

RAPDASA – A Vehicle for Product Development Technology Diffusion in South Africa

by

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Abstract

The ability to design and develop new products is generally accepted as a strong enabler for improving the competitiveness of a country's manufacturing industry. This paper describes the establishment and evolution of the Rapid Product Development Association of South Africa (RAPDASA) as representative body of the technical service providers and researchers in the product development field in the country. RAPDASA is affiliated to the Global Alliance of Rapid Prototyping Associations (GARPA), which also positions it very well in the global arena. The growth of this association from an initiative of a few government supported institutions into a powerful vehicle for technology transfer and diffusion into the private industry is described. The facilitating role that it is playing as an independent organisation in stimulating and improving the level of communication and interaction between the users of technology and the technology providers is discussed. The paper also highlights the effect that international affiliation had on establishing a credible nationally inclusive association. Reference is made to the value of the annual international RAPDASA conference and the utilisation of an internet portal, productdevelopment.co.za, in providing information on the product development process, as well as direct access to expertise and resources supporting competitive product development in South Africa.

Key words: Rapid Prototyping, Product Development, RAPDASA, GARPA

Introduction

For many years, especially during the isolation of the sanctions era, South African companies have manufactured to imported designs, supplied by their principals in developed countries. The original design component of the manufacturing industry has therefore been limited, although the general product engineering and manufacturing experienced gained over the years laid a strong foundation for building the local product design, development and engineering capacity. When the armaments industry was scaled down in the mid 1990s, many of the skills were transferred to the general manufacturing industry through the migration of staff into this sector. Consequently, pockets of world-class expertise were found across South Africa, although the resources and capacity were limited, often located in sub-critical groups and not commercially exploited.

Since the middle to late 1990s there has been a growing realisation of the importance of competitive new product development in support of the growth of South Africa's manufacturing industry. Given the rate of introduction of new products and new models of products into the global market during the past decade, the enabling power of rapid product development (RPD) technologies and methodologies was recognised. In this context, a consensus has grown in South Africa regarding the need for a broad-based improved understanding and application of computer-aided design, engineering and manufacturing technologies in the manufacturing industry. This was identified in the *Foresight* study commissioned by the South African Department of Arts Culture, Science and Technology (DACST) [1]. The report stressed the need for increased migration to and adoption of new product development tools such as CAD, CAM, Rapid Prototyping and Tooling and Virtual Prototyping. These insights were substantiated and confirmed in interactions of South African delegations with governments of successful developing economies.

The report pointed out that manufacturing was moving into an era of tri-polar global competition between Asia, North America and Europe, which redefines the traditional playing fields for all other manufacturing competitors. The traditional approach to customer service, the definition of products, markets and value, is being revolutionised as consumers of manufactured goods now demand product reliability, conformance quality, after-sales service, product flexibility and on time delivery. To be globally competitive, manufacturers should focus on integrated product, process and production system design to reduce production time.

Evolution of Rapid Product Development Technology in the RSA

Recognition of this challenge was fundamental to the establishment of a product development unit in the Materials Science & Technology division (MATTEK) of the CSIR in 1995. This unit, known as the MATTEK Product Development Centre, evolved into a collaborative venture with some key industry players and was launched in its new form with industry support in July 1997 as the Time Compression Technologies Centre (TCT Centre). The TCT Centre placed a strong emphasis on reducing time to market through effective application of rapid product development technologies and methodologies. The concurrent engineering approach was key to the success of this initiative and required networking with service providers across the country. In this network the Centre for Rapid Prototyping and Manufacturing (CRPM) in Bloemfontein and the Global Competitiveness Centre (GCC) of the University of Stellenbosch were the leading tertiary education institutions, with Rapid Design Technologies (Pty) Ltd the leading industry player.

Following on discussions between CSIR and DACST during 1998, the National CAD/CAM Training Centre was established at the CSIR in 1999. Subsequently, the growing awareness of the need in the South African industry for state of the art product development support led to the conversion of the National CAD/CAM Training Centre into the National Product Development Centre (NPDC) in 2000 with the active support of DACST.

From 2000 to 2005 the NPDC led the South African manufacturing industry, design community and educational sector in building South Africa's international standing as a respected source of distinctive products. It acted as the hub of a national network of distributed resource units at tertiary education institutions and in industry, providing product development support to the manufacturing industry. This network with its technologies and technical skills development offerings operated in synergy with a network of Manufacturing Advisory Centres (MAC's), to provide business management and commercial support to small and medium enterprises. From the inception of the Technology Stations programme, which evolved into the Tshumisano Trust, the product development network has collaborated closely with this initiative to transfer technology to South African SMMEs.

The first Rapid Prototyping (RP) system was introduced into the RSA in 1994 [2]. It was a 3D Systems SLA 250 machine purchased by the 3D Systems agent in South Africa. This was followed by two FDM 1500 machines, later upgraded to 1650s, owned by the CSIR. The then-called Technikon Free State (TFS) in Bloemfontein (now the Central University of Technology Free State) purchased a Sanders ModelMaker II and an SLA 250 in 1996. The CSIR installed an SLA 500 in the same year and two years later, the TFS purchased a DTM Sinterstation. Hence, by the end of 1998 there were seven RP machines in the country [3]. It is important to note that only one of these was owned by a private company. This is indicative of the fact that RP was initially introduced into the tertiary education sector and other research institutions with the aim of assisting their co-operation with industry. In addition, the diverse and complimentary nature of the machines installed allowed active collaboration, efficient planning and conducting of research programmes. By end 2005 there were 54 RP machines in South Africa, of which approximately 74% (40 machines) belong to private companies.

RAPDASA – The Vehicle

Through the efforts of the CSIR, the Central University of Technology Free State, the University of Stellenbosch and other key players in the national network, the Rapid Product Development Association of South Africa (RAPDASA) was established during 2000. At a seminar in Stellenbosch in 1999 a small group of enthusiasts conceptualised the organisation as a mouth piece for the Rapid Product Development community in the RSA. It was constituted at the first Annual Conference, hosted by the CSIR on 6 and 7 November 2000 in Pretoria. It draws its members from research organisations, academic institutions and industrial companies. The management committee is composed in a manner that reflects this diversity. RAPDASA is involved in a range of activities that are all aimed at encouraging the further development and usage of RPD technologies.

The role that RAPDASA has undertaken has contributed much to the progress of Rapid Prototyping and Manufacturing (RP&M) in South Africa. A particular strength is that its remit is not limited to Rapid Prototyping and so the relationships with other Rapid Product Development technologies and the product development process feature widely in its activities.

Growing Credibility – Affiliation with GARPA

The Global Alliance of Rapid Prototyping Associations (GARPA), and its annual meeting, known as the Global Summit, were formed to encourage the exchange of information 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 informal sharing of information [4]. Furthermore, GARPA's members developed a website to promote this sharing [5].

At the time under the auspices of the Time Compression Technologies Centre (which at that stage was hosted by the CSIR), South Africa became part of the initiative to form the Global Alliance of Rapid Prototyping Associations (GARPA), on 19 May 1998, at an SME meeting in Dearborn. Being a founder member of GARPA¹[6]. South Africa became a member for an interim time, with the challenge to form a national (non-exclusive) association to obtain full membership, which was subsequently met with the establishment of RAPDASA.

Very early in its existence the need for international collaboration in this rapidly expanding field was recognised and consequently RAPDASA's affiliation to the Global Alliance of Rapid Prototyping Associations (GARPA) supported this need. RAPDASA managed to host the annual GARPA meeting in the Western Cape in November 2001, to coincide with the annual RAPDASA conference, hosted by the GCC at the University of Stellenbosch. The linking of a national conference with a Global Summit, then became the new international trend, as it gave the conference's host organisation access to up to 20 international experts in this field, which could be tasked as key-note speakers, session chairs, speakers and adjudicators, and has helped a number of international conferences to grow rapidly [7]. The same initiative has helped Portugal to grow its conference in 2005.

South Africa managed to again present the Global Summit at RAPDASA's 2004 Annual Conference in Bloemfontein. The presence of the international speakers brought more than hundred attendees to a special industry session as a pre-conference event. Mrs Jenny van Rensburg, assistant to Prof Deon de Beer, was elected as GARPA secretary in 2003.

¹ **PRESS RELEASE: DEARBORN, MICHIGAN, May 19, 1998** – Leaders from 13 rapid prototyping (RP) groups and associations worldwide met yesterday to discuss current and future applications of RP. The meeting, dubbed a Global Summit, investigated ways in which these groups might cooperate on projects that would help educate companies on the benefits of rapid prototyping and related technologies. Involved were representatives from Australia, Canada, China, Finland, France, Germany, Hong Kong, Italy, Japan, South Africa, Sweden, the United Kingdom, and the United States. This was the first ever meeting of RP groups and associations worldwide [6]

Outputs and Offerings

Annual Conference

The first major offering of RAPDASA has been the annual conference as a local forum for practitioners of product development, R&D players, academia and industry to spend time together and share their latest understanding of developments in this exciting field. From the beginning this has proven to be a powerful enabling event, not only for awareness creation, but also technology diffusion and technology transfer. As the conference evolved, already from its second year, into an event with substantial international participation, and the linkages with GARPA strengthened, the potential for accessing the most recent global thinking became a reality. Whereas the RAPDASA leadership initially had a tremendous challenge to entice local industry to participate, this has now grown to a stage where champions from industry are actively leading in the Management Committee. A further consequence of the international participation is that the conference has become an international information source for RP developments in South Africa.

Wohlers Report

Directly after its establishment RAPDASA started contributing to the Wohlers Report, *Rapid Prototyping & Tooling State of the Industry Annual Worldwide Progress Report* through its members [8]. This contribution has been sustained since then and the exposure following from this has contributed strongly towards positioning RAPDASA in the international arena.

Productdevelopment.co.za – Online Support for Product Developers

The power of the internet as means to promote Rapid Product Development and Concurrent Engineering has been harnessed with the establishment of the internet portal, *productdevelopment.co.za*. In view of the importance of small enterprise establishment and development for economic growth, the primary target audience for the services of the portal is the inventor, designer or entrepreneur operating in the SMME environment. These people are often not experts in product development and have to be introduced to the process and guided with regard to current international best practices. Due to limited in-house competence and capacity, they usually have to rely on external contractors and service providers when developing new products. On the other end of the spectrum the experienced and well-trained product engineers and designers are found. The latter usually know exactly what they need and prefer to do their own selection of appropriate technologies or expertise.

The portal provides three-fold functionality:

- The front-end has information sharing functionality, with open access for all visitors to the site. Various routes can be followed to navigate through the site, depending on the user's preference. Inexperienced product developers are prompted on the home page to indicate their status in the product development process, from where they are guided to the applicable information and the subsequent development stages. At various points they

are given the option to link through directly to a service provider who can assist them.

- Experienced developers, or others who know exactly what service they require, can use drop-down menus to select the relevant topic and link through to the appropriate source of help.
- For collaborating service providers and members of RAPDASA a password protected communication and collaboration platform is provided. Within this environment confidential information can be shared freely and discussions on project-related topics can be held.

Case studies

Following from own experience and international learning, the RAPDASA leadership has all along believed in the importance of sharing actual case studies to promote technology adoption and diffusion. Local and international conferences, seminars and workshops were used as platforms for sharing the South African experience [e.g. 9, 10, 11, 12], while the product development portal proved to be a powerful site for publishing case studies.

Membership database

Over the past six years RAPDASA has developed a comprehensive database of participants in conferences and active members of the association. It not only contains contact information of individuals, but also details on their areas of expertise. This has recently enabled the association to start adding this database to the range of offerings that RAPDASA provides to its members.

Rapid Prototyping Book

In a further attempt to share the South African learning in the RPD field with the scientific and engineering community locally and abroad, a team of RAPDASA members are engaged in compiling a book with the provisional title *Rapid Prototyping in the South African Academic and Industrial Environment*. RAPDASA is convinced that there would be significant value for practitioners, both from the service delivery and end user communities, from such a publication.

Impact

Due to the comprehensive approach taken by RAPDASA and its members to RPD (see Figure 1), which is imperative for successful implementation of Concurrent Engineering, a number of weaknesses were identified in the South African industry. Consequently, strategies were developed and initiatives taken to intervene and address these shortcomings. A number of these have since grown to fully-fledged national initiatives in support of the South African industry. Some examples are the following:

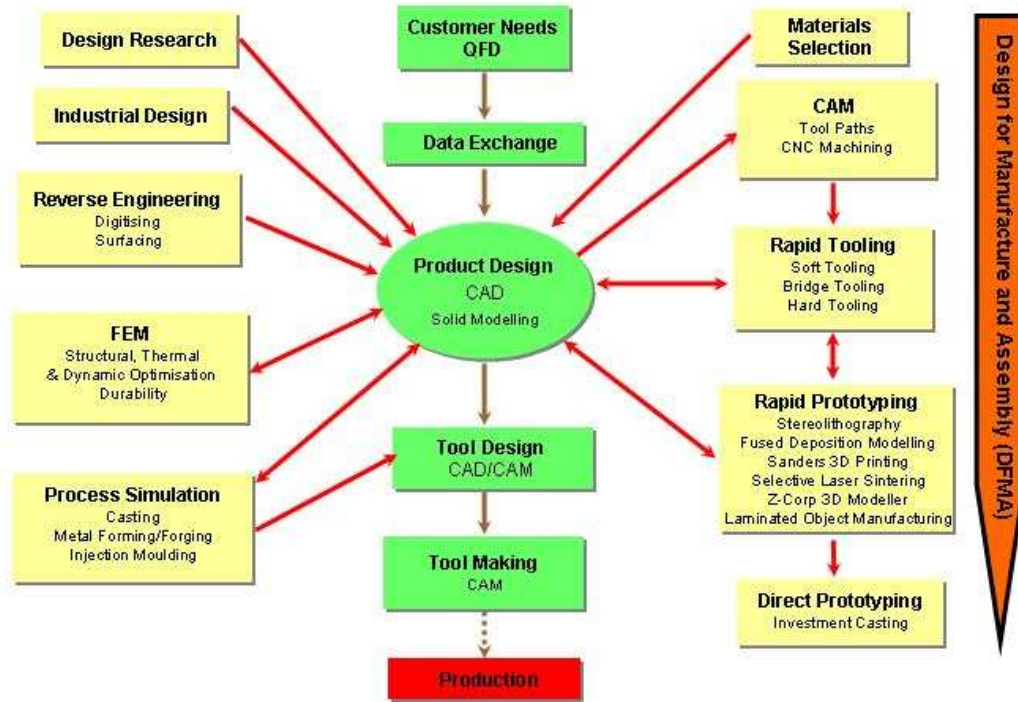


Figure 1: Product Development Technologies and Methodologies used by RAPDASA members

- ***The National Tooling Initiative (NTI)***

It was realised early on that the South African toolmaking industry was not ready to take on new technologies. There were fundamental problems in the industry sector that had to be resolved first, before modern technologies could be introduced. The NPDC in collaboration with the Automotive Industry Development Centre (AIDC) and key players from the toolmaking industry launched the South African Tooling Industry Support Initiative (SATISI) in 2002 to redress the situation. This resulted in the establishment of the Toolmaking Association of South Africa (TASA), that has taken ownership of the initiative since beginning of 2005. SATISI was transformed into the National Tooling Initiative, with a multi-million Rand plan for upgrading the local industry. As part of this an Institute for Advanced Toolmaking (IAT), supported by the Department of Science and Technology (DST), was launched in 2006 to lead the human resource development activities needed for a vibrant industry.

- ***The CAD in Schools Programme***

Initially, short courses in CAD/CAM and Concurrent Product Development were offered to the manufacturing industry by the National CAD/CAM Training Centre. However, it was soon realised that for sustainable impact, this training should already start on secondary school level. This led to the establishment of a CAD in Schools programme, which offers CAD training pitched at grades 10 to 12.

The success achieved in the original pilot with 25 schools confirmed the validity of the approach and since then many more schools have been involved in this programme that lays the foundation for a thriving Rapid Product Development community.

The message spread by RAPDASA and the services provided by its members in support of other national initiatives to grow the local industry have also had the following positive outcomes:

- **Successful Products**

Over the past decade a number of successful product developments by South African companies have been supported by the service providers that are members of RAPDASA. Examples of these are the Body IQ kiosk (see Figure 2) [10], the Eyeborn® orbital implant (see Figure 6) [13], Free Play Flashlights [10], radios and other battery-free accessories (see Figure 3), world firsts such as the development of a Constantia Villa (see Figure 4) [14], Groundbreaking Alumide Rapid Tooling achievement [15], Actaris Prepaid Electricity meters [16], the development of a replacement elbow for a Capetonian patient after a motorbike accident [17], a fully functional turbine [18], masks for oncology treatment (see Figure 5) [19], Lawn Star Line Trimmer [20], etc.

- **Improved Competitiveness of SMMEs**

Although specific contributions are difficult to quantify, RAPDASA members can testify to the positive impact that their interventions have had on the competitiveness of companies they have serviced. This has contributed to the general growth of the South African economy over the past decade, and specifically the growth of the manufacturing industry. Many SMMEs have experienced the value of RPD since adopting the enabling technologies and have been able to compete successfully in the local and international marketplace.



Figure 2: Development of the Body IQ Project



Figure 3: Freeplay Flashlight and Radio Developments



Figure 4: Model Developed for a Constantia Villa



Figure 5: Masks for Oncology Treatment.

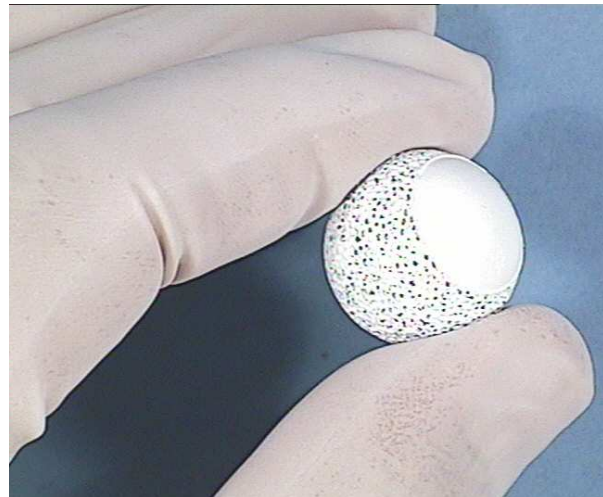


Figure 6: The Eyeborn® Orbital Implant

Conclusions

The history of the past decade has clearly demonstrated the powerful contribution that a vehicle such as RAPDASA can make towards the diffusion of technology into the industry. Whereas the intervention was initially mainly championed by government supported institutions, industry players have joined in, taken ownership and are now actively applying and promoting these technologies.

However, these kind of initiatives are not one-size-fits-all and must be customised and internalised to optimally address the needs of the local industry. It can also not only follow from a top down approach, but must allow for grass roots initiatives and organic growth of small core activities.

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References

1. DACST. (1998). *The National Research and Technology Foresight Project: Manufacturing Report*. Department of Science and Technology, Pretoria, RSA. Available at http://www.dst.gov.za/reports/forsight_reports.htm (accessed November 2004).
2. R I Campbell and D J de Beer, *Rapid Prototyping in South Africa: Past, Present and Future*, Rapid Prototyping Journal. Vol. 11 (4) [September 2005]., pp. 260 - 265
3. Deon de Beer, *Rapid Prototyping & Tooling State of the Industry Annual Worldwide Progress Report: South Africa*, Wohlers Associates, Inc. (1999)., pp. 113 - 115
4. <http://www.wohlersassociates.com/GARPA.html>
5. <http://www.garpa.org>
6. <http://www.wohlersassociates.com/press7.html>
7. <http://www.wohlersassociates.com/press19.htm>
8. Deon de Beer, Willie du Preez and Debbie Leeson, *Rapid Prototyping & Tooling State of the Industry Annual Worldwide Progress Report: South Africa*, contribution to Wohlers Report 2001, Wohlers Associates, Inc., pp 135 – 137
9. R Schenker, D J de Beer, W B du Preez, M E Thomas and P W Richter, *Novel combination of reverse engineering and rapid prototyping in medicine*, South African Journal of Science Vol. 95, No. 8, (August 1999), p 327
10. Deon de Beer and Willie du Preez, *RP Related Activities & Developments in South Africa*, SME web site, Product ID: TP04PUB309, (Nov 05, 2004)
11. Deon de Beer and Willie du Preez, *RP Applications and Design Collaboration Tools in South Africa*, **New Developments and Trends in RP Around the World, Euromold/Wohlers Associates Special Conference**, Exhibition Center Frankfurt, 30 November 2001
12. Willie du Preez, *Tools, Technologies and Services available in the South African Network*, **Plastics Institute of South Africa Lecture Evening**, Plastics Federation, Midrand, 14 October 2003
13. Irma Venter, *Engineering Longevity - Medical innovations promise longer, better life*, Engineering News, September 30 – October 6 2005
14. Terry Wohlers, *Rapid Prototyping & Tooling State of the Industry Annual Worldwide Progress Report: South Africa*, contribution to Wohlers Report 2003, Wohlers Associates, Inc., pp 25 – 27
15. De Beer DJ, Booysen GJ, Barnard LJ and Truscott M, *Rapid Tooling to Support Accelerated New Product Development*, International Journal for Assembly and Automation, Vol 25 (4), (2005) pp. 306 – 308

16. DJ de Beer. *Innovation A function of New Product Development?* Proceedings of the TCT Conference, 11-13 November, 2003, Birmingham.
17. Gillian Warren Brown. *Ti-bone*, Popular Mechanics, February 2006, pp. 58 – 59.
18. DJ de Beer, *Rapid Prototyping & Tooling State of the Industry Annual Worldwide Progress Report: South Africa*, contribution to Wohlers Report 2006, Wohlers Associates, Inc., pp 125 – 127.
19. De Beer D.J., Truscott M., Van der Walt J.G., Barnard L.J. and Booyesen GJ. *Rapid Manufacturing of Patient-specific Shielding Masks using RP in parallel with Metal Spraying*. Rapid Prototyping Journal. Vol. 11 (5) [October 2005]., pp. 298 – 303.
20. De Beer, D.J., *The Role of Prototyping to support Concurrent engineering in SA*. Proceedings of the 1st Annual Conference of the Rapid Product Development Association of South Africa, CSIR, Pretoria, 7 – 9 November 2000.