Future manufacturing – towards a South African vision

Dr Anthon Botha, InnovationLab (centre); Lorraine Ngwenya, DST (right); and Joe Manchu, InnovationLab, at the future manufacturing workshop on October 02nd at the Innovation Hub, Pretoria.

Earlier this month, a future manufacturing workshop – presented by Dr Anthon Botha and Joe Manchu of InnovationLab (Pty) Ltd, and Lorraine Ngwenya of the Department of Science and Technology – was held at the Innovation Hub in Pretoria. Key roleplayers from South Africa – PBMR, Aerosud, CSIR, DST and several universities, as well as a substantial delegation of German manufacturers and decision makers – engaged with innovative future business solutions and emerging manufacturing and process technologies. *MechTech* reports:

According to InnovationLab's Dr Anthon Botha, demanding markets of the future will change the paradigms that we manufacture in today. "Unsurpassed quality requirements, customisation to fit consumer individuality and fast delivery, will dominate the manufacturing agenda. Rapid transition from industrial age thinking to the digital factory supported by design-as-you-go, product visualisation, automation and integrated logistics will challenge the manufacturer of the future, large and small."

The key focus of the future manufacturing workshop was to engage small and medium-sized enterprises and leaders in innovation in the manufacturing sector. Representatives from the South African and German governments, academia and industry were invited in order to deliberate on how to encourage participation from SMEs in exciting new developments in emerging markets.

Key presentations on the programme included: Future manufacturing scenarios and trends, a presentation by Dr Anthon Botha, and Mechatronics and Robotics research for Advanced Manufacturing systems, by Professor Glen Bright of the Department of Mechanical Engineering at UKZN. Dr Botha also presented an overview of the vision of the European think-tank Manu*future*-EU, made up of a comprehensive range of European manufacturers.

After the presentations however, the real work began: A panel discussion on future manufacturing trends, an open discussion about the role of SMEs in future manufacturing and the development of a vision for future manufacturing in South Africa.

Future trends: Dr Anthon Botha

Botha opens his presentation by taking us through some of the waves of manufacturing change we have, are and may experience in the future. He starts with the industrial economy, initiated in 17th century by the invention of steam. The second wave, he tells us, was the information economy, driven by the widespread use of computers. "Obviously the manufacturing environment economised on that by starting to use ICT-based manufacturing."

Botha continues: "The next wave after that was the bio-economy, and following that is what we call the nano-economy. The nano-economy will very soon be driving the thinking we are doing in manufacturing. Up to now we have worked from the top down but the nano-economy will help us to think from the atomic level up to the top. One of the things we can address today is how real it is and how close," he suggests.

He then tells us about the hydrogen economy, possibly a misnomer: "People say it will not only be hydrogen that will be a carrier for energy in 20 to 25 years from now. It will be a different energy mix though. He tells us that InnovationLab is involved with the government developing long term future energy strategies for South Africa based on hydrogen energy and fuel-cell environments, "developments which will change the world we live in, "Botha proclaims.

Lastly, Botha tells us about an economy being called the neuro-economy, an emerging futurist's vision: "Genetic engineering and miniaturisation through the nano-economy has become so promising that these things can be combined so that you may have a DNA computer implanted in your brain as a natural extension of your capabilities. How far these things are off, we don't really know," says Botha, "but the challenge that we now face is that we are living in a time when all of these economies overlap. This is what is called the knowledge era. In the knowledge era, more and more of our products will be driven by the intelligence that we put into them."

Botha uses the motorcar as an example of how knowledge has changed them. In the past, he tells us, the car was knowledge poor. It had an engine and wheels and all of the knowledge was held by the driver. Now a car is knowledge rich, it has engine management systems, GPRS systems, ABS, etc. "It is interesting to look at concept cars on the internet and at shows. All of them still have something called a steering wheel

or the paradigm of a steering wheel, some sort of control that the driver still has over the car," he says. "In imagining the future, we should ask ourselves, Why won't we have driverless vehicles in the future that still move on roads?"

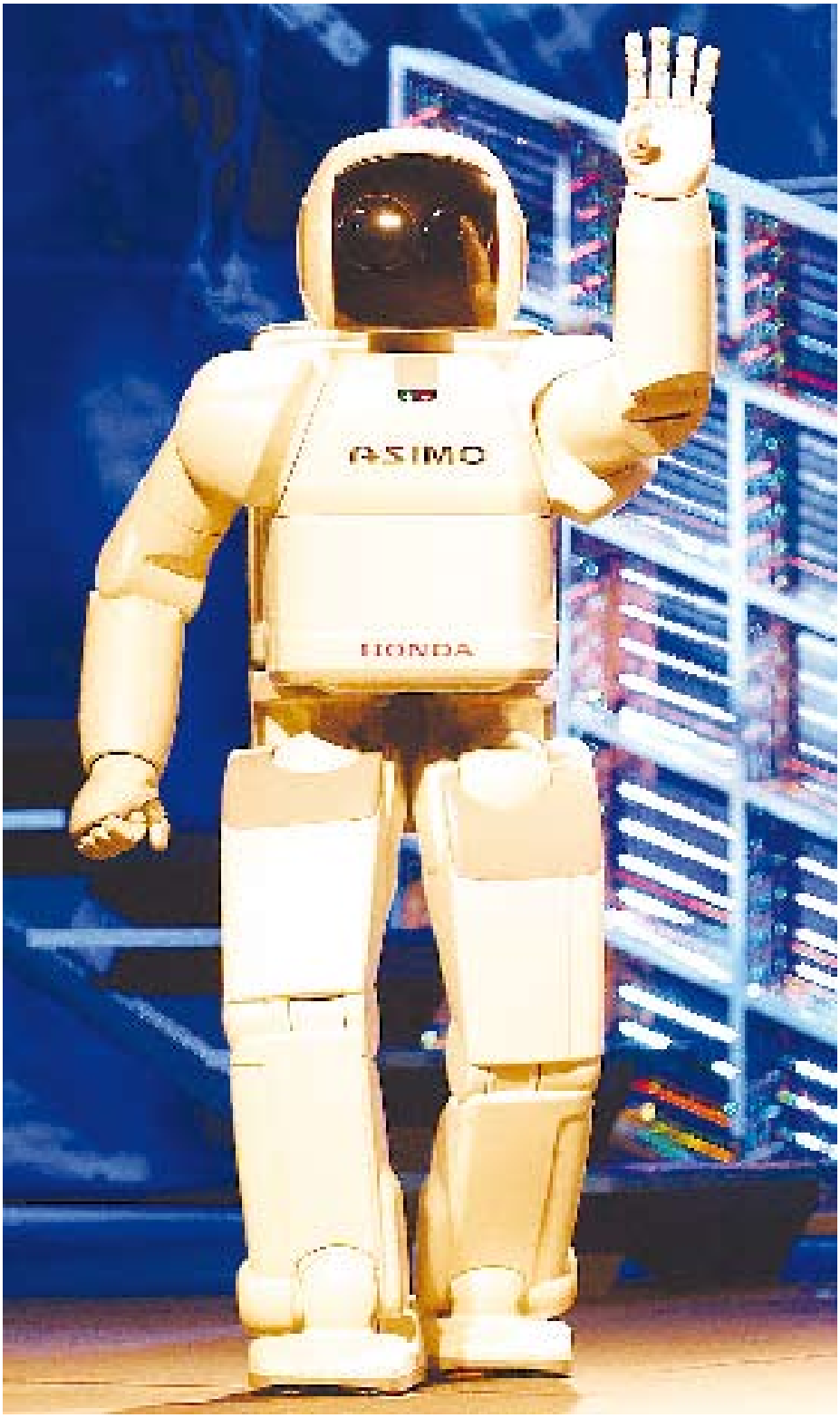
Mechatronics and robotic research: Prof Glen Bright

Professor Glen Bright's work at UKZN – largely sponsored by the National Research Foundation (NRF) – has involved thinking about the manufacturing systems of the future for the last 20 years. "Part of our strong motivation for funding was to always present an application for research into the manufacturing systems of the future, so that when we get there we will already know what we want," he says.

Bright leads the mechatronics group of the Mechanical Engineering department of UKZN. "Our vision has always been to raise the quality of life of South Africans. That is basically the bottom line. For that reason we have collaborated with a lot of industries, Bell Equipment and Toyota Manufacturing," he tells the delegates. "Our mission: To be globally competitive in manufacturing, using mechatronic principles or mechatronic engineering for advanced manufacturing systems."

Bright tells us what, in his view, mechatronics is: "For us mechatronics is about integrating. We integrate systems. We integrate mechanical engineering, electronic and electrical engineering and software engineering. What we used to do is we would research an area, like mechanical engineering, and then use commercial off-the-shelf electronics to control it and then software programmers to program it. We do this to optimise the system." He tells us that mechatronics has now moved on though. "Mechatronics is now a design tool. We now use mechatronics principles to design manufacturing systems, for manufacturing facilities of the future."

Bright, along with several other engineers, believes that we are currently in the decade of robotics. "The most ideal mechatronic system is in fact an industrial robot. It has the mechanical articulation; it has the electronics to control it and the software to program it. These are the three core engineering principles of mechatronics," Bright explains. "So where are we now?" he asks. "In 2007 we have the ASIMO robot, which can run and climb stairs. We have lawnmower robots available to buy, vacuum cleaner robots available to buy, and its only 2007. We still have two years to go and robots are set to change all of our lives."



Asimo, a humanoid robot from Honda is already able to run and climb stairs.

Bright's view on future manufacturing? "We believe that many manufacturers will go the way of mass personalisation. They will be able to mass produce customised products."

He uses cell phones as one example. "Everyone needs a cell phone to communicate but everyone wants their cell phone to look different."

He has a vision where people order a product to exact specifications before it is manufactured. The manufacturer then incorporates these specifications into its manufacturing process and delivers the product to the customer a few weeks later.

"Manufacturers can't yet do this but as the demands of customers become more apparent, manufacturers will have to go that way," Bright predicts.

ManuFuture and global networking: Dr Anthon Botha

The extract below has been taken from the executive summary of the ManuFuture Strategic Research Agenda report, available for download at www.manufuture.org:

'A fundamental concept of the Manufuture vision is that of 'innovating production', which embraces new business models, new modes of 'manufacturing engineering' and an ability to profit from ground-breaking manufacturing sciences and technologies. The 'virtual factory' of the future will manufacture in adaptable networks linking medium- and large-sized OEMs (original equipment manufacturers) with value-chain partners and suppliers of factory equipment/services selected according to needs at a given time. Its composition will not be limited by the presumption of physical co-location, nor by a need to maintain rigid long-term relationships.

'This will demand a tremendous and concerted effort. At the heart of the new enterprises will be knowledge management, network management, and relationship management based on trust and ethics. The understanding that Europe and its population cannot forever live on a cushion of welfare underlines the fact that there is no other way into the future but to network globally in a reliable way'.

This vision from Europe is what brought the German delegation to this workshop, to begin to forge networking opportunities with South African manufacturers. "We want to discuss some suggestions about how German and South African relationships can work in future," Botha tells us. "This is very much the reason why the German delegation is joining us today."

Dr Josef Gochermann, leader of the German delegation tells us more about why they are here: "SMEs in Germany are very good at their specific technologies. They are very good at solving problems and if they are unable to operate alone then they will develop networks and groups. The problem with South Africa is that you have all of the global players here. Then you have the universities with all of their developed knowledge and research. In between we see a gap that your ministry calls the innovation gap. This is a gap for medium-sized technology orientated companies. We hope to make a direct link between companies currently working in their areas of expertise and the manufacturing future we see outlined here. For example we will be visiting the nuclear industry tomorrow morning and we have some nuclear specialists with us. That is why we are here. We can not only discuss a broadening strategy but we can directly work it out."

The Advanced Manufacturing Technology Strategy (AMTS)

"South Africa has formulated an Advanced Manufacturing Technology Strategy (AMTS) that sets the road map towards the future of manufacturing here," Botha tells *MechTech*. "This strategy outlines what is required to be globally competitive in automotive, aerospace, chemicals, capital goods, clothing and textiles and metals and minerals markets, supported by advanced materials and product technologies, production and logistics."

He adds that the importance of clean processing in terms of environmental protection, the integration of Information and Communication Technologies (ICT) in manufacturing and the role SMEs are to play in this future world of manufacturing, are also recognised as important components of the AMTS.

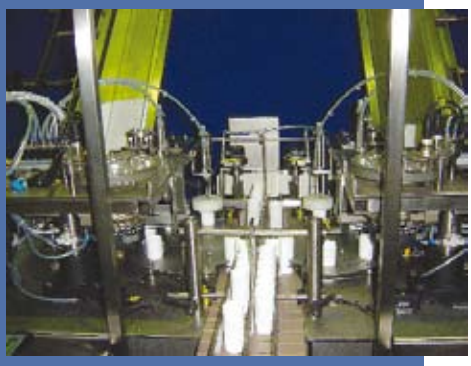
Botha continues: "The South African and German Governments are in the process of defining a bilateral programme to support advanced manufacturing. The future success of the manufacturing endeavours of SMEs – for them to become globally competitive – depends on the building of joint research and development partnerships.

"Taking into account the future scenarios that unfold, the advanced manufacturing technology trends and the required integration of intelligence into products, the future will certainly be different, but not an impossible challenge," he predicts. "South Africa is a recognised player in the global manufacturing arena, has advanced technology development and world-class market demands. Its future strategies and policies are on a par with that of Europe and it is ready to exploit partnerships in manufacturing with some of its oldest trade and technology partners," says Botha. ❑

Ingenious leaflet inserter uses roll-up technique

Ingenior, a Pretoria-based company that designs and supplies custom-built machinery for unique applications, recently used Festo to design and manufacture a leaflet inserter that uses the roll-up technique.

Ingenior's pharmaceutical client required a high-speed leaflet inserter for use on medication containers that function at a rate of 90 units / minute. The unit takes the securitainer from the line, inserts the leaflet and returns the container to line.



The Ingenior team faced two challenges. The first was to find a manner in which to divert the container to and from the line within 300 mm, and the second, to insert the leaflets to expand in the securitainer to allow space for the tablets. The system had to accommodate four different securitainer sizes and various leaflet sizes with a changeover time for system being less than 10 minutes.

"What makes this system unique," says Ingenior director Andries van Jaarsveld, "is that the inserting machine uses an ingenious roll-up mechanism that first rolls the standard pamphlet into a tube and then shoots it into the container."

The pamphlet expands and is positioned tightly against the inner wall of the container, minimising the space needed by the insert and enabling the container to be easily filled with tablets and capsules. The system makes use of its own up-and downstream line control. Van Jaarsveld says this means the leaflet inserter can control the feed of empty securitainers into the system, as well as the outfeed of filler containers out of the system.

It also features an onboard display screen that enables users to adjust time delays without changing the programme. All function errors are displayed on the screen to assist the operator with fault finding.

Festo supplied pneumatic linear drives, double acting cylinders, rotary actuators, valves, venturis, vacuum cups, a pressure regulator / water trap, speed controls, fittings and piping for the project.

Van Jaarsveld says the line speed has increased dramatically due to the fact that previously, the leaflets were inserted manually. "The system is also capable of doing a 100% quality check, rejecting containers without leaflets or upside down containers," he confirms.