## TuksBaja rocks

TuksBaja is certainly the project at the University of Pretoria that most benefits the professional (and personal) development of mechanical engineering students, in particular. The students attest to this, saying that they not only gain practical experience of engineering principles, but also of aspects such as finance and logistics, which are just as important in the world of work. This is especially true when TuksBaja competes overseas, which it managed to do for the third consecutive year in 2014.

In April 2014, the current TuksBaja team showed that it can hold its own against the best in the world. The Tuks team, which consisted of Reyn Kapp, Matthew Perry, Ruan van der Merwe, Kraig Wright, and Carl Becker as faculty advisor for the trip, performed extremely well, and ended in 20th place overall. This is an enormous feat if one takes into account that 100 universities from the USA (which constituted 90% of the competitors), Canada, India, Mexico, Venezuela, Iran and Egypt competed and only approximately a third of the field finished the endurance race, where TuksBaja ended in 16th place.

This international event took place in El Paso, USA, and was hosted by the University of Texas at El Paso. It was one of a number of annual international Baja SAE events. Three of the competitions are hosted by the USA. The others take place in Brazil and Korea. South Africa hosts its own local competition in October every year.

This was the fourth time that TuksBaja competed in an international event, and the team members were excited not only to represent their university, but also their country. The team from the University of Pretoria is the only South African Baja team that has managed to raise the funds in the last three years to compete internationally.

For the Baja SAE competition, all teams are provided with a 10 hp Intek Model 20 engine donated by the Briggs & Stratton Corporation. The innovation and manufacture of the rest of the car is up to the different teams. It is remarkable that no Baja car is exactly the same as any other.

The students literally build their own off-road vehicles – constantly tweaking and improving different parts to give them the edge in the endurance race and earn them maximum marks in the static design event.



→ The TuksBaja team with their sturdy car (from left): Matthew Perry, Reyn Kapp, Ruan van der Merwe and Kraig Wright.

In addition to the usual work that goes into preparing the car for an event – the students say their academics suffer a bit, as they have tight deadlines for work on the car – they have to arrange for the shipping of the vehicle when they compete overseas. They also have less time to work on the car, as the car needs to be shipped one month before the race.

Once their car is delivered – in the hotel's parking lot – they start working on it immediately to complete the final tweaks. Most of the work in assembly is done right there in the parking lot. Then the car is taken to the work area that the event managers provide for the duration of the competition. However, these work areas close at nine in the evening, and any additional adjustments have to be made quite quickly. (If a team is not finished by the time the work area closes, they need to find another working area.)

The competition consists of four sections. It starts off with the teams giving sales and design presentations. After that, there is a technical evaluation, where the judges verify that the vehicles meet the requirements stipulated in the hefty rules book. Once the technical inspection has been passed, teams can progress to the dynamic events, which generally include a hill climb, acceleration, suspension and traction, and manoeuvrability. After all these sections have been completed, the teams compete in the four-hour endurance race. This is the true and ultimate test to see if the cars can handle the harsh conditions.

Apart from the endurance race, teams can be sure that they will encounter a few problems. At El Paso, the judges found that the way the University's team mounted its engine was not according to regulations. The Tuks students had to go back to the work area to get the car up to standard overnight. Fortunately for them, they had a good relationship with the team of the Virginia Polytechnic Institute and State University (Virginia Tech), who assisted them.



ightarrow International collaboration: Virginia Tech helped out the South Africans in a big way.

The engine had to be encased within the framework of the car – it required a "minor adaptation" in the sense that they only had to weld a tube around it, so that it did not protrude from the back of the car. This was to make sure that the engine – which, of course, uses fuel – would not make contact with the ground in the event of the car rolling.

Eventually the team passed the technical inspection (in time), but the fact that they had to work on the car for so long put them at a disadvantage in the dynamic events. They had little time left for these and scored naught in most of these events.

On to the four-hour endurance race – the determining factor in this competition. The event managers always ensure that the track conditions adhere to the definition of "harsh". This year, the conditions were desert-like, with a lot of dust and rocks on the track.

The team says the worst thing was that the rocks moved when the cars went over them, so the driver could never get familiar with the track and could not anticipate any obstacles. All the teams that finished could be proud of themselves. Reyn says: "It was not so much about driving, but more about surviving." It is indeed a case of the driver's (and the car's) endurance on a near-impossible course over four hours.

## How TuksBaja compares

The TuksBaja team's achievement in the American Baja SAE competition is remarkable on a couple of different levels. Apart from the fact that Tuks is the only South African team that competes overseas, it would be fair to say that it has more obstacles to overcome than the American teams.

The budgets of most of the other teams are much bigger than the one of Tuks. The University of Pretoria provides some funding, but the team members have to obtain sponsorships to be able to compete at the level they do. Their budget amounts to approximately R300 000 a year – that includes sponsorships. As the economy is in a recession, it has become increasingly difficult to obtain this kind of funding.

Because of the limited budget, TuksBaja's car is larger and heavier than those of the other competitors, because they don't have the money to use more sophisticated materials - but it is absolutely reliable. Furthermore, they build their car from scratch and manufacture the parts for the car themselves. The Tukkies are quite proud of the fact that they cut their own gears, write their own code and build their own shocks. They also take great pride in the excellent quality of work they do, and this is why the car is so reliable. This adds an extra dimension to the students' understanding and experience of real-life mechanical engineering. Although some teams mock South Africa for building "tanks", many of them are quite amazed by the team's innovations, as most of the others simply purchase state-of-the-art parts. "Ours was definitely the cheapest of all the cars that placed before us in the endurance race," says Reyn.

## TuksBaja

Although it sounds quite simple, the Baja SAE project has to be run like a business for the team to be successful. It is an opportunity for would-be engineers to experience a simulated work situation during which they learn about aspects other than



→ The team about to unload the precious cargo (from left): Carl Becker (Faculty advisor), Matthew Perry, Reyn Kapp, Ruan van der Merwe and Kraig Wright.

engineering that influence projects and in which they develop additional skills.

Apart from building the car, the team is responsible for administration (such as submitting the entries for competitions), financial matters (they have to raise all the funds by themselves and rely on sponsorships), project management and logistics. Other skills relevant to the professional world they gain are people skills - they simply have to learn to work as an effective, cohesive team and each member has to respect and accommodate the views and ideas of the others. Generally speaking, this is not known to be a strong competency in engineers.

A slightly different skill set is developed when the team goes overseas. Being out of their comfort zone, the students quickly have to determine where they can source parts and other necessities they did not take along. They describe it as a steep learning curve and having to grow up quickly – not only on a professional level, but also on a personal one.

On international level, these students are also building relationships with

teams from other universities, especially Virginia Tech, with which they have close ties. Apart from socialising, a strong relationship for potential future cooperation is established.

This ties in with the University of Pretoria's strategy to strengthen and enhance its international academic collaboration and, consequently, its international profile.

The TuksBaja team is busy for the entire year. At the start of the project each year, engineering students across all disciplines are invited to apply to become a part of the team if they are interested. They work with the team for a while, and if they show the required commitment, they are accepted.

The University usually ends up with quite a diverse team in the sense of strengths and personalities, which is essential for a project of this nature.

TuksBaja's current strategy is to use the South African competition as a kind of test run for new innovations, and then to send a refined car to compete overseas.

Sometimes this strategy can end in disaster. Last year, for example, the

team entered its "old, reliable" car and a prototype for the South African Baja SAE. However, they were so confident that the reliable car would perform that they concentrated on the prototype and neglected to replace a vital part in the old one – and they did not get anywhere in the race.

One can see this as gaining experience, and this is what the Baja SAE is all about: gaining experience in a diverse range of skills, learning from good and bad experiences, and learning from other teams.

Kraig Wright, the TuksBaja captain, states: "For me, the most important thing about Baja SAE is not the final position at the end of the event, but rather how the team has learnt and grown from the experience. Our ability to not give up after having failed technical inspection the first time is what Baja SAE is all about."

"If you have done the Baja SAE, you are basically a plug-and-play engineer," says Reyn.

The following sponsors made it possible for the TuksBaja team to once again compete internationally:

- Sasol
- Kühne + Nagel
- Bearing Man Group
- Investmech
- Faculty of Engineering, Built Environment and Information Technology, University of Pretoria

The material for this article was provided by Reyn Kapp (final-year mechanical engineering student, member of this year's international team and driver of the car in the USA), Odette Scholtz (third-year mechanical engineering student, member of last year's international team) and Matthew Perry (third-year mechanical engineering student, member of this year's international team).

To follow TuksBaja's work, please visit its website, www.tuksbaja.co.za, or like the Facebook profile "TuksBaja". ⊖