

- The Selection Committee may invite applicants for an interview, if deemed necessary.

1. Name of Applicant: Prof DG Hattingh
2. Names of Team Members: Andrew Young, Annelize Botes, Dirk Odendaal, Donnie Erasmus, Etienne Phillips, Ian Wedderburn, Julien De Klerk, Louis Von Wielligh, Lucinda Lindsay, Maïen Hamed, Marlon Koopman, Nadine Marupen, Sivuyile Daba, Stephen Grewar, William Rall.

3. Indicate the Award Category being applied for

3.1.	NMMU Engagement Excellence Award	
3.2.	NMMU Engagement Excellence Team Award	X
3.3.	NMMU Emerging Engagement Award	

4. Nature of the engagement activity/project

eNtsa's engagement initiatives are primarily driven by an innovation through engineering philosophy, providing technical solutions to the automotive-, transport- and power generation sectors. This is achieved by a well-structured supplier development programme focusing on the automotive component sector as well as a research and technology transfer group looking at exploiting Friction Processing as an alternative solution for the power generation and transport industry.

With this focus eNtsa has earned national and international recognition as a prominent research, innovation and technology support unit for the advanced manufacturing sector in South Africa. Over the past 11 years the "eNtsa team" has allowed market needs to drive the development of expertise in the group and with active support from Technology Station Program at the Technology Innovation Agency (TIA) and guidance from a "hands on" board, the original strategic scope naturally broadened and became reflective of the wider engineering and manufacturing needs of South Africa. This approach allowed eNtsa to create new opportunities, enabling the transfer of innovative technologies and applications proudly developed within the NMMU, for example WeldCore® and the development of Friction Stir Welding capacity at GRW.

The changes in the vision over the past number years reflect this development within eNtsa with the original vision: "To be the preferred strategic partner for technology innovation and commercialization to the benefit of the South African industry"; to the current vision: "Engineering innovative solutions for a sustainable future". Historically eNtsa's focus was to enhance the South African industry's global competitiveness through technology advancement within the identified sector. This was supported by developing the ability to leverage international partnership in order to facilitate technology transfer and knowledge generation in support of build local "high level" technological competencies.

eNtsa's current "modus operandi" is geared more towards enabling new opportunities for the South African industry through innovation with a commercialization advantage. We realise that technology advancement can only be achieved by doing industry driven applied research and linking these research outputs to turn-key solutions for the manufacturing sector. Leveraging local and international partnership, in order to facilitate technology transfer still forms an important pillar in achieving this. The building of local technological competencies is imperative for continuing the growth of our efforts for establishing a culture of innovation within the engineering and manufacturing community of South Africa.

5. Assessment Criteria

Motivate stating how you meet the criteria for the award for which you are applying. Refer to the Assessment Criteria section of the application form above for the information you have to provide under each criteria.

5.1. Criteria 1

The impact and significance of the engagement activity.

eNtsa has positioned itself nationally as an establish engineering and research unit operating from within a new generation university. Knowledge generation through research activities contributes to local and regional development, by providing cutting edge innovative solutions to industry partners. This passion for providing real life solutions for today's problems is demonstrated further by unpacking eNtsa's vision of being a provider of solutions for industry through innovative engineering, creating new commercialization opportunities for the benefit of all people living in South Africa.

eNtsa's vision statement is:

"Engineering innovative solutions for a sustainable future"

eNtsa's mission is to enhance the South African industry's global competitiveness through the following:

- Assist and create new opportunities for the South African industry through commercialisation
- Technology advancement through research and development
- Leveraging local and international partnership in order to facilitate technology transfer
- To facilitate knowledge generation and transfer to build local technological competencies
- Building a culture of innovation within the broader engineering community

Furthermore eNtsa has incorporated the following values:

- **Integrity**
 - We act with integrity, communicate respectfully and accept responsibility for our words and actions.
 - We require ethical, professional behaviour by all persons associated with the institute.
 - We conduct our activities in an accountable and transparent manner adhering to the guidelines set-out by the relevant professional bodies.
- **Innovation**
 - We nurture creativity, innovation and entrepreneurship.
 - We promote and reward innovation research, teaching and learning practices that advance our institution and support sustainable development.
 - We enhance our capacity for creativity, innovation, entrepreneurship a financial sustainability by establishing mutual partnerships with government, business and other community stakeholders.
- **Excellence**
 - We value and reward excellence in the performance of our people, and take pride in our programmes, research, facilities and services.
 - We offer a comprehensive range of relevant programmes, emphasizing professional and technological development.
 - We commit to institution-wide quality management and continuous improvement.

- **Engagement**

- Engagement is focused at economic growth, employment creation, increased black and female business participation and increased productivity.
- We proactively develop programs, conduct research and offer technology based services that are supportive of the engineering industry.
- We encourage reciprocal relations with universities nationally and internationally.

The following endeavours can be used as case studies to support the eNtsa's stride in attaining our vision and mission (these listed items will be further discussed throughout this document):

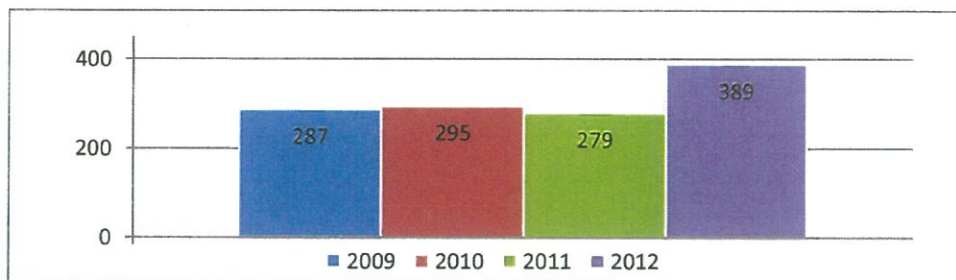
- **The Friction Processing Research Unit (FPRU)**, which acts as a friction processing knowledge generation hub, operating from within eNtsa
- **The Uyilo E-Mobility Programme** – a national programme awarded to the NMMU for rollout based on the success achieved by eNtsa in the field of Technology Management of innovation and support.
- **Mantacor, Pty (Ltd)**, a spin-off company within NMMU which will serve as the commercial vehicle for rolling out the WeldCore® repair process to the power generation and related industries developed by eNtsa.
- **Research collaboration and active relationships** with experts within international universities and industry in various related research disciplines.
- **Supplier development program** funded by TIA and AIDC:
- **Various awards won** for research endeavours
 - **National Innovation Competition 2010**
 - **National Science and Technology Forum's, Research leading to an innovation award 2011**
 - **Eskom Chairman's award 2012**
 - **SAIW Gold Medal award 2012**

5.2. Criteria 2

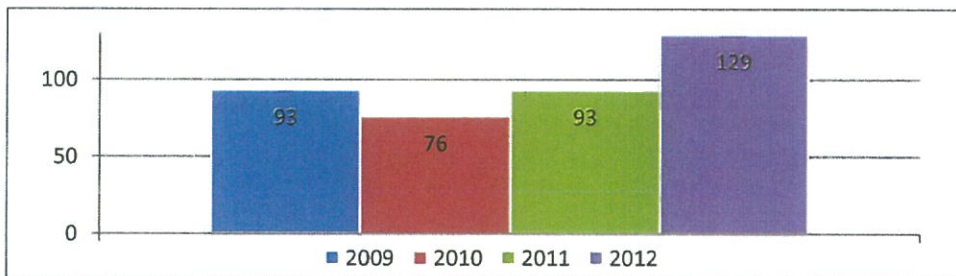
The intellectual endeavours contributed by the engagement activity.

eNtsa's interventions contribute towards supporting local component manufacturers to expand current export production volumes, reduce scrap rates and become more cost effective. International trends indicate that the relatively small production facilities and low volume producers, as prevalent in the Eastern Cape, has a specific niche to offer. By growing this sector we will make a substantial impact in, not only sustaining the current jobs, but also contributing to the important process of creating new opportunities.

The following graphs summarises the number of projects and companies linked to eNtsa from April 2009 to March 2013.



Number of projects and services since 1 April 2009 to 31 March 2013



Number of participating companies since 1 April 2009 to 31 March 2013

As seen from the graphs there was a substantial increase in the number of projects and participating SME's (includes repeat business) in the 2012 financial year with a total; of 129 SME's supported through 389 projects.

eNtsa strives to function as an integrated driver within the Faculty of Engineering, the Built Environment and Information Technology (EBEIT), not only undertaking R&D/Engagement activities but also promoting multi-disciplinary projects and offering specialised Short Learning Programmes (SLPs), to improve skills within the local manufacturing industry.

R&D Projects

a) GRW003 - Butt welding of large AL plates

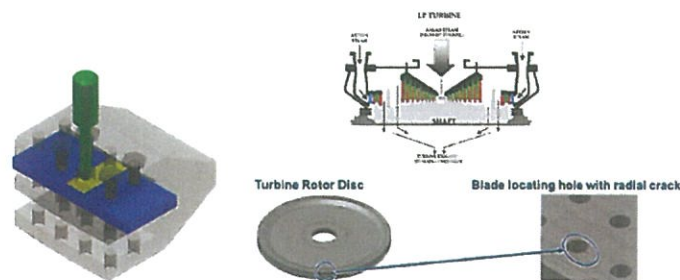
eNtsa/NMMU has developed a Friction Stir Welding (FSW) platform which successfully completed the longest friction stir weld (8 meters) in Africa. The Friction Stir Welding machine was successfully commissioned at GRW, road tanker manufacturer in Worcester.

The commissioning incorporated the installation of the entire facility which includes electrical, mechanical, pneumatics and hydraulic systems. To encourage machine usage, training and technology transfer the eNtsa team joined GRW Engineering in the development of a 'drop test' tanker module. The 'drop test' module was designed to compare the structural integrity of a conventional weld (MIG/TIG) with that of a friction stir weld in an impact accident scenario. The tank was equipped with accelerometers as well as strain gauges for determining the total impact and deformation. The eNtsa team is currently completing the commercial implementation of the technology after which the platform will be used for fabrication of road-tankers.



b) Repairing turbine blade attachment holes with Hydro pillar processing

This investigation is to determine whether or not it would be possible to use a modified Friction Hydro Pillar Welding (FHPW) technique to repair radially cracked, turbine blade locating holes on a removable rotor. The rotor material is 26NiCrMoV145. The minimum and maximum hole diameter to be repaired were identified as 10 and 18 mm respectively.



c) Late Stage R&D for WeldCore® Technology

The WeldCore® Technology is a novel patented in-situ sample and repair technology. The technology has been developed by the eNtsa in collaboration with Eskom's sustainability and innovation division. A three year late stage R&D agreement worth **R12 million** is now in its final year to refine the technology for commercial application.

The active tasks include:

- The development of a sampling procedure taking into account quality and safety aspects
- The development of Friction Hydro Pillar Process for X20 material
- Investigation the in-situ heat treatment of welds
- Development of a commercial prototype

Two successful industrial pilot studies have been completed.

- The first study completed was on a turbine rotor disc worth €10 million. The test resulted on the extension of the life of the unit for a further 10 years differing capital expenditure.
- A second study on the primary inlet pipes of a turbine casing has also been conducted. Four core samples were successfully removed and assisted maintenance engineers in creating an operating plan for safely running the plant. The technology has major commercial potential and eNtsa is actively working on a strategy to roll-out this technology for the future benefit of all stakeholders. This project is in the final stages of completion with much of the material studies and heat treatment investigations complete. The sampling techniques have been further enhanced through tooling developments while the project scope has been widened to include the recovery of tool fragments in the holes.

d) Development of a NMMU Process Development System (PDS) for Friction Processing (Total Development cost R3.4 million funded from a THRIP project)

Friction Process Welding techniques have proven to be both robust and reliable. In an effort to expand the 'working window' of the joining technology it had become necessary to develop a platform that could meet the higher rotational speeds envisaged as well as the higher forge forces required. This requirement resulted in the development of a purpose built spindle able to achieve both the speeds and the high axial loads. The machine was designed to include load sensing and logging in all axis.



The PDS design and development included:

- Steel frame and axis (Designed at eNtsa, built and fabricated by local industries)
- Spindle (Designed at eNtsa, machined by locally, assembled by eNtsa engineers)
- Hydraulics (System design by eNtsa, installation and component supply by local supplier)
- Electrical (System design by eNtsa, installation and component supply by local supplier)
- Software (Software design and commissioning by eNtsa engineers)

e) EVTP001 – Uyilo E-mobility programme

NMMU has been chosen nationally to lead South Africa's charge towards the use of electric vehicles. News of the multi-million-investment decision and its implications for the country, and especially the Eastern Cape, was officially announced by the Technology Innovation Agency (TIA) at the launch of the national electric vehicle technology centre at NMMU on 13 March 2013. eNtsa's award-winning history contributed to their selection by TIA to facilitate the establishment of a centre which will develop infrastructure, research, technology and competencies needed for the future integration of Electric vehicles. Initially the team will focus on stakeholder engagement to ensure that important role players are given the opportunity to get involved in such an exciting project.



f) Supplier Development - Applied Engineering, Design and Development Projects

Interventions by the Supplier Development initiative ensure that human resource for investigations requiring metallurgical studies (including welding integrity), metrology (including both CMM and optical scanning measurement), product design (using CAD and Finite Element Analyses) as well as corrosion studies (Salt Spray), are easily accessible to industry.

Metallurgical Studies: The supplier development initiative has assisted with the analysis of a number of projects including a study on the welding integrity of a new shipping tank container. The tank container has higher volumetric capacity and has thus excellent export potential. Studies on both the welding integrity and stress condition of the tank were performed during test. An investment in the human resource capacity within our metallurgical testing facility has 'continuous assessment' possible for a number of suppliers. Currently Welfit Oddy (Shipping tank containers) uses our services for continually assessing their welders and Ford (Engine plant) uses our services to continually assess their machining quality.

Design: The supplier development initiative assisted with the design and manufacture of fixtures used to test the interior trim of the new VW Polo. The test fixture includes fixtures for testing the side mirrors (shaker table) and grab handles etc. Initial prototype fixtures will be manufactured by eNtsa and local testing will aid in an effort to localize the supply of components

Corrosion: A number of corrosion related tests were performed including a major cyclic corrosion test (variable environment), performed for a supplier to Ford Motor Company. The test qualified the paint used on the oil pans of a truck engine. The oil pans are manufactured locally and tested according to the most stringent global standards.

g) Three wheel motorcycle: Development of a lightweight three-wheel vehicle

The project is based on designing a vehicle that needs to be safer than its two-wheeled scooter counterpart, yet does not have to conform to the rigorous passenger car regulations. The design was complete with the first two prototype vehicles currently in a testing phase with some refinements already identified. One of the prototype vehicle is complete and in operation around the campus. The first prototype has also been used for displays and technology demonstrations.



h) Armstrong: Development of an Automated Sound-Based Testing System for Shock Absorber Quality Management

The control systems engineers at eNtsa were able to identify and filter characteristic noises from a shock absorber on an assembly line to determine potential problems as a quality control measure. The system was tested in the lab conditions and thereafter implemented in a trial on the assembly line. Both the supplier (Armstrong) as well as their customers (OEM's) has endorsed this project. We are currently in discussions with Armstrong-India who would also like to implement this technology. The project is on-going with trials being performed in an effort to refine and optimize software.

i) Residual Stress Analysis by means of iXRD – Raised bore drilling cutters for the mining industry

Over the past decade eNtsa established itself as a national facility for determining Residual Stresses in engineering components and structures. The induced residual stresses could be manufacturing, process or service related. For this study eNtsa was tasked with developing a technique and comparing the results for the residual stress of carbide buttons used as inserts in rock drilling cutters. The study would assist in refining a technique for prolonging the usable life of a mining rock drilling cutter.

j) Residual Stress Analysis by means of iXRD – Automotive anti-roll/stability bar

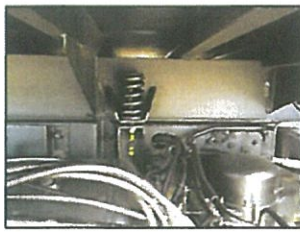
Expertise in the measurement of residual stresses in engineering components and structures has led eNtsa to develop methods to assist a local component supplier with techniques to aid the localisation of both manufacture and evaluation of suspension components. A locally manufactured antiroll bar was supplied for residual stress evaluation and a comparison between measurement techniques used in Europe were completed.

k) Engineering of re-deployable housing units

Bazer is a local company specialising in the construction of re-deployable housing units. The units are mostly exported to harsh climates and remote areas. eNtsa has been assisting with the development of the housing unit (typically used in exploration activities e.g. Mining, Antarctica). Our activities have included the testing of wall panels as well as endurance tests of the units were performed on the road.

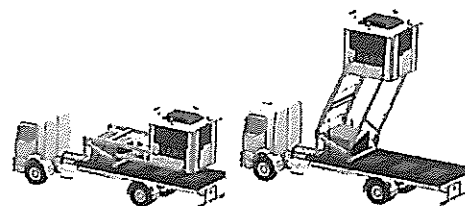
l) Engineering of load bodies

Southern Star Engineering / Kanu Engineering has used the services provided by eNtsa to evaluate the load body mounting configuration of locally developed load bodies mounted to truck chassis. The work included the strain gauging of a truck chassis and logging the strains over a pre-determined course. The work aims to benefit both the OEM by providing them with load body / chassis mounting information as well as the load body manufacturers that need to ensure that their load bodies can be exported without compromising the structural integrity of the truck chassis. Many of the locally developed trucks travel into Africa.



m) Development of a mobile observation post.

eNtsa was approached and tasked to develop a virtual prototype of a mobile observation post used for event management and crowd control. The virtual prototype should allow for local manufacturing and redundant lifting and safety systems.



Conceptual design for a transportable elevated observation system for public parking or crowd monitoring

n) Welfit Oddy

Welfit Oddy has been eNtsa's biggest partner for a number of projects completed. They are a world leading **manufacturer of stainless steel intermodal tank containers**. They are also world renowned for their design and innovation in this industry and a long history and wide product range. They are manufacturing high volumes of standardised tank containers as well as customised individual solutions. eNtsa assists Welfit Oddy on a daily basis to ensure export readiness and product of quality. eNtsa have completed over 100 projects related to weld certification, corrosion testing and product development for this industry partner.

o) Journal publications, Conferences, Books

The following table is a summary of research outputs and projects presented as evidence in support of contributions claimed with respect to research and engagement during 2012.

Type of output	Date	ISBN / ISSN	Title of contribution	Journal / Conference	Authors
Conference	April	n/a	Condition monitoring of High Temperature, High Stress components by means of core sampling and Friction weld repair	18th World Conference on Non-Destructive Testing	P Doubell, M Newby, DG Hattingh, IN Wedderburn
Conference	June	n/a	Design of a Motor Glider Landing Gear Strut – The Role of Failure Analysis in Structural Integrity	Electrical Power Research institute (EPRI) Conference 2012	P Doubell, R Scheepers, M Newby, DG Hattingh, L von Wielligh, DH Odendaal, IN Wedderburn
Conference	July	1350-6307	Friction Hydro Pillar Process as an Alternative Repair Steel Structures	Fifth International Conference on Engineering Failure Analysis	DJ Erasmus, DG Hattingh, A Young, A Botes, MN James
Conference	October	n/a	Friction Hydro Pillar Process as an Alternative Repair Steel Structures	Ferrous 2012	DLH Bulbring, DG Hattingh, A Botes, DH Odendaal
Conference	November	n/a	Feasibility of utilizing Friction Hydro Pillar Processing as a repair technique for incorrectly drilled holes	International Institute of Welding (IIW) Regional Congress 2012	W Pentz, DG Hattingh, L von Wielligh
Conference	November	n/a	Development of a procedure for the filling of blind holes in thick section AA6082-T6 Aluminium by Friction Hydro Pillar Processing	International Institute of Welding (IIW) Regional Congress 2012	DAG Samuel, DG Hattingh, A Botes
Conference	November	n/a	The Development of a platform for the Friction Stir Welding (FSW) for large aluminium sheets	International Institute of Welding (IIW) Regional Congress 2012	A Young, DG Hattingh, DJ Erasmus, L von Wielligh
Journal	February	0032-3861	Fatigue crack growth and craze-induced crack tip	Polymer	MN James, CJ Christopher, Y Lu, EA

			shielding in polycarbonate		Patterson
Journal	April	0972-2815	Effect of cryogenic treatment on the tool material in friction stir welding of pure copper	Transactions of the Indian Institute of Metals	S Krishnan; A Els-Botes
Journal	May	1362-1718	Residual stresses, microstructure and tensile properties in Ti-6Al-4V friction stir welds	Journal of Science and Technology of Welding & Joining	A Steuwer, DG Hattingh, MN James, U Singh, T Buslaps
Journal	May	0142-1123	Local plasticity and its influence on the global elastic stress field	International Journal of Fatigue	MN James, CJ Christopher, Y Lu, EA Patterson
Journal	June	1059-9495	Optimizing Friction Stir Welding via Statistical Design of Tool Geometry and Process Parameters	Journal of Materials Engineering and Performance	C Blignault, DG Hattingh, MN James
Journal	August	2043-9903	Interactive on-line resources for training forensic engineers	Forensic Engineering	MN James

p) Patents

The following table is a summary of patents linked to eNtsa and presented as evidence in support of contributions claimed with respect to research and engagement.

Patent no.	Authors	Description
SA Patent Application (Provisional) no. PA147201/P	DG Hattingh; IN Wedderburn; P Doubell	Friction Welding Apparatus
SA Patent Application (Provisional) no. PA147358/P	DG Hattingh; IN Wedderburn	Undercut Tooling Arrangement
SA Patent Application no. (Provisional) no. 2012/03293	L von Wielligh, W Pentz, DG Hattingh, P Doubell.	Method of repairing radially cracked hole

5.3. Criteria 3

Communication and dissemination of knowledge and expertise.

eNtsa is recognized as a leading research, design and technology support centre for the manufacturing sector, with specific focus on automotive components. This is achieved through: the provision of research supporting new process and technology support for optimizing existing production processes and infrastructures and; advancing the high-end skills by offering technical training according to international best practices. eNtsa has identified the necessity to improve internal and external awareness. Increased awareness aspires to improve stakeholder and public knowledge of eNtsa's operations, and services and products available. Furthermore, increased awareness aims to improve client interaction, establish a network of prospective clients, determine the needs within industry and support eNtsa in achieving its mission and vision. This section highlights basic project management information of eNtsa and summarises the essentials of a customised branding and marketing plan for the eNtsa.

a) eNtsa Project Management System (PRO MS)

Engagement activities within eNtsa are managed according to an internal project management handbook (eNtsa Project Management System (PRO MS) Handbook), set-up by Mr Dirk Odendaal, eNtsa Director Business Development and Commercialization. This handbook describes a standardised project management and dissemination procedure to be followed within eNtsa. The guide applies to all mayor projects be it research, product development or services. The project management system is informed by DIN ISO 9001:2000 and *Stage Gate* methodology, but full compliances with this has not been achieved.

PRO MS is used for execution of all projects that are of the following nature

- Industrial research
- Product development
- Turn-key Solutions
- Services

Even though these projects may differ significantly, similar stages will be required for their completion. However no system can cover all circumstances and it's left to the project managers and project leaders to adapt the procedures and documents as may be applicable. To better understand projects they can be dived into the generalised phases. These phases follow each other in sequential manner.

At a high level a project time line will consist of the following.

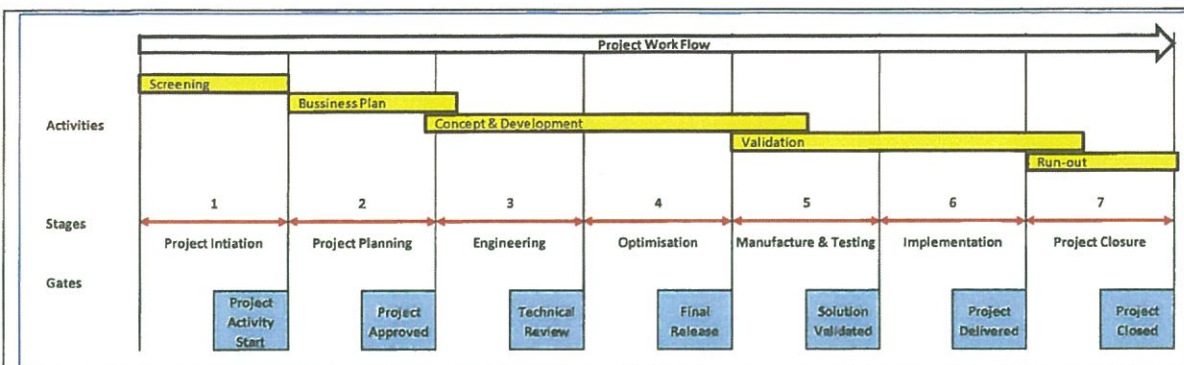
- 1 - Initiation of the project
- 2 - Planning for its execution
- 3 - Execution
- 4 – Handover and closing

Expanding these phases, PROMS divides a project into manageable sections. Each section is described by:

- **STAGES** detailing the actives, responsibilities and milestones
- **GATES** that are checklists required to complete a stage. Gate documentation is regularly updated and used to track progress through a stage.

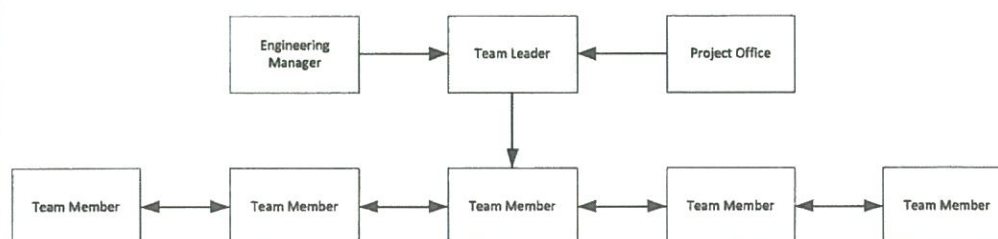
The stages will be used as roadmap to complete a specific project. In PROMS following stages and gates have been defined to describe the lifecycle of projects.

- **Stage 1:** Project Initiation / **Gate 1:** Project Activities Start
- **Stage 2:** Project Planning / **Gate 2:** Project Approved
- **Stage 3:** Engineering / **Gate 3:** Technical Review (Product, Procedure and Process Approved)
- **Stage 4:** Optimisation / **Gate 4:** Final Release
- **Stage 5:** Manufacture & Testing / **Gate 5:** Solution Validated
- **Stage 6:** Implementation / **Gate 6:** Project Delivered
- **Stage 7:** Project Closure / **Gate 7:** Project Closed



b) Organisation Of Project

Projects are organised according a set structure. The following table illustrates that the organisation of projects within eNtsa



• Team Leader

Team leader will be responsible for co-ordinating the execution of team members' activities. Most prominently the team leader will be responsible for monitoring the project budget and timeline to ensure that activities are delivered.

• Team Member

The team members are specifically assigned to projects and responsible for engineering activities.

• Project Office

The project office assists the team leader with administrative functions. Further the project office will be responsible for evaluating new projects and assigning members to a team with the help of the engineering managers.

• Engineering Manager

The engineering manager is responsible for technical oversight of the project activities. The engineering manager will also be responsible for the approval of technical documents. Together with the project office the engineering manager will be responsible for resource scheduling.

c) Project Control

Projects within eNtsa are governed by three basic documents:

- The project initiation
- The budget
- The time plan

d) Weekly meeting

Weekly project meetings are held where the project status is discussed. Its responsibility of the team leader to review and update project documentation before the meeting. The project leader is required to gather time spent on the projects by the team members as well as expenditures made during the week.

e) Project Status

During the project meetings the project will be assessed as being:

- “Green” - if everything is on track
- “Yellow” - if an issue has been identified and plan is in place to solve that issue.
- “Red” - if the project is endanger of missing a deadline or exceeding the budget.

A typical check list for Project Completion include:

- Documentation Completed
- Project reviewed
- Warranty Period completed
- Customer has signed-off the project

Within the various engagement activities within eNtsa, different forms of communication approaches are followed, depending on the nature of the engagement.

f) Branding and Marketing Plan

In order to formulate a tailored branding and marketing plan, the following items have been identified as important elements that are unique to eNtsa and play an essential role within operation:

- **National / international interaction**

As eNtsa thrives on research, the unit takes part in local and international interaction with researchers and leading role players within industry to encourage the link of expertise and knowledge.

- **Products and services**

eNtsa provides the industry with a variety of products and services. eNtsa strives to strengthen research and development relationships, ensure availability of products and services and anticipate future products and services for both national and international clients.

- **Consumers**

eNtsa aims to provide consumers with professional and consistent service delivery by informing and building the understanding of operations and processes. Grow with our consumers and broaden areas of interest.

- **Community**

The eNtsa is situated and functions within the Nelson Mandela Metropolitan University. With branding we aspire to enhance internal awareness of eNtsa, within the local and international community.

The eNtsa branding is a plan aimed to establish the eNtsa and its capabilities within the South African and international industry. The branding plan will focus on giving the eNtsa the opportunity to operate and interact with present and prospective clients. Branding efforts are focussed at conveying a presence of professionalism and unique dynamics, by presenting eNtsa as a reliable and cutting-edge research and services establishment.

Operations within the institutional communication perimeters has led to the lack of internal awareness and contributed to the poor external awareness of eNtsa. Since existence the unit has built a solid client base and one of the main marketing tools used, was the quality of service provided, referrals by clients in industry and expertise of eNtsa members This marketing plan aims to increase not only internal and client awareness but also the awareness of the units capabilities on the South African economic platform.

g) Report on training

The training eNtsa offers continues to be mainly in the form of technology focused workshops addressing various topics for which industrial experts or visiting professors are used. The levels of the content can vary from basic engineering principals to advance structural design and material processing. During 2012/13 the training workshops hosted by eNtsa was attended by 54 delegates from NMMU and SMEs.

Development training

eNtsa was requested by two supplier development companies to present company specific short learning programmes:

Stainless Accessories - Metallography – Ferritic Stainless Steel (30 May 2012)

It was requested by Stainless Accessories that their Quality laboratory staff be given formal training on the preparation of ferritic stainless steel weld sections. The one day practical training module included a theory section covering the main methods of metallurgical sample preparation as well as practical microscopy and introductory report writing for Quality labs. It is a requirement from the company's customers that they do regular quality checks (through the weld cross-section) and reports are to be filed for future reference in cases of warranty claims. Outcome: Quality laboratory staff will be able to prepare metallographic samples properly and be able to interpret general quality requirements for good weld quality.

SJM Flex – Stainless steel (15 & 16 January 2013)

A two day theory short learning programme was developed specifically for the stainless steel automotive component manufacturing market. The topics covered included the theory associated with the various grades of stainless steel as well as methods of testing and evaluating quality products. The group trained various staff from the production line, management, procurement as well as the quality department. Special emphasis was requested on the effect of material defects on various manufacturing techniques such as welding and forming processes. Outcome: Staff has a better understanding of the material they use in the manufacture of their components. They can also make quicker decisions with regard to replacement grades and changes in manufacturing settings.

Furthermore eNtsa hosted a **Causes and Combating the Potential Failure of Metals and Alloys course** in October 2012. This course has been prepared by Professor Denis Twigg for South African engineers and related personnel involved with the causes and combating the potential failure of metals and alloys. The content of this workshop covers areas of knowledge discussing the characteristics of materials, the different types of mechanical testing, general causes of failure, on the therefore be of value to a wide range of delegates from differing metallurgical backgrounds. The course commences with some basic metallurgical principles relating microstructure of metals to their mechanical properties. Members of industry and NMMU researchers attended the workshop in 2012.

h) Service Delivery

The following table is a summary of plans of operations indicating targets and actual values achieved in the 2012 financial year (01 April 2012 – 31 March 2013).

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
SME Activities	SME Contacts	57	43	37	71	208
	New SMEs assisted	20	15	8	29	72
	Repeat SMEs assisted	37	28	29	42	136
	PDI (Black)	5	5	7	8	25
	Female	5	5	7	4	21
	Disabled SME	0	0	0	1	1
	Total Number of SMEs	57	43	37	71	208
Technical Activities	Testing & Analysis Services	81	76	65	75	297
	Manufacturing/ Prototyping	4	19	7	17	47
	Consultation/ Technology Audit	0	7	2	14	23
	Product & Process Development	71	56	49	65	241
	Applied Engineering, Design & Development	3	9	1	7	20
	Research & development	5	7	1	7	20
	Technology Demonstration	12	8	0	15	35
Training Activities	For one client	2	1	0	1	4
	Open to group of SMEs	0	0	0	0	0
	New clients trained	3	0	0	7	10
	Repeat Clients trained	16	28	0	0	44

5.4. Criteria 4

The strategic importance of the role performed by the individual/team.

a) Governance and Management

eNtsa has set up three committees to ensure good governance and strategic alignment, i.e. a Management Committee, an Executive Committee of the Board and a Board with strong representation from senior managers in industry. These committees ensure that eNtsa meet the needs of industry as well as the objectives set by TIA.

Strategic and operational issues are decided on by the Director of eNtsa without negative interference by academic and administrative line functions within the NMMU. The Director is however guided by a number of committees (as mentioned in the previous paragraph), where collective decisions are made, that support him in his endeavours to successfully manage eNtsa.

The Technology Advisors have become a very important link between eNtsa and the Faculty to industry as they can provide short turn-around solutions. Further capacity will however have to be created within the unit to meet the growing and more complex nature of the needs of industry.

Scheduled meeting dates held for the financial year:

Management Committee: Weekly on a Tuesday morning from 08:30 to 10:00

Board: Board meetings were held on:

- 17 May 2012;
- 16 August 2012;
- 08 November 2012 and;
- 21 February 2013

b) eNtsa Technology Station of TIA

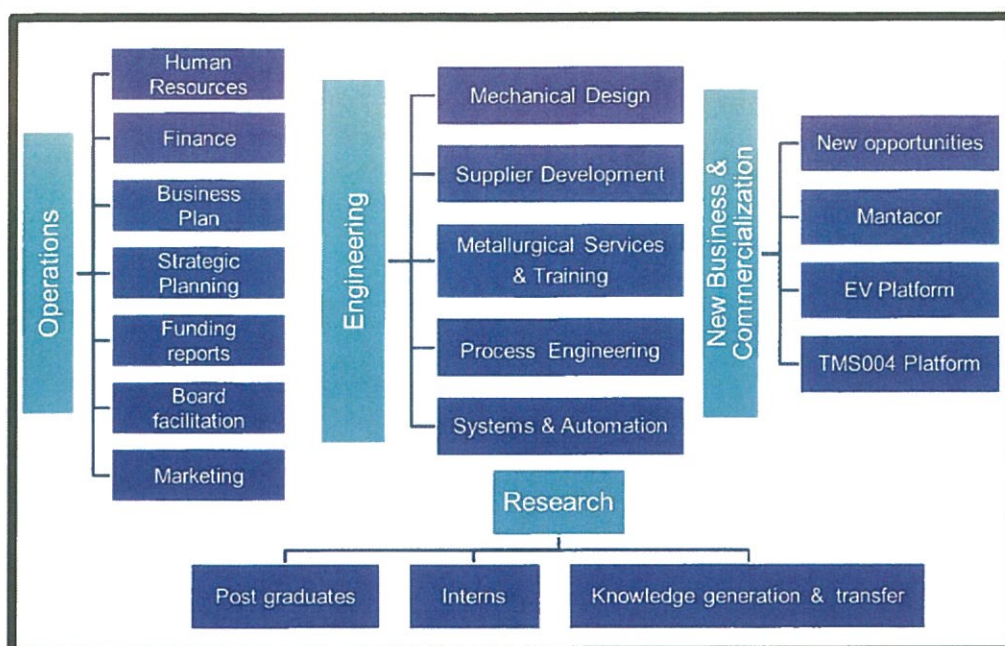
eNtsa is a Technology station of TIA which forms part of one of the two technology stations hosted at the NMMU. This Department of Science and Technology initiative aims to create support for SMEs in targeted business sectors and for this purpose they provide funding to:

- Improve capacity and facilities with the NMMU
- Subsidize development/support cost of SMEs and SMMEs on a slide scale.

The decision of what projects are to be supported, the level of subsidization and the management of the finance are handled by eNtsa. This process is formalized through various structures and activities that include eNtsa's weekly management meetings and quarterly Board meetings.

c) Operational categories within eNtsa

There are four operational categories within eNtsa, namely: Operations, Engineering, New Business & Commercialization and Research. The partnership between these categories is illustrated in the diagram below and is named the Organizational Responsibility Matrix to support our strategy:



The aim of eNtsa is to strengthen and accelerate the interaction between the NMMU and companies in the targeted sector through:

- Human Resource Development
- Advancement of Industries through technology transfer
- Institutional learning and development
- Economic value added (Creation and sustaining employment)

eNtsa will thus play a major role in identifying the specific needs of the SME's and will provide the appropriate technology solutions based on the full potential of the NMMU.

The envisaged outputs of eNtsa with respect to the manufacturing industry sector are:

- To improve products, production technologies and productivity.
- To improve global competitiveness.
- To build capacity for continued technology assimilation and innovation.
- Advance the involvement of black woman and people with disability involvement in the sector as owners of SME's.

With respect to NMMU the envisaged outputs are:

- To ensure a better understanding of industry needs.
- To effect improved and enriched R&D and teaching and learning activities.
- To ensure the availability of support services and related laboratory test equipment for industry through the presence of eNtsa on campus.

d) Partnerships and Cooperation Agreements:

The following table list the institutions/organizations (national and international) and the nature of agreement signed or entered into by eNtsa

NATIONAL	
Institution / Organization	Nature of agreement
SEDA	Memorandum of Understanding
TiCoC - CSIR Light Metals Initiative	Contract
SPII	Project to project basis
AIDC	Memorandum of Understanding

ECDC	Project basis		
Aluminium Federation of South Africa	Project basis		
ECSA Accreditation Panel Involvement	Engineering Metallurgy and Extractive Metallurgy qualifications (Diploma & BTech)		
INTERNATIONAL			
Country	University	Field of Collaboration	Contact Person
Germany	Ingolstadt University of Applied Sciences	Mechanical Engineering	Prof Wellnitz
Germany	Braunschweig-Wolfenbuettel University of Applied Sciences	Automotive Engineering	Prof H Holdack-Janssen
Germany	Esslingen University of Applied Sciences	Materials and Joining Technology	Prof Issler
Germany	Esslingen University of Applied Sciences	Automotive Engineering	Prof Walliser
Germany	Esslingen University of Applied Sciences	Materials and Joining Technology	Mr Merk
Germany	University of Stuttgart	Laser Technologies	Prof Graf
Netherlands	University of Groningen Netherlands	Applied Physics – Electron Microscopy	Prof De Hossen
United Kingdom	University of Plymouth	Mechanical Engineering	Prof James
United Kingdom	University of Lund	Senior Lecturer	Dr Steuwer
America	University of Michigan	Electrical Engineering	Dr G Kruger
United Kingdom	FaME38 Facility at the ESRF-ILL	Manager	Dr Steuwer
America	University of South Carolina	Mechanical Engineering	Prof Anthony Reynolds
United Kingdom	University of Sheffield	Structural Integrity	Prof Luca Susmel
Italy	University of Ferrara	Fatigue and Structural Analysis	Prof Roberto Tovo

5.5. Criteria 5

The extent to which the engagement activities are acknowledged/recognized.

eNtsa has received numerous awards in recognition of research endeavours and contribution to innovation and technology transfer. (Refer to Appendix A)

- **National Innovation Competition**

In 2010 the eNtsa group won the first prize for the WeldCore® technology. This victory was followed by a first round of the competition held in 2009 at each institution, where the top three teams from each institution went through to this final round. The technology has been developed under the guidance of Prof Danie Hattingh and other members of the eNtsa (then Automotive Components Technology Station) within the Department of Mechanical Engineering. At the time of this award Eskom has pledged to R11 million support to get the technology finalized as it can make a huge difference to the life and safety of aging infrastructure. This is the second time in a row that the NMMU has won the National Innovation Competition.

- **BHP Billiton's National Science and Technology Forum**

In 2011 the eNtsa team won the BHP Billiton NSTF award for "Research leading to an innovation" for the WeldCore® technology.

- **NMMU's Innovation and Technology Transfer awards**

Also in 2011 eNtsa won the NMMU's Innovation and Technology Transfer award for the endeavours and efforts related to the WeldCore® Technology.

- **SAIW Gold Medal**

Prof Hattingh won the 2012 SAIW Gold Medal in recognition of his vision and leadership in developing a friction stir welding (FSW) technology unit at NMMU being at the very forefront of this technology and applying the process commercially in industry to solve complex problems.

- **Eskom's Chairman's award**

Eskom Chairman's award for Innovation with their research partners from ESKOM. The engineering team received this award in recognition of their efforts and work done on the Hendrina Turbine project, implementing the NMMU developed WeldCore® technology. This resulted in an R1billion rand saving for ESKOM.

5.6. Criteria 6

The integration of engagement into the core academic functions.

a) Interns hosted by eNtsa

The table below depicts the status of our interns. none of the interns has left and they are all currently busy with post graduate studies.

ID No.	Names & Surname	Gender	Race	Studies	Registered for Post Grad	Period of Intern		Placed at station
		M/F	Bl/wh/ci/Ind	Qualification level		Commence date of internship	End date of internship	
BN566021	Davies Tsikayi	M	BL	B Tech Mechanical Engineering	M Tech Mechanical Engineering	01-Jul-12	30-Jun-13	Yes
8908115198083	Evan van Rensburg	M	WH	National Diploma Mechatronics	B Tech Mechatronics	01-Mar-12	30-Jun-13	Yes
8705275008080	Jarad Wade Bradfield	M	WH	National Diploma Mechanical Engineering	B Tech Mechanical Engineering	25-Sep-12	30-Jun-13	Yes
8512015812080	Melikhaya Nohanyaza	M	BL	National Diploma Mechanical Engineering	B Tech Mechanical Engineering	15-Oct-12	31-Dec-13	Yes
7304035090082	Jaco Allers	M	WH	National Diploma Mechanical Engineering	P1/P2	01-Mar-13	31-Dec-13	Yes

b) Capacity building and staff development measures/courses undertaken by staff for development purposes

The following training sessions were attended by eNtsa staff members, interns and post grads:

- **World Conference on Non Destructive Testing 2012** held from 16 to 20 April 2012 in Durban
- Nelson Mandela Bay Business Chamber – **Workshop: Manufacturing of PV Cells**, held on 17 April 2012
- SAIEE – Presentation: Presidential Address held on 19 April 2012
- NMMU Business School – Short Course: **Competitive Intelligence** held 5 to 8 June 2012
- **Welding and Repair Technology for Power Plants Tenth International EPRI Conference** from 26 to 29 June 2012 held at Marco Island Marriott Resort & Spa, Marco Island, Florida
- **Fifth International Conference on Engineering Failure Analysis** from 1 to 4 July 2012 held at The Hague, The Netherlands
- **Management Skills for 21st Century Leaders (NQF level 5)** held from 10 to 12 July 2012
- Nelson Mandela Bay Business Chamber – Workshop: **Market Demand Strategy and Its Impact on the Eastern Cape Economy** held on 3 August 2013
- **Interpersonal Skills (NQF level 5)** held from 30 to 31 August 2012
- **5th SA Innovation Summit**, 28 to 30 August 2012, The Forum, Bryanston
- **Practical Introduction to CFD** 28 August to 25 September 2012, 4 week online training course one 2.5 hr session p/w
- **SARIMA Conference 2012** workshop on IP valuation held on 4 September 2012
- Nelson Mandela Bay Business Chamber – Workshop: **Project Mthobo Update - Oil refinery planned for the Coega IDZ** held on 18 September 2012
- SAIEE – Presentation: **Bernard Price Memorial Lecture** held on 25 September 2012
- Regional Innovation Forum – **Renewable Energy Networking Workshop** held on 26 September 2012 –
- **Time Management (NQF level 5)** held on 10 October 2012
- SANEDI – **Workshop: Ocean Energy Stakeholder** held on 10 October 2012
- **Automotive Industry Conference** held 10 to 11 October 2013 at The Boardwalk in Port Elizabeth

- **Workshop: Nuclear Power Today** held on 17 October 2012
- **TestXpo - 21st International Forum for Materials Testing** held from 15 to 18 October 2012 in Ulm (Germany)
- **FERROUS 2012** Ferrous and Base Metals Development Network Conference held from 15 to 17 October 2012 at the Mount Grace Country House & Spa, Magaliesburg
- **Theory of sampling – representative sampling in practise** held from 23 to 25 October 2012
- **Causes and Combating the Potential Failure of Metals and Alloys** held on 30 to 31 October 2012 at NMMU Summerstrand Campus (North), Conference Centre
- **Quality Management** held from 30 to 31 October 2012 at the One and Only Hotel, Cape Town
- **International Institute of Welding International Congress 2012** held on the 7 to 8 November 2012 at Emperors Palace
- **Finance for non-financial managers** (NQF level 6) 5-7 November, 12-13 November 2012
- **Training course on Spinouts and Startups** held from 13 to 15 November 2012 at Wits Professional Development Hub, Braamfontein
- **British Society for Strain Measurement (BSSM) Level 1 Certification** - Seminar & Examination from 28 to 29 November 2012 held at ESTEQ Test & Measurement Pretoria
- Regional Innovation Forum – Presentation: **Hydrogen in South Africa** held on 26 November 2012
- The University of Illinois at **Urbana-Champaign's 6-week free online course on heterogeneous parallel programming** during December 2012 and January 2013.
- **Summer School on Advances in Finite Element Methods** presented at UCT from 14 to 18 January 2013
- **Reflections of the Usefulness of System Theories for research within Informatics, Information Systems and Information Technology** held on 18 February 2013 at NMMU, North Campus
- **SANS 10142-1 Legal Requirements Workshop** on 20 February 2013 held at the New Engineering Building, North Campus, Summerstrand, Port Elizabeth
- **Autodesk Inventor Intermediate Training Course** from 25 to 26 March 2013 at Micrographics in Port Elizabeth

The following table summarises figures on the actual utilization of NMMU competence using the following indicators.

Input from NMMU in person hours over total volume of person hours on Projects/Services/Training in %						
	Station Staff	Professor / Lecturer	Technician / Lab staff	External Consultant	Students	Total
Total hours	19617	41	610,4	0	5164,95	25433,35
% input	77,13%	0,16%	2,40%	0,00%	20,31%	100,00%

5.7. Criteria 7

In the case of engagement through research and scholarship, the information referred to under Assessment Criteria (Criteria 7), where applicable needs to be provided.

The different research areas of friction processing practiced by eNtsa in collaboration with the Friction processing Research Unit (FPRU) at the NMMU includes: Friction Stir Welding (FSW); Friction Taper Stud Welding (FTSW), Friction Stud Welding (FS) and Friction Hydro Pillar Processing. The common feature of friction processes is that the material used is processed in the solid state (i.e. below the melting point of the material) to produce a high quality joint or repair. These processes are of major interest for applications where the original material characteristics are required to remain unchanged as far as possible.

a) Academic postgraduate research projects

NMMU postgraduate projects currently being researched within eNtsa are summarised in the following table :

Student	Title	Level	Completion date
Daniel Bulbring	Characterisation of FTSW properties as applied to 10CrMo910 creep resistant steel for application in the power and nuclear industry	PhD Mech Eng	2013
Darren Samuel	Characterisation of Joint Integrity of Blind Friction Taper Stud Welds in the Partially Supported Condition as applied to AA6082	PhD Mech Eng	2014
Dreyer Bernard	Verification of the Dynamic Performance of Friction Stir welds for use as an Industrial Joining Technology in the Road Tanker Industry	PhD Mech Eng	2016
Madindwa Mashinini	Dynamic Properties of 3mm Ti-6Al-4V laser beam and friction stir welded sheets	PhD Mech Eng	2014
Willem Pentz	Development of Repair Procedure for Rotor Steel Material (26NiCrMoV145) by Friction Hydro Pillar Processing	PhD Mech Eng	2015
Davies Tsikayi	Development and Analysis of a Friction Hydro Pillar Riveting process applied to Titanium alloy (Ti 6AL-4V)	Mtech Mech Eng	2016
Raymond Pothier	Closed-loop Temperature Control of Friction Stir Welding	MEng Mechatronics	2016
William Rall	Analysis of the Critical stress intensity factor of Friction Stir Welding	PhD Mech Eng	2014

Completed projects of students graduated in April 2013 include:

- **Process Heat Flow for Temperature and harness prediction during Friction Taper Stud Welding of AISI4140** (PhD: Mechanical Engineering Project)

Hypothesis – Development of a finite element model to predict the temperature field and weld hardness in the weld area will assist in optimising weld parameters of FTSW to ensure good weld quality during the design and usage stages of FSTW.

- **Development of a Creep Sample Retrieval Technique and Friction Weld Site Repair Procedure** (PhD: Mechanical Engineering Project)

Hypothesis – The processes developed by this project will provide a method of creep sample retrieval and an alternative repair technique of the retrieval location. Samples will improve the creep condition monitoring of thick walled components by providing creep assessment in a shorter time as well as creep assessment with depth.

- **Conclusions:**

This work has high scientific and technological impact arising from the collaboration between researchers at Plymouth and Nelson Mandela Metropolitan universities and from the interface with ESKOM, a major operator of thermal power plant. The results further added to the understanding of how the prescribed weld repair and induction heat treatment processes influence the residual stress field of the FTSW repaired region. Understanding this will allow for the selecting of process parameters that optimise the residual stress field and mechanical properties. The data also offers valuable insights that advance understanding of residual stresses induced by FTSW as a repair technique and how these might be influenced by localised induction post-weld heat treatment. Finally this data places the modelling of residual stress distributions arising from repair processes for these high value components on a firmer footing.

6. Contacts

Provide the names and details of internal and external stakeholders/partners that can be contacted.

Internal:

- Dr Annelize Botes – Annelize.Botes@nmmu.ac.za – 041 504 3019/ 041 5043553;
Group Metallurgist – eNtsa
- Mr Sarel Schoombie – Sarel.Schoombie@nmmu.ac.za – 041 504 3208/0845829494
Principal lecturer – Department of Electrical Engineering
- Dr Russell Phillips – Russel.Phillips@nmmu.ac.za – 041 504 3609
Senior lecturer – Department of Mechanical Engineering
- Ms Jaci Barnett – Jaci.Barnett@nmmu.ac.za – 041 504 4307
Director - Innovation Support and Technology Transfer
- Dr Pieter Van Breda – Pieter.VanBreda@nmmu.ac.za – 041504 4536
Director – Research Management
- Mr Johan Wasserman – Johan.Wasserman@nmmu.ac.za - 041504 3414
Senior Director - Finance

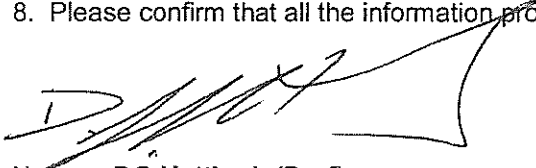
External:

- Dr Tony Paterson - Tony.Paterson@wits.ac.za
Chair of Welding - Southern Africa Institute of Welding (SAIW)
- Mr Mark Newby - NewbyM@eskom.co.za; Cell no. 083 251 6563
Chief Consultant – Experimental Stress Analysis – Eskom
- Mr Philip Doubell - DoubelP@eskom.co.za; Tel. 011 629 5132, Cell. 083-273 5328;
Chief Research Engineer - Eskom
- Mrs Zoleka Ngcete - Zoleka.Ngcete@tia.org.za ; Tel. 041 503 6700
Business Development Manager – Eastern Cape
- Mr John Asbury - John.Astbury@gm.com; Tel. 041 403 2105,
GMSA Vice-President GPSC
- Mr Trevor Hayter - thayter@engeli.co.za; Tel. 083 616 0138
- Mr Themba Mtati - yenzaman@iafrica.com - Tel. 041 487 1683
Manager – Yenza Manufacturing

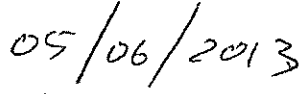
7. Attach a Portfolio of evidence and supporting documents linked to the above criteria

Throughout this document extracts and information of the relevant mentioned projects have been used. Any additional information required is available on request on conditions that a non-disclosure contract is signed.

8. Please confirm that all the information provided is correct by signing your application

A handwritten signature in black ink, appearing to read 'DG Hattingh', written over a faint rectangular box.

Name: DG Hattingh (Prof)

A handwritten date '05/06/2013' in black ink.

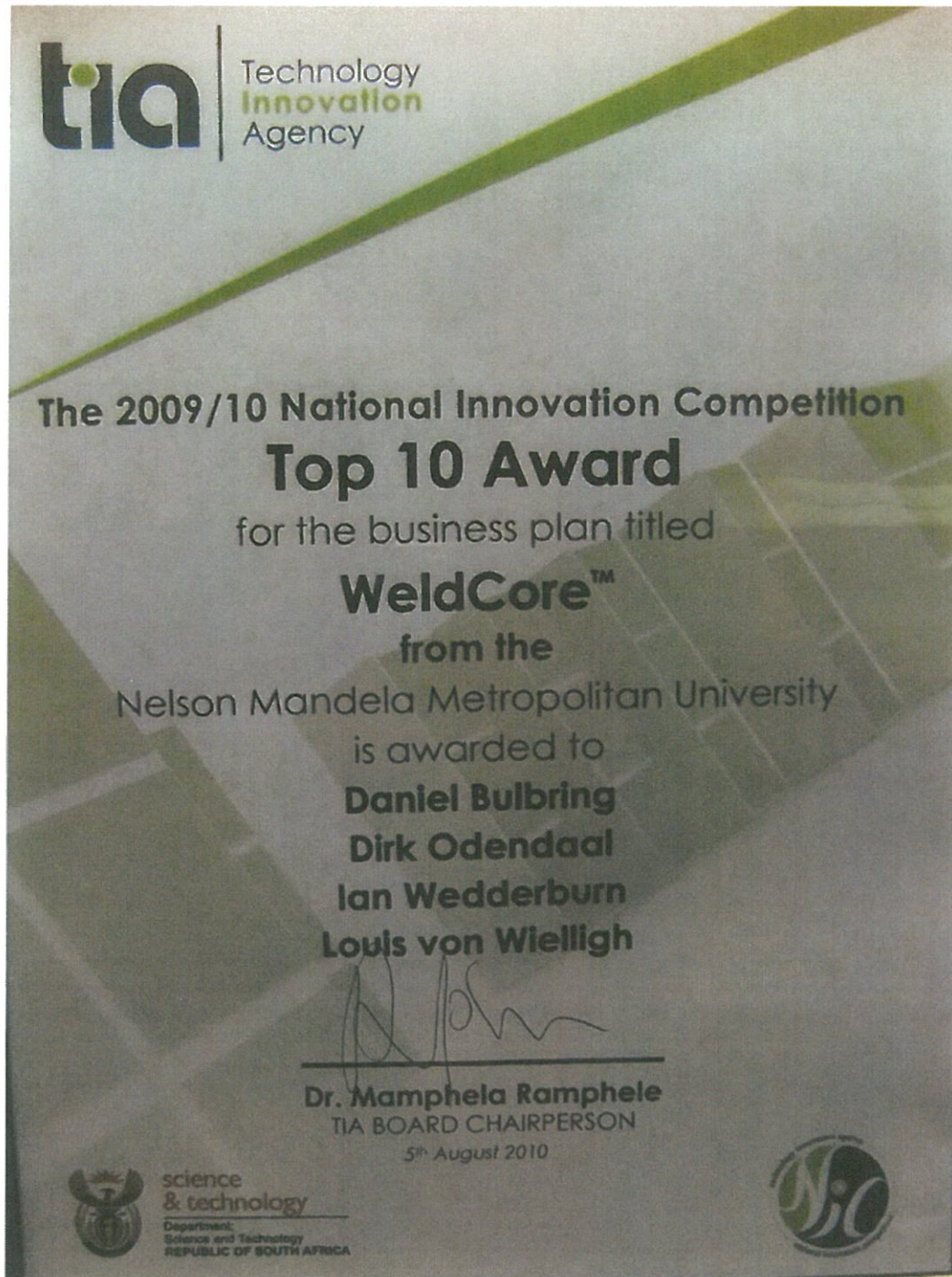
Signature:

The NMMU Engagement Conceptual Framework and Typology

Outreach & Community Service	Professional/Discipline Based Service Provision	Teaching and Learning	Research and Scholarship
<ul style="list-style-type: none"> • Graduate Placement • Networking and Partnership Development • Open Days/Careers Fairs • Clinical Service • Non-disciplined based volunteerism • Media Consultation • Outreach programmes to under serviced communities • Winter Schools • Counselling Services • Socio-cultural activities 	<ul style="list-style-type: none"> • Consulting and professional services • Partner in socio-economic projects • Contribute to public debate/Conferences • Partnerships with local and national agencies • Research based policy recommendations • Expert testimony • Public scholarship • Technology Commercialisation 	<ul style="list-style-type: none"> • Service Learning • Work-integrated/Based learning/Clinical Practice • Discipline related Volunteerism • CPD/Customised Programmes/SLP's • Part-time off-campus programmes • Project based learning • Internships • Clinical Practical • Conferences 	<ul style="list-style-type: none"> • Participatory • Action Research • Applied Research • Collaborative Research • Professional Services • Technology Transfer • Contract Research • Evaluation and Impact studies • Problem analysis and solving.

It should be emphasized that the activities and categories are often linked, interdependent, synergistic and integrated, but for purposes of providing a diagrammatic representation of the NMMU Engagement Conceptual Framework they are separated.

NIC Award





Finalist for an **NSTF-BHP Billiton Award**
2010-2011

Recognising an outstanding contribution to
science, engineering, technology and innovation

Weldcore Team, NMMU

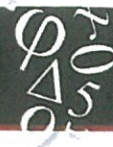
Research for innovation through an organisation

Prof B Wingfield
Chairperson: NSTF

J Niehaus
Executive Director: NSTF

Presented: 6 May 2011

National Science and Technology Forum in partnership with BHP Billiton



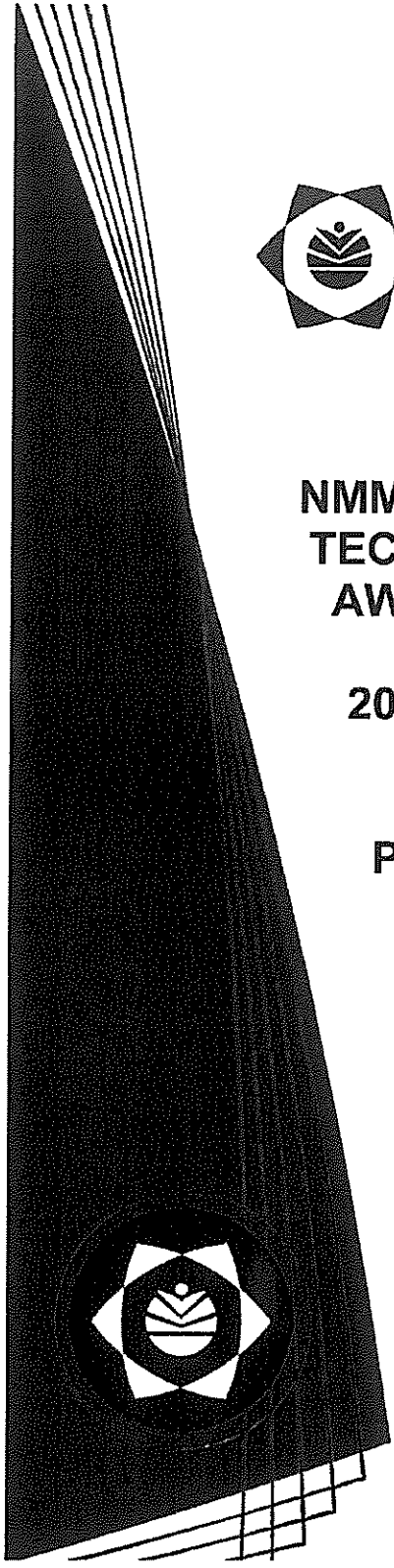


**Nelson Mandela
Metropolitan
University**

**NMMU INNOVATION AND
TECHNOLOGY TRANSFER
AWARD**

2011

Prof Danie Hattingh



Handwritten signature of Prof Derrick Swartz.

Prof Derrick Swartz
Vice-Chancellor

Handwritten signature of Prof Thoko Mayekiso.

Prof Thoko Mayekiso
DVC: Research & Engagement

15 September 2011



3 July 2012

Personal Attention: Danie Hattingh

Nelson Mandela Metropolitan University
P O Box 77000
Nelson Mandela Metropolitan University
Port Elizabeth
6031

Email: danie.hattingh@nmmu.ac.za

Dear Danie

Award of SAIW Gold Medal for 2012

I am very pleased to inform you that at a recent meeting of the Institute's Council you were nominated and confirmed as this year's winner of the Institute's Gold Medal. This award is made in recognition of outstanding contributions to developments and applications of welding technology.

"In recognition of his vision and leadership in developing a friction stir welding technology unit at Nelson Mandela Metropolitan University at the very forefront of this technology and applying the process commercially in industry to solve complex welding problems."

The presentation of the award is made at the annual dinner which will be held on Friday, the 17th of August 2012 at the Gold Reef City Convention Centre in Johannesburg and we invite you to attend the dinner to receive the award. Our executive secretary, Dimitra Kreouzi (kreouzidm@saiw.co.za or telephone number 011 298 2102) will issue the invitation to the dinner shortly.

The award is well earned – many congratulations!

Yours sincerely

A handwritten signature in black ink, appearing to read "Jin Guild", written in a cursive style.

JC Guild
Executive Director

