

APPLICATION FORM: NMMU ENGAGEMENT EXCELLENCE AWARDS

(CONSULT THE NMMU ENGAGEMENT EXCELLENCE AWARDS POLICY AND READ THE APPLICATION FORM BEFORE COMPLETING THE TEMPLATE IN ORDER AVOID A DUPLICATION OF INFORMATION.)
COMPLETE THIS FORM IN TYPESCRIPT.PROVIDE ONLY THE INFORMATION REQUESTED.

SECTION A: Application category

- Indicate with an X in the appropriate box the award you are applying for.
- Your application will only be considered for the award you have applied for

- Engagement Excellence Award – Science, Technology and Engineering
- Engagement Excellence Award – Social Sciences and Humanities
- Engagement Excellence Team Award
- Engagement Excellence Project Award – Science, Technology and Engineering
- Engagement Excellence Project Award – Social Sciences and Humanities
- Emerging Engagement Excellence Awards *(note that Professors and Associate Professors are not eligible for this category)*

Surname of Applicant/Team Leader	Hattingh	
First Name	Daniël	
Initials	DG	
Title	Prof	
Telephone numbers	0415043608	
E-mail address	Danie.Hattingh@nmmu.ac.za	
Employment position held at NMMU	Distinguished Professor / eNtsa Director	
Faculty	Engineering, the Built Environment and Information Technology	
Department	Mechanical Engineering	
Division	eNtsa	
Immediate line-manager	Dr Oswald Franks	
Eligibility: Are you permanently employed and/or on a long term (3 years or more) fixed contract? (indicate with an X)	Permanent X	Fixed term contract
If this is an application for one of the <u>Engagement Excellence Project Awards</u>, provide a brief title and description of the project (250 words maximum)	n/a	
If this is an application for either the <u>Excellence Awards</u> or the <u>Emerging Award</u>, provide a brief description of your engagement activities and initiatives (250 words maximum)	n/a	
If this is an application for the <u>Engagement Excellence Team Award</u>, provide	Staff & students:	
<ul style="list-style-type: none"> • the names of all staff members and students participating • the nature of their involvement • a brief description of the team's engagement initiatives and activities (250 words maximum) 	See Annexure A: eNtsa organogram	
	Description:	
	eNtsa is internationally recognized as a hub of innovation based at Nelson Mandela Metropolitan University (NMMU) with strong strategic relations with the Technology Innovation	

Agency (TIA) and the Department of Science and Technology (DST).

eNtsa continuously strives to enhance technology innovation and to stimulate a climate of sustainable socio-economic growth in South Africa. Furthermore, eNtsa's ambition is aligned with the NMMU's Vision & Mission, aiming towards providing an environment in which cutting-edge knowledge generation can take place, while providing a platform for diverse educational opportunities to constructively contribute to a globally sustainable future.,

With the support of TIA and the DST eNtsa is able to make much needed engineering skills, services and training more readily available to SMEs operating in the local manufacturing sector, according to international best practices.

The Technology Station Programme (TSP) of TIA, enables eNtsa to support and stimulate local engineering innovation in order to improve the competitiveness of local manufacturers enabling industry to exploit and develop new markets.

eNtsa believes that growing the manufacturing economy in South Africa holds the key to sustainable job creation and improved quality of life.

Are your Engagement activities/projects/initiatives registered on the Engagement Management Information System (E-MIS) on SharePoint?

If not, please ensure that they are before you submit this application.

Applications that are not registered and updated on the E-MIS will not be considered for Awards.

The most recent date on E-MIS for each project update (achieved when 'submit' is clicked) must be in 2015.

Provide the exact titles (as featured on the E-MIS) for all of the Engagement activities/ projects/ initiatives with which you are involved.

Visit <http://caec.nmmu.ac.za/Engagement-Information-and-Development/Engagement-Management-Information-System>

Titles: eNtsa

1. Supplier Development Programme
 - Technology Station Programme
 - Automation & Controls
 - Advanced Design and Modelling
 - Welding and Materials Engineering
2. uYilo eMobility Technology Innovation Programme
 - Electric Vehicle Systems
 - National Battery Testing Laboratory
 - Live Testing Environment

SECTION B: Engagement categories

- You are required to describe and report in detail on a minimum of two engagement categories (these are 1, 2, 3 and 4 below) in order to be considered for an award.
- If you or your team are involved in three or four of the engagement categories, report in detail on all of these categories.
- Applications that describe and can provide evidence of engagement activities across all four categories are encouraged.
- Refer to section 5 of the attached Engagement Excellence Awards policy which provides a guideline on the specific activities you should report on under each of the categories you have chosen.

Report on your:

1. Engagement through Community Interaction, Service and Outreach:

The TSP programme within eNtsa is a supplier development initiative that provides local manufacturers within the automotive, manufacturing, power-generation and petro-chemical industries with highly skilled and innovative services as well as access to state-of-the art-facilities and equipment.

Positioned in the Eastern Cape, eNtsa is ideally situated in an area which is in need of economic growth. Though the automotive industry is no longer the sole focus of the group, according to the Eastern Cape Development Corporation (ECDC), the Eastern Cape hosts five of the major OEMs operating in South Africa, along with more than 100 major component manufacturers and the Eastern Cape manufactures 51% of South Africa's vehicle exports.

On the outskirts of Port Elizabeth, the Coega IDZ, in close proximity to the new Ngqura deep-water harbour, is showing promising industrial growth. The Coega IDZ focuses on development in the Metals, Textiles, Automotive, Chemicals and Energy sectors and is developing an automotive production cluster linked to established industry in the Eastern Cape (ECDC, 2016). This Industrial Development Zone provides a new and exciting opportunity for expansion of the local manufacturing industry.

According to the ECDC, "The Eastern Cape has solidified its position as an important producer of renewable energy and the country's leader in wind energy" (ECDC, 2016), being second only to the Northern cape in renewable energy projects. This places eNtsa in a unique position to focus on opportunities to provide support to this fast growing technology sector ensuring the viability and sustainability of local projects, also ensuring future sustainability of the station through diversification of services and industries supported.

(See Annexure B: Article in Business Link on eNtsa services)
 (See Annexure C: uYilo Battery Testing Services poster)
 (See Annexure D: Case study – Example of Supplier Development assistance to local entrepreneur)
 (See Annexure E: News clipping of the QBell project)

Report on your:

2. Engagement through Teaching and Learning:

Within the supplier development initiative, eNtsa, through TIA & DST and SETA, is afforded the opportunity to host a number of undergraduate students to comply their P1/P2 modules to complete their qualifications. Collaborations with industry experts (local and international) provides eNtsa with the opportunity to host various technical and highly specialized training opportunities to industry, exposing our engineering students to training initiatives and addressing the needs of industry.

Report on your:

3. Engagement through Profession/Discipline-Based Service Provision:

eNtsa staff members are uniquely skilled engineers and office professionals providing a specialized set of services and innovative solutions to industry utilizing resources available at NMMU. Furthermore, office professionals, academic- and technical staff within the Department of Mechanical Engineering, industry partners and research associates within the Faculty of Engineering, the Built Environment and Information Technology form part of the consulting and service delivery component supporting supplier development initiatives within eNtsa.

Report on your:

4. Engagement through Research and Scholarship:

There are a number of research projects within the supplier development initiative underway to assist industry. These projects are not only linked to the needs of industry but also support various postgraduate research projects.

(See Annexure F: Eskom article on WeldCore® and ASME accreditation)
 (See Annexure G: DVC visits the Small Punch Creep Testing Facility)

SECTION C: Descriptions

1. Describe the impact your Engagement activities have made on stakeholders/beneficiaries/communities and provide details on how these activities are acknowledged/recognized by:

1.1. External communities/stakeholders/beneficiaries:
 (not staff and students of NMMU)

eNtsa, with the support of the DST and TIA, is able to provide high-end services to qualifying SMEs (at subsidized rates)*, assisting in supporting the competitiveness of local industry through the services and facilities available within the group.

The supplier development initiative is directly aligned with TIA's objective of "*stimulating and intensifying technological innovation in order to improve economic growth and the quality of life of all South Africans by developing and*

	<p><i>exploiting technological innovations". (TIA, 2016)</i></p> <p>Recently South Africa has seen the services sector driving economic growth, while the manufacturing sector has seen growth below desired levels. (DTI, 2015) This fact emphasises the need for support and advancement of the local manufacturing sector.</p> <p>In the 2015-2016 Financial Year eNtsa's supplier development initiative assisted over 120 SMEs/Entrepreneurs and most of the major Automotive OEMS and tier 1 component suppliers in the local manufacturing industry. eNtsa completes in excess of 400 industry projects per annum in support of the local economy, providing much needed engineering skills and facilities to South Africa's local manufacturing industry.</p> <p>eNtsa is well on track to increase this figure in the current financial year.</p> <p>(See Annexure H: eNtsa's Supplier Development Statistics)</p>
<p>1.2. Internal communities/stakeholders/beneficiaries: (staff and students of NMMU)</p>	<p>eNtsa's success in providing world class support to industry (as categorised by an independent benchmarking audit), lies in the experience and technical skills found in its human resources, continued access to cutting edge technologies, and the support of the Nelson Mandela Metropolitan University (NMMU).</p> <p>The engineering and administrative professionals within eNtsa have a unique skill set and associated with the best professional practices. A healthy level of student involvement in industry projects, both in internships and applied research, eNtsa, through its various programmes ensures, an active participation of university students and the Faculty of Engineering in a number of project areas.</p> <p>Furthermore, eNtsa hosts a number of training and skill development opportunities according to industry needs, that the local engineering community and NMMU students benefit from.</p> <p>(See Annexure I: TSP Operational Plan April 2017 – March 2018)</p>
<p>2. Describe how your Engagement activities contribute towards faculty/department/entity engagement goals and objectives. (Refer to your Department/Faculty/Entity's strategic plan here)</p>	
<p>Activities within eNtsa's Supplier Development initiative aims to create an environment that addresses industry needs, encourages excellence through research and innovation and assists in establishing NMMU as an engaged university that contributes to sustainability and human resource development.</p> <p>This is achieved by the following</p> <ul style="list-style-type: none"> • Engaging in research to grow knowledge in the field of solid state processing with a focus on process optimisation, modelling and material characterisation • Development and optimization of innovative joining and repair technologies 	

- Increase of publications in quality journals with high impact factors to strengthen NMMU and researchers' international standing
- Strengthening of the existing advanced manufacturing and engineering focus area at NMMU
- Creating infrastructure, process skills and understanding of the principles in support of expanding international collaboration through increased bilateral agreements with leading universities doing research in similar fields
- Create new research opportunities for post graduate students
- Attract leading international scientists to contribute to knowledge generation
- Expand the boundaries of technology by means of technological analysis and innovation

3. Describe how your Engagement activities contribute towards the achievement of the NMMU Vision 2020 Engagement Strategic Goals and Objectives. *(Refer to the attached NMMU Engagement Strategic Goals and Objectives)*

The institutional research theme, namely Advanced Manufacturing, Technology and Engineering, supports engineering research and advanced manufacturing support initiatives (such as supplier development and the TSP programme), which underpins much of the South African economy and holds great opportunity for large-scale job creation and social upliftment. Supplier Development initiatives and research within eNtsa is aligned with NMMU's strategic goal to create and sustain an environment that encourages, supports and rewards skill development and nurture a culture of engineering innovation.

4. Describe how your Engagement activities contribute towards: *(Refer to any relevant media coverage, representation on boards or committees, scholarly publications, conference presentations etc.)*

4.1. Addressing the needs of society and various external communities served by NMMU:

As part of the TSP supplier development initiative eNtsa is in the process of developing a professional relationship with the Business Chamber attending various Task Team meetings related to the supplier development and the manufacturing sectors.

Researchers within the group produce a number of journal articles and journal papers focusing on research projects related to solid-state processing.

4.2. Profiling and promoting the NMMU as an engaged university: Involvement

Through the supplier development initiative and the efforts within eNtsa, promotion and awareness of NMMU as an engaged university takes place on the following platforms;

Local & international conferences (related to solid state welding, engineering design, fatigue analysis and material characterization) [Target audience: Local government, leading engineering HEIs, local and international researchers, local and international academia, potential postgraduate students and experts within the engineering community]

Local advertising (Business Link) [Target audience: Local industry, local government, entrepreneurs and local business development organizations]

eNtsa website & Facebook page [Target audience: Industry, scholars, students academia & potential clients]

5. Describe how you have successfully integrated engagement into the Teaching and Learning and Research functions of the university. *(Refer to sections 5.1, 5.2 and 5.3 of the Engagement Excellence Awards Policy as a guideline)*

Engagement through Profession/Discipline-Based Service Provision

Prof DG Hattingh is a C-rated NRF researcher and has won numerous awards from external entities for contributions made by him as researcher and the eNtsa team
(See Annexure J: Prof Danie Hattingh's abbreviated CV)

Prof Hattingh services as editor on various journals (See Annexure J: Prof Danie Hattingh's abbreviated CV)

Many of the engineering staff within eNtsa are professionally registered (ECSA and SAIMEchE)
The office professionals within eNtsa are professionally registered and members of business societies (PRISA & BWA)

eNtsa has received a special invitation to attend the NMB Business Chamber SME Task Team meeting

The WeldCore® technology, research conducted at the NMMU, has been accredited by ASME. This positioned NMMU as the first HEIs in South Africa with such an achievement.

(See Annexure F – Eskom article found at the following link <http://www.eskom.co.za/news/Pages/Jan17.aspx>)

Engagement through Teaching and Learning

eNtsa hosts a number of interns and researchers that form part of various science and engineering initiatives. Such initiatives include: Titanium Centre of Competence (TiCoC), Light Metals Development Network (LMDN), Technology Station Programme (TSP), Education, Training and Development Practice Sector Education and Training Authority (ETDP-SETA). (See Annexure K: List of eNtsa interns and researchers as per December 2016)

Commencing January 2016 to current, eNtsa has hosted the following workshops:

Introduction to Basics of Safety System Integration & Design Training – 08 & 09 March 2016 [Student attendance: 79 delegates; Industry attendance: 19 delegates)

Metallurgy training – 04 March 2016 (Student attendance: 8 delegates)

Sigma Six training – 01 June 2016 (Entrepreneur: 1 delegate)

Creaform 3D scanning training – 16 August 2016 (Industry: 3 delegates)

Creaform 3D scanning technology demo – 28 October 2016 (Industry: 17 delegates)

3D scanning demonstration and knowledge sharing demo for Faculty of Arts students – 30 November 2017 (NMMU delegates: 19 delegates)

VWSA 3D scanning system training – 13 February 2017 (Industry: 5 delegates)

Introduction to Basics of Safety System Integration & Design Training – 07 March 2017 (NMMU: 20 delegates)

ASME VIII Course – 28 to 30 March 2017 (Industry attendance: 48 delegates; NMMU attendance: 6 delegates)

*** Note: Attendance registers for above mentioned training sessions are available upon request**

Furthermore, as part of an internal knowledge sharing initiative eNtsa conducts Tech Talks:

Research colloquium – F Jonck (PhD Mechanical Engineering) – 08 May 2017 (NMMU: 12 delegates)

Tech Talk - Personal Financial Planning (Old Mutual) – 24 March 2017 (NMMU: 12 delegates)

Tech Talk – Andre Louw- 10 March 2017 (NMMU: 9 delegates)

Tech Talk – Dantec Digital Image Correlation system – 27 February to 01 March 2017 - (NMMU: 4 delegates)

Small Punch Testing Facility Brain Storm session – 28 February 2017 (NMMU: 10 delegates)

Tech Talk – Proceq Portable Harness Tester – 24 February 2017 (NMMU: 17 delegates)

Tech Talk – Live Testing Environment Microgrid Project – uYilo project – 16 November 2016 (NMMU: 31 delegates)

Research colloquium – L Swan & M Nohanyaza (MEng Mechanical Engineering) – 24 October 2016 (NMMU: 21 delegates)

Tech Talk – Creaform System - 19 October 2016 (NMMU: 17 delegates)

Tech Talk – Readyng SA for Lithium-ion disruption – 01 July 2016 (NMMU: 16 delegates)

WeldCore® 3 training – 29 June 2016 (NMMU: 12 delegates)

XRD training – 28 June 2017 (NMMU: 10 delegates)

Tech Talk – Impact of Laser Manufacturing – 10 June 2016 (NMMU: 15 delegates)

Tech Talk – TSP – 19 May 2016 (NMMU: 27 delegates)

Tech Talk – eMobility – 15 April 2016 (NMMU: 20 delegates)

Tech Talk – SAIEE Smart Grid Conference feedback session – 11 March 2016 (NMMU: 17 delegates)

Tech Talk – Measuring Residual Stress: Neutron/Synchrotron diffraction – 19 February 2016 (NMMU: 16 delegates)

Tech Talk – Applied Mathematics to assist engineers – 05 February 2016 (NMMU: 10 delegates)

Research colloquium – D Tsikayi (PhD Mechanical Engineering) – 05 February 2016 (NMMU: 10 delegates)

*** Note: Attendance registers for above mentioned Tech Talk session are available upon request**

eNtsa, through the NMMU is partaking in the Newton Fund's Royal Academy of Engineering - Engineering Education Existing Staff Capacity Enhancement Programme (EEESCEP). RAEng application made to the Newton Fund Industry Academia Partnership Programme (IAPP) is intended to assist with building capacity in the research related aspects of importance to the EEESCEP, i.e.:

- Enhanced capacity for postgraduate supervision in engineering education;
- Research-led improvements in teaching, learning and curricula in engineering education.

It will do this in the specific, and important, manufacturing, design and materials components of mechanical engineering with the stated goals of:

- Development of the Eastern Cape academic research base (facilities, techniques and personnel) in advanced design and manufacturing and extending its reach and impact into historically disadvantaged institutions;

- Building a collaborative research and knowledge-sharing network between Eastern Cape industry and HEI, in particular in mechanical engineering between NMMU and Walter Sisulu University.

Engagement through Research and Scholarships

As before mentioned, eNtsa hosts a number of interns and researchers that form part of various science and engineering initiatives. Such initiatives include Titanium Centre of Competence (TiCoC), Light Metals Development Network (LMDN), Technology Station Programme (TSP), Education, Training and Development Practice Sector Education and Training Authority (ETDP-SETA).

(See Annexure K: List of eNtsa interns and researchers as per December 2016)

Contract research remains one of the lifelines of eNtsa, Eskom has been instrumental in this regard with a number of active projects closely aligned to the use and implementation of the WeldCore® and associated technologies. Site applications utilising the WeldCore® technology at Arnot Power Station and the Rotek facility in Gemiston on Hendrina turbine rotors were successfully completed in the past year. Regular working group meetings provide a platform for feedback on projects and the discussion/interaction on potential projects directly addressing current concerns within the power utility.

Sasol has positioned eNtsa as a strategic partner in the sampling, evaluation and life extension of pipework at the Secunda Synfuels facility. eNtsa has actively played a pivotal role in the removal of metallurgical samples at identified locations on pipework over the past year utilising the WeldCore® technology. Contract research and the use of Small Punch Creep testing (SPCT) to evaluate material state and assist with plant condition monitoring within Sasol has grown into one of the focus areas of eNtsa. Regular working group meetings provide the platform for feedback and interaction as to potential requirements within this field where eNtsa could assist.

(See Annexure G: DVC visits the Small Punch Creep Testing Facility)

6. Provide details of scholarly outputs/contributions made to a body of knowledge as a result of your engagement activities. (Refer to publications, new teaching programmes, technical reports, conference proceedings, etc.)

(See Annexure J: Prof Danie Hattingh's abbreviated CV - Research outputs section on Prof Hattingh abbreviated CV (a full record of outputs are available on request)

7. Describe the important role performed by you or the team in:

7.1. The leadership and management of the engagement activities and initiatives:

For clarification and or contextualization there is no "you" in eNtsa but only an "us" the eNtsa team. This team works together as one unit. The main function of the leaders in eNtsa is to ensure that our strategic plan stays relevant, dynamic and is implemented through every decision we make. We have a strong focus on cultivating an entrepreneurial culture within eNtsa through the implementation of a structure that lends itself towards empowering all eNtsa members as business leaders of business units. This approach assists eNtsa staff to develop an understanding of their financial responsibility to deliver a financially sustainable professional service to all stakeholders. The way eNtsa staff are managed and take responsibility for deliverables was well demonstrated with the challenges posed by the Fees Must Fall campaign and the manner in which they dealt with it. During the last financial year we saw a rapid rise in the value of eNtsa funded R&D projects. This is in line with our drive to add in-house value to engineering services rather than simply responding to client needs.

eNtsa management and staff, take responsibility for ensuring that NMMU, through eNtsa, can unpack the next best technology and knowledge gaps to the benefit of our industrial partners, enabling us to capitalise on the opportunities and challenges presented by our industrial transition.

7.2. The level and extent of partnerships/collaborations/networks/linkages formed internally and externally:

a. Internally (*inter-departmental, inter-faculty and interdisciplinary*):

eNtsa internal collaborators include:

- Department of Chemistry
- Innoventon
- HRTEM facility
- Renewable Energy Research Group

	<ul style="list-style-type: none"> - uYilo eMobility Technology Innovation Programme (programme within eNtsa) 		
<p>b. Externally <i>(at local, national and international level):</i></p>	<p>eNtsa external government, research and business development organizations include:</p> <ul style="list-style-type: none"> - Automotive Industry Development Centre (AIDC) - Council for Science and Industrial Research (CSIR) - Department of Science and Technology (DST) - Department of Trade and Industry (DTI) - Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) - Eastern Cape Development Corporation (ECDC) - ESKOM - European Synchrotron Research Facility, France - Groningen University, The Netherlands: CUT - Leverhulm Trust - Light Metals Development Network (LMDN) - National Research Foundation (NRF) - NECSA - SAIW/WITS University of Johannesburg - Sector Education and Training Authority (SETA) - Small Enterprise Development Agency (SEDA) - Technology Innovation Agency (TIA) - The MAX IV Laboratory - Titanium Centre of Competence (TiCoC) - University of Ferrara - University of Lund, Sweden - University of Malta - University of Plymouth, UK - University of Sheffield - University of South Carolina 		
SECTION D: Signature			
Applicant Signature		Date	
SECTION E: FOR OFFICE USE <i>(Administered by the Centre for Academic Engagement and Collaboration and the NMMU Engagement Committee)</i>			
Resolution regarding application from Awards Committee:			
Feedback to applicant:			

SECTION F: Portfolio of Evidence

Attach any relevant documents as a portfolio of evidence to support your application. **Limit this portfolio of evidence to a maximum of 20 pages.** This can include photographs, promotional material, commendations from stakeholders/beneficiaries etc., publication references, (extracts from) annual or project reports to funders/sponsors etc., or any other relevant materials that may serve as evidence.

List of supporting documents submitted along with this application as addendums:

Please ensure that the documentary evidence below is clearly cross-referenced with the relevant section and number in the application template, for example Section B1 or Section C4.

Annexure A: eNtsa organogram {Section A}

Annexure B: Article in Business Link on eNtsa services) {Section B-1}

Annexure C: uYilo Battery Testing Services poster) {Section B-1}

Annexure D: Case study – Example of Supplier Development assistance to local entrepreneur {Section B-1}

Annexure E: News clipping of the QBell project) {Section B-1}

Annexure F: Eskom article on WeldCore® and ASME accreditation) {Section B-4}

Annexure G: DVC visits the Small Punch Creep Testing Facility) {Section B-4 & Section C-5}

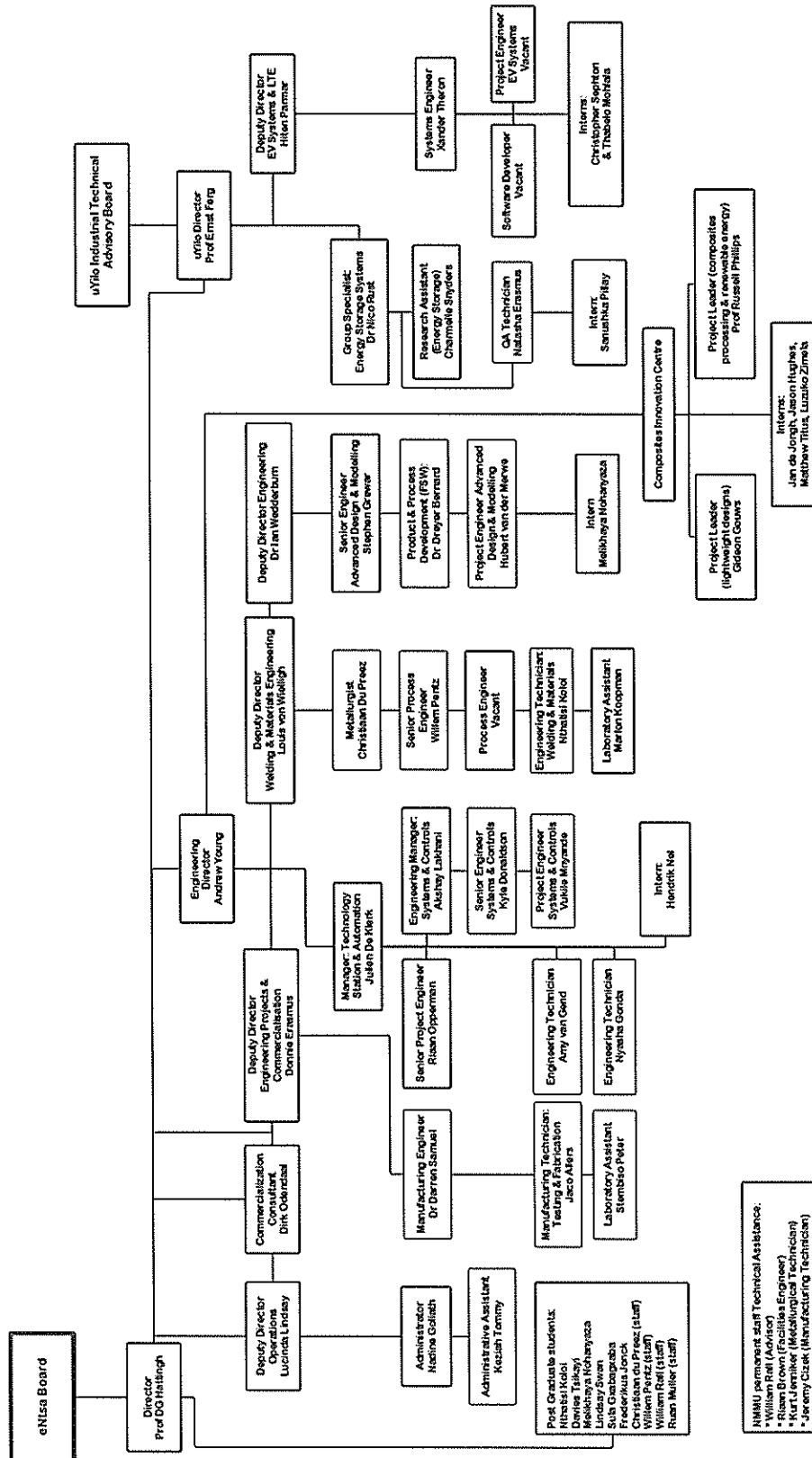
Annexure H: eNtsa's Supplier Development Statistics) {Section C-1.1}

Annexure I: TSP Operational Plan April 2017 – March 2018) {Section C-1.2}

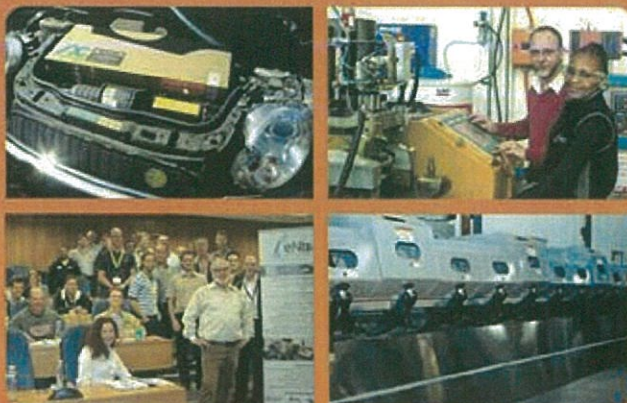
Annexure J: Prof Danie Hattingh's abbreviated CV) {Section C-5 & Section C-6}

Annexure K: List of eNtsa interns and researchers as per December 2016) {Section C-5}

Annexure A: eNtsa organogram



NMMU permanent staff Technical Assistance:
 *William Brown (Facilities Engineer)
 *Kurt Lemmer (Metallurgical Technician)
 *Jeremy Cizek (Manufacturing Technician)



Innovation & Research Centre

Offering services & specialised skills to boost local industries

eNtsa is recognised as an innovative research centre at the Nelson Mandela Metropolitan University (NMMU) specialising in design and technology support for the engineering, manufacturing, power generation and nuclear sectors. This is achieved through provision of research supporting new process and technology development, technology support for optimising existing production processes and infrastructure and advancing the high-end skills level by offering technical training according to international best practices. eNtsa's workforce consists of highly specialised and skilled engineers, office professionals, technical support, postgraduate candidates and interns.

The centre has highly equipped laboratories with specialised and state-of-the-art equipment.

More recently eNtsa has entered a sphere of commercialisation of their processes and services. In 2013 the eNtsa e-mobility programme was launched which signified the acclaimed dawn of the renewable era within the group. This programme is a national joint initiative of the Technology Innovation Agency (TIA) and NMMU which aims to support technology development in the fields of Battery Systems, Electric Drive Trains and Charging Infrastructure.

PROJECTS AND SERVICES LINKED TO ENTSA

Product Engineering:

- Product and process development - Fatigue analysis - Failure analysis

Process Control and Automation:

- Automation - Quality Control - Robotics - Circuit Design

Development and design:

- Mechanical design - 3D Modelling - Finite Element Analysis (FEA) - Portable 3D scanning

- Portable Optical CMM measurement

Services (Materials and Mechanical):

- Mechanical Testing (e.g. Chemical, tensile, fatigue) - Optical and Scanning Electron Microscopy (SEM)

- Residual stress analysis (X-ray diffraction non-destructive) - High speed hole drilling (semi-destructive) - High Speed camera

Services (Prototyping and Manufacturing):

- EDM wire cutter - EDM die sinker - Water Jet cutter - 3D printing - CNC - Turning and Milling - 5-Axis CNC

OTHER SPECIALISATION AREAS AND SERVICES INCLUDE:

• Customised innovative engineering solutions • Joining Technologies • Renewable 'green' energy

• Friction Processing (FP) - In all the FP technologies the material is processed in the solid state (i.e. below the melting point of the material) to produce a high quality joint. These processes are of major interest for applications where the original metal characteristics must remain unchanged or be improvable.

• Specialised training - training opportunities offer value to a wide range of delegates providing skill and knowledge in focused areas with engineering presented to experts on the topic of hand.

• Small and Medium Enterprises Development - eNtsa provides support for enterprises in the first, second and emerging economies (SMEs) within the engineering and manufacturing sector as well as specific focus on the automotive component sector with the aim of linking South African automotive industry more globally with the.

• Technology Station Programme (TSP) - eNtsa has recently outlined a plan of action to assist SMEs in various key industries (such as the automotive component industry) and Original Equipment Manufacturers (OEMs) with supplier development support to uplift the South African socio-economic market.

Recently, the NMMU group has incorporated various new equipment and skills which have broadened the scope of services on offer - including a recently commissioned 40W robotic laser cell capable of cutting, welding and cutting investment in an advanced modelling and design division increasing the group's ability to perform advanced simulation and portable 3D scanning and measurement equipment.

eNtsa is able to offer these services affordably to those who need it most, local SMEs and industry. Furthermore, qualifying SMEs are given the opportunity to access this support through the TSP initiative.



To find out more about eNtsa, its service and the TSP initiative, call 041 504 3608 or visit entsa.nmmu.ac.za or visit the Facebook page www.facebook.com/entsanmmu

BATTERY TESTING LABORATORY

LEAD-ACID BATTERIES

INTERNATIONAL AND NATIONAL TESTING SPECIFICATIONS:

- Full and partial accredited testing available and according to:
 - IEC60095-1 (SANS/IEC60095-1) Lead-Acid Starter Batteries Part 1 and SANS2:2013 Lead-Acid Starter Batteries
 - Capacity (C₂₀, Reserve)
 - Cranking performance
 - Charge acceptance
 - Charge retention
 - Endurance testing
 - Water consumption
 - Vibration resistance
 - Electrolyte retention
- Other types of testing services:
 - Uninterrupted Power Supply batteries
 - Solar batteries
 - Battery testing according to various automotive specifications
 - Start-stop testing of Enhanced Flooded Batteries

LITHIUM-ION CELLS (Specialised testing services)

- Full and partial testing services available and according to:
 - IEC62620 (2014): Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for use in industrial applications
 - Discharge performance at 25°C
 - Discharge performance at low temperature (-20°C)
 - High rate permissible current
 - Charge retention and recovery
 - Cell and battery internal resistance (AC and DC impedance),
 - Endurance
 - SANS62660-1:2013 (IEC62660-1:2010): Secondary lithium-ion cells for the propulsion of electric road vehicles Part 1: Performance testing
 - Capacity
 - Power
 - Energy
 - Storage
 - Cycle life
 - Energy efficiency
- Other types of testing services:
 - Low current cell testing (Coin and cylindrical)
 - Electrochemical Impedance Spectroscopy (EIS) with model fitting capabilities (cells)

MATERIAL DEVELOPMENT AND TESTING SERVICES

- Portable X-Ray Fluorescence analysis of automotive components for substances of concern (Hg, Cr, As, Cd, Br, Pb) as well as Alloys and Precious metals identification
- Melt flow Indexing of Thermoplastic automotive components such as, Polypropylene, Polyethylene, Polycarbonates and PP-EPDM
- Semi-quantitative X-Ray Diffraction of crystalline powders
- Laser Particle Size Analysis of powders (0.04-2500µm)



STRATEGIC PARTNERS



www.uYilo.org.za
 NMMU North Campus
 Tel: 041 504 3508
 Fax: 041 504 9123
 Email: uYilo@nmmu.ac.za



The uYilo Testing Laboratory is SANAS accredited and conducts all of its activities according to the requirements as set out by the ISO17025 quality management system.

Annexure D: Case study – Example of Supplier Development assistance to local entrepreneur

John Gray & Son is a 75% female owned manufacturing company in Port Elizabeth, established over one hundred years ago, which manufactures industrial and technical brushware. Industrial clients include those in the following industry sectors: civils, pharmaceuticals, engineering, food-and-beverage and manufacturing. Their current customers include Willard Batteries, Continental Tyre, Basil Read, Haw & Inglis, WBHO and Gentech.

John Gray & Son contacted eNtsa to provide assistance with product and process development with the aim of localizing a currently imported brush product, for which they had been resellers. Since then, eNtsa has provided John Gray & Son with continued design and manufacturing solutions.

The completion of projects for John Gray & Son has directly resulted in:

- A small scale production system to **manufacture road sweeping brushes**
- **Increased product markets and productivity**
- **Localisation** of previously imported product
- **Sales of over 1 500 units** in the first 3 months of production
- The creation of **4 new permanent jobs** (approximately 30% increase in staff)
- **Training of employees** in workshops skills and computer skills
- **Exporting of products** to African countries, including Namibia and Zambia.
- **Support of local suppliers**, as all components used by John Gray & Son in their manufacturing process are sourced from local South African companies.



Image: John Gray & Son manufacturing staff, owner (Kate Gluckman) and eNtsa engineer (Riaan Opperman) with new locally manufactured brush product

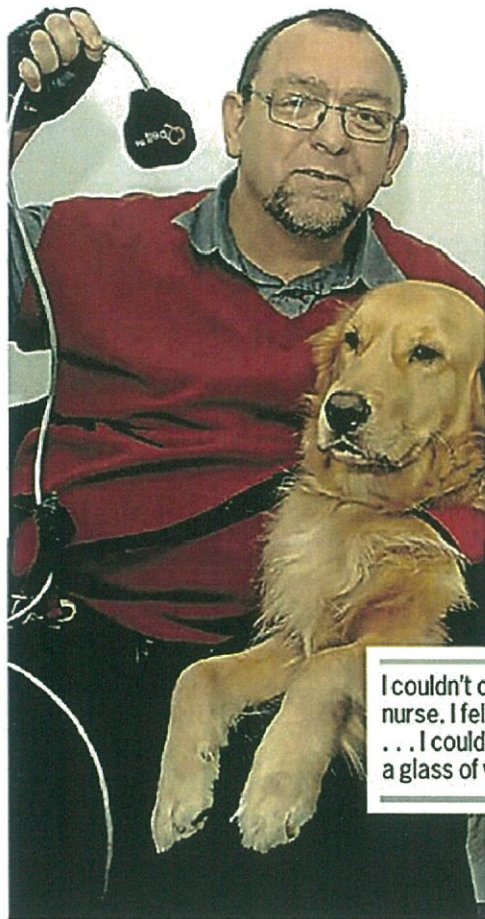
John Gray & Son have contacted eNtsa for additional assistance. This assistance will facilitate the manufacturing of new brush products using modified tooling and processes to widen their range of product offering and further localise currently imported brush products.

Expansion of new technologies:

In the 2016/2017 period funding was secured to purchase new high end equipment to expand eNtsa's abilities and maintain a high end portfolio of technology available at the unit. Funded equipment includes a portable hardness testing system as well as a Digital image correlation (DIC) system for dynamic, full field strain measurement. These new systems pave the way to new research and development, product testing, analysis and improved technology based innovation in both academic and industrial projects within eNtsa/NMMU.

Adversity sparks design innovation

Disabled man creates new assistance device, writes Devon Koen



I couldn't call out for a nurse. I felt so frustrated . . . I couldn't even ask for a glass of water

HIS CALL: Heinrich Williams, seen here with service dog Viking, shows off the QBell nurse call system he designed PHOTOGRAPH: Mike Holmes

FIVE years ago Heinrich Williams was at the top of his game. Managing his own engineering firm, the 44-year-old former South African Air Force aircraft electrician, who grew up in Ultenhage, had a bright future ahead of him.

"In 2002 I resigned from the SAAF and worked in the automotive industry as a jigs and fixture designer, process engineer and project manager on different local and international projects," Williams said.

In 2010 he was in China assisting an automotive company with the design and development of a new vehicle when tragedy struck in the form of an illness that led to paralysis.

But Williams fought through his adversity and is now, with the help of NMMU's Innovation Office, patenting products to help the disabled.

Explaining his paralysis, he said: "Two weeks into the trip I started having [muscle] spasms. Shortly afterwards he woke up one morning not feeling too well, and after having a shower he retreated back to his bed.

"My left leg and arm were numb. By the time the paramedics arrived, I was completely paralysed."

Williams had contracted a bacterial infection in his spine that left him a quadriplegic.

"The doctor in China could not give me any explanation of how I could have contracted the infection," he said.

After weeks of lying in a Chinese hospital, not being able to move a muscle, Williams returned to South Africa for further medical treatment. "I was in ICU at Greenacres [Hospital] for a week before being admitted to Aurora [Hospital] for three months."

Having virtually no arm function, Williams became increasingly frustrated with the fact that he could not summon a nurse for assistance.

"My diaphragm was also paralysed, so I couldn't even call out for a nurse. I felt so frustrated . . . I couldn't even ask for a glass of water."

Williams also found himself in a situation where

he had to close his business. "After being disabled I had called various clients, but they did not have work for me so I had to close my company. It is not easy to find work [when you are disabled]."

While regaining partial function of his arms, Williams decided to study further and went back to university, where he completed a diploma in industrial engineering at NMMU.

He is now on a mission to prove that people with disabilities are fully capable of making a difference in society, and has developed a new call bell he hopes will be put in all hospitals.

"I approached eNtsa [the innovation agency at NMMU] with this idea to develop a call bell which would require minimum pressure," he said.

Working closely with the research, design and technology support unit at NMMU, Williams and eNtsa developed the prototype for the QBell.

"It is not only for disabled people, but also for patients in frail-care facilities," Williams said.

The call button used minimal pressure and was compatible with standard call buttons already available in local hospitals, he said.

"With this, people with disabilities can get the attention they need. It is small and simple."

NMMU's Innovation Office director, Jaci Barnett, has assisted him in patenting the device and securing trademark rights.

"We have developed 20 of these and distributed them to three hospitals [Greenacres, St George's and Aurora] in Port Elizabeth.

"The next aim is to have them installed at hospitals and care facilities nationwide. The only thing standing in the way is getting to the right person in government to have them rolled out."

Next on Williams's list is a way to monitor parking bays for the disabled.

"The development of the technology has passed the first phase and we have received a large investment for the next phase."

The project will see a mobile application available to the disabled. The app would be used to access the parking bays, which would be blocked off to the public by a security beam which could be lowered by using the app.

Williams - who is assisted by his service dog, Viking - said his main goal was to make day-to-day living for disabled people a little easier.

He has been married to wife Daidre for 13 years and is now enrolled at NMMU studying towards a BTech in industrial engineering.

INNOVATION OFFICE

In the ever-changing world of technology and innovation, the Nelson Mandela Metropolitan University (NMMU) has taken the proverbial bull by the horns with its Innovation Office to facilitate and assist fledgling innovators in their various quests.

Founded in 2007, the office aims to "nurture innovation, foster creativity, embrace technology and develop people to meet the challenges of the world of tomorrow".

Innovation support and technology transfer director Jaci Barnett said her office had become an integral part of the university.

Working closely with government structures, the office assists prospective innovators with grant and contract management, proposal and business plan development and prototype and proof of concept funding.

Another key element of the Innovation office is to manage technology transfer through intellectual property (IP) awareness and support, IP identification and protection, and IP management and commercialisation.

Major partners include Innovate, the university's wholly-owned commercialisation company, as well as the newly launched Propella, NMMU's incubator which supports the development of small businesses in Port Elizabeth, including the NMMU's spin-off companies.



Eskom and NMMU develop innovative world-first welding technology

2016/01/17

Sunday, 17 January 2016: No load shedding is anticipated today. Eskom is progressing well with the maintenance of its power generating plant whilst supplying the country's electricity needs.

Eskom in collaboration with Nelson Mandela Metropolitan University (NMMU) has developed a "commercial-ready" technology (WeldCore®) for the power generation and petro-chemical industry.

The technology, WeldCore®, directly influences the life extension programmes within the local and international power generation and petro-chemical sector by unlocking new ways of determining remnant life of high value engineering components.

WeldCore® is a sampling and repair process which allows for the removal of a representative cylindrical metallurgical sample from a pipe or component, and the subsequent repair of the removal site using a unique friction welding technique called friction taper hydro-pillar processing (FTHPP).

The metallurgical sample can be analysed to ascertain, amongst others, the level of material creep life deterioration, fracture toughness and remnant life. Current techniques for assessing the material integrity of thermally aged components rely on tedious and costly processes which often lead to over-conservative results.

All of the above has now been tested and validated and internationally accredited. The committee for Section IX of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) granted approval for industry application of the WeldCore® technology. The ASME code approval places the process on the international front as an accepted procedure, for users world-wide.

By all indications, this is the first approval by ASME BPVC for a South African institution.

We would like to encourage customers to continue using electricity sparingly. We will continue to provide regular updates on the state of the power system through various media platforms.

ENDS

Source: <http://www.eskom.co.za/news/Pages/Jan17.aspx>

eNtsa Small Punch Creep Testing (SPCT) Facility on NMMU South campus



DVC Research & Engagement - Prof Andrew Leitch, Director: Innovation - Ms Jaci Barnett and Director: Maintenance Services - Mr Melvin Syce visited the eNtsa Small Punch Creep Testing (SPCT) Facility on NMMU South campus. eNtsa team members accompanied guests on this site visit to the facility that hosts 6 SPCT platforms used to perform accelerated small sample creep testing. The SPCT platforms were developed and built by the eNtsa engineers. These platforms are

used to test specimens from components that experience creep damage due to high temperature operating environments. The samples are removed using the patented WeldCore® technology. The tests forms part of life cycle management projects where the creep damage in components are evaluated, in an attempt to predict the remaining service life of the components. The SPCT initiative at NMMU has been developed with strategic partners, Eskom & Sasol! #eNtsavalues #innovation

MK2 SPCT platforms built on NMMU South Campus

Following the building of additional MK2 SPCT platforms assigned to testing for the petrochemical and power generation industry, a dedicated laboratory has been built on NMMU South campus to house the equipment. These platforms are highly sensitive to temperature variation and vibration, hence the need to be located in a dedicated and controlled facility.

The long test durations, typical of creep testing, points to more equipment being built in the next few months, the scope of the lab will also be expanded to the more common uniaxial testing required by local industry.



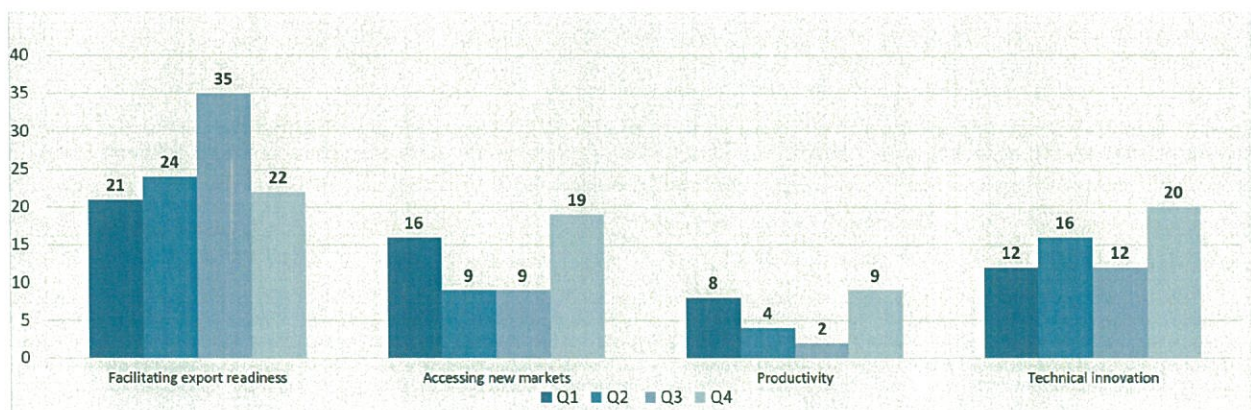
MK2 SPCT platforms situated on South Campus, NMMU.

Annexure H: eNtsa's Supplier Development Statistics

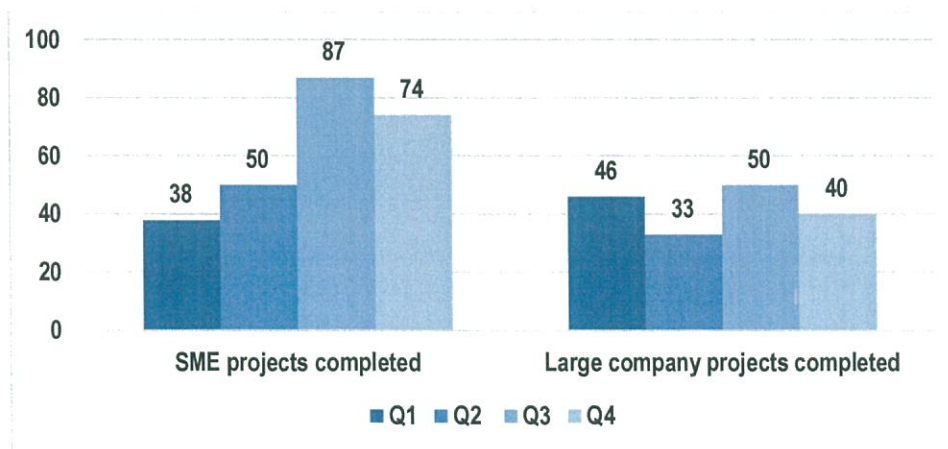
The supplier development and TSP initiatives within eNtsa, is to support and stimulate local engineering innovation in order to improve the competitiveness of local manufacturers which will enable industry to exploit and develop new markets. With the support of the Technology Innovation Agency (TIA) and the Department of Science and Technology (DST) eNtsa is able to make much needed engineering skills, services and training more readily available to SMEs operating in the local manufacturing sector according to international best practices.

In the 2016/2017 period eNtsa provided custom knowledge transfer and training to 51 individuals in technical areas ranging from Safety in electrical design to operation of 3D scanning systems. In the period of 1 April 2016 to 23 March 2017 eNtsa assisted in **246** projects for **128** SMEs. During the same period, **183** projects were completed for large companies, with an average of **21** large companies assisted each quarter. Thus, **429** industry interventions were completed during this period. This industry assistance covers a wide spectrum of testing, design, product/process development, technology demonstrations and manufacturing assistance.

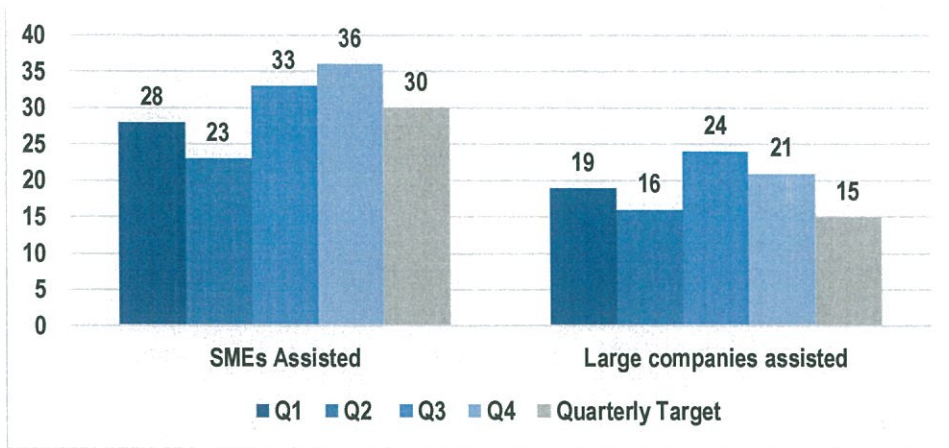
Many projects enable the production of local components and/or products destined, fully or in part, for export markets. Most of these clients require assistance in product design, process development, product quality verification or product testing in order to maintain or secure supply contracts for the export market. From the analysis done it can be observed that **102** of the projects completed had an element of export readiness identified. The areas of impact for the TSP projects completed in 2016/2017 can be seen in the graphs below.



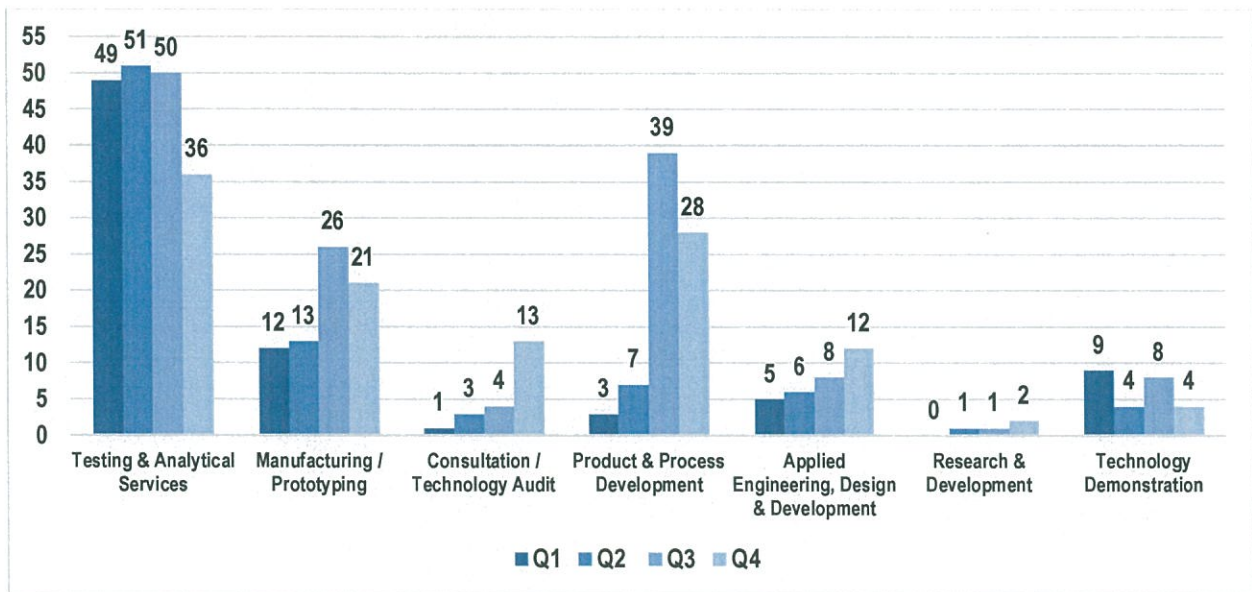
Number of projects completed



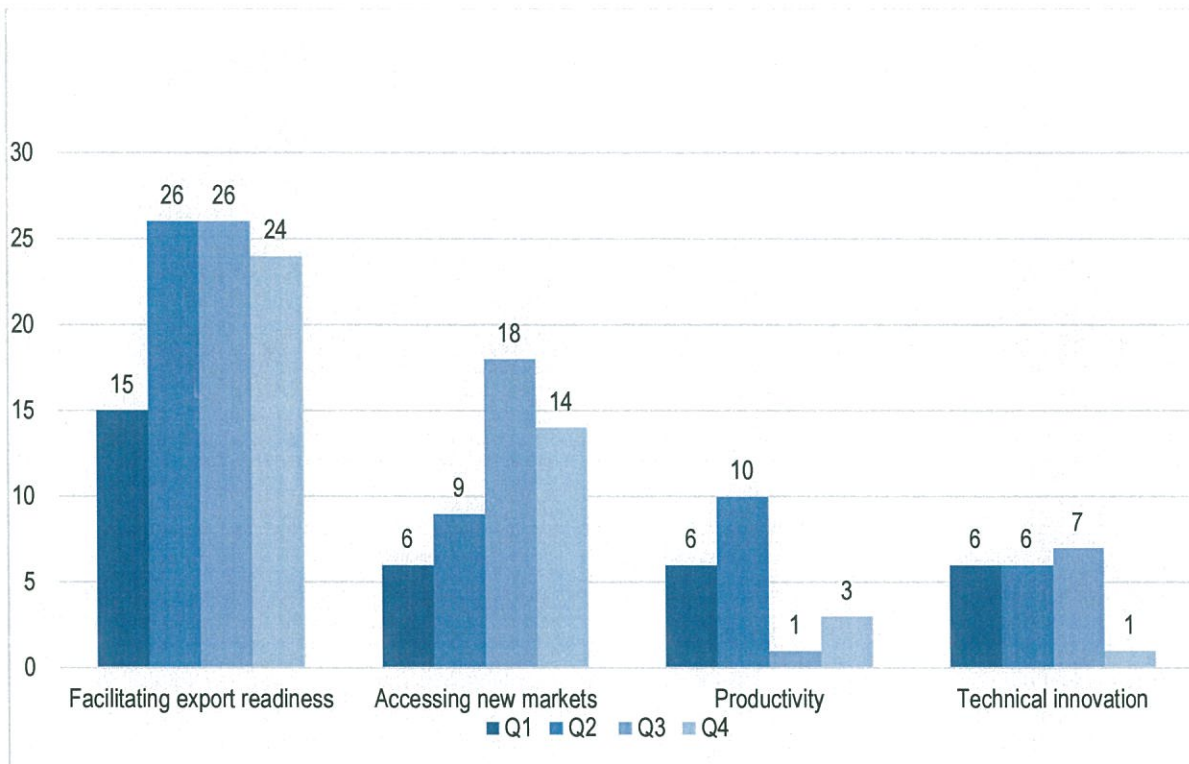
Number of companies assisted



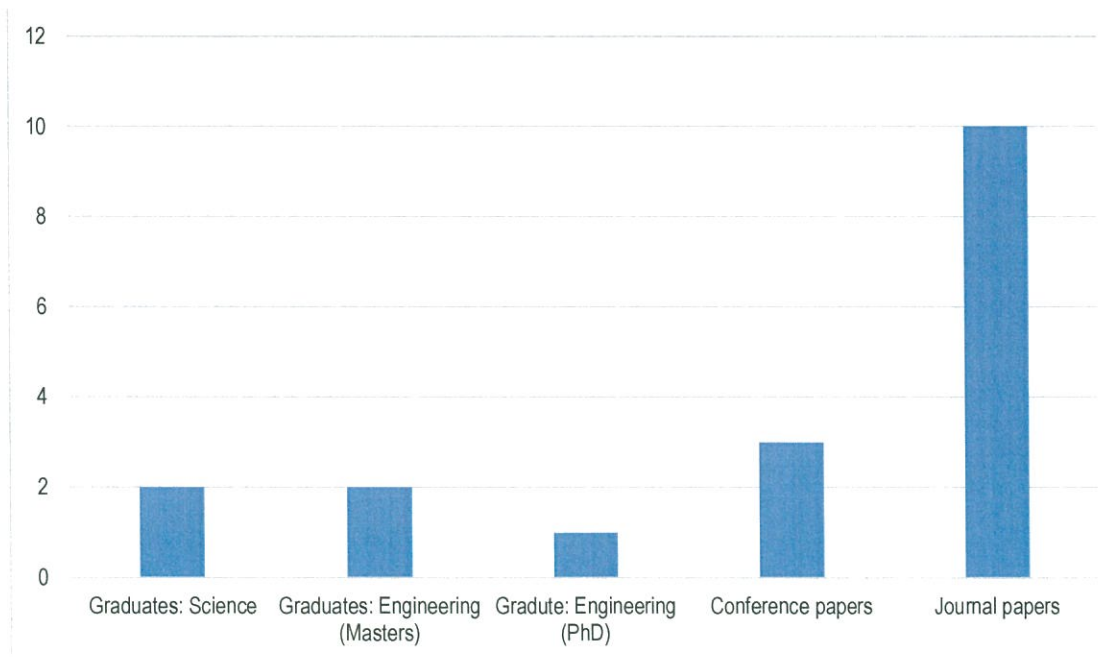
Type of services performed



Impact in industry in FY2016/2017



Research Conference and Journal Publications



Context of the Technology Station Programme

Established in 2002, eNtsa (initially the Automotive Component Technology Station – ACTS) was primarily focused on supporting the automotive components manufacturing industry in the Nelson Mandela Bay area. Over the years, as the expertise of the group expanded, the project scope broadened and became more reflective of the wider engineering and manufacturing sector.

The group was rebranded as 'eNtsa', a name derived from an isiXhosa word meaning 'new'. The expansion in scope created new opportunities enabling the transfer of innovative technologies and applications to a wider industry, all proudly developed in South Africa.

Today, eNtsa is recognised as a prominent research, engineering innovation and technology support unit for the advanced manufacturing and engineering sectors in South Africa, with strong links to the Automotive, power generation and petrochemical industries. eNtsa comprises of a number of key pillars, namely, the Supplier Development Programme, Friction Processing Research Unit (FPRU), uYilo and the newly introduced Composites Innovation Centre (CIC).

The main focus of the Supplier Development programme and Technology Station (TS) Programme, within eNtsa, is to support and stimulate the local manufacturing and engineering industries in order to improve the competitiveness of local manufacturers which will enable industry to exploit and develop new markets.

In the 2014-2015 Annual report of the Department of Trade and Industry (DTI), Minister Davies refers to the manufacturing sector as a primary part of the 'industrial engine' of South Africa and notes the need for growth in this area (DTI, 2015). Again in March 2015, the DTI noted in their publication, "*Facts and Figures on Skills in Manufacturing*", that 'manufacturing is the key determinant of future growth and competitiveness in the provision of a skilled technical workforce'. (DTI, 2015)

With the support of the Technology Innovation Agency (TIA) and the Department of Science and Technology (DST) eNtsa is able to make much needed engineering skills, high-tech services, and training more readily available to Small and Medium Enterprises (SMEs) operating in the local manufacturing sector.

This supplier development initiative is directly aligned with TIA's objective of "*stimulating and intensifying technological innovation in order to improve economic growth and the quality of life of all South Africans by developing and exploiting technological innovations*". (TIA, 2016)

Recently South Africa has seen the services sector driving economic growth, while the manufacturing sector has seen growth below desired levels. (DTI, 2015) This fact emphasises the need for support and advancement of the local manufacturing sector.

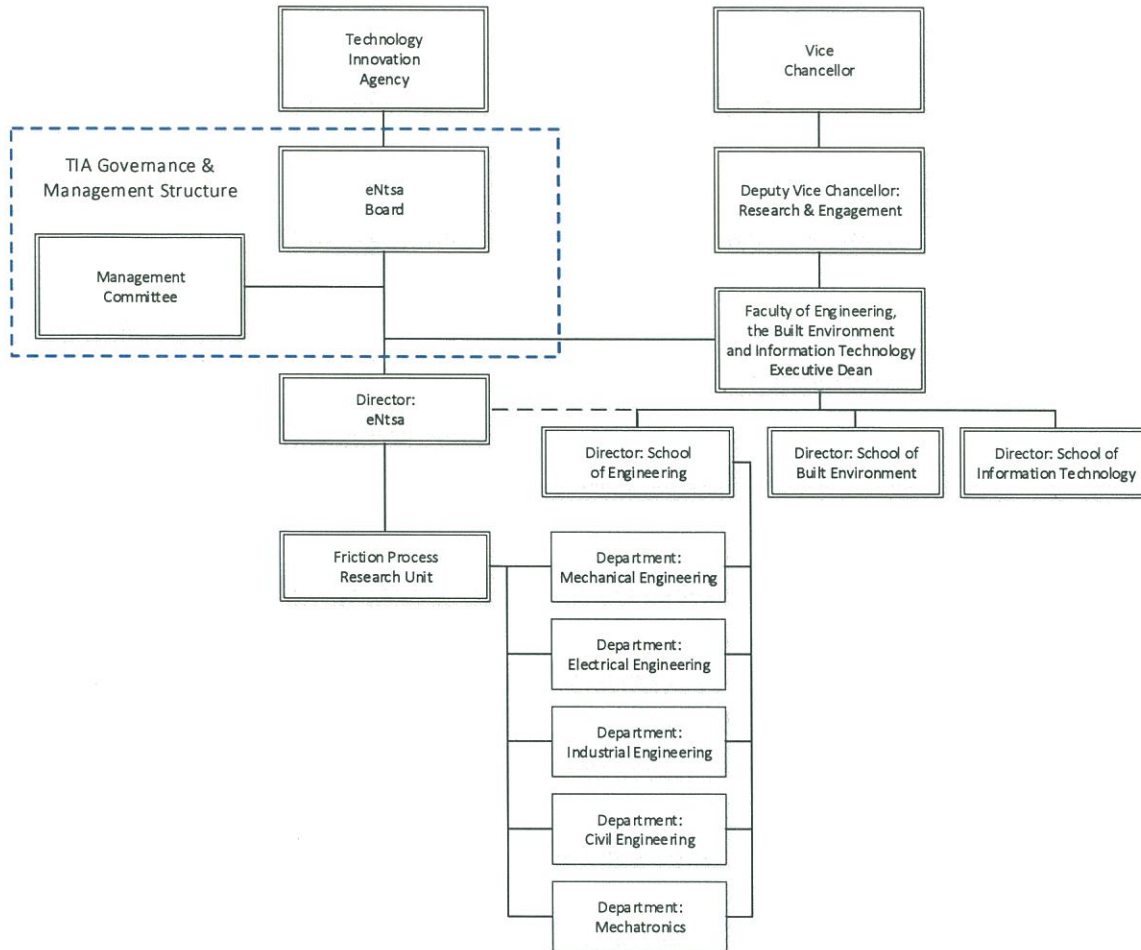
We believe that growing the *advanced manufacturing* economy in South Africa holds the key to sustainable job creation, international competitiveness, economic growth and improved quality of life for South Africans.

Apart from the continued support of TIA and DST, the success of eNtsa in providing industry with world class support (as categorised by an independent benchmarking audit), lies in the experience and technical skills found in its human resources, continued access to cutting edge technologies, and the support of the Nelson Mandela Metropolitan University (NMMU).

With a healthy level of student involvement in industry projects, both in internships and applied research, eNtsa ensures an active participation of university students and the Faculty of Engineering in a number of project areas.

Institutional positioning

The following figure shows a graphical representation of eNtsa's positioning within the NMMU and Faculty of Engineering, the Built Environment and Information Technology. For more detail on eNtsa's governance and institutional positioning, see section **Error! Reference source not found..**



Status of the Industry/sector

Positioned in the Eastern Cape, eNtsa is ideally situated in an area which is in need of economic growth. Though the automotive industry is no longer the sole focus of the group, according to the Eastern Cape Development Corporation (ECDC), the Eastern Cape hosts five of the major OEMs operating in South Africa, along with more than 100 major component manufacturers and the Eastern Cape manufactures 51% of South Africa's vehicle exports.

This sector continues to face local and international challenges, in their 2016 3rd quarter report, NAAMSA, indicated that new vehicle sales for 2016 expected to show a decline of 12.0% compared with 2015, confirming ongoing difficult economic conditions (NAAMSA, 2016). NAAMSA went on to indicate that the volume reductions had placed cost pressures on local automotive component manufacturers (NAAMSA, 2016). As there exist over 40 000 formal sector jobs within Eastern Cape OEMs and over 1500 supplier companies (ECDC, 2015) providing employment, this highlights the need for assistance businesses within this sector and why this remains a significant focus area of eNtsa in supporting and driving the advanced manufacturing sector.

On the outskirts of Port Elizabeth, the Coega IDZ, in close proximity to the new Ngqura deep-water harbour, is showing promising industry growth. The Coega IDZ focus on development in the Metals, Textiles, Automotive, Chemicals and Energy sectors and is developing an automotive production cluster linked to the industry already established in the Eastern Cape (ECDC, 2016). This Industrial Development Zone provides a new and exciting opportunity for expansion of the local manufacturing industry.

According to the ECDC, “The Eastern Cape has solidified its position as an important producer of renewable energy and the country’s leader in wind energy” (ECDC, 2016), being second only to the Northern cape in renewable energy projects. This places eNtsa in a unique position to focus on opportunities to provide support to this fast growing technology to ensure the viability and sustainability of local projects but also to ensure future sustainability of the station through diversification of services and industries supported.

TARGETS FOR THE NEXT FINANCIAL YEAR

A brief view of the upcoming year’s activities and focus areas can be found in the sections below.

KPA1: Institutional Learning and Development

eNtsa’s focus areas provide significant advantages for local industry as well as for the NMMU which benefits through staff and student industry-engagement, the creation of third stream opportunities for the university and advancement of infrastructure housed within the university.

Advanced infrastructure and engagement with industry provide unique opportunities for academic research which is relevant and aligned to the dynamic requirements of the global advanced manufacturing industry.

The eNtsa supplier development programme envisages utilising expertise within the NMMU that may include:

- Academic Staff (Mechanical design review, Test method evaluation, Report writing, etc.)
- Doctorial post-graduate researcher (New technologies and test methods, etc.)
- Masters post graduate researcher (New technologies, test methods, mechanical and software design, etc.)
- B.Tech and B.Eng student Interns (New technologies, test methods and measurement, mechanical and software design, etc.)
- Diploma students (Mechanical and software design, practical experience, etc.)

A key focus area for research and development in conjunction with the NMMU in FY2016-2017 are in the field of Laser welding and cladding.

This technology represents a significant advancement in joining technologies available to industry, in 2011, the CSIR noted that laser welding is characterised by high levels of productivity achieved through the ability to control fast welding speeds while producing ‘excellent’ weld quality (CSIR, 2011), yet local industries adoption of the technology is limited due to a lack of process knowledge and high initial capital outlay.

KPA2: Technology Transfer and Industry Support

As stated in the introduction, the main focus of the Supplier Development programme and Technology Station (TS) Programme, within eNtsa, is to support and stimulate the local manufacturing and engineering industries in order to improve the competitiveness of local manufacturers which will enable industry to exploit and develop new markets.

In order to achieve this eNtsa aims to add value in the following areas:

- **The support of local component manufacturers through applied engineering and analytical services.** Improving the quality and financial competitiveness of local products leads to the localisation of OEM components and an increase in global export opportunities. This development leads to economic growth and retention/increase of local employment especially in SMEs owned by previously disadvantaged individuals (black, women, etc). By providing manufacturing and rapid prototyping services eNtsa is able to offer the local manufacturing sector a means of fast tracking product research, development and testing.
- **The introduction and demonstration of new technologies to industry.** New technologies act as a catalyst for local industry, prompting progression in the level of technological advancement in local manufacturing. This advancement is

necessary for South African manufacturers, specifically SMEs, to maintain/achieve the high quality and production standards set by international customers and competitors.

- A focus on **Research and development**. By providing the necessary infrastructure to support and maintain research in the fields of manufacturing and materials we aim to develop new and improved customer products and processes. This includes short, medium and long term exploratory research in the fields of product and process development based on industry needs.
- **Human resource development**, consisting of education and training. Supporting industry by continuing to provide opportunities for high quality profession training through Continued Professional Development and Short Learning programmes. This creates opportunities for up skilling of technical staff of many levels in industry. Without a culture of continued learning advancements in the manufacturing sector are not possible. Through extensive involvement in industry projects a number of interns and post-graduate students are exposed to real world challenges, opportunities and practical applications of knowledge. This leads to the development of human resources which are sought after in industry or more prepared as emerging entrepreneurs.

Annexure J: Prof Danie Hattingh's abbreviated CV extract

CURRICULUM VITAE – Daniël Gerhardus Hattingh

PhD, M Dip Tech Mech Eng, NHDip Mech Eng, N Dip Mech Eng, Pr Tech, MSAIMechE

PERSONAL PROFILE

Professor Hattingh leads a research and innovation group at the NMMU known as eNtsa. This group provides engineering solutions for mainly the manufacturing, power generation and transport industries. He is further renowned for the work done around Friction Stir Welding and efforts in establishing this alternative joining technology in South Africa. Over the past ten years Prof Hattingh and his team of researchers have won various national awards and international acknowledgment for their ground breaking research and applications conducted within the friction processing arena. He obtained his PhD from the University of Plymouth, UK, in 1998 and in 2012 he was one of the first five professors who received a Distinguished Professorship at the Nelson Mandela Metropolitan University. Prof Hattingh has published number well cited scientific papers and also act as external reviewer for a number in international journals.

CAREER RÉSUMÉ

Jan 2009 – Director eNtsa (Centre for Innovation through Engineering) and Professor in Mechanical Engineering

Oct 2001- Dec 2008 Professor in Mechanical Engineering and Manager Automotive components Technology Station.

June 2001 – November 2001 Sabbatical leave in the School of Marine, Manufacturing and Mechanical Engineering, University of Plymouth, UK: Research project on Friction Stir Welding and Residual Stress Measurement using Synchrotron Radiation.

April 1995 – Sept 2001 Head of Department Mechanical Engineering, Port Elizabeth Technikon.

Dec 1992 – March 1995 Program Manager Production Management and Senior lecturer Department of Mechanical Engineering, Port Elizabeth Technikon.

Aug 1989 – Dec 1992 Lecturer Mechanical Engineering, Department of Mechanical Engineering, Port Elizabeth Technikon.

Jan 1986 – Aug 1989 Research and Development engineer in a leading international fan manufacturing company. Main responsibility was the Design and Research and Development of new product ranges for potential future markets.

Jun 1984 – Dec 1985 Industrial experience with Donkin Fans Manufacturing in Port Elizabeth. Development as a Mechanical Engineering Technician.

Jan 1982 - Dec 1983 National Service with the South African Defence Force (SADF) as an Infantry Soldier later as a Platoon Sergeant at Infantry School: Oudtshoorn.

PROFESSIONAL REGISTRATIONS

1995 Registered with the Engineering Council of South Africa as a *Professional Technologist*. (Registration number: 9570064)

1992 Member of the South African Institution of Mechanical Engineers. (Registration number: 080792)

OTHER SIGNIFICANT RECOGNITION

2016 Researcher of the year award: School of Engineering

2012 Awarded the title: Distinguished Professor

2012 Awarded the Eskom's Chairman Award for Innovation – Hendrina WeldCore® team

2012 Awarded the Southern African Institute of Welding's Gold Medal in recognition of vision and leadership in developing a friction stir welding technology unit at the Nelson Mandela Metropolitan University

2011 WeldCore® research team won the National Sciences and Technology Forum (NSTF) prize in the category: Research for Innovation by an individual or a team through an Organisation/ Institution

2009 Won the National Innovation Fund Competition in 2010 (53 teams and 19 participating universities)

2008 Finalist for NSTF award Recognition for outstanding contribution to Science, Engineering, technology and Innovation

2007- Member of the review panel for Materials Research Group at the CSIR.

2006 - Invited to join the *Editorial Board* of the Elsevier publication *International Journal of Fatigue*.

2005 – 2010 *Chairman: South African Institute of Mechanical Engineering* (SAIMechE) Eastern Cape Branch. Member of National Council.

2004 – 2009 Member of the review panel for all THRIP applications in the field of Materials Sciences. *THRIP Materials Review Panel Member*.

2001 – 2004 Elected to service as an advisory member for the National Standards Generating body for Manufacturing in South Africa: *NSB 06 SAQA/NQF*

2001 - 2003 *Chairman: South African Institute of Mechanical Engineering* (SAIMechE) Eastern Cape Branch. Member of National Council.

2003 *Member: Advisory Panel* – Economic Growth and International Competitiveness Focus Area of the Materials Sub-Focus Area.

REVIEWER FOR INTERNATIONAL JOURNALS

International Journal of Fatigue (Editorial Board Member)
Journal of Material Processing Technology
Fatigue and Fracture of Engineering Materials and Structures

ACADEMIC MANAGEMENT EXPERIENCE

Lecturer in 1989 in the Mechanical Engineering at the Port Elizabeth Technikon. Promoted to Senior Lecturer in 1992. In 1996 was promoted to Head of Department of Mechanical Engineering. During 1998 took over the management of the Department of Materials and Metallurgical Engineering with the responsibility to incorporate it into the Department of Mechanical Engineering. eNtsa Director from 2009 – eNtsa has an annual turnover of some R50M generated from industrial and government contracts for assistance with research, design, or process development. eNtsa comprises the full range of skills necessary to design, build, control and research innovative and bespoke friction welding and processing platforms for industry.

AREA OF RESEARCH

The friction processing research can be divided in two main process categories; Friction Stir Welding (FSW) as a joining technology and Friction Taper Stud Welding (FTSW) and Friction Hydro Pillar Processing (FHPP) as repair techniques. The FSW research is focused on Aluminium for the transport industry, Ti6Al4V for the medical and aerospace industries and 304L Stainless Steel for the nuclear sector. FSW of aluminium considers optimisation procedures for aluminium alloys via control of weld process parameters and tool design modifications. The developed system and technique used in these experiments demonstrated the potential of the 'force footprint' indicator diagram, a force model developed at the NMMU providing a real-time graphical user interface for process optimisation of friction stir welding. The research further exploits these developments for friction welding practice in as far as linking process parameters to assist with optimal tool design. The Friction Taper Stud Welding (FTSW) and Friction Hydro Pillar Processing (FHPP) research is concerned with identified the most suitable process parameters giving the optimum strength. The research considers the effect of weld process parameters on weld defects, macrostructure and mechanical. The research team also developed a novel "on-line, in situ core removal and repair process geared towards the power generation industry. This unique repair process, trademarked as WeldCore™.

RESEARCH EXPERIENCE

Has been involved with the establishment of two Research entities at the NMMU over the past ten years. The first is the Manufacturing Technology Research Centre (MTRC) which forms the research base for all the post graduate research done in the School of Engineering. The MTRC has over the years developed capacity and expertise in a number of strategic fields. This includes fatigue, friction stir welding, residual stress, digital signal processing and intelligent manufacturing. The MTRC is now incorporated into the eNtsa. The second facility was the Automotive Components Technology station (ACTS) now also part of eNtsa, an engineering facility driving innovation. eNtsa are mainly responsible for Contract Research and Technology Transfer. Hattingh is a "C1", rated researcher, NRF grant holder and research leader. He has been extensively involved in research capacity and infrastructure development for 28 years. Currently the Director of eNtsa, a research, innovation and technology transfer centre at the NMMU providing high technological engineering solutions for the power, nuclear and transport industries. Hattingh became actively involved with Friction Processing research during 2000 while taking part in an international experiment with University of Plymouth and the European Synchrotron Radiation Facility (ESRF) in Grenoble. A Friction Stir Welding (FSW) research program was initiated during 2001 with the aim of creating an international facility that would generate local knowledge and expertise to develop friction processing technology for the broader manufacturing industry. As an indicator of success of the research, it is important to note that to date the eNtsa group has attracted in excess of R50 million of industry funding to assist with research and technology development. In 2008, Hattingh was one of five finalists nominated for the National Science and Technology Forum Awards for contributions made as an individual through research and scientific outputs over five years in SETI. This included contribution to the advancement of science, innovation and new knowledge. Hattingh is internationally-recognised and his research group recently developed a platform and process, trademark as WeldCore™, a novel on-line, in situ core removal and repair procedure. The unique process has two international patents associated with it and won the National Innovation Fund Competition in 2010. Evidence of the research impact can be seen in participation and leadership in competitive peer reviewed EU beam time applications at the world class ILL and ESRF facilities who have provided over 38 days of synchrotron and 17 days neutron radiation beam time with a real facility costs of around £675,256. Hattingh serves on the "Editorial Advisory Board of the International Journal of Fatigue" published by ELSEVIER and has reviewed a large number of papers for international journals like Fatigue and Fracture of Engineering Materials and Structures (FFEMS), International Journal of Fatigue. He has also served on the council of SAIMEchE (2005 to 2010). In 2011 his research team won the National Sciences and Technology Forum (NSTF) prize in the category: Research for Innovation by an individual or a team through an Organisation/ Institution.

RESEARCH STATISTICS: January 2017

eNtsa NMMU Engagement Excellence Awards Application – Team Award 2017

h-index 14

Reads: 3300, Citations: 600

2016	0142-1123	Multiaxial fatigue assessment of friction stir welded tubular joints of Al 6082-T6	International Journal of Fatigue	In press	L. Susmel, DG Hattingh, MN James, R Tovo
2016	1971-8993	Crack initiation and propagation paths in FSW tubes under fatigue loading	International Journal of the Italian Group of Fracture	2016 (10) 36	R Tovo, L Susmel, MN James, DG Hattingh, E Maggolini
2016	0142-1123	Crack path and fracture analysis in FSW of small diameter 6082-T6 aluminium tubes under tension-torsion loading	International Journal of Fatigue	92	E Maggolini, R Tovo, L Susmel, MN James, DG Hattingh
2016	2452-3216	Applications of Residual Stress in Combatting Fatigue and Fracture	Procedia	2	MN James, DG Hattingh, D Asquith, M Newby, P Doubell
2016	0924-0136	Semiautomatic friction stir welding of 388mm OD 6082-T6 aluminium tubes	Journal of Materials Processing Technology	238	DG Hattingh, LG von Wielligh, D Bernard, L Susmel, R Tovo, MN James
2016	0257-9669	Implementation Aspects of an Industrial programmable Controller Using PID Control on a FSW Process	R&D Journal	32	DG Hattingh, TI Van Niekerk, R Pothier
2016	0167-8442	Damage assessment and refurbishment of steam turbine blade/rotor	Theoretical and Applied Fracture Mechanics	83	DG Hattingh, MN James, M Newby, R Scheepers, P Doubell

Research outputs 2016:
Journal articles

20 – 24 June	MN James, DG Hattingh, D Asquith, M Newby, P Doubell	21 st European Conference on Fracture, ECF21	Applications of Residual Stress in Combatting Fatigue and Fracture	Catania, Italy	2452-3216 Note: Conference papers published in the Procedia Journal
29 June – 01 July	PM Mashinini, DG Hattingh, H Lombard	World Congress on Engineering	Mechanical Properties and Microstructure of Friction Stir and Laser Beam Welded 3mm Ti6Al4V Alloy	London, UK	ISBN: 978-988-14048-0-0 ISSN:2078-0958 (Print) ISSN: 2078-0966 (Online)
20 – 24 June	P Ferro, F Bert, MN James, T Borsato	21 st European Conference on Fracture, ECF21	Review of recent advances in local approaches applied to pre-stressed components under fatigue loading	Catania, Italy	2452-3216 Note: Conference papers published in the Procedia Journal

Conference papers

Annexure K: List of eNtsa interns and researchers as per December 2016

Doctoral candidates	Qualification discipline	Research project summary
Tsikayi, Davies Student number: 209080067 First registration: 18/02/2015	PhD Mechanical Engineering Full-time	Influence of microstructure homogeneity on fatigue and creep properties of Ti6Al4V, and applied to Rotary Friction Welding of small rods
Jonck, Frederikus Student number: 9514086 First registration: 05/04/2016	PhD Mechanical Engineering Part-time	Provisional: Characterisation of laser welds for thin-walled complex shape structural components
Muller, Ruan Student number: 20616327 First registration: 22/03/2016	PhD Mechanical Engineering Part-time	Laser Beam Welding Process Development of Ti6Al4V Additive Manufactured Tubular Sections
Pentz, Willem Student number: 20301001 First registration: 16/03/2012	PhD Mechanical Engineering Part-time	Influence of Process Energy on Stress Corrosion Susceptibility of a Friction Hydro Pillar Repaired Steam Turbine Rotor Disc Blade Locating Hole
Rall, William Student number: 9341463 First registration: 17/02/2009	Graduate for 2017 PhD Mechanical Engineering Part-time	Determining the fracture toughness of friction stir welded Ti-6Al-4V
Masters students	Qualification discipline	Research project summary
Davoren, Brandon Student number: 212208837 First registration: 01/2016	Graduate for 2017 MSc Chemistry	Tribo-corrosion analysis of Aluminium and Titanium alloys used in Friction Stir Welds (FSW) and Laser Welds
Du Preez, Christiaan Student number: 21127557 First registration: 23/04/2015	Graduate for 2017 MSc Chemistry	Investigating the effect graphitization has on the static mechanical properties of service exposed ASTM A516 Grade 65 steam pipe material
Swan, Lindsay Student number: 20530294 First registration: 01/07/2016	MEng Mechanical Engineering Full-time	Characterization of the influence of build height on thin wall laser metal deposition Ti6Al4V components
Nohanyaza, Melikhaya Student number: 208001524 First registration: 04/2016	MEng Mechanical Engineering	Computational Analysis and Cavity Optimisation to Achieve Directional Solidification in a Cast Aluminium Alloy [Al7Si0.4Mg] Component
Koloi, Nthatsi Student number: 214359417 First registration: 03/02/2014	Graduate for 2017 MTech Mechanical Engineering	Friction Welding of Thin Walled Zircaloy-4 Tubes for the Nuclear Industry
Grewar, Stephen Student number: 20213075 First registration: 14/03/2015	Graduate for 2017 MEng Mechanical Engineering	Modelling the effect of graphitization on the fracture toughness of ASTM A516 G65/70 using the small punch technique.
Gxabagxaba, Sula Student number: 217079121 First registration: 11/05/2016	MEng Mechanical Engineering Part-time	Provisional: Optimisation of Laser welding parameters for thin Al sheets as applied in automotive industry
Momsen, Timothy Student number: 209033034 First registration: 01/2016	Graduate for 2017 MEng Mechatronics	
Intern information	Programme	Narrative
Mr Christopher Sephton Student number: 212335650 ID number: 8702105057080	BEng Mechanical Engineering uYilo EMTIP – EV Systems Pursuing Masters qualification in 2017	In 2017, I will begin the development of a wireless charging system for use on various e-Mobility platforms. The project, which is an objective of the uYilo group will form the basis of my M.Eng which will be supervised by Prof. Theo Van Niekerk of the Advanced Mechatronic Training Centre (AMTC). I am excited and proud to be part of the uYilo team in these electric times!
Mr Floyd Mgbendi ID: 9504195610086 Student no: 214046303:	NDip Analytical Chemistry uYilo EMTIP – Battery Testing	I am an Analytical Chemistry student that started with the uYilo team in 2017. I am looking forward to gaining experience with the team.
Mr Hendrik Nel Student number: 213377306	NDup Mechanical Engineering	Working at eNtsa has taught me to be open-minded and to listen to other peoples' opinions. I have been exposed to how

<p>ID number: 9409295313088</p>	<p>eNtsa - Engineering</p>	<p>projects are run and what to keep in mind when managing one which will certainly come in handy in the future. eNtsa has taught me how responsible in everything I do and to be mindful of my surroundings at all times. It has been a great exposure to the work environment and industry so far. In the last few weeks at eNtsa I have been exposed to various fields in engineering such as Research and Design, manufacturing and renewable energy. It has certainly raised my curiosity in all of these but the ones I see myself pursuing in the future would be Research and Design and Renewable Energy.</p>
<p>Mr Jan Hendrik De Jongh Student number: 213373726 ID number: 9106265189080</p>	<p>NDip Mechanical Engineering eNtsa - CIC</p>	<p>My name is Jan Hendrik de Jongh. I started to work at eNtsa from 1 February 2016 and will finish the end of January 2017. The year that I have worked here I have learned a lot and gained a lot of experience in the engineering field, especially in composite materials. I assisted in a lot of different projects but mostly spend my time with the CIC's program. We prepared wings, moulded them, build the parts and are now busy building the skins of the wings. eNtsa has been very good to me as a work environment as well as the people working there.</p>
<p>Mr Jason Hughes Student number: 214049787 ID number: 9503045427089</p>	<p>NDip Mechanical Engineering eNtsa – CIC Pursuing BTech qualification in 2017</p>	<p>I joined eNtsa in February 2016 where I was assigned to the CIC's programme where I would be working with projects like composite aero plane wings, building a 3D printer and also a composite spare wheel. Training completed in the metallurgy lab includes preparation of samples for testing and testing them on machines such as the Vickers hardness tester and the tensile testing machine and also verify hardness values obtained with values gathered from the microscope. I have had training and worked on various hand tools and manual machines in the mechanical workshop which includes the: lathe, milling machine and the surface grinder. Before the aeroplane actual wing parts are made a mould is made with the same outline or shape the final part will take. There are several steps taken before this mould is made: Wing mould preparation: preparing the wing to be moulded by means of sanding down and removing orange peel created by paint, polishing the wing to prevent the mould from sticking to the plug, using resin, slow hardener, cotton flox or cabosil applied to fibreglass to develop a mould of an aeroplanes wing.</p>
<p>Mr Luzuko Zimela Student number: 214251519 ID number: 9512145971086</p>	<p>NDip Mechanical Engineering eNtsa – CIC Pursuing BTech qualification in 2017</p>	<p>Luzuko Zimela, born in Umtata and grew up in Butterworth. I did my high school at Butterworth High school. I am currently doing my third year in mechanical engineering. I work as an intern at eNtsa with the CICs (Composite Innovation Centre) program. We are currently working on various composite projects which includes research on lightweight composite design/fabrication. During my first two months, I have developed the necessary skills and experience to perform basic machining, fabrication and maintenance. Working in an artisan work environment has mainly focused on developing my hand skills and taking into consideration all the safety precautions, putting into practise the academic knowledge gained in manufacturing classes. Workshop training that was provided was helpful when it came to familiarising myself with how the different machinery. I am fortunate enough to work at the university where we have lab facilities to conduct tensile tests and visual microscopic inspections. I was then exposed to friction welding, CO2 welding and plastic welding which was just introduced at the</p>

		<p>university. Design work and project management is yet to be unfolded to lay a foundation for advanced engineering studies and application.</p> <p>With the knowledge and experienced gained during this time phrase, I can confidently say that I can perform any artisan work required.</p> <p>The first project included building an aircraft wing out of fibreglass. The main objective of the project is to research, build and test a composite airplane wing that will be lighter and economical. The project is to introduce interns to moulding and working with composite materials and to understand manufacturing operations.</p> <p>Initially we worked as a team to prepare the wing for moulding, afterwards we were each given specific projects to focus on. I was fortunate to design the spar mould to prepare the actual spar.</p>
<p>Mr Matthew Titus Student number: 213383764 ID number: 9412045101084</p>	<p>NDip Mechanical Engineering eNtsa – CIC Pursuing BTech qualification in 2017</p>	<p>I am a mechanical engineering student hoping to do my BTech this year. One particular reason I enjoy this profession and the challenges involved in it is that it gives me the opportunity to interact with different people and also enhance my skills as a future engineer. I am part of the CIC's group within eNtsa and our main task for 2017 is to complete and test the wing and 3D printer projects.</p> <p>My responsibilities also include general engineering tasks within the eNtsa group who mainly focus on the advanced manufacturing and automotive sector. I have undergone training on all manual machines and some CNC ones. Most of my other work besides CIC's is from TSP where i would regularly set up and scan using the Creaform 3D scanner.</p>
<p>Ms Sanushka Pillay ID number: 9306150322081 Student number: 212392492</p>	<p>NDip Analytical Chemistry uYilo EMTIP – Battery Testing</p>	<p>I started studying towards my NDip in Analytical chemistry in 2014. I have completed my first and second year successfully. In order for me to receive my qualification, I have to do a year of in-service training work where i will gain hands on experience in this field of study. I will be a lab analyst in the uYilo lab and work in the materials testing and battery testing laboratories. for the future i hope to only progress as an analyst and be an asset to a large company.</p>
<p>Mr Thabelo Mohlala Student number: 211076929 ID number: 9003085994080</p>	<p>BEng Mechanical Engineering uYilo EMTIP – EV Systems</p>	<p>Thabelo Mohala is a 4th year BEng (Mechatronics) student at NMMU and a reliable trustworthy, numerate and meticulous person. Eager to learn and able to work efficiently on his own initiative or as part of a team. Currently doing two modules and will be doing two modules in the next semester. Did vacation training at Jendarmark Automation and worked as a mechanical trainee student. Currently working at STEM (Science, Technology, Engineering and Mathematics) Laboratory as a student assistant. Exposed to the uYilo initiative and its facilities on numerous occasions through the STEM Programme. Had already shown interest in taking part of the uYilo Programme. Have an interest in renewable energy and related fields. Keen in taking part of the uYilo initiative. Sees the uYilo Programme as an opportunity to contribute towards electro mobility development, what one believes is an aspect that the country really needs and is behind is this regard.</p>
<p>Ms Chuma Gqokoma Student number: 213495821 ID number: 940926 0647 080</p>	<p>NDip Electrical Engineering uYilo EMTIP – EV Systems</p>	<p>I am a NDip Electrical Engineering student completing my P1/P2. I am really looking forward to completing my practical session with the eNtsa team and being part of the uYilo group.</p>