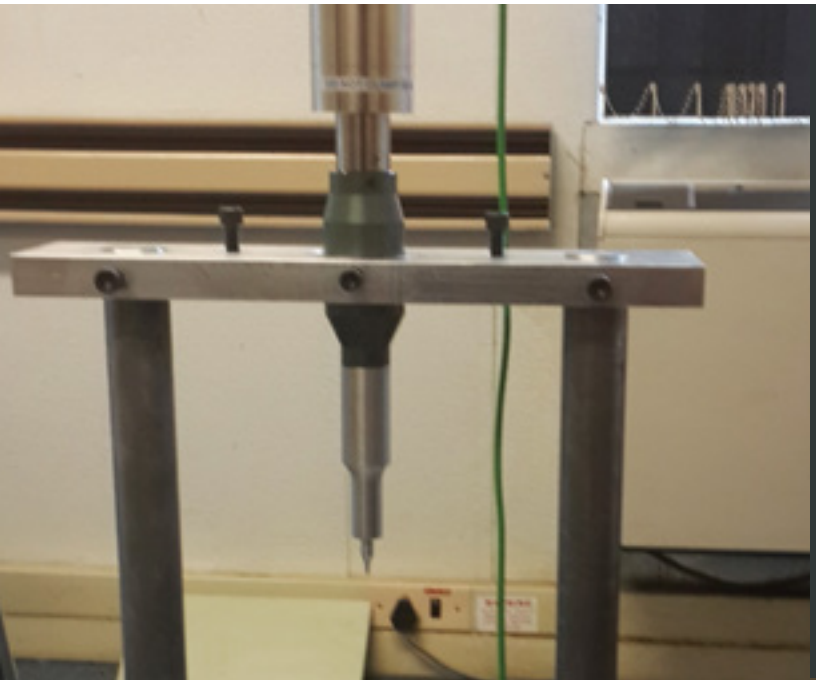
The funding provided by the AISI ensured that expertise was available to design, manufacture and perform testing on the equipment. This ensured that off-the-shelf consumables could be procured to form the backbone of the Ultra High Cycle Fatigue (UHCF) testing machine. These components are very expensive to procure and would have been impossible to design from scratch.

Establishment of the first Ultra High Cycle Fatigue Testing Machine in South Africa

South African industry now has a machine capable of verifying and generation of fatigue data which surpasses 10^9 cycles in a short period of time.

Productivity Improvement

It is believed that the ability to create in-house SN (stress vs cycles) curves exceeding 10^7 and 10^9 cycles in short periods of time will be beneficial to overall productivity in finalising future designs. As an example, consider the latest 100Hz servo-hydraulic fatigue testing machine which takes 115 days to define one sample point at 10^9 cycles. The standard ASTM specification requires a minimum of 12 data points to define a design SN fatigue curve. Hence, to generate a SN curve in the region of 10^9 cycles takes a very long time using a single standard fatigue testing machine. However, if the 20 kHz UHCF testing machine is implemented, then a data point at 10^9 cycles can be obtained in 14 hours.



Skills & Human Resource Development

1

Number of interns supported / involved in the project.

One Master's student from the University was directly involved.

Job Creation

1

The facility would require a testing engineer to maintain the facility, gather and interpret the data.

Market Access

Many new applications are coming to light in which the UHCF testing machine can be used. One of these applications is in the certification of civil aircraft which need to be certified against sonic fatigue as stated in the FAR/JAR regulations CS 25.571. This requires a demonstration of the integrity of the primary structure subjected to sonic excitation, i.e. sonic fatigue strength.

The regulations state that it must be shown by analysis, supported by test evidence, or by the service history of airplanes of similar structural design and sonic excitation environment, that:

1. Sonic fatigue cracks are not probable in any part of the flight structure subject to sonic excitation; or
2. Catastrophic failure caused by sonic cracks is not probable assuming that the loads prescribed in the previous section are applied to all areas affected by those cracks.

Consequently, the test evidence can be provided by the UHCF testing machine for coupons of the same material type as that being certified on the aircraft. This type of certification has been implanted on the A400M project and will become more prevalent as propellers increase in diameter and speed.

In addition to the usage in the aeronautical industry, we envisage usage of the testing capability in diverse industries such as the rail industry, automotive industry and energy generation industry.

Facilitating Networking Opportunities for Industry

Access to the CSIR was facilitated through the AISI, which helped in the development of requirements for the piezo-electric actuation system. The CSIR has also assisted in the verification of the monitoring system of the UHCF testing machine via the use of the laser vibrometers at the Pretoria facility.

Supply Chain Development and Redesign

An in-house quality management system was implemented to track the usage of man-hours and ensure that deliverables for the project were maintained.

Some unexpected delays were experienced through overlapping of projects; however, they were effectively managed to ensure overall impact of the project.

Testimonial

The scope of this project has had an impact on the knowledge of 2D axisymmetric modelling as compared to fully 3D modelling using MSC Nastran. Further understanding of the definition of element types in the development of the Matlab code to create the specimens has been possible. Elements covered are Quad4, Quad8, Tria3 and Tria6. These elements have been created for both the standard 2D case as well as the 2D Solid case of axisymmetric elements.

Ultra high cycle fatigue knowledge has improved through the development of this facility and it is guaranteed that further knowledge will be developed as additional testing is undertaken on the current rig design.

This project adds to Denel's current testing facilities capabilities. This allows Denel the opportunity to offer a unique capability to future aircraft design projects. This together with Denel Aerostructures's strong background in sonic fatigue analysis on the A400M will provide a significant benefit for future engineering bids. After the initial completion and the stage of validation and verification has been completed, a new stage of advertising the usage of ultra-high cycle fatigue testing procedure in other engineering fields' will be undertaken.

- Tristan McMillan, Denel Aerostructures

Hyperspectral Sensor Upgrade

Hyperspectral Sensors are a systems technology whereby images of a scene are collected in tens to hundreds of narrow spectral bands nearly simultaneously.

Simera Technology Group previously developed a hyperspectral sensor used for aerial vegetation and soil surveying research in partnership with the Department of AgriSciences, specifically Forest Informatics of Stellenbosch University (SUN). The term "hyperspectral" usually refers to an instrument whose spectral bands are constrained to the region of solar illumination, i.e. visible through shortwave infrared, and in the remote sensing context which has an observing platform that is either airborne or spaceborne.

The goal of the original development was to conceptualise, design and build an instrument that can capture useful hyperspectral as cost effectively as possible. To stay within very tight cost limitations, certain performance parameters had been reduced to lower limit values of which the most noteworthy was a fairly low field of view and high levels of spectral frown. These initial performance shortcomings could be overcome with longer duration data capturing and post processing respectively, both of which are not ideal from a system cost-effectiveness viewpoint.

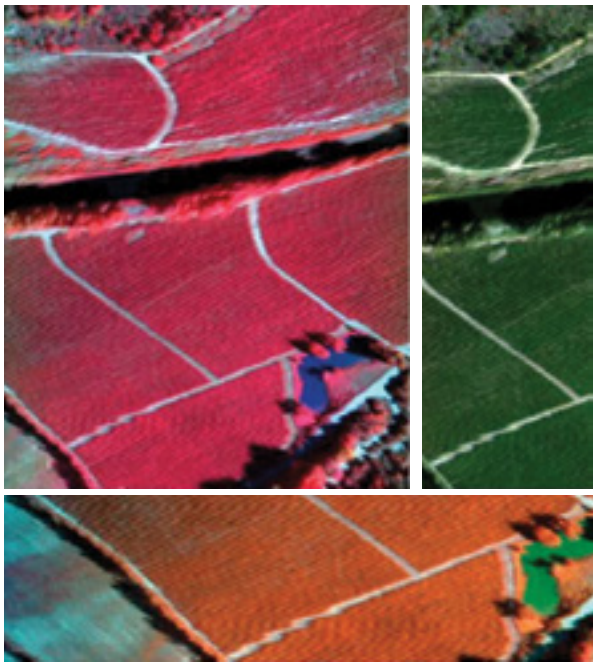


Figure 1: Sample data of first flight (16 Jan 2012)

A test image from the very first test flight is shown in Figure 1. The effect of jitter and, more importantly, the spectral errors present on the sides of the full field images, are clearly visible.

The principal goal of the current AISI-funded project was to improve the baseline hyperspectral imager, referred to as the MK 1 unit, to deliver more accurate data from a spectral viewpoint and at the same time, cover a larger swath width. Both these improvements will lead directly to a more commercially competitive product. The goal was to keep the cost of the final design as low as possible, since the development of a low-cost unit will service a larger market sector.

In addition to the two main performance upgrades, the system includes other softer upgrades such as the inclusion of internal measurement unit (IMU) data for each image frame, and changes to the control software graphical user interface. In addition, a corrective optical system was developed that will allow the aerial remote sensing instrument to be used for very close objects distances (0.5 m to be exact). This will give the user the capability to use the same instrument for laboratory and sample calibration where originally it was intended to be used at object distances of 500 m. Lastly, the system now includes an easy-to-implement spectral calibration source and the option for the control software to correct spectral errors prior to data export.

Seven engineers, draughtsmen and industrial designers plus three interns gained experience and participated in the execution of this project.

Unlocking core technology for future commercial expansion in sensor development

Skills & Human Resource Development

3 students employed during holiday periods.

One of the students continued as a part-time intern and might be permanently employed as an optical systems developer during 2014.

Job Creation

7 In total, seven engineers, draugthsmen and industrial designers. Two external engineering development companies (Forest Sense and Garcer), an academic institution (SUN) and a research institution (Agricultural Research Council - ARC) participated.

All of these changes supported by the AISI programme will make the SIMERA Hyperspectral MK 2 imager far more commercially attractive.

Productivity Improvement

Considering the nature of the hardware and the low production volumes associated with this item, wastage of materials or consumables are not relevant. Wastage of man hours (effort) for design and assembly are, however, applicable and due to this, an important design driver was to use – as far as possible – known design and integration procedure experience gained from the first design. The final implemented design thus only varied from the original MK 1 unit in an incremental fashion.

For the commercial-off-the-shelf (COTS) building blocks, executing a repeat of the project gave SIMERA the opportunity to conduct thorough market research and identify the most cost-effective parts and suppliers.

For the custom hardware items, the design improvement and repeat production gave SIMERA the opportunity to foster relationships with specialist optical and hardware manufacturers. Both elements will ensure that the repeat of the production will be executed faster and with more accurate cost baselines.

Market Access

The execution of the project and the trust AISI placed in SIMERA, together with the associated internal capability and capacity expansion, led to SIMERA securing additional optical system development contracts for two more hyperspectral sensors of the MK 1 type; both are used as research test beds, and additional remote sensing payloads for light aircraft and UAV platforms. The total value of these projects already exceeded the value of the initial research grant.

It is clear that the AISI grant was a key enabler for SIMERA to grow rapidly in this field and it is certain that after the successful completion of the Hyperspectral MK 2 unit, SIMERA and the local support industry will be in an even more favourable position to market and commercially gain from this seeding project.

Supply Chain Development and Redesign

The focus of the project was to establish the core technology for future commercial expansion. The engineering development process followed, especially in the initial phases of this project, involved baseline technical requirement specifications investigation, which was used to design and, eventually, evaluate alternative design proposals. SIMERA typically follows the European Council for Space Standardization (ECSS) systems engineering and project management standard and tailors this to suit particular project management requirements. The current project provided SIMERA with the opportunity to gain experience to tailor the ECSS process to these types of hardware development projects and the process followed will serve as a template for future project repeat or development work.

Socio-Economic Impact

All the technologies for this observatory can be sourced internationally; however, a significant part can be developed at a system and even component level in South Africa. By supporting this project, the AISI will give the participating members the opportunity to venture into new technology areas, to unlock potential future markets. Downstream supply companies will benefit from the local participation.

The final utilisation of the hardware will definitely assist the community at large, since the development of lower cost specialty remote sensing equipment will reduce the cost of precision farming and this will assist with food security and quality planning.

Figure 2: Simera MKI Hyperspectral Sensor

Identifying and Sharing Best Operating Practices

Team members attended Computer Aided Design (CAD) and Finite Element Analysis (FEA) training as part of their SIMERA internal training; others attended internal optomechancial specialist training based on available short course notes, training matter and skills transfer from more experienced colleagues.

Testimonial

It is clear that the AISI-funded upgrade project immediately improved SIMERA's position to market and grow its optics offering. The funding gave SIMERA a sound platform from which to investigate and market similar technology offerings and it is certain that after completion of the Hyperspectral MK 2 sensor, SIMERA can market and further commercially gain from this technology baseline.

- Johann Du Toit, MD, SIMERA

A Gas Turbine is a turbine driven by hot expanding gases produced by burning fuel such as a jet engine

Small Gas Turbine Technology Improvement

This project has made remarkable technical achievements by getting the first new gas turbine prototype running in South Africa since the late - 1980's.

A new SMME has been brought into life and a consortium formed to support the development of a gas turbine engine.

Key knowledge in combustion and shaft dynamics has begun to be re-established and developed in favour of the project and should be brought to bear in a more systematic and meaningful way in the near future.

There remains significant market opportunities for the consortium for engines up to the 600 N thrust class where the market and business opportunities reside. The aim is to make the business self-sustaining and able to contribute to high technology employment and manufacturing in the Western Cape; at the same time, it should enable new aerospace defence products within the Denel group and beyond.

Development of the first new Gas Turbine prototype in South Africa since the late 1980's.

Establishment of a new SMME for the development of Gas Turbines in South Africa

Productivity Improvement

During the course of the project, the high precision manufacturing process for the manufacture of the centrifugal compressor was developed and perfected.

Facilitating Networking Opportunities for Industry

Access to Stellenbosch University facilities and expertise as well as CSIR expertise was a fundamental part of this project.

Skills & Human Resource Development

1

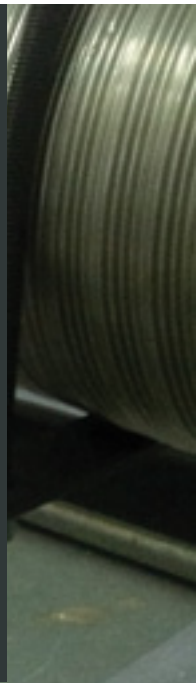
Number of interns supported / involved in the project.

All students involved are funded by the Defence Research and Development Board.

Job Creation

1

This funding was instrumental in facilitating the starting of the CAT (Pty) Ltd business and at this stage it has resulted in the employment of one engineer.



Socio-Economic Impact

The development of such propulsion units and the intended later derivatives can contribute to maintaining the sovereignty and security of the nation through the maintenance of a strong national arms manufacturing capability. This can contribute to a strong and technologically able Defence and Border Safeguarding capability.

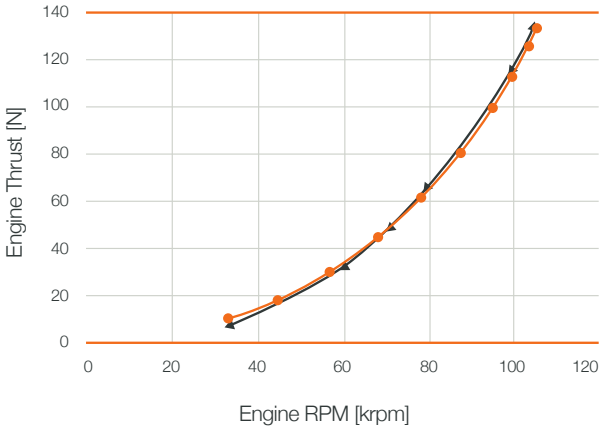


Fig 1: Engine thrust comparisons between the GR 180 and the CAT 200 KS gas turbines

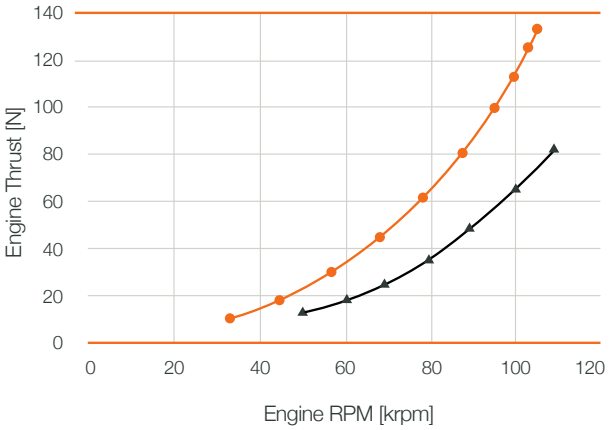


Fig 2: Engine thrust comparisons between the BMT 120 KS and CAT 200 KS gas turbines

Testimonial

The Micro Gas Turbine Development Project enabled like-minded people with a passion to enhance the Aerospace Industry in South Africa to collaborate and deliver a prototype within 12 months.

This project enabled me, together with colleague Andre Baird, to start a company in the Aerospace Industry in 2013, namely Cape Aerospace Technologies. With the financial support from the AISI we could deliver a micro gas turbine within the first 12 months of operation, namely the CAT 200 KS.

My studies on micro gas turbines started at undergraduate level at the Stellenbosch University and led to an MSc degree. Had it not been for the support received from the AISI, all the work done in this regard would have been to no avail and my pursuit of aerospace in South Africa would have ended, leaving me to pursue a different career locally or work abroad.

This project made it possible for people like Andre Baird, with at least 20 years' experience in the micro gas turbine industry, Everhard van Niekerk, a combustion expert, the Stellenbosch University and the CSIR to work together to deliver a fully operational micro gas turbine within 12 months. Stellenbosch University allowed Cape Aerospace Technologies access to their labs for micro gas turbine testing. In exchange, this creates invaluable exposure and interest to upcoming students and scholars.

I can, with regret, name a handful of recently qualified engineers who would've benefited from this project initiative, had it been launched earlier. None of them are currently working in the aerospace industry or on gas turbines due to the absence thereof in South Africa. Should an opportunity present itself in the aerospace industry, most of them would look no further.

I am therefore truly grateful for this project initiative and opportunity to pursue my dream. I'm excited to think that we can include more qualified engineers on this project in a combined effort to improve the aerospace industry in South Africa.

- David Krige, MD, Cape Aerospace Technologies

Aerodynamic Investigation of a Rhomboid Wing UAS

An unmanned aerial vehicle (UAV), commonly known as a drone or a Remotely Piloted Aircraft (RPA) is an aircraft without a human pilot aboard.

Paramount Advanced Technologies (PAT) has developed a small Unmanned Aerial Vehicle (UAV) called Roadrunner. Roadrunner makes use of a novel rhomboid wing configuration that has several potential aerodynamic and structural advantages. Road Runner is an innovative airframe design which is expected to be suitable for high maneuverability, operating in a wide speed envelope. The rhomboid wing concept offers high structural strength and reduced size compared to conventional designs, making it advantageous in a wide range of applications. There is, however, very little literature available on the rhomboid wing configuration, resulting in the estimation of an aerodynamic model. Previously conducted manual flight tests only provided a rough confirmation of the flying ability and stability of the design.

Although the project is in an advanced stage and a prototype airframe has been manufactured and flown, it is still not clear whether the true potential of the configuration is being utilised by the current design. Further optimisation is essential in achieving a truly competitive product. Through the current support from the AISI, the configuration was studied further, possible improvements identified and the impact of these improvements quantified.

The extent of the study included experimental testing at the CSIR, Aeronautics Systems Low Speed Wind Tunnel, modelling of the airframe in the multi-disciplinary tool currently under development at the CSIR, application of the tool to achieve an optimised airframe, and control surface scheduling to improve on control efficiency. By using a relatively new experimental approach (Modern Design of Experiments) and multi-disciplinary design optimisation, the project ensures the maturation of the methodologies. The approach also offers the opportunity of increasing industry confidence in the methods, thereby increasing the rate of adoption.

This project provided PAT access to both national expertise, as well as national facilities at the CSIR.

Novel rhomboid wing configuration for a UAV suitable for high maneuverability

Productivity Improvement

The full impact of the project on productivity improvement may be assessed after completion of the project. Potential improvements include rapid configuration studies of a continually growing range of possible configurations. The application of Modern Design of Experiments techniques to wind tunnel testing also allowed for the maturation of the test technique, which builds client confidence in the potential of the relatively new technique. This test technique significantly reduced wind tunnel test costs as fewer test points were needed to be achieved.

Enhanced development of experimental and computational tools for effective aerodynamic modelling of UAVs

Identifying and Sharing Best Operating Practices

The identification of best Modern Design of Experiments (MDOE) wind tunnel test practices has evolved through the wind tunnel testing of the Roadrunner airframe. These lessons will be applied to further wind tunnel test programmes based on the discretion of clients (as it is a relatively new technique). As the multi-disciplinary design capability is still maturing, guidelines on aerodynamic modelling techniques have been developed and will also be applied to further projects moving forward. The current project offered a postgraduate student the opportunity to develop and specialise in the field of flight dynamics and control.

Skills & Human Resource Development

1

One female postgraduate student (M.Eng.) was involved in this project.

Job Creation

To date, the project has provided an opportunity for the CSIR Multidisciplinary Design and Optimisation (MDO) capability and knowledge base to be transferred to junior engineers.

Facilitating Networking Opportunities for Industry

The AISI ensures CSIR expertise and infrastructure are made available to improve local industry's offerings. The CSIR is constantly striving to perform research that is relevant to the industry. This project provided an opportunity for the CSIR to work closely with an industry partner, PAT, in order to help them provide a more globally competitive product. The project allowed PAT access to unique expensive wind tunnel facilities, which under normal circumstances they would not have access to. In this project, PAT was provided with wind tunnel data on this novel configuration where they would have had to rely alternatively on computational estimates. The data significantly reduce the risk of flying the airframe as it informs the engineers of what to expect from the design from a performance point of view and provides the necessary information with which to design the control system.

Socio-Economic Impact

The AISI support for this project allowed a Historically Disadvantaged Individual (HDI) to further his knowledge and interests in the field of multidisciplinary aircraft design.

The knowledge and understanding gained from this project not only enhanced the individual's capability but contributed to the knowledge generation within the industry.

By fostering the maturation of the relatively new experimental aerodynamic test methodologies (i.e. MDOE), the cost of aerodynamic test programmes supplied to clients is reduced due to the knowledge of their product rather than masses of data. This reduction in wind tunnel test cost broadens access to these national test facilities to SMMEs and industry, which may have not had the funding for such testing in the past.

Testimonial

The advantages and impact of the AISI funding can be summarised as follows:

- **Expansion of MDOE capability**
  The CSIR started using MDOE to offer test programmes focused on answering the client's questions, rather than generating data for the client. Practical use of MDOE is difficult, however, and requires considerable insight from the users. The CSIR has already demonstrated this approach on the test programmes of two other UAV airframes.

- **Ability to model unconventional geometries**
  The analysis programmes currently used by the optimiser were originally developed for more conventional configurations. This fact was demonstrated during a recent project where configurations such as outboard horizontal stabilisers (OHS), flying wings and blended-wing-bodies (BWBs) were studied. It was found that considerable additional work was required in order to model these configurations. The current project has provided wind tunnel data that can be used to calibrate the analysis programmes for rhomboid wings, adding one more 'well-understood' configuration to the toolbox of the designers.

- **Development of MDO capability**
  The CSIR has been developing multi-disciplinary methods for aircraft design since approximately 2004. This discipline is a challenging one and a current topic for research around the world. The current AISI supported project provided an opportunity for further expansion of this capability. Significantly, since it is to be used on a real design, it will force the use of a large number of realistic constraints in order to end up with a practical design.

- **Human capital development (HCD)**
  The project has thus far provided a challenging research problem for one MEng student. The development of her skills within this field will have a direct positive impact on the CSIR's offerings to industry.

- **Track record in industry support**
  The CSIR is constantly striving to perform research that is relevant to the industry. This project provided an opportunity for the CSIR to work closely with PAT in order to help provide a more globally competitive product.

- Kreelan Padayachee, CSIR

Higher Level of Mode S Technology Development

Mode S is a Secondary Surveillance Radar technique that permits selective interrogation of aircraft by means of a unique 24-bit aircraft address, thus avoiding the risk of confusion or mis-identification due to overlapping signals.

The new features of the PT-2000 include higher levels of Mode S (an air traffic control identification mode) such as Mode S Level 2, Elementary Surveillance, Enhanced Surveillance, Extended Squitter and a Traffic Collision Avoidance System (TCAS) interface.

The AISI Higher Levels of Mode S Development support has put the PT-2000 IFF/Mode S transponder back into an internationally competitive position.

This project supported the career growth of two software engineers and in part a firmware engineer, hardware engineer, test engineer and quality assurance (QA) engineer.

Higher levels of Mode S includes: Elementary Surveillance, Enhanced Surveillance, Extended Squitter and a Traffic Collision Avoidance System (TCAS) interface

Skills & Human Resource Development

This project has allowed the refreshing and upskilling of two software engineers and in part a firmware engineer, hardware engineer, test engineer and quality assurance (QA) engineer, in the new standard developments found within RTCA DO-181E.

Job Creation

It is believed that future PT-2000 opportunities should lead to much more job retention and even creation, due to production contracts being placed on Tellumat.

The major benefit to Tellumat is obtaining new orders for transponders, which would not be possible without the higher levels of Mode S. This funding carries part of the Tellumat engineering team through a period of low trading volume; the team will be available to address new contracted opportunities when the business cycle picks up.

Productivity Improvement

The main aim for the project is to provide a technology refresh, allowing development of a technically competitive product for the local and international market.

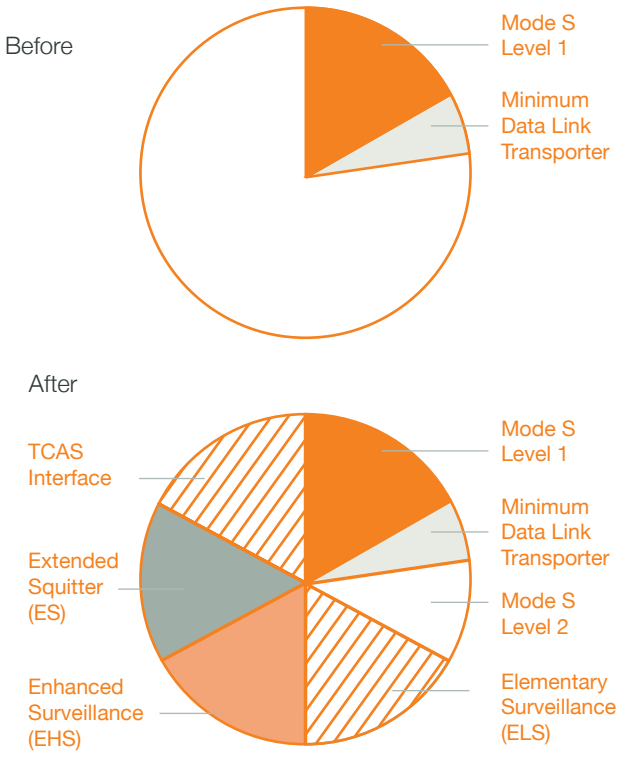


Figure 1: PT-2000 Mode S capability before and after the AISI project

Market Access

Within a short time of receiving AISI funding, Tellumat secured its first order for the improved version PT-2000 IFF/Mode S transponder. This was possible through the AISI support, which made it possible to meet customer requirements of higher levels of Mode S. This resulted in replanning of the project to meet the customer timescales.

The product is manufactured in-house by Tellumat, providing employment retention and opportunities. Some work is sub-contracted and preference is given to SMME/B-BBEE enterprises. SMME/B-BBEE piece part component suppliers are also given preference as part of Tellumat's supply chain.

The main impact is that Tellumat could obtain new orders on an existing hardware platform (the technology refresh was applied in the software), thereby retaining existing suppliers on the database, which would otherwise have been lost.

Identifying and Sharing Best Operating Practices

The international best practice software development standard, RTCA DO-178B: Software Considerations in Airborne Systems and Equipment Certification, is being used in this project. Tellumat's internal process was improved due to the continued use of this standard.

In accordance with the standard, several review meetings were performed during the Phase 1A software development process and captured in the software accomplishment summary (SAS).

Facilitating Networking Opportunities for Industry

The first customer for the improved version PT-2000 IFF/Mode S transponder is a global military and civil rotary wing aircraft supplier. Their international experience was transferred to Tellumat in the form of product specification and functional, environmental and software qualification requirements.

Tellumat presented a paper at the South African Joint Air Defence Symposium (SAJADS) in September 2013. The symposium theme was Joint Air Defence in the context of SADC (Southern African Development Community) regional cooperation and **the dti's** IPAP (Industrial Policy Action Plan) goals for industry. The subject of Identification, Friend or Foe (IFF) within the IPAP framework, including AISI funding, was presented.

Socio-Economic Impact

Without the support of AISI, low trading conditions may have resulted in layoffs with negative socio-economic impacts. Due to the AISI's support, this is no longer considered.

The project has four historically disadvantaged individuals as part of the team.

This project will take the PT-2000 IFF/Mode S transponder to the latest Mode S standard, namely RTCA DO-181E, effectively placing it as a noteworthy competitor in the defence market place, where civil aerospace standards are increasingly being applied.

Testimonial

I am a software architect in the Defence Division of Tellumat (Pty) Limited, specialising in the subject of Identification Friend or Foe. Our business has been going through some difficult times recently, with all its uncertainties. The AISI-funded Higher Levels of Mode S development has provided us a way to continue and has brought some stability in my and my team's work environment. I am confident that this support from AISI will unlock new orders for Tellumat and that we will turn for the better. For this I am very grateful.

- Lutfie Abrahams, Tellumat Defence

Radiation Screening Services for Satellites

The presence of radiation in space causes effects in electronic devices. The effects range from degradation of performance to functional failures. As a result, satellites may experience shortened lifetimes and major failures.

Radiation effects on satellite electronic components (especially Single Event Effects) have proven to be a major impediment to the survivability of satellites in the space environment, and one which is quite hard to test for. South Africa's SumbandilaSat, for which only Total Ionising Dose radiation testing was performed, was plagued with Single Event Effects (SEE) during its operational lifetime. Avoiding these effects has traditionally required the use of extremely expensive radiation hardened components which are only available with low performance and very long delivery times. Another solution is to screen the components for radiation effects, and qualify them for use on satellites. However, there are few facilities that can perform this screening for SEE and it is usually quite difficult to obtain access to those facilities as they are fully booked by other research and for medical isotope production. As there is currently no provider offering a radiation screening service in South Africa, every satellite development team that wishes to screen their components must dedicate personnel and funds to learning how to perform these tests and arrange once-off access to the facility.

For satellite developers, SEE screening provides an assurance that selected parts will not fail in the space environment. SEE screening identifies failures due to high energy cosmic radiation and trapped proton effects.

SEE testing requires access to facilities that can deliver high energy protons, up to 100MeV. There are only a handful of these facilities in the world, and they are typically booked out and expensive. The skills required to perform tests of this nature, though highly specialised, can be harnessed using local talent from the space-related programmes hosted at some local universities with the help of international expertise.

Heliocentric Technologies ZA intends to close these gaps by forging the necessary relationships, developing capability in terms of local skills development, and devising a test methodology which can be applied at a local test facility.

Heliocentric Technologies ZA (Pty) Ltd was formed to provide affordable radiation screened components for small satellites using the Cyclotron beam at iThemba LABS in Cape Town, South Africa.

1 Bursar (CPUT) and two students (NMMU) were supported to further their knowledge in radiation screening.

Productivity Improvement

Locally, the AISI-funded project is helping to cement our competitive position by establishing us as the first major provider of radiation testing services. Previous efforts, though not many, were on an ad hoc basis and failed to publish any successful results.

Generally, due to very tight schedules at test facilities, radiation services have very long lead times (up to ~ two years) and some satellites are launched even before an opportunity for testing arises. Judging by in-house experience with beam time availability, Heliocentric anticipate an average lead time of three months to provide this service to both local and international clients after our 'go live' date at the end of the project.

The by-products of the test include electronic components and devices; research on these components will be used to support postgraduate research projects in partner universities.

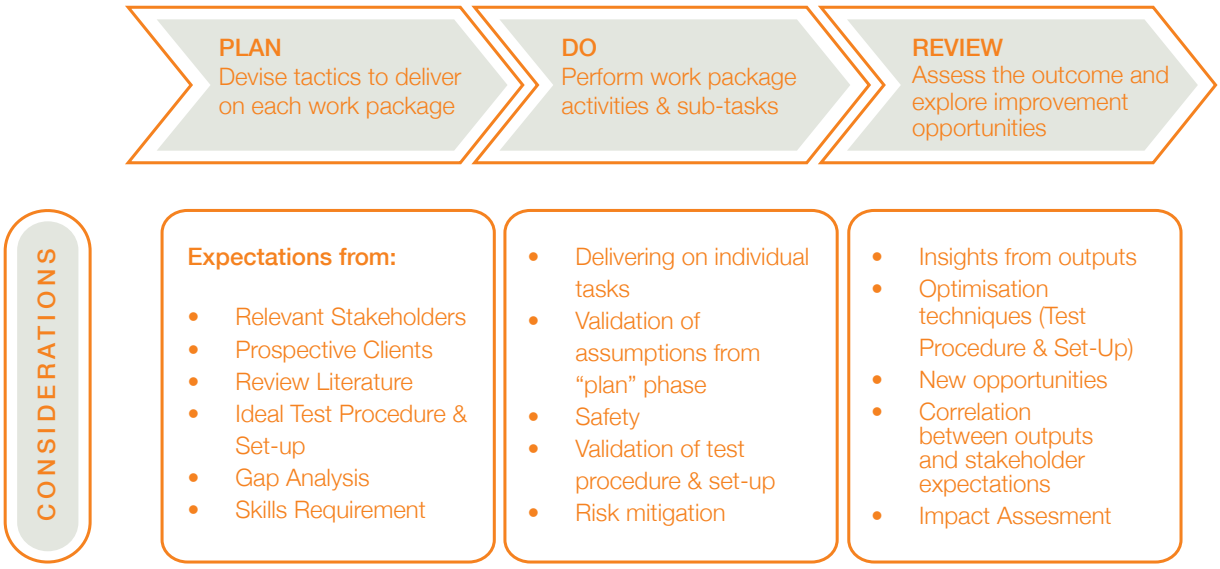


Figure 1: Plan-Do-Review Process

Market Access

Heliocentric have built a healthy pipeline of customers ready to send us their devices and components for testing after the development phase. Contracts with clients have been signed.

Socio-Economic Impact

A previously disadvantaged individual (PDI) graduate from UCT, serves on the board of directors and is being trained on entrepreneurship initiatives geared at commercialising scientific work.

Skills & Human Resource Development

3 The project has supported one PhD candidate and two MSc students.

Job Creation

1 Permanent Job

4 Contract Jobs

Identifying and Sharing Best Operating Practices

The guidelines and procedures for our tests which will be specific to iThemba (or related facilities) will be published as soon as they have been validated in accordance with the project plan. The test procedure will be published as Heliocentric Technologies ZA SEE qualification procedure.

Two staff members were trained in industry best practices and they are integral to the development of Heliocentric's specific test procedure.

Facilitating Networking Opportunities for Industry

Access to iThemba LABS's high energy facility as well as experts in proton beam technology, which is a critical success factor for the project. Pr. Engr. Daniel Faber, a renowned expert in radiation qualification of satellite components, provides his valuable services to Heliocentric by supporting the end-to-end development process. It has been possible to contact global industry leaders TRIUMPH labs in the United States, for input on the project.

Laser Shock Peening

Laser shock peening (LSP) is an innovative surface treatment technique that induces compressive residual stresses beneath the surface through the high magnitude shock waves generated by a high-energy laser pulse.

The goal of this programme is to establish a Laser Shock Peening (LSP) Technology Demonstrator which will be showcased to industry champions, with a view of demonstrating the competitive advantages this advanced technology offers. This project is a multi-institutional effort which combines the unique laser expertise of the CSIR and the Laser Shock Peening (LSP) expertise at the School of Mechanical, Industrial and Aeronautical Engineering at the University of the Witwatersrand (Wits), with support from the Laser Rental Pool Programme and the contributing CSIR funding.

Industrial impact has been achieved through modifications implemented on the LSP processing cell, following validation tests on aerospace related test samples. The LSP process is shown in Figure 1. Based on the results from these tests, industrial roleplayers in the aerospace (Aerosud) and energy (Eskom) sectors have approached the AISI-funded LSP programme to develop a prototype LSP work cell for local industry-related applications. This has resulted in the creation of a consortium consisting of the CSIR, University of the Witwatersrand (Wits), Stellenbosch University (SUN), University of Cape Town (UCT), and the Nelson Mandela Metropolitan University (NMMU).

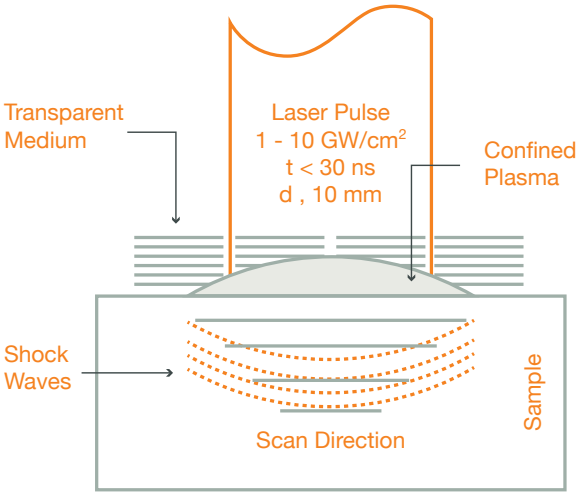


Figure 1: LSP Process

The impact would be as follows:

- Increase the contribution of small enterprises to the aerospace industry by giving them access to world-class aerospace-related LSP technologies
- Increase market access opportunities by improving competitiveness through the uptake of unique, locally developed LSP technology
- Expansion and improvement of the aerospace-related national research and manufacturing infrastructure
- Promote human capital development by promoting the utilisation of the LSP platform by science councils, Higher Education Institutions (HEIs), and industry to create new jobs

Productivity Improvement

Demonstrated improvement in fatigue properties of laser beam welded (LBW) butt joints for aerospace application (Figure 2). There is considerable interest in the aerospace industry for the incorporation of LBW joints instead of conventional riveted joints (Figure 3), to reduce weight, production and maintenance costs of the airframe structure. However, the thermal process of LBW results in detrimental tensile residual stresses in the heat-affected zone. Therefore, LSP is being explored as a potential technique to reverse effectively or relax the adverse tensile residual stress from the LBW process (Figure 4).

Skills & Human Resource Development

4

Four students involved in the development of the LSP system and processes.

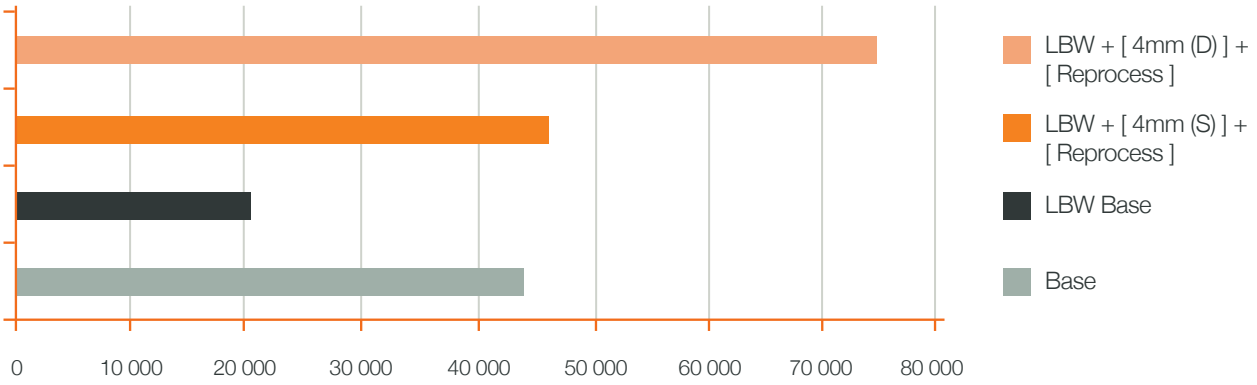


Figure 2: Cycles To Failure

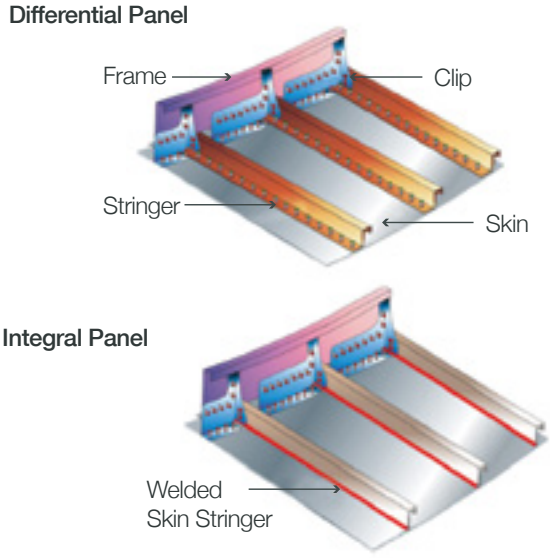


Figure 3: A differential and integral panel

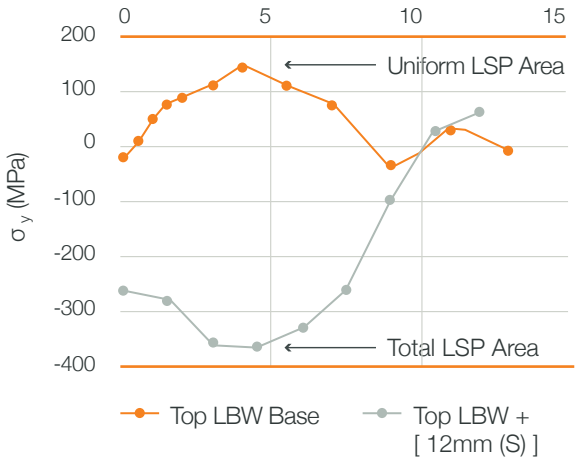


Figure 4: The residual stress profile of a LBW butt weld before and after LSP treatment

The Aerospace and Energy sectors have approached the Laser Shock Peening (LSP) programme to develop a prototype LSP work cell for local industry-related applications.

The impact of the LSP work has resulted in the creation of a consortium consisting of the CSIR, University of the Witwatersrand, Stellenbosch University, University of Cape Town and the Nelson Mandela Metropolitan University.

Market Access

Assisted in the establishment of a consortium consisting of the CSIR, Wits, Aerosud, Eskom, SUN, UCT and NMMU

Facilitating Networking Opportunities for Industry

AISI facilitated access to European universities, companies and institutions through the provision of funding for LSP of industry-related components. These LSP processes were developed and tested with the assistance of the following European companies, institutions, and universities:

- AgustaWestland
- Airbus
- Elettra Sincrotrone Trieste
- University of Bologna
- University of Pisa

Programme 2 Projects

1. Joint Aerospace Steering Committee (JASC)
2. Portable and Distributed UAV Ground Station Product Capability Development

Sector Strategic Support Initiatives

The Joint Aerospace Steering Committee (JASC) was established as a result of findings of the Aerospace Sector Development Plan (SDP). The aim of JASC is to provide strategic positioning for the aerospace and defence industry in South Africa. Due to **the dti's** involvement in the commissioning of the SDP, as well as their leading role in developing JASC, JASC and its activities has been positioned as a sector wide strategic support initiative.

By integrating and utilising policies to strengthen aerospace and defence, JASC aims to facilitate competitiveness improvement programmes, government procurement, supplier development, international and multi-lateral agreements, export support mechanisms and funding for IP exploitation, new product development and exports. JASC aims to play a role in South African R&D coordination by influencing research agendas and financing mechanisms. JASC will also support various skills development initiatives while providing support and funding for technology industrialisation projects, R&D, and industrial infrastructure. JASC aims to achieve the above through the implementation of strategic national flagship projects, managed and implemented by the AISI. The AISI will take the lead in IDAP's interventions under the sector strategic support initiatives.

The AISI acts on behalf of **the dti** and the DST, as custodians of JASC, by hosting the JASC secretariat. The AISI is responsible for ensuring the JASC and its operations are in accordance with the processes and procedures of the PFMA, through the CSIR, and established to fulfil the objectives of JASC as stipulated above. Dedicated personnel are tasked to achieve these objectives, and report impact and progress to the stakeholders, while ensuring that relevant stakeholders remain informed and engaged. In addition to the secretariat, the AISI contributes to national flagship projects identified by JASC and implemented by the AISI.

Joint Aerospace Steering Committee

The Joint Aerospace Steering Committee (JASC) was established as a result of findings of the Aerospace Sector Development Plan (SDP). The aim of JASC is to provide strategic positioning for the aerospace and defence industry in South Africa. In addition, JASC aims to improve South Africa's aerospace and defence industry, while monitoring and evaluating progress. It was officially launched during the Africa Aerospace and Defence show 2012, to a large contingent of stakeholders and media.

Through JASC's activities it is envisaged that national industry will benefit through focused R&D, human capital development, skills- and infrastructure investment. This will be guided through industry and R&D roadmaps and agendas. JASC takes on a leading role in positioning and profiling the aerospace and defence sector as pivotal to technology and industry development. By integrating and utilising policies to strengthen aerospace and defence, JASC aims to facilitate competitiveness improvement programmes, government procurement, supplier development, international and multi-lateral agreements, export support mechanisms and funding for IP exploitation, new product development and exports. JASC aims to play a role in South African R&D coordination by influencing research agendas and financing mechanisms. JASC will also support various skills development initiatives while providing support and funding for R&D and industrial infrastructure. JASC aims to achieve the above through the implementation of strategic national flagship projects, implemented by the AISI.

JASC meets on a monthly basis and comprises members of the following institutions:

- Department of Trade and Industry
- Department of Science and Technology
- Department of Defence
- Department of Public Enterprises
- Department of Transport
- National Treasury
- Aerospace Maritime and Defence Association (Two seats representing industry)
- Commercial Aviation Association of South Africa
- CSIR
- Industrial Development Corporation
- Technology Innovation Agency

The government sub-forum takes responsibility for resourcing the JASC through funding initiatives, and ensures integration with related government policies and strategies. It aims to ensure ease of conducting business with South African industry, as well as assisting to leverage government procurement.

The industry sub-forum will review technology development and requirements, and define elements for increased competitiveness and market opportunity.

The R&D sub-forum is tasked with defining and maintaining the strategic R&D agenda with relevant stakeholders.

The AISI supports **the dti** and the DST, as custodians of JASC, by hosting the JASC secretariat. The AISI is responsible for ensuring the JASC and its operations are in accordance with the processes and procedures of the CSIR, and established to fulfil the objectives of the JASC as stipulated above. Dedicated personnel are tasked to achieve these objectives, and report impact and progress to the stakeholders, while ensuring that relevant stakeholders remain informed and engaged.

Portable and Distributed UAV Ground Station Product Capability Development

A ground control station (GCS) is a land and sea-based control centre that provides the facilities for human control of unmanned aerial vehicles in the air or in space.

The AISI Portable UAV Ground Control Station (GCS) consists of a combination of hardware and software components, which enables the ground staff to execute the command and control functions in an Unmanned Aircraft System (UAS). The development of a networkable and portable GCS will enable the extension of the UAS command and control to beyond-line-of-sight (BLOS), through a distributed network of multiple control stations. The development of the portable GCS will be executed in two phases. The first phase entailed the high level system design, and the design, procurement and build of the hardware for a portable and distributed GCS. An existing GCS software baseline, which was developed for non-flight demonstration purposes, was enhanced with added features so as to make the GCS ready-for-flight.

The application of UAS in the civil commercial sector is a developing area featuring discernable trends. One common barrier in this regard has been the level of trained staffing required to operate a UAS. The AISI Portable GCS successfully addresses this barrier. Another such inhibiting factor has been the costs associated with traditional military UAS systems. This has created a significant amount of new entrants into the industry, mostly in the category of small systems, ramping-up quickly by integrating cheaper hobbyist-level products and subsystems. These small systems have a limited mission footprint and are difficult to develop further without the support of the original equipment manufacturer. The AISI Portable GCS project addresses this challenge to a significant extent.

Four key personnel retained

Two Master's students were involved with development of the Ground Control Station

Market Access

1. In November 2013, Tellumat finalised and flight tested the AISI GCS tracker sub-system in South East Asia. For the first time ever, the system integrator was able to integrate and fly its locally produced payload beyond 100km; this event now holds the promise of establishing a strong long-term business relationship.
2. Key elements of the AISI GCS were included in a demonstrator system proposal to a Middle-East client. This proposal was approved and a commitment from the client was received in December 2013.
3. As planned, the outcome of this programme is aligned with the needs of the CSIR's and University of Johannesburg's Modular Unmanned Aerial Systems (MUAS) programmes. Since the commencement of the project, alignment has also been gained with other local industry and development programmes:

- The Adaptronics Advanced Manufacturing Technology Laboratory at CPUT. On the merit of this project, the Adaptronics lab elected to adopt Tellumat's avionics and AISI GCS for their UAV development programmes starting with the adoption of a Hardware in the Loop Simulator (HILS) to be followed by the acquisition of hardware with which to complete the system integration.
- A local player has acquired the first of several AISI GCS Tracker Sub-systems and it is currently being integrated into a manned surveillance platform. This solution will be used to monitor key infrastructure such as mines and pipelines in South Africa and in various parts of Africa. It is expected that these manned platforms will be replaced with UAV systems in the future.
- The intention is and the opportunity exists for the Denel Hungwe platform to integrate the Tellumat avionics and AISI GCS. Discussions are ongoing and positive and likely to be finalised in the short term.

Skills & Human Resource Development

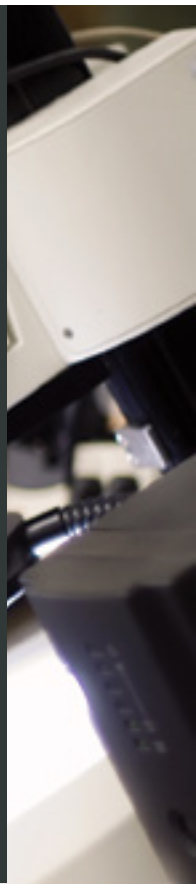
2

Supported by AISI, Tellumat will be placing two Master's level graduates on the programme granting them the opportunity to gain valuable experience. It is further intended that these graduates become a part of the product management team to develop this product portfolio through its lifecycle.

Job Creation / Retention

4

The project has provided Tellumat with the opportunity to retain four key personnel.



Identifying and Sharing Best Operating Practices

The project has allowed the possibility to sustain and maintain existing best practice in the company responsible for the systems engineering development process. A downturn in compliance with best practice has been observed in the past where there was a gap in development projects.

Key service areas in the business such as configuration management control have also been maintained at an acceptable level of efficiency on a sufficient number of projects.

Facilitating Networking Opportunities for Industry

Albeit informally, the project has intensely facilitated interaction with the greater industry specifically regarding the merits and appeal of the project. This bodes well for entrenching the alignment of the outcomes of the project with other industry projects such as the CSIR MUAS UAV project and the CPUT Adaptronics lab.

Tellumat is an active participant in the Aerospace, Maritime and Defence Industries Association (AMD) UAV Forum, ensuring that the project is aligned with national UAV activities.

Socio-Economic Impact

Tellumat was very proud of putting a key staff member to the test on this project. Nontobeko Myanda is technically qualified and has been making a transition into project management on the basis of her interests as well as her previous good record of performance at Tellumat. In her role as project manager-in-training, Myanda, is able to apply her skills directly to this project.

The project will shortly enter a phase which will be procurement intensive. Key historically disadvantaged organisations have already been identified for the provision of these services and work to be rendered. An SMME, EezeeCAD, has been contracted for mechanical design services.

Testimonials

I studied Electrical Engineering. I started working at Tellumat in 2006 doing my in-service training to complete my ND in electrical engineering. I worked for over 4 years as a Technician during which I had a responsibility to lead a team in production. In 2011 I started studying for project management and I am now given further training; an opportunity to practice managing projects.

I feel very grateful that Tellumat management has enough confidence to allow me the opportunity of project management. I am equally grateful to projects such as AISI Portable UAV for enabling support and encouraging training in order to develop individuals in this industry.

- Nontobeko Myanda

I would like to convey my appreciation to Tellumat for the mechanical design work on the AISI Portable UAV GCS (Ground Control Station) project that we are performing. EezeeCAD is a two-man organisation with a total experience of more that 40 years of collective experience in providing mechanical design services to the military and engineering industry.

As an independent contractor, this project is really appreciated and has proven vital to sustaining our organisation and ambitions.

Thanks to AISI, **the dti** and Tellumat for creating this opportunity for us.

- Wayne Zeeman, EeZeeCAD

The team during initial Tracker Field Tests in Cape Town

Programme 3 Projects

1. Standards, Accreditations and Certification Support
2. Supply Chain Optimisation - MyXchange Web Portal
3. Development of an Inventory Control System and Quality Improvement

Supplier Development

The AISI's supplier development interventions provide enabling mechanisms to assist industry to improve their competitiveness, productiveness and quality management systems and in doing so optimise its operations and procedures to ensure the South African industry integration into global supply chains. The strategic focus remains on SMMEs with the objective of ensuring industry transformation, and the broadening of the economic base participating in the industry. Economic benefits derived through supplier development projects include competitiveness improvement, productivity improvement, improved lead times, improved quality, cost savings, compliance to environmental standards, improved delivery performance, increased customer satisfaction and job creation and retention.

Standards, Accreditation and Certification Support

Airbus General Requirements for Aerostructure and Material Suppliers (GRAMS) is a requirement in order to achieve Airbus supplier approval.

Several companies in the South African aviation, defence and space industry act as suppliers, at various tiers, to the global Original Equipment Manufacturers (OEM). Examples of those specifically using South African suppliers are Boeing, Airbus, EADS, Pilatus, Embraer, etc. Furthermore, some of the Tier 2 suppliers to these OEMs also utilise South African suppliers. These Tier 2 suppliers using South African suppliers include Spirit Aerosystems Europe and Spirit Aerosystems USA. In South Africa we have several Tier 1 and Tier 2 suppliers to these OEMs as well and these South African suppliers usually offload work to South African Tier 2, Tier 3 and lower Tier suppliers. This supply chain structure is illustrated in the diagram below.

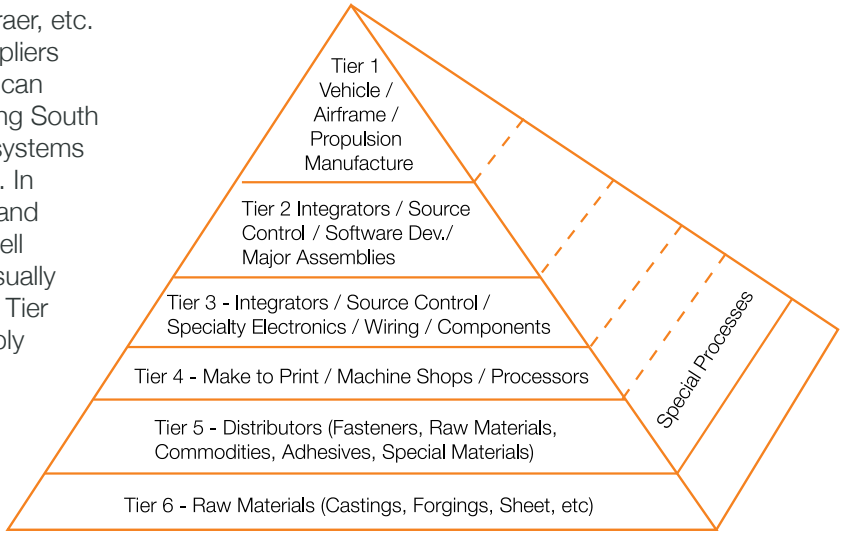


Figure 1: Supply Chain Tiers

The aircraft and aerospace industries have recognised AS9100 as a means for constantly improving quality and on-time delivery within their supply chain.

AS9100 is the quality management system (QMS) standard specific to the aerospace industry.

The OEMs (Tier 1) require (and enforce on) any and all of their lower Tier suppliers compliance with several requirements. Those requirements include, but are not limited to, the suppliers' management system, quality of product (as this could adversely affect safety), environmental factors as well as safety of the workforce at such lower Tier suppliers. This is achieved by the OEMs requiring the lower Tier suppliers to have management systems that conform to, are certified to, and accredited to specified international standards.

In addition, the OEMs also enforce their own unique OEM requirements (customer requirements) onto their lower Tier suppliers. This they achieve by laying down qualification criteria and then auditing these lower Tier suppliers to verify compliance before officially approving and adding such a supplier to their approved supplier list. They also enforce entry requirements for any lower Tier supplier to comply with before such a supplier will even be considered as a supplier to an OEM.

The certifications and accreditations required by OEMs on lower Tier suppliers are governed by International Standards. The International Organisation for Standardisation (ISO) governs the majority of these standards, but the standards applicable to the aviation, defence and space industry are governed by the IAQG (International Aerospace Quality Group). These International Standards ensure conformity and standardisation across the globe and across all Tiers of supply, whether it is a Tier 1 or Tier 6 supplier. Furthermore, these International Standards come at various levels of sophistication, detail and complexity and these levels also reflect industry specific requirements related to certain of these International Standards. In the aviation, defence and space industry, the hierarchy of the applicable International Standards to achieve OEM approval can be reflected as follows (with a short explanation of their application).

In addition to the above quality related International Standards, OEM also encourage their suppliers to comply with ISO 14001 (Environmental Management Systems) and OHSAS 18001 (Occupational Health and Safety Assessment System). Certification to these two International Standards is also done by global Certification and Registration Bodies (CRBs) through the IAF (International Accreditation Forum).

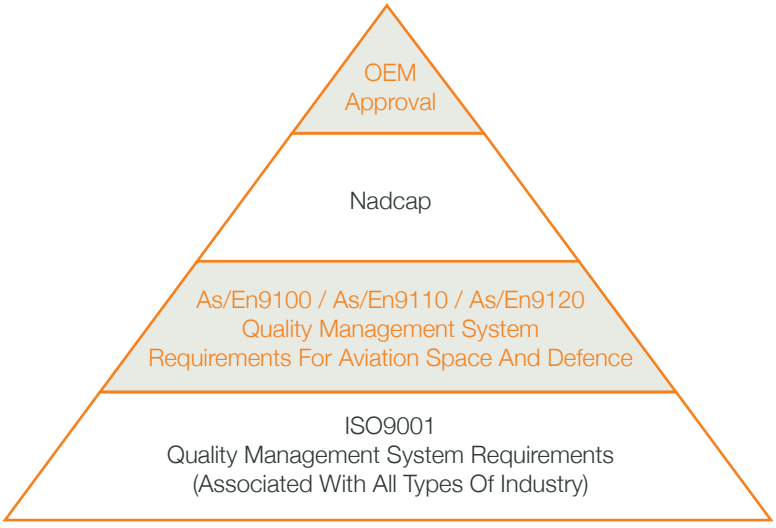


Figure 2: Certification Hierarchy

The OEMs publish their own set of 'standards' that lower tier Suppliers have to comply with in order to conduct any form of work for such an OEM. As an example, Airbus have GRAMS (General Requirements Aerostructure and Material Suppliers) and GRESS (General Requirements Equipment System Suppliers) while Sprit Aerosystems have their Document SC125 (Quality Requirements for Suppliers). To even be considered for approval by an OEM, any supplier has to have AS/EN9100 type certification and accreditation (Figure 2) and then demonstrate compliance to the OEM specific requirements. Furthermore, for specific industry sector suppliers in aviation, space and defence, the suppliers are also required to have the National Aerospace and Defense Contractors Accreditation Program (NADCAP) accreditation (Figure 2). Note that AS/EN9100 type certification and accreditation is an entry requirement for achieving NADCAP accreditation.

It is also important to be aware that while a Tier 1 supplier to an OEM has to be officially approved by that supplier, the lower Tier suppliers may not necessarily be approved by the OEM, but are expected to have AS/EN9100 type certification and accreditation, NADCAP accreditation (in certain cases) and be in compliance with OEM requirements. The effect of this is that the requirements imposed by an OEM on a Tier 1 supplier are also applicable and flow down to all the lower Tier suppliers.

From the above paragraphs, it is clear that any South African supplier to an OEM, at any Tier of the supply chain (Figure 1) has a raft of requirements to comply with to be a successful roleplayer in the global chain of supply. A short summary of the effect on a South African supplier of these requirements follows below. It should be borne in mind that the majority of South African suppliers involved in the aviation, defence and space industry are SMMEs.

Management

An SMME's management has to be committed to participation in this industry sector (aviation, space and defence). Furthermore, this commitment, coupled to the requirements listed above, will require financial commitment from the SMME. In most cases, even though the management commitment for participation is present, the financial commitment is just impossible for SMMEs to achieve. Getting certificated and accredited to the above International Standards comes at a price for the said certification and accreditation activities, but extremely high costs are also incurred in the implementation of these complex systems (these standards are at a much higher level than the baseline ISO9001 standard) in the organisation. Implementation cost factors are elaborated on below.

Human Resources

Due to the advanced and complex nature of implementing these International Standards, development of human resources is essential for ensuring implementation and sustainable compliance to these International Standards. On the global scene, the availability of skilled human resources in this industry is limited. Human resources development also carries a financial factor.

Infrastructure, Equipment & Facilities

To ensure compliance with these International Standards, improvements, additions and changes to an SMME's infrastructure, equipment and facilities are usually required in some form or another. This adds up to the financial burden of participation in this industry sector.

Environment

Operating in an environmentally sustainable manner (iaw ISO14001) and in a safe and healthy manner (iaw OHSAS18001) brings its own challenges (once again financial as well) in terms of compliance and implementation. As a rule, the first step is to comply with the AS/EN9100, NADCAP and OEM requirements, and then follow that up with ISO14001 and OHSAS18001.

Technology

Due to the stringent specifications and tolerances associated with the aviation, defence and space industry (in addition to regulatory requirements), technological advancement of an SMME's methods are usually required. In most cases this also carries a large financial burden with it.

Standards, Accreditation and Certification Support

Update of AS9100 QMS to accommodate Airbus GRAMS

Daliff Precision Engineering (Pty) Ltd (Daliff) is a supplier of precision machined (milling and turning) aircraft parts and components to Aerosud (whose customers are mainly some of the large OEMs like Boeing, Airbus and BAe), Denel Aerostructures, Denel Aviation and other subsidiaries in the Denel group. They also supply, on a limited scale, the general engineering industry. They are currently based in Cape Town and certificated to AS/EN9100. Due to the current programme between Aerosud, Denel Aerostructures and Airbus, Daliff needed to expand their management system to demonstrate compliance with Airbus General Requirements for Aerostructures and Material Suppliers (GRAMS) requirements in order to achieve Airbus supplier approval. In order to accommodate Airbus GRAMS, their current AS/EN9100 QMS needed an extensive upgrade.

This upgrade and Airbus GRAMS approval also enhanced their market access opportunities, positioned them better as a direct supplier to Airbus and contributed to the improvement of the South African aerospace and defence industry as the company now has a better rating and is on the Airbus Qualified Parts List (AQPL).

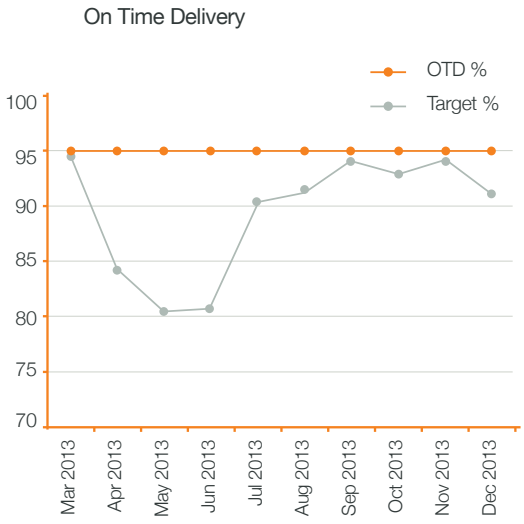


Figure 1

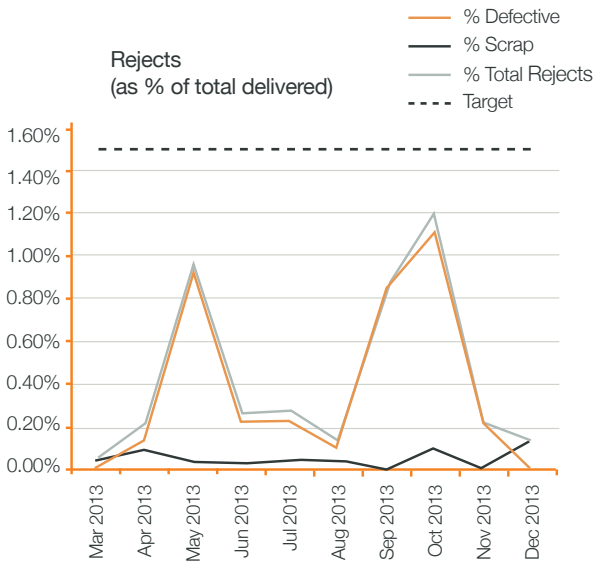


Figure 2

Productivity Improvement

Overall productivity improved by 12% due to the enhancement of the QMS and standardisation of documents. In addition to this, there was also a lead time improvement of 20%, due mainly to more detailed contract review and industrialisation process implementation. The overall reject rate has also stabilised the above target.

Market Access

Additional Airbus work (A350XWB) and big rail contracts are in the pipeline due to GRAMS processes that are now in place. GRAMS has opened up a new level of clients as well as improving current client relationships.

Socio-Economic Impact

Individual historically disadvantaged personnel members are gaining OEM and world-class processes training and experience.

Supply Chain Development and Redesign

The knock-on effect from Daliff to other organisations in the industry should be positive. As Daliff expands on the back of increased turnover, it will be sourcing additional Computer Numerical Control (CNC) equipment, cutting tools, cutting fluids and other consumables from the local industry. Indirectly this should lead to further jobs being created in the supply base. Other suppliers should also benefit, provided they obtain the necessary approvals for Daliff to be able to utilise their services.

Facilitating Networking Opportunities for Industry

World-class (Airbus) procedures and processes are now in place. The ability of another South African organisation to service global OEMs (like Airbus) directly as a Tier 1 supplier is important for the local industry.

The main partner in this project was Airbus directly. This included two on-site visits by an Airbus delegation of three during the course of the project. These visits were to establish the progress made with the project and to verify the effectiveness of measures taken to accommodate Airbus GRAMS.

Furthermore, several interventions and on-site visits by Aerosud (Airbus Tier 1 supplier) also occurred. This mainly resulted in a knowledge transfer from Aerosud to Daliff. Aerosud has been a Tier 1 supplier to Airbus, and has been GRAMS approved, for several years (one of only two local companies that hold Airbus GRAMS approval).

Identifying and Sharing Best Operating Practices

As Daliff sees it, the AISI's goal is to assist in the development of the local aerospace industry.
To achieve this there are three key elements:

- Improve the technical capability of local industry to make the local industry globally attractive to the OEMs and their Tier 1 and Tier 2 suppliers.
- Obtain the necessary certifications and OEM approvals.
- Create market awareness of the local industry's capabilities, and create contact between local industry and the potential global customers.

Skills & Human Resource Development

47

At present Daliff employs 47 people.

Of those, 87% are previously disadvantaged.

17% are women

50% of the Executive Management team are previously disadvantaged

66.6% of the executive directors are previously disadvantaged.

Job Creation

4

Four new jobs have already been created

The AISI support for Daliff on the GRAMS project has had a significant impact to Daliff. The transfer of intellectual property (mainly in the area of systems) from Airbus to Daliff in the process of implementing and enhanced QMS (and GRAMS) has lifted Daliff's processes/documentation to an international standard. This was proven by the recent detailed ALSTOM audits for the PRASA work where Daliff passed with ease and has become an approved supplier.

The financial assistance of the AISI enabled this project to take off.

Testimonial

The support of the AISI has enabled Daliff to implement a global best practice system in the Airbus GRAMS, which is now opening very significant business opportunities for Daliff to manufacture locally and supply to the OEMs. Since implementing GRAMS, we have become an approved supplier to two additional global OEMs and are in discussion with a further two to whom we have already quoted.

- Rowland Chute, Chairman, Daliff Precision Engineering

Implementation of AS9120 AQMS

Aerotechnic (Pty) Ltd has facilities in both Cape Town and Johannesburg; the company is a stockist and distributor of aircraft parts (consumables and components) and other services (exchanges, loans, repair management). Their customers consist of commercial and regional airlines, maintenance, repair and overhaul (MRO) facilities and aerospace manufacturers (sub-contractors to Boeing, Airbus, etc.). Aerotechnics support primarily covers the Airbus, ATR, Boeing, Bombardier and Embraer aircraft families, therefore they have to operate in strict compliance with international aviation regulations.

They deal with aircraft spare parts (new/overhauled/repaired) for commercial and regional aircraft in the civil and military aerospace industry, Mankiewicz aircraft paints (interior and exterior) and technical support; the company has an aircraft paint colour mixing facility. Stock holding typically includes bearings, chemicals, engine spares, filters (air, fuel, oil), fuses, hardware (bolts, nuts, rivets, screws, washers, etc.), igniters & exciters, lamps, lights, o-rings, packing, propeller spares, seals, starters, generators, wheel & brake spares, and many more products.

Their current Quality Management System (QMS) is certificated to ISO9001:2008 and FAA AC00-56. In order to further enhance their regional and global footprint and to facilitate expansion and sustainability, certification to AS9120 is a requirement. This would also bring their South African operation in line with their facilities in the US, Singapore and Vietnam.

Skills & Human Resource Development

Previously disadvantaged personnel members are gaining OEM and world-class processes training and experience. Several in-house briefing sessions on AS9120 specific requirements were held during the course of this project to date.

Job Creation

4

From 2012 Aerotechnic has increased its total staff from 26 to 30

Productivity Improvement

Aerotechnic is not in a production environment and measuring productivity improvement can only be done by means of lead time improvements, as reflected by customer satisfaction. This has risen from 73% in 2011, to 86% in 2012 and finally to 87% in 2013. Similarly, customer complaints have dropped from 18 in 2011, to 3 in 2012 and 2 in 2013. See indicators (KPIs) below.

Risk analysis requirements in AS9120 have improved Aerotechnic's acceptance of contracts, and the terms offered to the client.

POLICY & OBJECTIVES OF MANAGEMENT

Element	Target	Current	Previous	Trend	Comments / Remarks
Monthly QA Meetings	> 75%	58%	58%	→	Excludes Management Review, December & January due to holidays
Employee Satisfaction	> 8/10	6.52/10 [09/12]	6.51/10 [09/11]	↗	Main Concerns Stress, Stress of Others, Workload, Personal Growth
		7.20/10 [03/13]	7.14/10 [03/12]	↗	Main Concerns Stress, Facilities, Stress of Others, Personal Growth

CONTINUOUS IMPROVEMENT

Element	Target	Current	Previous	Trend	Comments / Remarks
Customer Satisfaction Replies Received	> 50%	13%	15%	↘	Actions Required Review Exchange Agreement and state clearly terms of Exchanges in Quotes
Customer Satisfaction Replies Received	> 50%	> 50%	> 50%	↗	
Customer Complaints New Per Month: Unresolved Per Month:	< 1% < 0.5%	2%	3%	→	
Customer Complaints (CC) Ratio CC : DN	< 1%	0%	0.1%	↘	

PURCHASE MANAGEMENT

Element	Target	Current	Previous	Trend	Comments / Remarks
No. of PO's to Supplier	> 200pm	1,962	1,902	↗	+3%
No. of items in PO's	> 350pm	3,338	3,009	↗	+11%
No. of Exchange PO's	> 4pm	92	52	↗	+77%
No. of Repair PO's	> 7pm	14	5	↗	+180%

RECEIVING

Element	Target	Current	Previous	Trend	Comments / Remarks
No. of Receipt Forms (RF)	> 300pm	2,388	2,298	↗	+4%
No. of items in RF	> 550pm	5,572	4,162	↗	+34%
No. of Discrepancies (DR) New per Month: Unresolved per Month:	< 3% <0.5%	50	50	→	Main DR Reasons 49 x No certificates or inadequate certificates 1 x Missing proof of Interchangeability
Ratio DR : RF (Items)	< 3%	1.1%	1.4%	↘	

DISPATCH

Element	Target	Current	Previous	Trend	Comments / Remarks
No. of Delivery Notes (DN)	> 320pm	2,992	2,924	↗	+2%
No. of Items in DN	> 650pm	7,029	5,968	↗	+17%

HUMAN RESOURCES

Element	Target	Current	Previous	Trend	Comments / Remarks
No. of new Employees	-	+5	-	-	
No. Employees Resigned	-	-2	-	-	
Total No. of Employees	-	28	-	-	
Absenteeism Days	-	64,7	102,4	↘	37%
Absenteeism Ratio	< 2%	1%	1,7%	↘	
Training Man Days	-	48,5	9	↗	

Market Access

Potential access to further business with OEMs.

Supply Chain Development and Redesign

Stricter controls will also be imposed on Aerotechnic's supplier base (in line with AS9120 requirements).

Identifying and Sharing Best Operating Practices

AS9120 ensures enhanced controls, analysis and reporting processes, which are crucial factors in the business of Aerotechnic.

Facilitating Networking Opportunities for Industry

Aerotechnic views the AISI's goal as assisting in the development of the local aerospace industry. Part of this is to obtain the necessary certifications and OEM approvals to AS standards, including AS9120.

Socio-Economic Impact

This has been an approach of Aerotechnic from its inception, and therefore, AS9120 does not necessarily alter the company philosophy. 95% of their South African employees are historically disadvantage individuals.

Testimonial

The project for Aerotechnic has the sole goal of enhancing the sophistication level of the Aerotechnic QMS to be compliant with the requirements of AS9120 and successfully be certificated by a Certification Registered Body (CRB) to the AS9120 standard.

- Chris De Beer, Standards, Accreditation and Certification Support Consultant, Revolavia

Implementation of AS9100 AQMS

West Engineering supplies precision machined (milling and turning) aircraft parts and components to Aerosud (whose customers are mainly some of the large OEMs like Boeing, Airbus and BAe), the Denel Group and Cassidian Optronix (formerly Zeiss Optronix). The company also supplies the automotive industry. It currently holds ISO9001 certification and is based in Olifantsfontein in Gauteng. Due to the current programme between Aerosud and Airbus relating to manufacturing of the new Airbus A400M components, West Engineering has a requirement to expand its management system certification to include the requirements of AS/EN9100. This is an Airbus requirement being filtered down to its lower tier suppliers. This will also enhance West Engineering's market access opportunities, especially in the aerospace sector and ensure an efficient and effective organisation that can operate economically and be sustainable.

Skills & Human Resource Development

48

At present West Engineering employs 48 people.

Of these, 75% are previously disadvantaged.

Women make up 12.5% of the total workforce, and 50% of those are previously disadvantaged individuals.

Job Creation / Retention

4

Four new jobs were created, which have all been filled by previously disadvantaged individuals.

There is the potential for more job creation, should workload increase as a result of AS9100 certification.

Market Access

Due to the fact that AS9100 is in process of final implementation, some additional work has been forthcoming from West Engineering's main customer, Aerosud. The full effect of AS9100 certification would in all likelihood only be evident once West Engineering has been certificated for some time to the AS9100 standard.

Supply Chain Development and Redesign

Several interventions and on-site visits by Aerosud (Airbus Tier 1 supplier) occurred. This resulted in a knowledge transfer from Aerosud to West Enginering to assist with enhancement of the system to AS9100 standards.

Identifying and Sharing Best Operating Practices

The project is still work in progress. At present the basic AS9100 documented system is in place and being reviewed, while partial implementation of several aspects has already taken place. Full implementation is expected by end April 2014, followed by the checking and verification stages and certification towards end June 2014.

Facilitating Networking Opportunities for Industry

Internationally recognised procedures and processes are now in the process of being introduced. This is expected to assist the company in the longer run in terms of efficiency and profitability.

When the project is complete, it will position West Engineering as one of only five machining houses in South Africa to have AS9100 certification, and thus enhance the overall aerospace industry of South Africa.

Socio-Economic Impact

Individual historically disadvantaged personnel members are gaining OEM (due to AS9100 requirements) and world-class processes training and experience.

Testimonial

The AISI support for West on the AS9100 implementation project is having a positive impact on West. The transfer of intellectual property (mainly in the area of QMS) is enhancing West's processes to a higher standard. The financial assistance of the AISI is enabling this project to take place. Without the AISI's financial support, the project would not have got off the ground.

- Chris De Beer, Standards, Accreditation and Certification Support Consultant, Revolavia

Supply Chain Optimisation - MyXchange Web Portal

The success of the MyXchange solution in the motor industry resulted in its implementation within the aerospace industry

MyXchange Portal

The MyXchange web portal is an online platform that allows users/suppliers to view and action orders received from manufacturers. Users have the option to view, accept and pend orders. The manufacturer has full visibility on the status of the order throughout its life cycle. Once an order has been accepted and the goods are to be delivered, the user/supplier creates an advanced shipping notification (ASN) which informs the manufacturer that the goods are on their way. When the manufacturer has received the goods, a goods received notification (GRN) is created, which is visible on the portal for the supplier to be informed that the goods have been received. The MyXchange solution negates the need for emails, faxes and phone calls to confirm orders, and allows for all parties' visibility. Below is a list of benefits associated with the portal :

- Full supply chain visibility for any SMME and original equipment manufacturer (OEM)
- SMME visibility into OEM order forecasts and requirements
- Reduction in costs for SMMEs and OEMs, as they no longer require expensive enterprise resource planning (ERP)/materials requirement planning (MRP) systems
- Increased productivity due to accurate and real-time data for the SMME and OEM
- Improved lead times due to automated solutions and shipment processes
- Support lean manufacturing due to confirmed ordering process
- Cost saving to SMMEs as minimal warehouse space is utilised.

Full supply chain visibility for any SMME and original equipment manufacturer (OEM)

Thirty-five SMMEs are currently active on the MyXchange solution

Identifying and Sharing Best Operating Practices

SMMEs' employees get training on how to use the system effectively, which in turn empowers them to grow within their own organisation, as they are involved in the supply chain process. Awards were won for best practice in other industries under the MISCCIP (motor industry supply chain competitiveness improvement process) project which became industry standard for supply chain processes within such industries. Systems drive best practices through systemised step-by-step guidelines, enforcing a high quality supply chain output.

RFQ & Technical Drawing

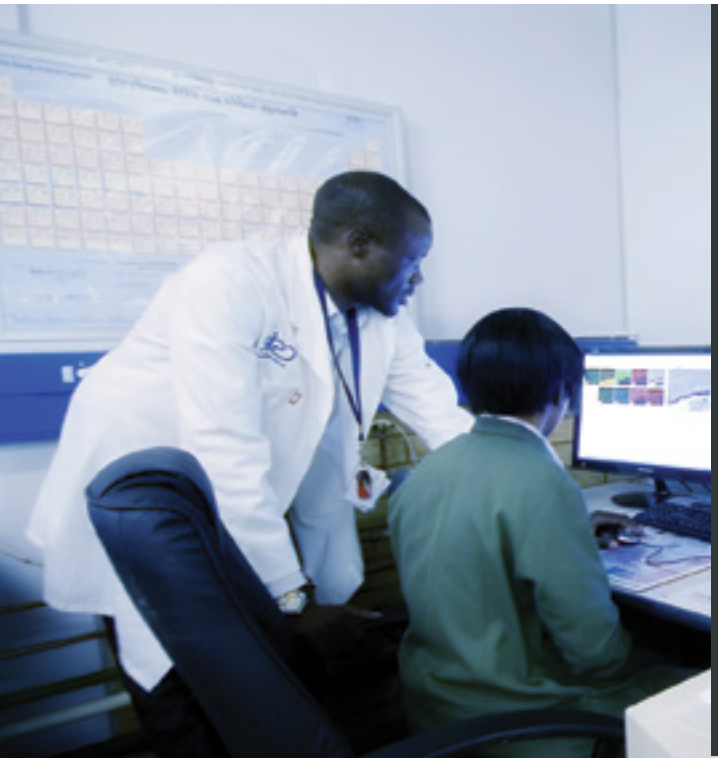
The preorder phase known as request for quotation allows the supplier to bid on supply of parts to the OEM. The RFQ module will cater for the ability of a buyer to electronically send out a request for prices on OEM parts to suppliers via the MyXchange web portal. The buyer is also able to attach a document or technical drawing to the RFQ on detail line level. This takes away the need for manual collation of different Excel sheets and the couriering of technical drawings on a CD; this also allows for complete visibility when requests were sent, and a response on the status of each with an ability to comment electronically.

Productivity Improvement

The MyXchange Solution assists with lean manufacturing by providing detailed order data in real time, which informs both the SMME and the OEM of exact delivery/shipment dates. Time efficiency is enhanced, as recapturing of requirements is not required for either the SMME or the OEM. All orders and invoicing processes are available in a centralised environment. Reduction in payment disputes is another advantage as a complete electronic audit trail of all ordering transactions is available to both the SMME and the OEM. Paper usage is reduced through electronic ordering.

Supply Chain Development and Redesign

The solution drives quality management system (QMS) assurance as the SMMEs know exactly what to deliver, and to what quality specification. The OEM can inform the SMMEs electronically of goods received in good order as well as raise any quality-related discrepancies.

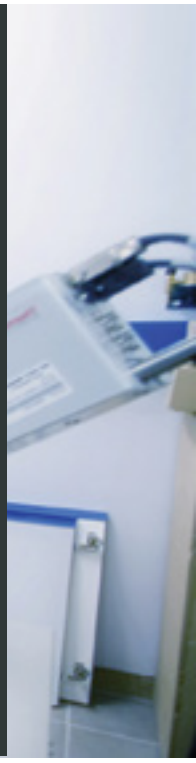


Skills & Human Resource Development

The ease of use which the solution provides makes it easy for unskilled and semi-skilled staff to use it. This alleviates administrative time, therefore making other resources more effective in the workplace.

Job Creation / Retention

Users are able to focus their skills in other areas, as no data capturing is involved, thus allowing them to grow in their respective organisations. Unskilled and semi-skilled staff are able to use the solution. In doing so, they increase their skill and contribution to the organisation. Skilled staff are able to use the solution to drive supplier ratings and by doing so, increase the profitability and track potential risks.



Market Access

Thirty-five SMMEs are currently active on the solution. The SMMEs see the following benefits from the solution:

- Suppliers are able to activate entire second tier supplier bases. Suppliers would effectively act as an OEM to their suppliers enabling them to have full visibility of their supplier's supply chain.
- Forecasts of orders are available for the SMMEs, which provides them with sufficient time for the production of goods in line with the OEM's requirement. This also assists the SMME to identify any production shortages based on demand and in doing so, ensure optimal productivity.
- Efficiency is achieved in terms of saving time, due to the elimination of recapturing of orders. As a result, SMMEs are able to focus on additional production requirements.
- Reduction in costs was reported, as expensive ERP/MRP systems are not required.
- Productivity is increased whilst reducing risk as accurate data and real-time data are available as well as automating forecasting.
- Improved lead times are reported due to automated solutions, shipment processes and production forecasting.

Facilitating Networking Opportunities for Industry

The MyXchange solution is an internationally recognised solution, which also adheres to international transactional standards. SMMEs using the solution therefore have access to international trade when or if required without having to invest in additional tools/infrastructure. The MyXchange solution was also demonstrated and marketed at the Mildest Expo in Paris during October 2013.

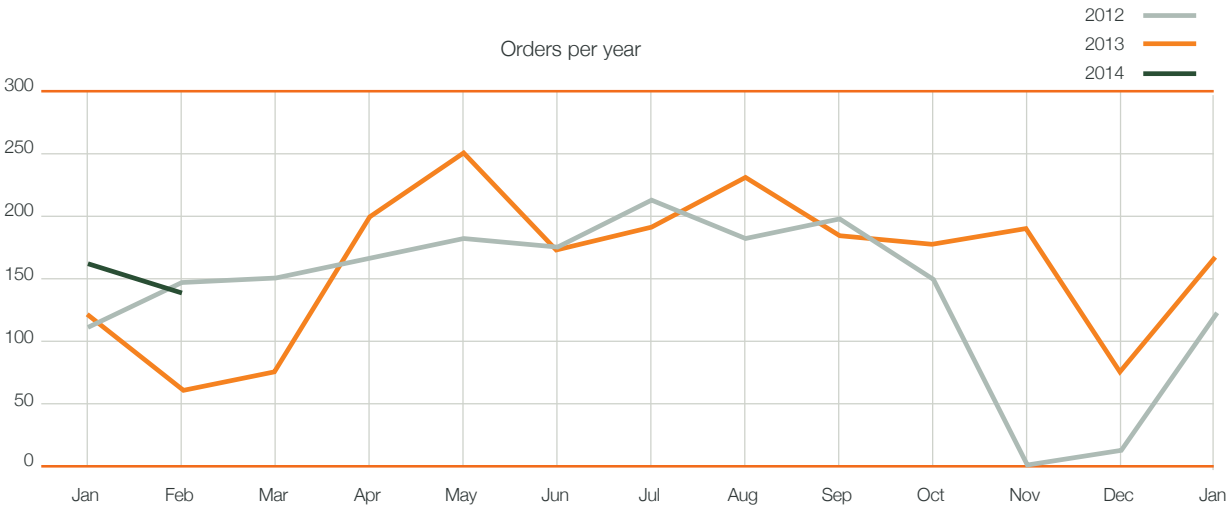
Socio-Economic Impact

SMMEs are able to interact with the OEMs on the same level as large corporations. The web portal acts as an ERP/MRP system for SMMEs that might not have access to expensive ERP/MRP solutions of their own. The MyXchange solution also allows for portfolio growth for any employee within an organisation. Since the platform is user role-driven, specific functions can be allocated to specific employees. Unskilled and semi-skilled staff are able to use the solution. In doing so, they increase their skill and contribution to the organisation.

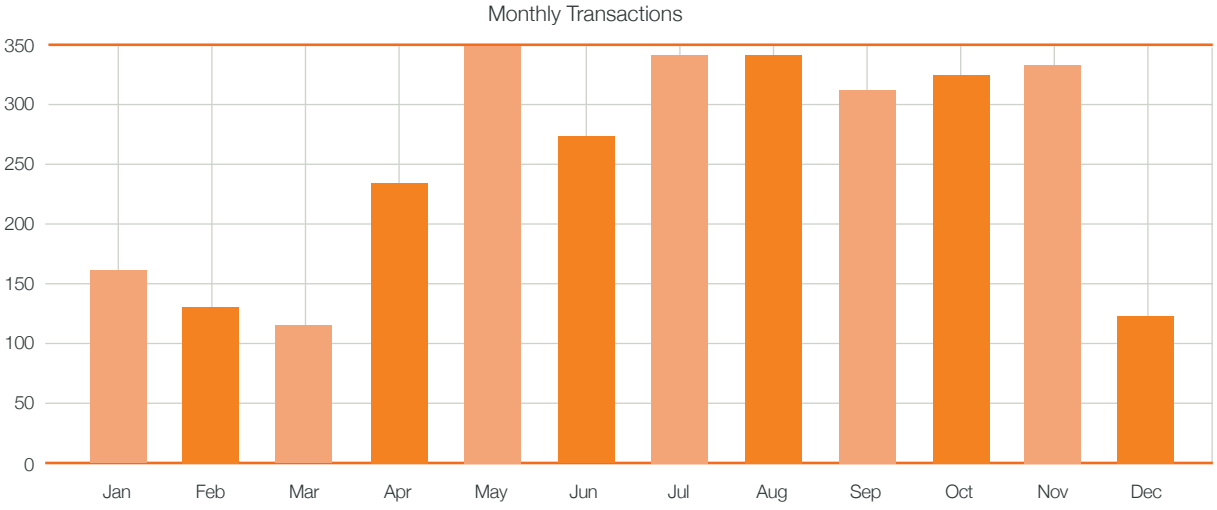
Testimonial by Beneficiary

- Jack Pack – 'Assisting in the elimination of paperwork and errors on the orders'
- TP Agencies – 'MyXchange Web portal eliminates the paper element when dealing with orders'
- Aerotechnic – 'The Web portal is a great benefit. Helps us be more efficient when dealing with our client'
- Compumach Engineering – 'The CX portal give us the heads up on orders coming, as we are able to view order forecasts. Without the portal we would not be able to plan ahead as we do now'
- Northern Bolt & Tool – 'The MyXchange web portal makes life easier and is easy to use'
- Aerosud - 'The AISI ordering and invoicing solution has assisted us by ensuring full visibility of the supply chain between us and our customers which resulted in fewer account queries and payment disputes'

The graphs below indicate the number of orders placed on the system over the past two years. The usage of the system by SMMEs has increased by 19% over the past year, indicating SMMEs activity on the solution as well as an overall increase in SMMEs production volumes.



The graphs below indicate activity between SMMEs and OEMs via the MyXchange web portals, which demonstrates that the MyXchange web portal has become standard operating practice for both SMMEs and OEMs alike.



Development of an Inventory Control System and Quality Improvement

An inventory control system is a management process utilised for managing and tracking objects or materials

This project focused on improving Vestcast's operations by improving its supply chain performance. The project was divided into two sub-projects:

- Developing an inventory management system
- Quality improvement.

The project is ongoing so the impact is expected in some cases but it has not yet realised. The project has a target to reduce the scrap percentage from 10% to 6%; this will save the company about R160 000 every year. This is in addition to other benefits, such as a satisfied client base and increased business opportunities. The inventory management system is expected to reduce finished goods inventory by 40%, which is equivalent to about R400 000 worth of stock, considering the current value of stock at hand.

Implementation of the management systems at Vestcast will result in a reduction in the scrap percentage from 10% to 6%, an estimated saving of R160 000 per year

Productivity Improvement

The company has currently finished product stock estimated at over R 1 000 000, which it cannot sell. The electronic inventory system will assist in making sure that stock on hand is known before the items are produced. The target is to reduce the finished goods inventory by 40% since this company is a make-to-order (MTO) company. Once this is realised, it will save the company approximately R400 000.

In addition to the reduction of scrap from 10% to 6% cumulating in a cost saving of R160 000 per year, additional benefits can be realised such as a satisfied client base and reduced lead times due to reduced lot sizes.

Additional benefits expected from this project include:

- Reduced wastage
- Reduced cost of holding inventory
- Lead time reduction (due to reduced lot sizes), which means reduced processing time.

Some of the benefits listed above can only be quantified once the project is complete and the results are monitored.

Four industrial engineering students from the University of Johannesburg are participating in the study as part of experiential learning.

The project will also help with job retention at the moment, but with the expected improvement in business performance, it is envisaged that job opportunities will be created in the near future.

Four third-year industrial engineering students from the University of Johannesburg are involved in the project.

Identifying and Sharing Best Operating Practices

The process of eliminating root causes of defects will help identify best practices for the company. Once the inventory system is in place, guidelines will be developed on how to use the system and on how to manage the warehouse effectively. Those guidelines will assist in continuous improvement of the system.

Market Access

It is envisaged that with the reduction in lead time, smooth production flow and improved processes and quality, the company will be able to secure more contracts.

Skills & Human Resource Development

4

There are four third-year industrial engineering students from the University of Johannesburg involved in the project. The students are assisting with investigations of root causes of defects and conducting time studies. Personnel from Vestcast responsible for the warehouse, ordering and shipping will receive training to enhance their computer skills and warehouse management skills.

Job Creation / Retention

50

The company currently has a staff complement of 50 permanent employees. The current project aims to improve productivity and increase the number of employees. If the company's competitiveness is improved, more job opportunities will be created, especially for previously disadvantaged individuals. In the meantime, job retention will be realised because the project will give them enough savings to allow them to maintain the current workforce despite the challenging operating environment.

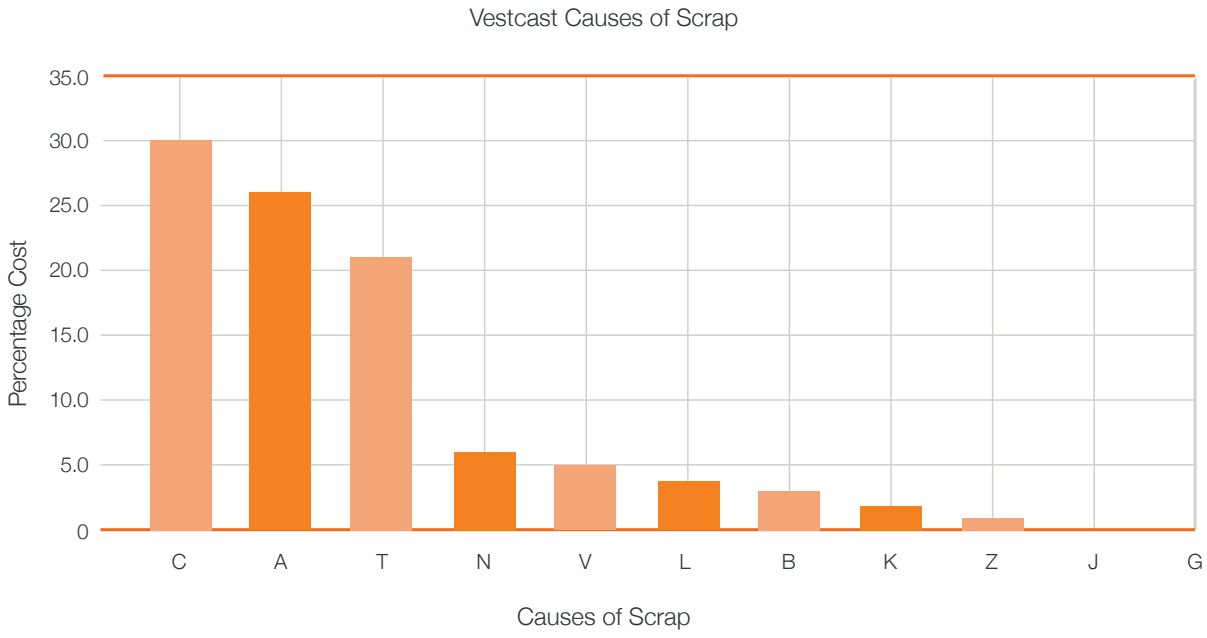
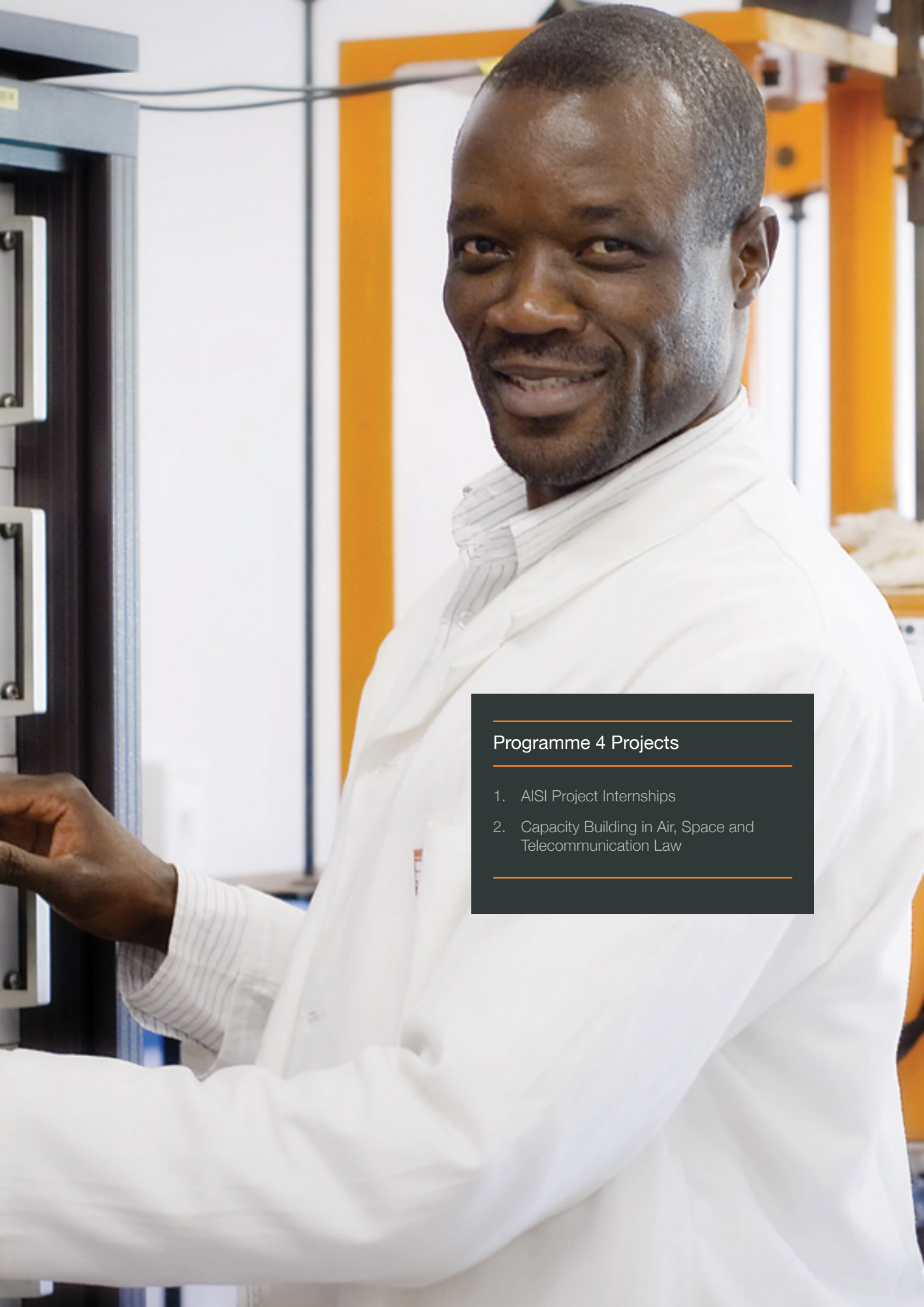


Figure 1: Pareto Analysis Based on Cost for Scrap Defects



Programme 4 Projects

1. AISI Project Internships
2. Capacity Building in Air, Space and Telecommunication Law

Industry Focused Skills Development

While there are existing skills development and training structures in government, such as departments of Basic and Higher Education, there is a need for focused and targeted skills development initiatives that are designed for the SA aerospace sector. This programme is undertaken under the leadership of the NAC, with its specific focus on knowledge and skills development. The AISI undertakes projects with a specific aim of utilising industry knowledge and technology to improve human capital.

AISI Project Internships

CSIR Materials Science and Manufacturing:

- Light Metals Group
- Primary Titanium Pilot Plant

Three PDI interns supported

Internships in industry can be seen as an important growth point in a student's career. The formal interaction of the interns within industry defines an early career path and provides valuable experience for the young inquiring mind. The AISI assist interns by exposing them to high technology research and development environments. The internship programme ensures that the internship is of maximum benefit to the intern and the organisation.

This year three interns were employed within the CSIR. The interns' focus was on Titanium processing and manufacturing. Titanium and its alloys are used extensively in the aerospace industry. South Africa has the second highest resources of titanium ore in the world and it is only over the past decade that a concerted effort is being made to establish a titanium industry sector in South Africa.

In order for this sector to be successful, it is vital that human capital with expertise in the field of titanium physical metallurgy be developed to support this industry at all levels.

Christina Kgomo

Christina's placement was within the Light Metals group. The internship work included training in the field of mechanical testing and in metallurgical analytical techniques.

The outcomes of the internship

- Desktop study on mechanical testing and a review report of the literature studied
- Training on the preparation of metallurgical samples for analysis. This involved understanding cutting, mounting and polishing samples for metallurgical analysis
- Trained on the use of the metallurgical light microscope and image analysis
- Trained on the basics of titanium physical metallurgy.

Highlights

- Submission of a conference paper to the Advanced Metals Initiative light metals conference to be held in October 2014
- Preparation of a proposal to study towards a MTech degree at Tshwane University of Technology.

Testimonial

When I first got to the CSIR light metals group, I only had knowledge of what I learned during my tertiary education. The internship opportunity broadened my practical knowledge within the field of materials testing and metallurgy. It further increased my passion for working in the laboratory. I have acquired advanced skills in the conduction of tests for light metals and in performing laboratory experiments, as well as improved skills in technical report writing. With the exposure that I received, I strongly believe that I am now ready and have the abilities to carry out and apply my technical knowledge and skills in the technical world and industry.

The internship has not only been helpful in equipping me career-wise but on a personal level as well. I'm now able to conduct myself professionally with a wide range of people, working in a variety of teams and as well as on my own initiative. The 17 months I've been working here at Light Metals have equipped me with valuable experience.

- Christina Kgomo

Buyisile Kholisa and Tlatsetso Daniel Dlamini

Buyisile and Tlatsetso were placed at the Primary Titanium Pilot Plant. The internship allowed them to be exposed to the designing and installation of a chemical plant. Various workshops and training courses were completed, which provided them with vital skills and experience in conducting research and in the complex nature of plant design.

The outcomes of the internship

- Lithium loading operation and safety (Including safe handling of Li)
- Reduction section operation and safety
- Titanium drying safety (Including safe handling of Ti powder)
- Titanium tetrachloride loading operation and safety (Including safe handling of TiCl4)
- Casting operation and safety
- Laboratory Safety and Chemical Grades Seminar
- Creativity
- Teamwork in research
- Research and Innovation Core Skills (RICS)
- Basic Fire Fighting
- Emergency First Aid Level 1
- Technical Report Writing

Highlight

- Buyisile and Tlatsetso were employed at the CSIR for a further one-year period.

Testimonial

Professionally, the internship programme has provided me with more than enough experience for the start-up of my career. The programme managed to link the concepts that I learnt at university with the practical applications that are present in the research and manufacturing industry. It also provided me with certain skill sets that enable me to complete required tasks more effectively.

Personally, the internship has made me see chemical engineering as a passionate hobby that I enjoy from day to day. The one awesome advantage of doing an internship at a research organisation is that one never gets to do the same thing over and over again. There is always something new to learn every day. The knowledge I have grasped here at the CSIR over the past 20 months is unlike any other.

- Tlatsetso Daniel Dlamini

Capacity Building in Air, Space and Telecommunications Law

The capacity building focused on the legal framework pertaining to international air, space and telecommunications, including the relevant international treaties and their application within the South African context.

The Institute for International and Comparative Law in Africa in the Faculty of Law of the University of Pretoria (UP) facilitated capacity building in international air, space and telecommunications law with the support of the AISI. This event offered a unique opportunity for members of the civil service and industry to develop specialised skills in these areas of law.

The capacity building was directed by a leading international expert in the field, Prof. Dr. Stephan Hobe, LL.M. (McGill), Director of the Institute of Air and Space Law at the University of Cologne, Germany and Extraordinary Professor in the UP Faculty of Law. The capacity building focused on the legal framework pertaining to international air, space and telecommunications, including the relevant international treaties and their application within the South African context.

17 members of the civil service, industry and academia (of which 14 were PDIs) were involved in the 2014 capacity building course.

Since 2011, 65 students have been trained during these capacity building courses in air, space and telecommunications law at the University of Pretoria

The capacity building course provided members of the civil service and industry who deal with legal aspects of air, space and telecommunications law in their daily work, with essential knowledge.

Key topics included:

- The public and private dimensions of air law
- The regulatory system of the International Telecommunications Union
- The combating of outer space pollution caused by space debris
- The history and major principles of space law
- The use of space for military purposes
- Liability for the wrongful use of space
- The role of international air law in combating terrorism.

Due to the generous support by the AISI, the course reached participants who would otherwise not have been able to attend.

Productivity Improvement

During the 2014 Capacity Building Course, 17 members (of which 14 were HDIs) of the civil service, industry and academia were trained in accordance with the goals and objectives outlined above. This brings the total number of individuals trained during these capacity building ('short') courses since 2011 (when it was first introduced) to 65.

Seven of the members attending the 2014 course are also in the LL.M. programme. Since three of these seven LL.M. students are also working in related areas of the industry or civil service, their academic development is channelled into relevant practice.

Similarly, two doctoral candidates have enrolled in 2013 with Prof. Hobe (course leader) in his capacity as extraordinary professor in the UP Faculty of Law. They will defend their research proposals pertaining to international space law in June 2014. If they pass this hurdle, they will continue with their doctoral studies with the expectation to graduate at the end of 2015.

Although the above numbers may sound modest, it should be underscored that it is the first time in the history of South Africa (and Africa), that students will graduate with a specialisation in the fields of international air and space law at a university on the continent. Similarly, the doctoral candidates are on track to become the first ones in Africa to get a doctorate in these fields from a South African university.

Facilitating Networking Opportunities for Industry

The course was directed by Prof. Stephan Hobe, Director of the Institute of Air and Space Law, University Cologne, Germany. We also involved Mr Kim Gorringe, member of the South African Council for Space Affairs (SACSA) in the teaching.

Testimonial

In a nutshell, the capacity building was an eye opener for me. It has broadened my knowledge and understanding on the application of the Air and Space law. Of particular importance was to understand how the industry operates broadly. Should I be required to deal with the complaint on anti-competition behaviour arising from the industry, the knowledge acquired therein will make it easier for me to enforce Competition law within the market. I strongly believe that based on the quality of the already presented topics, Telecommunications law part will also be useful and enhance my knowledge in telecommunications industry.

- Ngoako Peter Moropene,
  Competition Commission of South Africa

Testimonial

I truly enjoyed the course and had to process and digest a lot of information that was relevant in adding value to the knowledge I had on Air and Space Law.

The lecture on Space Law was truly beneficial to me as this is my area of specialisation.

- Ikho Tshweza,
  South Africa National Space Agency

Summer School on Air, Space and Telecommunication Law 2014

From left to right

First Row: R De Gama, N M Sonjani, T Crawley, Prof S Hobe, T Fardin Tabrizi, S M Mfenyana

Second Row: L Kock, I Kealotswe, D K Mokoena, N Davhana, M Gettliffe, J Matlou, I Mogashoa

Third Row: D K Antwi, E L Phalane, N P Moropene, I Tshweza

Programme 5 Projects

Experimental and Computational Aerodynamic Validation of the Nelson Mandela Metropolitan University Racing Car

Special Projects

The AISI is hosted by the CSIR to address technology challenges, and to give industry access to the national science council. Special projects aim to ensure that this goal is achieved by ensuring that the following tasks are adhered to under its special projects:

- Facilitating industry access to national facilities
- Facilitating industry access to CSIR expertise in specific fields
- Ad hoc projects as per **the dti** requirements.

The projects undertaken are technology advancement projects which meet these criteria, and the AISI, under leadership of **the dti**, is assisting industry to improve its competitiveness.

Experimental and Computational Aerodynamic Validation of the Nelson Mandela Metropolitan University Racing Car

The project support for NMMU was aero-derivative. The experimental and computational skills developed have relevance to the aerospace industry.

The NMMU Racing Formula Student is a multi-disciplinary student-driven programme that provides a unique opportunity for students to design, build and race a formula-style car against universities from around the world.

The Nelson Mandela Metropolitan University (NMMU) racing team comprises students, who were contributing as volunteers to the development of their electric car, DibaTwo. The students of NMMU racing team required experimental and computational validation of the aerodynamic data for DibaTwo. This was in the form of wind tunnel testing and computational modelling (Computational Fluid Dynamics or CFD). The project was aeroderivative, i.e. the wind tunnel and CFD skills set that will be developed, has relevance to the aerospace industry. The main objective of the wind tunnel testing was to test the aerodynamic platform of the NMMU racing car. Flow visualisation that showed the airflow around the car was also required. The computational work focused on simulating the car on a rolling road and analysing these effects on the aerodynamic platform. The aerodynamic platform consists of the front and rear wings and the overall body shape. This project allowed PDIs and previously disadvantaged institutions to directly benefit from national expertise and national infrastructure at the CSIR. In doing so, furthering their careers and skills development in aeroderivative applications resulted in increased awareness of the aerospace sector and in the development of new streams of application for engineers. The impact created by the AISI support (with additional student support from the National Aerospace Centre), vested in exposing the NMMU team to national aerospace infrastructure and CSIR expertise. This will continue with future development of the NMMU car. The skills developed from the experimental and computational aspects of this project are beneficial to the aerospace industry and were transferred to the NMMU students.

Productivity Improvement

Design process improvements were achieved, as the information gained in the evaluation of the car performance both through CFD and wind tunnel testing gives the participating students insight on how to use experimental and computational methods for direct design or indirect validation of their design solutions. This allows improvements to the concepts before committing capital outlays in the manufacture of the product. The procedures utilised for the testing of the NMMU racing car were noted and this will aid in reducing setup time for future projects of a similar nature.

Market Access

The AISI support was used to assist the NMMU student team in their quest for design excellence and validation of the aerodynamic package of their car. The NMMU racing team is continuing with the development of their car and future testing will be done utilising CSIR infrastructure.

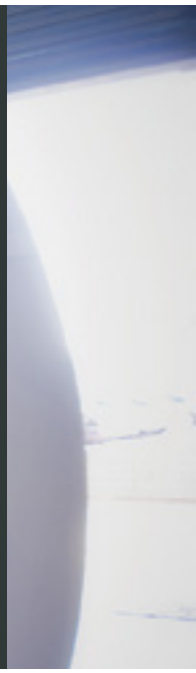
NMMU Racing Team was the first and only team from Africa to be selected to participate in the 2013 German Formula Electric Student Competition.

The NMMU is considered a previously disadvantaged institution, so the exposure of their students to the CSIR testing infrastructure constitutes an important step in the transformation of the industry supplier base. It allows these students to familiarise themselves with these tools which they in turn can offer to the industry.

Skills & Human Resource Development

The skills and techniques utilised during both the experimental and computational aspects of this project were beneficial to NMMU and its students. As NMMU is considered a previously disadvantaged institution, the exposure to the above stated methods was a direct intervention in the transformation of the workforce.

The processes and techniques for the CFD aspect of the project were transferred to the NMMU students to further their computational knowledge. As this project is envisioned to be an ongoing project, a future goal aims to enhance the NMMU student's aerodynamic skills and knowledge during the testing of the full-scale car, thereby furthering the required transformation.



Project Outcomes in Support of AISI Goals

The AISI mission and goals, which are related to the NMMU project, are:

- To provide a platform for facilitating partnerships and collaboration amongst government, industry and academia, locally and internationally
- Facilitating access to national infrastructure
- Facilitating access to CSIR expertise in specific fields, and
- Skills development

These goals were achieved with the support of the AISI. The NMMU team was exposed to national aerospace infrastructure and CSIR expertise. This will continue with future development of the NMMU car. NMMU has established a relationship with the AISI, which, in future, will ensure the exposure of its students to relevant national infrastructure and national expertise. The skills developed from the experimental and computational aspects of this project are beneficial to the aerospace industry and were transferred to the NMMU students.

Organisational Benefit

This will result in increased awareness of the aerospace sector and in the development of new streams of application for engineering students.

Facilitating Networking Opportunities for Industry

The project allowed substantial networking opportunities with the students from NMMU and technical experts. This project also involved knowledge transfer between the students and the technical experts in the specific fields of wind tunnel test design and execution including insight into what to expect from a wind tunnel test, and in the field of CFD modelling and results.

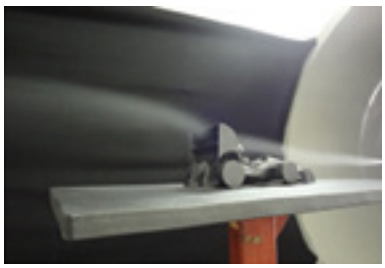
Socio-Economic Impact

NMMU is a historically disadvantaged organisation, and the majority of the team was PDIs.

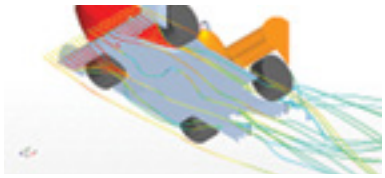
Testimonial

CSIR Aerospace Industry Support Initiative has helped the aerodynamics department of Nelson Mandela Metropolitan University (NMMU) racing in many ways over the past year. We were able to get results through simulation and wind tunnel testing in order to determine how effective our design was. This wouldn't have been possible without the willing and eager help we received from the team at CSIR. Without their help we wouldn't have been able to show that we are working on optimising our design before manufacture. We at NMMU racing are extremely grateful.

- Anga Hackula, NMMU student



Experimental validation of the NMMU racing car



Airflow under entire car

Airflow over entire car

Side view of airflow over entire car

Experimental validation of the NMMU racing car

Programme 6 Projects

IDAP Outreach, AISI Industry Networking Initiative - Defence Industry Day 2013

Coordination, Promotion and Awareness

The AISI plays a pivotal role in coordinating information on the aerospace sector in South Africa. This role enables the AISI to promote industry capability to relevant stakeholders and interested parties through its networks. The collective IDAP offerings are jointly promoted through the AISI's channels to ensure that **the dti's** aerospace initiatives are well presented at a wide variety of appropriate forums.

To support this strategic intent, awareness creation is achieved through a number of mechanisms such as print, electronic media and selected events and networking opportunities. This creates opportunities for thought leadership, thereby supporting the overall strategic aim of the AISI and its offerings

IDAP Outreach
AISI Industry Networking Initiative - Defence Industry Day 2013

IDAP Outreach

The AISI and the NAC participated in a number of outreach activities, jointly as IDAP.

- The AISI attended an afternoon's model flying session with 20 learners on 23 May 2013 with the Cornerstone College Model Flying Club members at the Silverton Model Flying Club. This club enjoys indirect support from the Aeronautical Society of South Africa, of which the CSIR and the Aerospace Industry Support Initiative (AISI) are corporate partners.
- The AISI successfully participated in the CSIR's Science Day in July 2013 (in support of the Department of Science and Technology's National Science Week). The AISI approached the Aeronautical Society of the Pretoria Boys High School, which receives indirect support from the AISI via its corporate membership of the Aeronautical Society of South Africa. The PBHS learners interacted with the visiting learners (from invited schools in and around Pretoria) at the branded AISI stand.
- The IDAP attended the International Civil Aviation Day from 4 to 7 December 2013 at the Tempe Airport in Bloemfontein. This event consisted of a career exhibition over four days and an airshow on 7 December. The purpose of the annual celebration is to establish and reinforce worldwide awareness of the importance of international civil aviation in social and economic development
- The IDAP had an opportunity to create awareness around aerospace by taking part in the Regional Symposium on the Next Generation of Aviation Professionals and TRAINAIR PLUS – Africa at Emperors Palace, Kempton Park from 10 to 13 December 2013. It was organised by the International Civil Aviation Organization hosted by the Air Traffic and Navigation Services Aviation Training Academy.

- The IDAP (in collaboration with the RGM School of Excellence) reached out to the school learners in Daveyton/Etwatwa high schools (in support of National Science Week) from 30 June to 2 July 2013. There were 650 Grade 10-12 learners from various Daveyton/Etwatwa high schools.
- The IDAP attended the Aerospace Career and fun day in Mulbarton Primary School on 24 August 2013. The event consisted of a formal presentation on the aerospace industry. The flight simulator was set up on the school field where it kept other learners busy. The Wits University students assisted with the presentation and the flight simulator.

AISI Industry Networking Initiative - Defence Industry Day 2013

The AISI supported a networking event at the CSIR International Convention Centre during August 2013 at which various representatives of the defence industry were able to meet and share ideas and insights.

Testimonial

The staff, learners and parents of Mulbarton Primary School would like to extend a huge thank you to the Aerospace Industry Support Initiative (AISI) for their participation in the Mulbarton Primary Aerospace Careers and Fun Day held on the 24th August 2013.

The aim of the careers day was to expose children to the careers in the aerospace industry early so that they can make more informed decisions on their curriculum as they progress into high school. The flight simulator was a huge attraction where learners had the opportunity to experience flying an airplane and what aeronautics as a career entailed. This certainly has ignited a spark of curiosity in aeronautics as a career for many of our "young potential aeronautical engineer's"! Over 500 children of all ages certainly benefited from this initiative.

The participation and support of AISI in the Mulbarton Primary Aerospace Careers and Fun Day led to the event being a huge success. We deeply appreciate the willingness in which you have partnered with our school to open and enlighten the minds of our young learners and in joining our efforts to make Mulbarton Primary School one of the top schools in the South of Johannesburg. We sincerely hope that this association with our school will be maintained and that you will continue to support us in our future endeavours.

- Mr L Kistadoo, Principal,
  Mulbarton Primary School

AISI Strategic Framework

The South African government has taken a decisive position: to address the barriers to industrialisation; and upscale and sustain the aerospace and defence industry by using different instruments which include policies and regulation; and implementation of strategic programmes.

The National Industrial Policy Framework (NIPF) supports and promotes diversification of the economy away from its traditional reliance on increased value-add per capita, characterised by: increased downstream participation in higher value activities and value chain segments; and technological leadership in specific technologies.

The NIPF serves as the foundation of the Industrial Policy Action Plan (IPAP), in a sense, it frames the key performance indicators of IPAP that seek to prevent industrial decline and also support growth and diversification of South Africa`s defence industry. IPAP places emphasis on critical human capital development and technology platforms that are sector based in order to unlock manufacturing growth and employment in different sectors of the economy. It puts particular importance, amongst others, on the establishment of sectorial support programmes such as the Integrated **dti** Aerospace Programme (IDAP).

IDAP resulted from two aerospace and defence support initiatives, namely the Aerospace Industry Support Initiative (AISI), and the National Aerospace Centre (NAC). IDAP is guided and based on the framework as outlined in **the dti** policy on Centres of Excellence. Its core mandate is on industrialisation and human capital development.

The industrial arm of IDAP is based at the Council for Scientific and Industrial Research (CSIR), whilst the branch that deals with human capital development is at the University of the Witwatersrand (Wits). The two branches have their own operational structure within their respective hosting organisations. For the purpose of this document, the AISI shall be referred to as the CSIR branch of IDAP, responsible for industrialisation, and the NAC shall be referred to as the Wits branch of IDAP, responsible for human capital development.

IDAP has a vision of **"positioning the South African aerospace and defence related industry as a global leader, in niche areas, whilst ensuring effective interdepartmental participation and collaboration"**. It aims to enhance the global competitiveness of the South African aerospace and defence industry by coordinating the implementation of an aerospace strategy as well as through either offering strategic interventions, or to fund such interventions within industry itself.

IDAP Strategic Structure

IDAP is an alignment of operations of **the dti's** current aerospace initiatives. Strategic guidance is provided by government key objectives, with input from the JASC, industry, academia, and science councils. The CSIR and Wits-based branches of IDAP are operationalised independently from each other at their respective hosting initiatives; however, their strategic intent is similar, and operations are aligned and informed by each other. In addition, the NAC is represented on the AISI's operations committee, and the AISI is represented on the NAC's quarterly review meetings.

AISI Operational Structure

The Aerospace Industry Support Initiative is an initiative of **the dti** which is hosted and managed by the CSIR's Strategic Initiatives Implementation Unit (SIIU). The AISI is managed to adhere to the Public Finance Management Act (PFMA), as well as to the CSIR's procedural and policy framework.

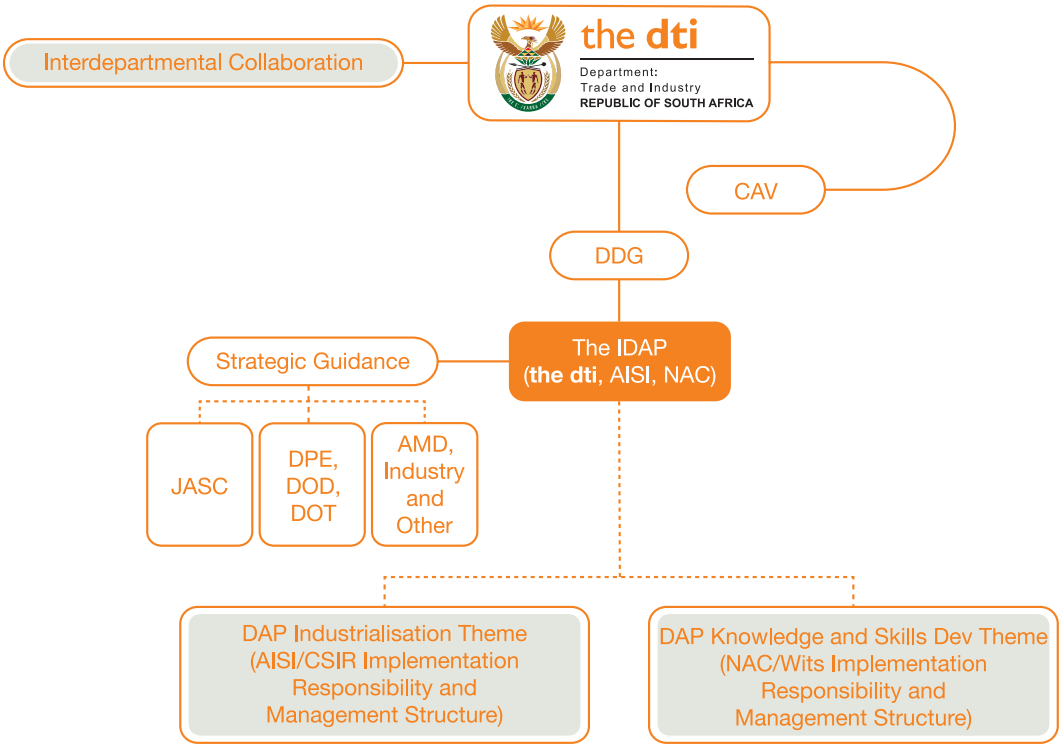


Figure 1: IDAP Strategic Structure

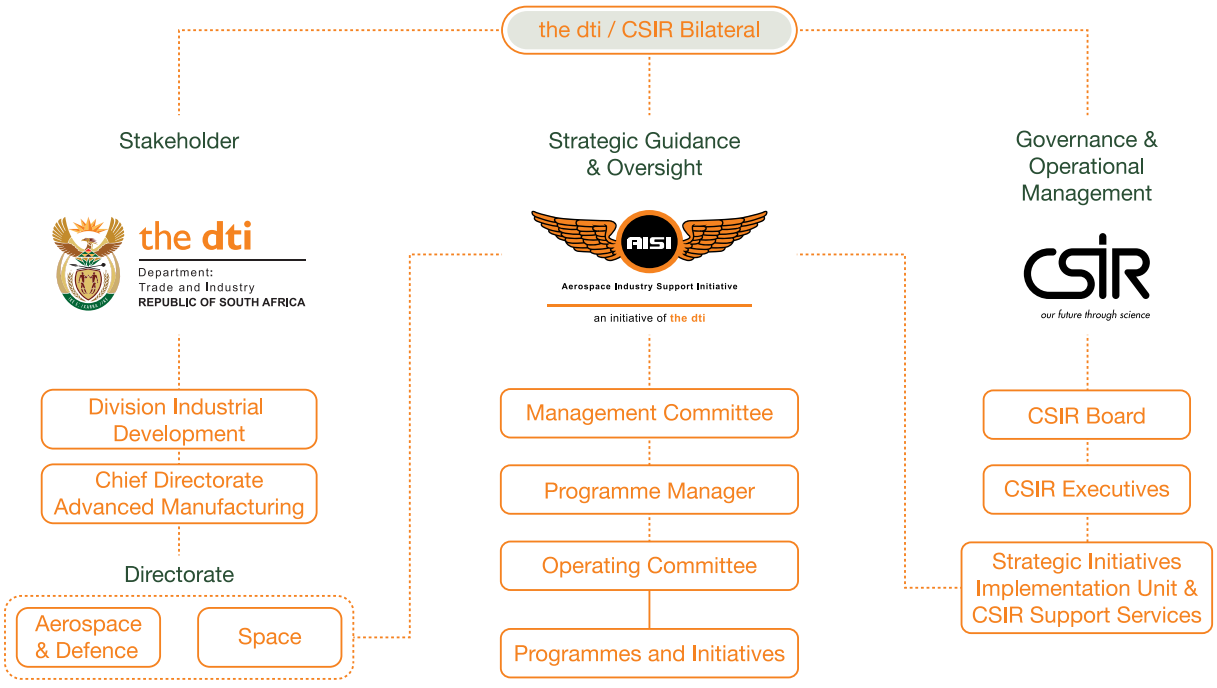


Figure 2: AISI Operating Structure

AISI Financial Results

Financial Report for the Period Ended 31 March 2014

	Actual Year To Date Mar 2014 R
Funds Including Interest Available at Beginning of Period 1 April 2013	**11 552 738**
Funds Received	18 619 298
Funds Received	**18 619 298**
- funds transferred	21 226 000
- less: VAT payable to SARS	2 606 702
Interest Received - 1 April 2013 to 31 March 2014	408 743
Interest Received YTD 29 March 2011	
Total Funding Before Expenses	**30 580 779**
Total All Expenses	12 429 747
Overhead Costs	**3 314 862**
Programme Costs	**9 114 884**
1. Industry Development & Technology Support	4 134 211
2. Sector Strategic Support Initiatives	1 746 180
3. Supplier Development	1 620 071
4. Industry Focused Skills Development	834 492
5. Special Projects	341 554
6. Co-Ordination, Promotion & Awareness	438 375
Funds Available but Contracted at the End of the Period, Including Interest Received	**18 151 033**

The AISI received R18 619 298 to fulfil its mandate for the 2013/2014 financial period. The funding received, along with the funding from the previous financial period totalled R30 580 779. This was allocated and committed to programmes and projects as defined in the approved AISI business plan. At the end of the 2013/2014 financial period, funding totalling R18 151 033 was committed and contracted to specific projects to be invested during the 2014/2015 financial period, continuing the implementation of the AISI strategy.

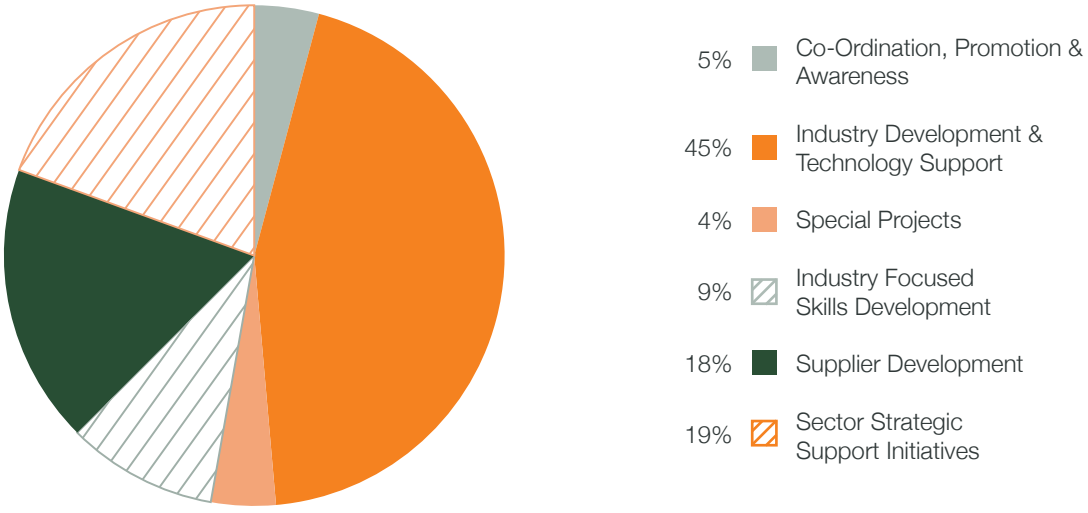


Figure 1: AISI Programme Spending 2013/14

During the 2013/2014 financial period, the majority of the AISI's funding was invested in industry development and technology support projects. This is in line with the predetermined objectives for investment to ensure that the AISI delivers against its strategic objectives. This change in strategic direction is evident in the graph below illustrating the growth in this investment area since 2011/2012.

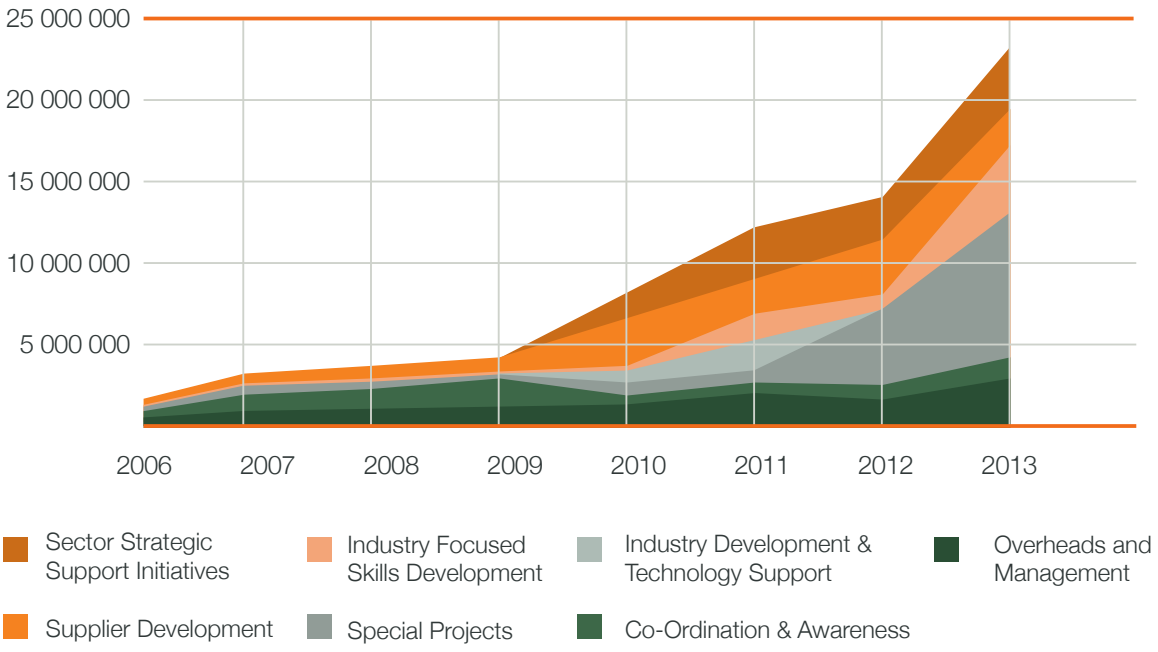


Figure 2: AISI Cluster Spending - per year

The change in focus in 2011/2012 to ensure majority investment in technology support projects is a result of **the dti's** mandate of industrialisation. A supporting focus area for the AISI remains supplier development. This is done to ensure growth in the aerospace industry and the broadening of industry supplier base. The AISI is committed to keeping overheads and management, along with coordination, promotion and awareness investments constant.

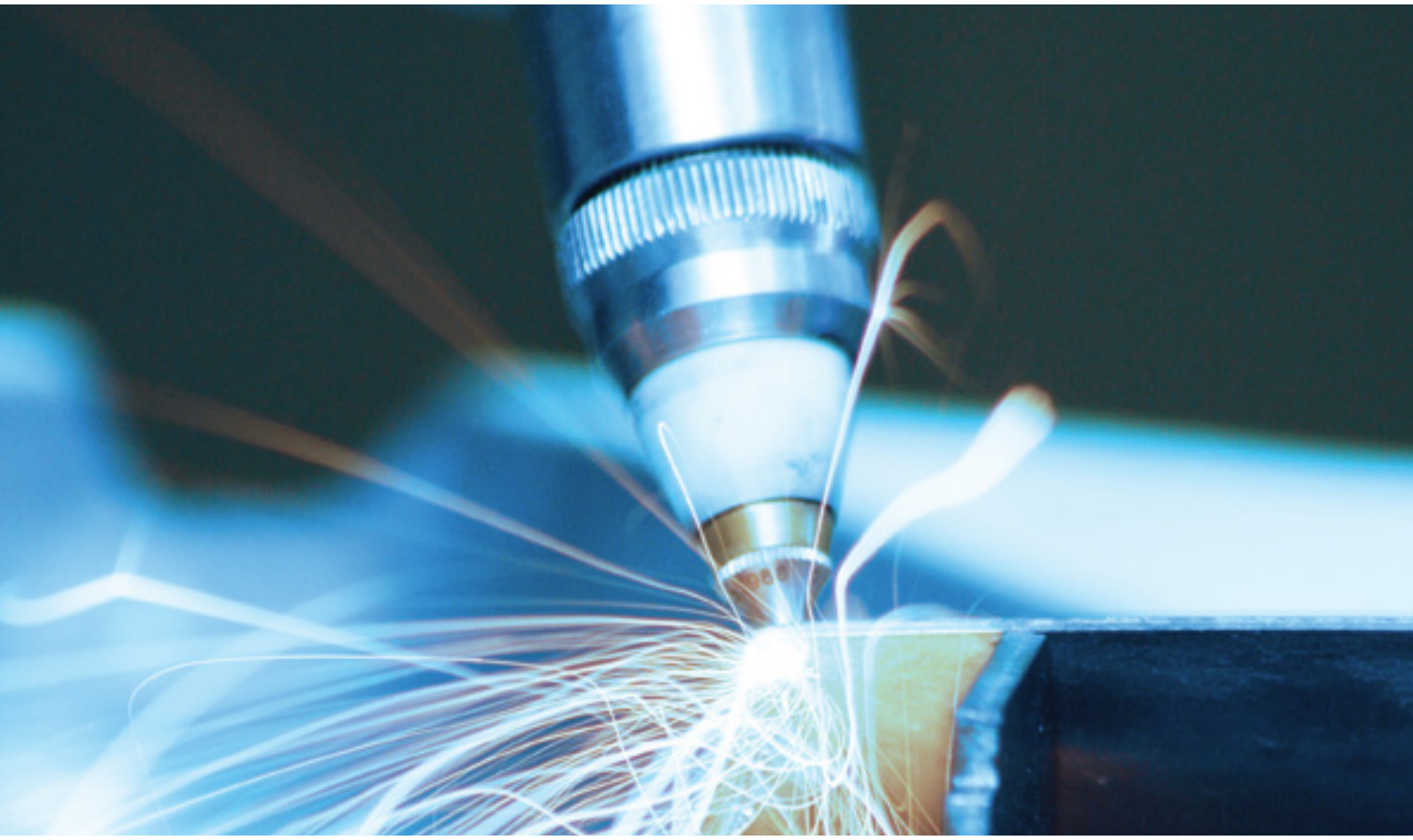
Summary of Organisations Benefiting from AISI Support

ORGANISATION NAME	PROJECT NAME	SMME
Adept Airmotive	LABAMA Support Project	YES
Advanced Material Technology	Supply Chain Optimisation - MyXchange Web Portal	YES
Aerospace Maritime and Defence Association	Joint Aerospace Steering Committee	N/A
Aerosud	• LABAMA Support Project • Laser Shock Peening • Supply Chain Optimisation - MyXchange Web Portal	NO
Aerotechnic	• Supply Chain Optimisation - MyXchange Web Portal • Implementation of AS9120 AQMS	YES
Agricultural Research Council	Hyperspectral Sensor Upgrade	N/A
Albetron Precision Engineering	LABAMA Support Project	YES
Alcoa Fastening Systems	Supply Chain Optimisation - MyXchange Web Portal	YES
ANDT Centre	Supply Chain Optimisation - MyXchange Web Portal	YES
Applied Services	Supply Chain Optimisation - MyXchange Web Portal	YES
Aquajet Profiles	Supply Chain Optimisation - MyXchange Web Portal	YES
Auvergne Aeronautique Slicom	Supply Chain Optimisation - MyXchange Web Portal	YES
Avex	Supply Chain Optimisation - MyXchange Web Portal	YES
Bohler Thyssen Welding SA	Supply Chain Optimisation - MyXchange Web Portal	YES
Cape Aerospace Technologies	Small Gas Turbine Technology Improvement	YES
Cape Peninsula University of Technology	Portable and Distributed UAV Ground Station Product Capability Development	N/A
Cassidian Optronics SA	LABAMA Support Project	NO
City of Joburg	Capacity Building in Air, Space and Telecommunications Law	N/A
Cliff'sway Engineering	Supply Chain Optimisation - MyXchange Web Portal	YES
CMI	Supply Chain Optimisation - MyXchange Web Portal	YES
Collaborative Xchange	Supply Chain Optimisation - MyXchange Web Portal	NO
Commercial Aviation Association of South Africa	Joint Aerospace Steering Committee	N/A
Competition Commission of South Africa	Capacity Building in Air, Space and Telecommunications Law	N/A

ORGANISATION NAME	PROJECT NAME	SMME
Compumach Engineering	Supply Chain Optimisation - MyXchange Web Portal	YES
ContactServe	Supply Chain Optimisation - MyXchange Web Portal	YES
CSIR	Implementation of AISI Projects	NO
Daliff Precision Engineering	• Supply Chain Optimisation - MyXchange Web Portal • Upgrade of AS9100QMS	YES
Denel Aerostructures	Ultra High Cycle Fatigue Testing Machine	NO
Denel Aviation	LABAMA Support Project	NO
Denel Dynamics	LABAMA Support Project	NO
Department of Defence	Joint Aerospace Steering Committee	N/A
Department of International Relations and Cooperation	Capacity Building in Air, Space and Telecommunications Law	N/A
Department of Public Enterprises	Joint Aerospace Steering Committee	N/A
Department of Science and Technology	Joint Aerospace Steering Committee	N/A
Department of Trade and Industry	Joint Aerospace Steering Committee	N/A
Department of Transport	Joint Aerospace Steering Committee	N/A
DK Mokoena Attorneys	Capacity Building in Air, Space and Telecommunications Law	YES
EezeeCAD	Portable and Distributed UAV Ground Station Product Capability Development	YES
EliteTech UPVC Windows	Capacity Building in Air, Space and Telecommunications Law	YES
Eskom	Laser Shock Peening	NO
Gofer Engineering	Supply Chain Optimisation - MyXchange Web Portal	YES
Heliocentric Technologies ZA	Radiation Screening Services for Satellites	YES
Heyns Laboratories	Supply Chain Optimisation - MyXchange Web Portal	YES
HFB Engineering	Supply Chain Optimisation - MyXchange Web Portal	YES
Independent Communications Authority of South Africa	Capacity Building in Air, Space and Telecommunications Law	N/A
Industrial Development Corporation	Joint Aerospace Steering Committee	N/A
ISCAR South Africa	Supply Chain Optimisation - MyXchange Web Portal	YES
iThemba LABS	Radiation Screening Services for Satellites	NO
Jack Pack Trading	Supply Chain Optimisation - MyXchange Web Portal	YES
Knowles Husain Lindsay Attorneys	Capacity Building in Air, Space and Telecommunications Law	YES

ORGANISATION NAME	PROJECT NAME	SMME
M Square Precision Manufacturing	LABAMA Support Project	YES
Maizey	Supply Chain Optimisation - MyXchange Web Portal	YES
MARCOM Aeronautics and Space	LABAMA Support Project	YES
Megapack	Supply Chain Optimisation - MyXchange Web Portal	YES
National Treasury	Joint Aerospace Steering Committee	N/A
Nelson Mandela Metropolitan University	• Experimental and Computational Aerodynamic Validation of the Nelson Mandela Metropolitan University Racing Car • Laser Shock Peening	N/A
NJR Steel	Supply Chain Optimisation - MyXchange Web Portal	YES
Northern Bolt and Tool	Supply Chain Optimisation - MyXchange Web Portal	YES
Paramount Advanced Technologies	Aerodynamic Investigation of a Rhomboid Wing UAS	NO
PPG Coatings South Africa	Supply Chain Optimisation - MyXchange Web Portal	YES
Revolavia	Implementation of Standards, Accreditation and Certification Support	YES
Rheinmetall Denel Munition	LABAMA Support Project	NO
Rosslyn Sandblasting and Engineering	Supply Chain Optimisation - MyXchange Web Portal	YES
Rost Precision Engineering	• LABAMA Support Project • Supply Chain Optimisation - MyXchange Web Portal	YES
SAAB Grintek Defence	LABAMA Support Project	NO
Safety First	Supply Chain Optimisation - MyXchange Web Portal	YES
Safomar Industrial Brands	Supply Chain Optimisation - MyXchange Web Portal	NO
Simera Technology Group	Hyperspectral Sensor Upgrade	YES
Sondor Industries	Supply Chain Optimisation - MyXchange Web Portal	YES
South African Civic Aviation Authority	Capacity Building in Air, Space and Telecommunications Law	N/A
South African National Space Agency	Capacity Building in Air, Space and Telecommunications Law	N/A
Stellenbosch University	• Small Gas Turbine Technology Improvement • Hyperspectral Sensor Upgrade • Laser Shock Peening	N/A
Stemela and Lubbe Inc.	Capacity Building in Air, Space and Telecommunications Law	YES
Technology Innovation Agency	Joint Aerospace Steering Committee	N/A
Tellumat	• Higher Levels of Mode S Technology Development • Portable and Distributed UAV Ground Station Product Capability Development	NO

ORGANISATION NAME	PROJECT NAME	SMME
Tiffy Safety	Supply Chain Optimisation - MyXchange Web Portal	YES
TI-TaMed	Supply Chain Optimisation - MyXchange Web Portal	YES
Tony Beverley Agencies	Supply Chain Optimisation - MyXchange Web Portal	YES
TP Agencies	Supply Chain Optimisation - MyXchange Web Portal	YES
University of Cape Town	Laser Shock Peening	N/A
University of Pretoria	Capacity Building in Air, Space and Telecommunications Law	N/A
University of South Africa	Capacity Building in Air, Space and Telecommunications Law	N/A
University of the Witwatersrand	Laser Shock Peening	N/A
Vestcast	Development of an Inventory Control System and Quality Improvement	YES
Wesco	Supply Chain Optimisation - MyXchange Web Portal	NO
West Engineering	• Supply Chain Optimisation - MyXchange Web Portal • Implementation of AS9100 AQMS	YES



Abbreviations

AISI	Aerospace Industry Support Initiative
AMD	South African Aerospace Maritime and Defence Industries Association
AQMS	Aviation Quality Management Services
AQPL	Airbus Qualified Parts List
ASN	Advanced Ship Notice
ASTM	American Society for Testing and Materials
BAE	British Multinational Defence, Security and Aerospace Company
B-BBEE	Broad-based Black Economic Empowerment
BLOS	Beyond-line-of-sight
BWBs	Blended-wing-bodies
CAD	Computer Aided Design
CC	Customer Complaints
CFD	Computational Fluid Dynamics
CFRTP	Carbon Fibre Reinforced Thermoplastics
CNC	Computer Numerical Control
CPUT	Cape Peninsula University of Technology
COTS	Commercial-off-the-shelf
CRBs	Certification and Registration Bodies
CSIR	Council for Scientific and Industrial Research
DN	Delivery Notes
DR	Discrepancies
DST	Department of Science and Technology
EADS	European Aeronautic Defence and Space Company
ECSS	European Council for Space Standardization
ERP	Enterprise Resource Planning
FAR	Federal Aviation Regulations
FEA	Finite element analysis
GRAMS	Airbus General Requirements for Aerostructure and Material Suppliers
GRESS	General Requirements Equipment System Suppliers
GRN	Goods Received Notification
GCS	Ground Control Station
HCD	Human Capital Development
HEI	Higher Education Institutions
HDI	Historically Disadvantaged Individual
IAC	International Astronautical Congress
IAF	International Accreditation Forum
IAQG	International Aerospace Quality Group
IDAP	Integrated **dti** Aerospace Programme
IDC	Industrial Development Corporation
IPAP	Industrial Policy Action Plan
IR	Infrared
ISO	International Standards Organisation
JASC	Joint Aerospace Steering Committee
JAR	Joint Aviation Requirements
LABAMA	Laser-Based manufacturing
LACS	Laser assisted cold spraying
LAM	Laser Additive Manufacturing
LBW	Laser beam welded
LL.M.	Master of Laws
LSP	Laser Shock Peening
MDO	Multidisciplinary Design and Optimisation
MDOE	Modern Design of Experiments
MRO	Maintenance, Repair and Overhaul
MRP	Material Requirements Planning
MTech	Master of Technology
MUAS	Modular Unmanned Aircraft Systems
NAC	National Aerospace Centre
Nadcap	National Aerospace and Defence Contractors Accreditation Programme
ND	National Diploma
NDT	Non-Destructive Testing
NIPF	National Industrial Policy Framework
NMMU	Nelson Mandela Metropolitan University
OEM	Original Equipment Manufacturer
OHS	Outboard Horizontal Stabilisers
PBHS	Pretoria Boys High School
PFMA	Public Finance Management Act
PO	Purchase Order
PT	Penetrant Inspection
QA	Quality Assurance
QMS	Quality Management System
OHSAS	Occupational Health and Safety Assessment System
R&D	Research and Development
RAASA	Recreation Aviation Administration – South Africa
RICS	Research and Innovation Core Skills
RF	Receipt Forms
RTCA	Radio Technical Commission for Aeronautics
RFQ	Request for Quotation
SACSA	South African Council for Space Affairs
SADC	Southern African Development Community
SAJADS	South African Joint Air Defence Symposium
SANSA	South African National Space Agency
SDP	Sector Development Plan
SEE	Single Event Effects
SMME	Small Medium and Micro Enterprise
SN	Cycle Stress (S) against Cycle to Failure (N) Curve
SUN	Stellenbosch University
TCu	Telemetry Control Unit
TEI	Tertiary Education Institutions
the dti	Department of Trade and Industry
TIA	Technology Innovation Agency
TIG	Tungsten Inert Gas
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UCT	University of Cape Town
UHCF	Ultra High Cycle Fatigue
UP	University of Pretoria
UT	University of Technology
Wits	University of the Witwatersrand
YTD	Year to Date

Aerospace Industry Support Initiative

an initiative of the dti

An initiative of the Department of Trade and Industry, managed and hosted by the CSIR

the dti

Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

CSIR

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