



**RAPID PRODUCT DEVELOPMENT  
ASSOCIATION OF SOUTH AFRICA**

**2013**

**SANparks Golden Gate Hotel**

**CHAIRMAN'S REPORT**

**31 October 2013**

**RAPDASA**

**Annual General Meeting**

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## 1. Overview

The Rapid Product Development Association of South Africa (RAPDASA) was formally founded at the First Annual General Meeting of the Association on 8 November 2000, at the CSIR Conference Centre in Pretoria. Since its inception, RAPDASA has been a cornerstone in the development of the Additive Manufacturing industry in South Africa.

During the 2013 year, strategic support for the growth of Additive Manufacturing received increased interest from the government. A formal process was launched to establish an Additive Manufacturing roadmap for South Africa. The Department of Science and Technology has acknowledged the interest and growth in the field of Additive Manufacturing, based on the uptake of the technology by industry, as well as the research and development outputs from the local research community in additive manufacturing. The growth and the increase in quality of conference papers presented at the annual RAPDASA conference borne testimony to the importance of this emerging technology for both the research community and industry.

As in 2012, several new Additive Manufacturing facilities were established in the past year. New R&D facilities were funded at the CRPM at the Central University of Technology, and at the Vaal University of Technology. These facilities not only support new R&D initiatives, but also provide valuable training facilities for our next generation of engineers and technologists.

Industry exposure was encouraged during the past year, and RAPDASA supported the Agents of the 3D Revolution exhibition, workshops and training events in June/July 2013 which saw unparalleled interest from the community. During the past year, the Vaal University of Technology has also put into motion several new initiatives to support the uptake of additive manufacturing technology in the foundries and in the shoe and leather industries.

RADASA's participation in the ASTM F42 work group continued during the past year. RAPDASA as industry association continued to circulate proposed standards to members for comments, as well as requesting members to advise on voting on the adoption of new standards.

## **2. Management**

The RAPDASA management committee elected at the AGM on 1 November 2012 had management meetings one average every two months during the past year. Key agenda points covered at these meetings included the Additive Manufacturing Roadmap development initiative, the RAPDASA 2013 annual conference, the upgrade to our RAPDASA website, special events as well as the treasurer's report on the RAPDASA financial situation. At the meeting of 26 February 2013, the following portfolios were assigned to the various RAPDASA management committee members:

- Chairperson - Mr. Hardus Greyling
- Vice Chairperson – Prof. Deon de Beer
- Secretary – Mrs. Maritha Theron
- Treasurer – Mr. Eugene Erfort
- Conference Organisation – Mr. Gerrie Booysen
- Education and Competition – Prof Deon de Beer
- Industry interaction and Outreach – Mr. Hardus Greyling
- International standards and collaboration – Mr. Marius Vermeulen
- Special Projects – Dr. Willie du Preez
- Website – Mr. Hardus Greyling
- Electronic media (regular RAPDASA newsletter) – Prof. Dimitri Dimitrov

## **3. RAPDASA Members**

All RAPDASA Conference participants receive a full year membership to the association.

## **4. South African Roadmap for Additive Manufacturing**

The South African Additive Manufacturing community has grown over the past 15 years. The level of success achieved by RAPDASA in involving industry and the impact of its annual conferences over the past thirteen years have resulted in a South African manufacturing industry that is fairly well informed regarding the unique characteristics of additive manufacturing technologies. The RAPDASA

annual conference has seen growth in the past numbers of years, with a constant increase in the quality of the conference papers being presented, as well as interest that the conference has generated amongst local and leading international researchers in the field of rapid prototype development and additive manufacturing. There has also been a dramatic growth in the adoption of this technology by industry, as can be seen by the strong growth of AM platforms being sold in the local manufacturing industry. However, there is still a limited understanding of the full potential of this technology to transform the South African manufacturing sector and what the differentiating opportunities would be for local companies to establish themselves as globally competitive players by utilising additive manufacturing.

During the Annual General Meeting of 2012, a proposal was tabled by Mr. Llanelly Simpson for a more strategic leadership role for RAPDASA, and specifically to coordinate the process for the establishment of a Roadmap for Additive Manufacturing in South Africa. The proposal was also to establish, as a result of the Roadmap development process, special portfolios within the RAPDASA management committee to support research and human capital development, industrial development and commercialisation, and mechanisms to attract and manage industrial and donor funding to institutionalise RAPDASA's operations.

A formal process was started during the past year to develop such a roadmap. A proposal was submit by the RAPDASA management committee through the CSIR to the Department of Science and Technology for this project. The project is managed by Dr. Willie du Preez in his capacity as RAPDASA management committee member with responsibility for special projects, and Mr. Hardus Greyling and Mr. Garth Williams from the DST. CSIR Materials Science and Manufacturing unit is providing the secretariat for this project. Based on the proposal, DST will make financial support available to develop **A South African Additive Manufacturing Technology Implementation Roadmap**.

A core team of experts have been tasked to develop the roadmap. The core team is lead by Professor Federico Sciammarella from the Northern Illinois University in Chicago, USA. Apart from the team leader, the core team currently consists of the following members:

- Prof Deon de Beer, Executive Director: Technology Transfer and Innovation, Vaal University of Technology
- Dr Neil Trollip, Strategic Research Manager, Materials Science and Manufacturing, CSIR
- Mr Marius Vermeulen, Project Leader: Additive Manufacturing, Aerosud Innovation and Training Centre
- Dr Terry Wohlers, President: Wohlers Associates, Inc

- Dr Andrew de Vries, Deputy Director: Advanced Manufacturing, Department of Science and Technology

Expectations of a **South African Additive Manufacturing Technology Implementation Roadmap** will be to:

- describe the research, development and innovation programmes (including human resource development) to develop key technologies (or alternatively the procurement of off-the-shelf mature technologies),
- define the enabling environment needed (e.g. technology incubators and science and technology parks) and the financial resources required, all in order to develop products to unlock specific market opportunities.
- describe the associated estimated impacts (jobs, enterprises and contribution to GDP) and outputs (knowledge products, intellectual property, human capital development and skills) for each market opportunity.
- The time-frame of the implementation plan is the period 2014-2025.

Activities of the core team will include:

- Establish the scope of work and project schedule.
- Undertake a study of available international AM roadmaps to inform the South African AM roadmap framework and relevant elements to be addressed.
- Develop a database of stakeholders and identify key stakeholders that need to participate in the project in some form in order to obtain early buy-in for participation once the project is complete and needs to be implemented.
- Establish a baseline of the SA AM industry in terms of market opportunities, equipment, expertise, capabilities, research fields, international linkages, outputs, human capital development, job creation and investment requirements, through a survey of all local AM stakeholders, including academia, research institutions, industry, end users and equipment resellers.
- Organise two regional and one national inclusive South African workshops with stakeholders to identify and discuss the different aspects of a local AM roadmap.
- Craft a roadmap based on the desk top studies performed and with the outputs of the AM workshops.
- Submit the final South African Additive Manufacturing Technology Implementation Roadmap to

the DST followed by a presentation to DST representatives.

The project is in the initial phases. An inception report detailing the work activities planned will be presented to the Department of Science and Technology in early November, with the regional and national workshops planned for the 2<sup>nd</sup> week in November 2013. It is anticipated that the project will be completed in May 2014.

## **5. RAPDASA 2013 Conference**

The Centre for Rapid Prototyping & Manufacturing (CRPM) as part of the Central University of Technology, Free State is hosting the 14<sup>th</sup> annual international conference on behalf of RAPDASA at SanParks Golden Gate Hotel. The theme for this year's conference is "AM-Improving your world layer-by-layer". The venue is located in the Golden Gate Highlands National Park which is a game reserve and is an excellent setting for the conference. The conference delegates will have the opportunity to attend 48 presentations from experts showcasing AM developments and technologies, material's research, design and direct manufacture and also have an opportunity to network with the South African and international AM community.

The 2013 conference proved to be one of the largest RAPDASA conferences with nine keynote presentations and 39 other presentations running in three parallel sessions. At the time of preparing this report, one hundred and twenty one delegates had already registered for the conference which includes approximately 20% participation from industry. The following exhibitors are present at this year's conference:

- Department of Science and Technology
- Titanium Centre of Competence
- 3D Solids (Stratasys)
- CSIR, National Laser Centre
- Central University of Technology, Centre for Rapid Prototyping and Manufacturing
- Central University of Technology, Product Development Technology Station
- Materialise
- Rapid3D
- Vaal University of Technology

RAPDASA is pleased to announce that the South African Institute for Industrial Engineers agreed to publish a select group of papers from the conference in the SAIIE Journal – an ISI accredited journal. Apart from the main conference, a pre-conference seminar named Additive Manufacturing of Titanium parts, hosted by the CUT in collaboration with the Titanium Centre of Competence, was held on 29-30 October. This seminar was attended by around 75 delegates, which consisted of industry, government and academia.

On behalf of RAPDASA and I would like to express my thanks to the generous sponsorships for this year's event and ensuring the success of the conference through their contributions:

- Department of Science and Technology
- Central University of Technology, Free State
- SASOL
- Technology Innovation Agency
- Vaal University of Technology
- Aerosud Innovation & Training Centre
- Materialise
- EDM-Shop

## **6. Website**

During 2012, we started an initiative to upgrade our RAPDASA website to specifically provide more functionality in support of arranging and organisation of our annual Conference. In the past, RAPDASA conference organisers experienced problems with on-line conference registration and the process around the submission of abstracts and papers, submission of biographies as well as to facilitate peer review processes for submitted papers. It was decided by the management committee to outsource the upgrade of the website to a professional website developer, who has experience in the development of a website that could provide information on events, news links, a repository of archived documents, but also capable of supporting all the activities required to arrange and organise a conference.

Softcode was appointed by the management committee in March 2013 to handle the upgrade. The website was migrated from an open source environment to a Microsoft platform, and the functionalities specified were successfully implemented. Feedback from the RAPDASA 2013 conference organising team is very positive, the website upgrades made a meaningful contribution

in facilitating the registration of conference attendees, the submission and peer review of abstracts and papers.

## **7. New Research and Development Infrastructure**

### **a. Successful RISP application at CUT**

The research team (Dr Kobus van der Walt, Mr Gerrie Booysen and Prof Michele Truscott) at the Centre for Rapid Prototyping and Manufacturing (CRPM) was successful in an application to the NRF's Research Infrastructure Support Program (RISP) for a new state of the art Objet Connex™ 350 3D printing machine. The new machine adds to the CRPM's already impressive line-up of 3D printing technologies and will ensure that the centre remains in the forefront of research into 3D printing technology internationally. A special feature of the machine that was up to the present time not available at the CRPM is its ability to print multiple materials simultaneously. The Connex™ 350 is presently the only 3D printer available that features simultaneous multi-material jetting technology (PolyJet™ polymer jetting technology). The materials are combined in specific concentrations and structures to create Digital materials with unique mechanical properties. Therefore an object consisting of hard plastic and soft rubber can for example be printed as a single part. The total cost of the machine was R1.938 million where two thirds of the cost was covered under the RISP initiative and one third by the CUT.

### **b. New R&D infrastructure at VUT**

Professor Deon de Beer and his team also submitted a successful RISP grant application to the NRF for new research and development infrastructure at VUT. The VUT through this grant acquired a Voxeljet VX 1000 that prints sand for direct metal casting. The VX 1000 will offer the largest sand printing volume and platform currently available in SA, and will be able to build dimensions of 1060x 600 x 500 mm. There is an interest from foundries for larger envelope systems (typically up to 1 meter high, 2 meters wide and 4 meters in length). In addition, the VUT has invested in a Voxeljet VX 500, which prints PMMA for investment casting applications in a build volume of 500 mm x 400 mm x 300 mm, also using standard 3D printing technologies (no laser). Both machines were commissioned during September 2013.

### Shoe and Leatherwear National Cluster Innovation Centre:

Following the VUT's successful contracting with the IDC & DTI to house the NFLC Innovation Centre, the following equipment was purchased and received:

- EOS P110 Formiga
- EOS P395
- EOS P760
- ZCorp Z850
- Further technology approved is an Objet Connex 500.

In addition, the VUT invested approximately R 1.8 million to also get a Stratasys Fortus mc 400 capability, due to the growing need for AM in diverse engineering polymers. This led to further NEP application for a Fortus mc 900 (approximately R 5.5 million), for which the outcomes are awaited. All machines are installed in a shop front window style, so as to facilitate technology demonstration to the public, and are part of the VUT's strategy to become a national centre of excellence.

## **8. Industry outreach**

### **a. Agents of the 3D revolution**

During July 2013, RAPDASA endorsed the Agents of the 3D Revolution exhibition, and workshops and seminars that was presented and hosted at the University of Johannesburg's Fine Art Design and Architecture departments, and gallery. The Agents of the 3D revolution was an exhibition of 3D printed design and artwork accompanied by workshops, seminars and live demonstrations of the technology. The objective of the event was to educate, inform and inspire. The aim was not only to present some of the foremost international 3D print designers and technology, but also to promote cross disciplinary interaction and collaboration amongst students, entrepreneurs, interested individuals and industry.

Dr. Michaella Janse van Vuuren and Dr. Lionel T. Dean collaborated on the project. The exhibition consists of two parts; a gallery exhibition of renowned international artists and designers working

with 3D printing, and a live technology demonstration and retail area. These areas was complemented by seminars, workshops, networking opportunities and courses to ensure that skills and knowledge is transferred.

The event attracted 70 guests to the VIP function, including high-level government officials. More than 280 people registered for the seminars, but it seems that due to the very bad weather, only 200 guests attended. Courses have been organized for school groups using amongst others, the VUT's I2P lab facilities, supported by design workshops.

The exhibition itself attracted more than 1500 visitors during the exhibition period, and received significant exposure on radio, TV and social media platforms.

### **b. Idea 2 Product lab**

Two labs have been commissioned, and a third (still in the Southern Gauteng Region) is on its way, together with an I2P lab in Cape Town, a mobile I2P lab, the Boschpoort combined lab and collaboration with a makers lab in Johannesburg.

Ms Carol Kuhn also started a training facility in the VUT's school for visual design. In addition, 30 interns have been appointed to undergo advanced AM training, and to become part of the SA AM workforce, or join a local incubation programme.

Following the high success rate of the exhibition at FADA, several schools are now organising training for their schools. Several post-graduate projects in AM education has also kicked off.

### **c. Foundry Innovation Centre at VUT:**

Following the very successful outcomes of a Rapid Appraisal of Local Innovation Systems (RALIS), the VUT's directorate for technology transfer and innovation (TTI) has embarked on a strategic advanced manufacturing drive through concentrating on industry needs as identified, and which could be mapped to internal expertise, capacity and/or infrastructure. Using existing design and additive manufacturing expertise as foundation, various local and national industry cluster support initiatives have been started, which also supported the development of the Southern Gauteng Regional Innovation Forum and VUT Southern Gauteng Science and Technology Park.

Within the VUT SG STP, an Advanced Manufacturing Precinct is taking shape, and is positioned to reinforce technology demonstration and transfer to industry. Simultaneously, it supports (basic and applied) research to solve existing industry needs through innovative solutions based on material, product and process development, supplemented by human capital development.

Through the completed RALIS audit, 30 odd local sand foundries that were in dire need for supported, was identified. As part of the industry-focused development approach, the TTI has embarked on a process to acquire two Voxeljet 3D printers to support innovative product and process development for the foundry industry. Voxeljet uses an inkjet printing approach to selectively print a binder on powder material to create complex 3D structures. Materials used are foundry sand to create complex sand moulds or cores, or PMMA for investment casting purposes. The hypothesis was that through our research intervention, we could help the local industry to steer away from making a living on “jobbing” and become more competitive by manufacturing innovative products that can participate in the Localisation Programme and counter costly imports.

## 9. ASTM

“ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development and delivery of international voluntary consensus standards. ASTM Committee F42 on Additive Manufacturing Technologies was formed in 2009. F42 meets twice a year, usually in January and July, with about 70 members attending two days of technical meetings. All standards developed by F42 are published in the Annual Book of ASTM Standards, Volume 10.04.” Committee F42 is developing standards specifically for Additive Manufacturing and has already published 5 standards:



- ISO/ASTM52921-13 Standard Terminology for Additive Manufacturing – Coordinate Systems and Test Methodologies
- ISO/ASTM52915-13 Standard Specification for Additive Manufacturing File Format (AMF)
- ASTM F2924-12a Standard Specification for Additive Manufacturing Ti6Al4V with Powder Bed Fusion
- ASTM F3001-13 Standard Specification for Additive Manufacturing Ti6Al4V ELI (Extra Low Interstitial) with Powder Bed Fusion
- ASTM F2792-12a Standard Terminology for Additive Manufacturing Technologies

A number of other standards are currently under development.

RAPDASA has been an organisational member of ASTM committee F42 since 2010, with the goal of supporting the local Additive Manufacturing industry with regards to the development of standards. As a member, RAPDASA is contributing to these standards and have voting powers in the implementation of these standards.

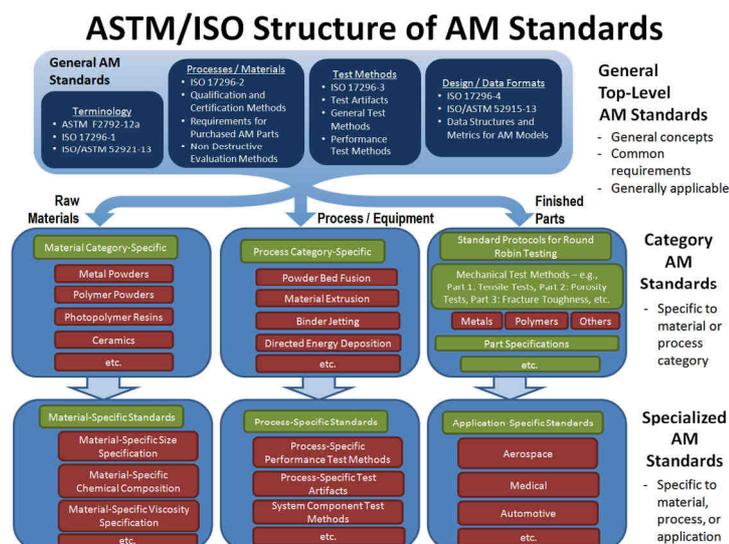
RAPDASA aims to provide a link between its members and the activities of ASTM committee F42 to ensure that members have access to the standard development process, as well as the global direction and objectives of ASTM F42. The RAPDASA management committee have nominated a delegate to represent RAPDASA at all ASTM main committee meetings (twice a year). The delegate, Mr. Marius Vermeulen, is co-sponsored by RAPDASA and Aerosud Innovation and Training Centre. He is also member of the ASTM F42 executive committee.

RAPDASA was represented at the last three ASTM F42 main committee meetings and the following meeting is from 27-28 January, 2014 in West Conshohocken, USA.

A special meeting was also held in 2013. The meeting was a joint planning session between ASTM and ISO and had the following outcomes:

- It was agreed that **one set of AM standards** should be developed – to be used all over the world
- A common roadmap and organizational structure for AM standards was agreed upon between ASTM and ISO.
- ISO and ASTM to co-develop standards in future.

The joint ASTM/ISO roadmap can be seen below.



A local RAPDASA/ASTM F42 workgroup meeting was also held at RAPDASA 2012 on the 2<sup>nd</sup> of November during the annual RAPDASA conference at Kwa Maritane Bush Lodge, Pilanesberg. The next meeting is to be held at RAPDASA 2013 on the 1<sup>st</sup> of November, 2013.

## **10. GARPA**

“The Global Alliance of Rapid (GARPA), and its annual meeting, the Global Summit, were formed to encourage the sharing of information on rapid prototyping and related subjects across international borders. As a part of this sharing, GARPA members from around the world participate in activities that include technical presentations at industry conferences, the publication of application case studies, business meetings, social events, and the formal and informal exchange of information. RAPDASA has been a member of GARPA since 2001. RAPDASA is allowed to nominate 5 members to become GARPA fellows. At the 2012 RAPDASA Annual General Meeting, Mr. Eugene Erfort and Mr. Gerrie Booysen were nominated and accepted as nominated GARPA fellows. Congratulations to Eugene and Gerrie for their contribution to the additive manufacturing community over the past number of years. Other RAPDASA members who were nominated GARPA fellows in the past include:

- Dr. Willie du Preez
- Prof. Dimitri Dimitrov
- Prof. Deon de Beer

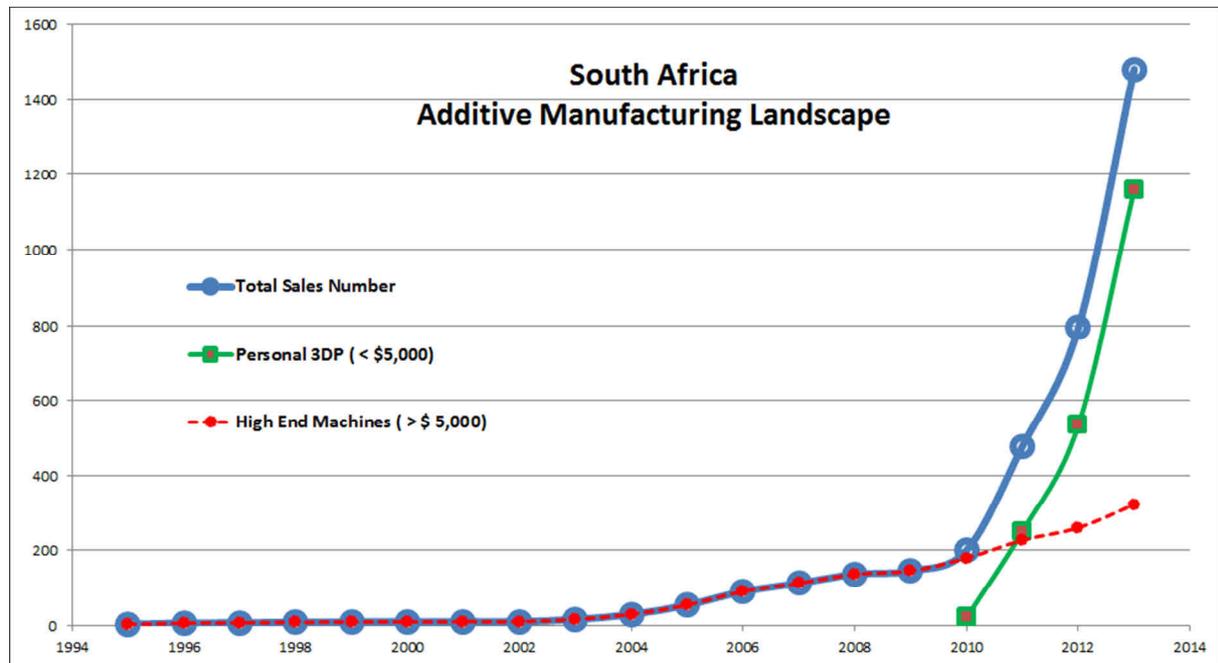
## **11. Financials**

RAPDASA currently has a healthy financial status as per treasurer’s report. On behalf of RAPDASA, I would especially like to thank the conference organisers for their commitment in maintaining this status. I also want to express my appreciation to our Treasurer, Eugene Erfort, for his tireless efforts over the years in this regard.

## **12. Conclusion**

Additive Manufacturing and the adoption of the technology by industry as a new manufacturing technology is on the increase. The fact that smaller and more affordable systems are now readily available makes the acquisition of the technology easier for smaller companies and individuals. There was a steady growth in the number of high end machine platforms in 2013, which is indicative of the acceptance by industry of this new manufacturing technology. From the research of Professor

Deon de Beer, the estimated number of systems sold during 2013 year to date was an impressive 1471<sup>1</sup> units at an estimated monetary value of R 86 million. These figures are still preliminary, as data is still being gathered and processed. Of these 1471 systems, indications are that approximately 22.5% are higher-end machines, with value higher than US \$ 5 000. Compared with the 2012 year, this represents an increase in the total number of platforms of 88%!



Notable from the past year is also the continued investment in new R&D platforms and upgrade of existing facilities by the local R&D fraternity.

During the past year RAPDASA also started the process to play a more strategic role within the local Additive Manufacturing community. The Roadmap development project under development will guide our thinking in terms of new investment in R&D, identify and assist in the design of initiatives to ensure that the human capital required to continue the adoption of the technology is in place, as well as suggests mechanisms to incubate new technology development in additive manufacturing.

RAPDASA has continued to support the roll-out and demonstration of additive manufacturing technology during 2013, through the endorsement of the Agents of the 3D revolution exhibition. It is planned that our role in demonstration of technology will increase in the coming years, with our role as industry association being driven by the strategic view developed within the South African Roadmap for Additive Manufacturing implementation project.

<sup>1</sup> Private communication from Prof. Deon de Beer

Our role as industry representative at ASTM allows our local research and development engineers to make inputs into the new standards that will govern additive manufacturing in future. RAPDASA's representative at ASTM's F42 workgroup, Mr. Marius Vermeulen, has diligently acted as our link to ASTM. As a result of his contribution to the F42 workgroup over the past 2 years, Marius was nominated and accepted as a member of the Executive Committee of the F42 workgroup. We congratulate Marius with this achievement.

I want to thank my fellow management committee members for the hard work that they have put in over the past year, for the additional hours, the dedication and commitment despite of increasing challenges from each of their fulltime positions! I also want to thank them for their valuable contributions to this chairmen's report.

I want to thank the organisers of our RAPDASA 2013 Conference for the excellent and well organised event that they have arranged on our behalf. On behalf of RAPDASA I also want to extend our thanks and appreciation to all the sponsors of the Conference, as well as all the delegates, local and international who has taken the time to register, and to travel to, attend and contribute to the Conference.

We are looking forward to 2014 with eager anticipation, to monitor progress on the key initiatives we are involved in, and to further expand and grow additive manufacturing in the South African industry.

Yours sincerely



Hardus Greyling

RAPDASA Management Committee

Chairman