

# Excellence and innovation reign ...

## In preparation for the real world

Four years on and the Siemens Cyber Junkyard (CJY) challenge has grown from relatively anonymous beginnings to being an industry recognised event, a standalone initiative bridging the gap between learning institutions and the realities of the market place. This year saw unprecedented entry levels with 10 functional projects in the finals displaying what the industry needs most – innovation, quality and a multi-disciplinary approach that prepares students for the 'real world'.

The awards ceremony at Emperors Palace in October was a grand culmination to the R2,5 M that Siemens Automation and Drives (A&D), Festo and SITRAIN invested in the 2006 challenge. As the showpiece for the best young talent in the country, the competition gives students the chance to be noticed by top industry players and a distinct advantage over their academic peers – they are more prepared for life after the lecture hall.

CJY administrator Conan Jones says, "Conceptually, we are trying to bridge the gap between educational institutions and the real world. We find that students who compete in the challenge can enter the hiring workplace environment and immediately be beneficial to a company, rather than being a teaching load for six months before they can add value."

The challenge gives students practical experience with a wide range of products they may encounter if they stay in the field of manufacture or automation - equipment they might only have heard of in lectures such as Programmable Logic Controllers (PLCs), touch panels, motors, drives, pneumatic equipment and actuator and sensor interface (AS-i) bus technologies. Apart from growing practical experience with new technologies, the challenge aims to develop a wide range of essential human skills and the scope of the human-machine interface (HMI) has broadened from year to year.

In its first two years, the challenge tackled particular industry problems – the detection and control of anti-swing mechanisms used in dock-yard cranes in 2003, and accurate bottle filling systems for the food, beverage and bottling industries the following year. 2005 saw the competition move away from particular industry needs towards conceptualising and encouraging ingenuity with regard to automated warehousing, barcode scanning and the automatic storage and retrieval of products.

This year CJY threw in a couple of curve-balls to encourage innovation and a multi-disciplinary approach with a strong mechanical engineering element.

Commenting that it is often light-heartedly said one can take electrical engineers and apply them to a mechanical challenge rather than the other way around, Conan says, "We aimed to put pressure on the students and the institutions to make up a multi-disciplinary team, to have mechanical, electrical, instrumentation, industrial, even your IT students writing the software and programming the HMI." Chief adjudicator Stefan Lamprecht reiterates this: "We encourage an inter-disciplinary approach to stimulate collaboration because, as you know, when you go out there into practice you're not going to be surrounded by people who think like you. You're going to

need to collaborate with various disciplines."

Across the board, entrants found the mechanical aspect tough, but rewarding. Wesley Allan of the University of Johannesburg's Doornfontein campus (competition runners-up) says, "We're all electrical engineering students so actually building the machine was the most difficult. We have a computer specialist on our team and we had him doing mechanical stuff like drilling and working with bearings. When we started he couldn't drill a straight hole." Sibusiso Radebe from Mangosotho University of Technology also enjoyed the learning curve: "Mostly we learn the theory about proximity sensors which we had never even seen before. Now I know how to use it, how it functions."

However, it proved problematic for many institutions to adopt a more multi-disciplinary approach and reaching inter-faculty agreement was a major stumbling block. Conan says, "Even though semesters run at the same time, different department syllabuses run out of sync with each other - projects don't occur at the same time. So for CJY to give a project to an institution and expect a mechanical and electrical engineering student to work on it concurrently when their course commitments are out of sync is really difficult. The institutions that have done really well are those that have adopted a multi-disciplinary approach and agreed across their faculties to allow a select group of students to work outside inter-faculty limitations." But according to Conan, some 70% of institutions struggled to facilitate this.

This year, students were challenged to tackle the concept of assembly – a very broad field that includes anything from crimping the lid onto a beer bottle to assembling a complete motor vehicle. The objective was to build a machine that automatically assembles a four-component key ring with one component being manually applied to the machine, thus introducing the need for a strong safety factor in design.

"Machine safety is pending in legislation and we wanted to teach students before they enter the market how to implement safety and the types of products involved in safety," says Conan. "Interestingly, we saw all the entrants choosing very different options when it came to selecting which of the four components would be applied manually." Any one of the four components – a stainless steel key ring tag which functions as a bottle opener, a U-shaped aluminium clasp, the conventional 32 mm key ring and a pair of identical plastic rivets which had to be perfectly aligned in order for them to engage – had to be applied manually and this demanded innovation, the primary force driving the industry.

At the awards ceremony, Dr Peter Drexel, board member of Siemens A&D, noted, "It is said that the technological advancement that has occurred in the 75 year period between 1925 and 2000 will repeat itself in the space of 13 years from 2000 to 2013. This is driven by the rate of investment in innovation." To catalyse innovation, students in the competition are left pretty much on their own. Conan says, "It's called a 'challenge' for a reason. We show them how each product works in its fundamental mode but each one has many characteristics and

specifications that need to be optimised. There are interconnectivity challenges. So we basically show students how to turn it on and where the buttons are and after that they must work it out for themselves."

### Real-world criterion

This year, Siemens A&D and the team of adjudicators changed the weighting of judging criterion away from the quantitative performance of a system to adopting a more homogenous approach. Judging parameters were far more complex than in previous years. According to Stefan, deciding on the winners was also much harder than in the past because there were a lot more functioning models – in fact, all 10 projects "at least had a pulse".

Conan reveals just how intense the process was. "We looked at a number of factors from the electrical and mechanical design, the team dynamics, even soft issues like what access to resources they had. Leadership, documentation, did everyone get equal role responsibility, or did some feel they were doing too menial a job, were all taken into account. Then aesthetics, good industry practice, wiring, safety issues which were a primary criterion, and obviously the vital minutiae like were there sharp corners and edges. We looked at a lot of other aspects such as access to a workshop and trained technicians, to Siemens A&D System Integrator (SI) partners, to funding, financing, did they have compressed air, electricity, and so on."

Judges scrutinised the way that the PLC programming and optional SCADA programming and the structure and design of the pneumatics were implemented. All teams were given the same components but the way they decided to use these, required imagination. "Every single team found a totally different approach. We looked for anything that stood out from the rest," says Stefan. "We also encourage highly professional communication. As a technical person, you have to be able to sell yourself. You might be a technical genius but it doesn't help if you can't convince your client that you do indeed have the right solution. So the technical and verbal presentations are both essential."

The judges looked for a strong team dynamics element. "It's all about showing them the value of working together. Was this a one-man show or was it really a team effort?" says Stefan. Students commented their degrees don't teach teamwork and this was a vital lesson for many. Morne Odendaal of third-placed Nelson Mandela Metropolitan University says, "Teamwork was essential to finishing the project and sticking to it with the same team throughout was really important."

### And the winners are...

North-West University (Potchefstroom Campus) emerged as the clear winners. Of the possible 120 points allocated to the various aspects of the adjudication, they achieved 108. The aspects that they excelled in above the other competitors were mechanical design, PLC functionality, HMI functionality, safety features, innovation, wiring and above all, the team dynamics.

The winning team won R100 000 worth of Siemens A&D equipment and R30 000 worth of Festo equipment for the institution. The individual students and the supervising lecturer each won three weeks worth of training courses from Siemens A&D SITRAIN facility (worth approximately R20 000 each). They also walked away with a Fujitsu-Siemens LOOX PDA N830 - complete with cellphone capabilities GSM/GPRS/EDGE/UMTS for 3G, also GPS positioning. Only 20 of these are in the country at present, seven of which are in the hands of these students!

Runners-up, University of Johannesburg - Doornfontein campus, made their mark for their HMI functionality, im-

plementation of the Festo equipment and also scored highly for their mechanical design and PLC functionality. This realised them a score of 93. What was impressive with their assembly system, was the 10 piece multiple assembly mechanism, using the same actuators to assemble more than one item at a time.

The runners-up won R20 000 worth of Festo equipment for the institution. Students and their supervisor also netted two weeks worth of SITRAIN training (worth approximately R14 000). They each received a Siemens A&D LOGO! News-Box starter kit to implement some PLC type functionality at home for building automation or any other innovative application that they might apply it to.

Nelson Mandela Metropolitan University made an impact with their mechanical design, as well as their implementation of the required safety features. They also utilised the Festo equipment very well and secured the third place with a score of 79.

Third place got R10 000 worth of Festo equipment, a week's SITRAIN training per student and supervisor, as well as a Siemens branded GIGASET A140 Duo cordless phone set.

### CJY gaining momentum

"I'm really impressed by the quality of the projects this year. It's the first year we've got 10 projects at the final and they're all well worth looking at. Last year we had eight and only six of these worked," says Conan. So, why the dramatically improved success rate this year?



The triumphant North-West University team holding their cheque. Pictured here (behind L-R) Tom Webster (Festo), Manfred Heer (Siemens AG), Jacques Pretorius (NWU), Cobus Naude (NWU), Joubert De Wet (NWU), (front L-R) Piet van Huysteen (NWU), Van Zyl Roos (NWU), Francois Oosthuizen (NWU) and Lúka Potgieter (NWU).



The laser tunnel at the awards ceremony, a grand climax to the most successful challenge since CJYs inception in 2003.



Conan Jones with one of the four-component key rings. Conan believes institutions need to give CJY entrants the freedom to work slightly out of syllabus framework so that students can be exposed to real world project situations.



Having been officially recognised by the Minister of Science and Technology and various science and education councils,

"Sleep? What's that? In the last three days I've slept like two hours." Ian Basson from the Tshwane University of Technology remarking on a common CJY experience.

Conan feels that Universities, Universities of Technology and especially the students are realising the value of CJY. "The first time we ran the challenge in 2003 it was a somewhat anonymous affair but it was a success. The second year proved that the concept was repeatable and it could be run successfully again. In the third year we started hearing from our industry partners that the people they'd hired who had competed in the challenge had very useable skills. That thinking has prevailed. The word is now out that if a student puts CJY on their CV they're much more employable. What's more, they have access to our customer base representing over 300 companies."

"You can see who has taken it seriously. Finishing at the top is not because of having better students but because of having a lecturer who is passionate about CJY - he has the vision." Adjudicator Stefan Lamprecht urging learning institutions to take the challenge more seriously.

**Co-sponsors raise the stakes**

Siemens A&D brought Festo on board two years ago to supply each entrant with pneumatic equipment. This year Festo's investment of R280 000 worth of equipment (retained by the competing institutions) and R60 000 worth of prizes at the ceremony went a long way to raising the stakes this year. "In the first two years of the challenge some institutions had a wonderful assortment of Festo products, but not all entrants received these," says Conan.

**Rise to the challenge**

Next year's CJY will address a vital industry need once again. When we're urged by a popular talk-show host to turn off our

geysers during 'prime time' and roast the chicken in the microwave rather than the oven, we are reminded that the next power outage could be tonight. That's why next year's CJY has decided to draw on aspects of Eskom's Demand Side Management (DSM) initiative which is addressing South Africa's need for electricity saving.

"CJY has taught me the kind of things I should look for in life and the kind of challenges I'll be facing one day in the industry, challenges like managing short-tempered people. I've learned to manage people and to manage time." Sibusiso Radebe from Mangosotho University of Technology in KZN.

Conan says, "A large number of applications that draw a lot of power are pumping applications - the measurement of flow, pressure, level, etc. So Siemens will be bringing in aspects from their process instrumentation group for the creation of mini, scaled-down versions of their process models. So for those who want to rise to the challenge, next year's project is process models. You'll be working with bigger hardware than what we've worked with in the past two years, but I believe this will equip the students with skills that are immediately needed."

As with this year, there will be a 'tendering process' for institutions to confirm their team's motivation to participate. They have to commit to maintaining a team of four to six participants that will stay the course and finish with at least four members. At least two students should fulfill an academic requirement through their project.

"While we were designing the machine another team told us they were going to make 200 key rings in five minutes which is like one item per second, so we thought oh well we've lost this, we don't have a chance." University of Johannesburg Doornfontein campus team leader Wesley Allan - before his team came second.

"Siemens A&D can effectively only cover the costs for 10 participants so we are looking for large corporate sponsors from our key customer companies who would like to be associated with CJY in terms of their commitment to tertiary technical training," he adds.

Article compiled by Ian Fleming, journalist, Crown Publications.

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