

# drive&control

## *local*

### Pneumobile Special Edition

As a member of the Bosch Group, Rexroth pays particular attention to those initiatives that engage in raising environmental awareness, deal with the question of alternative energy sources and the efficient use of natural resources. It was this spirit that initiated the Rexroth Pneumobile Competition a few years ago. In this creative and innovative competition the participating students have to design and construct compressed air-driven vehicles before putting them through their paces at an event consisting of a number of categories and disciplines. During the course of the design and production process the students gain first-hand experience of pneumatic, that is to say compressed-air technology, while at the same time they become familiar with Rexroth products. On top of all the program presents an ideal opportunity to tighten the co-operation between the Bosch Rexroth companies and the technical universities and colleges in Hungary. The special edition of this year's customer magazine provides a round-up of all the excitement, results and all interesting facts about the III. International Rexroth Pneumobile Competition. We hope you enjoy the reading!



# The 2010 Pneumobile event through the eyes of organizers

## Thomas E. Beyer

General Manager  
Robert Bosch Ltd.



The Pneumobile competition is an excellent example of the pace of technological progress. One only has to look at the amazing improvements that have been made in the compressed-air vehicles constructed by the students over the last year.

This kind of scientific improvement and these technological developments are only possible with the back-up provided by a company capable of supplying the kind of innovative strength and technical knowledge that comes with 120 years of industrial experience. Rexroth happens to be unique in the field of drive and control technology because of its ability to provide everything from one hand that is required. There is no other company that can claim to have a combination of so much technology, so many manufacturing activities and such professional knowledge at its disposal. Indeed, Bosch and its subsidiaries have come to be synonymous with innovation, the highest levels of technology environmental-friendly operation and social responsibility. The competition in question applies and puts into practice every single one of these key elements.

I hope that all young engineers who performed so well at the Pneumobile keep Rexroth and Bosch's names in mind when in years to come they go about designing the car of the future. As for ourselves I wish that the new improvements made during the course of the construction of these pneumatic vehicles will be used in one of Bosch's Hungarian operations.



## István Ács

General Manager  
Bosch Rexroth Ltd.

Seeing students and teachers so motivated led not only to the Pneumobile competition

becoming an event close to our hearts, it also made us work on the initiative even more motivated. The success of the concept has been proved by the fact that it has been imitated both within our company and among our competitors. From the point of view of the universities the importance of the Pneumobile lies not only in the fact that they get practical support, but because they also get the opportunity to teach their most gifted students in new, more varied and exciting ways. Three years ago university and college students weren't really in a position to know anything about Rexroth. Thanks to the Pneumobile competition our polls show that 70-80% of technical students not only know about our company, but they know exactly what we are involved with. One recent development is that the University of Debrecen is considering setting up a Mechatronics Department. For our part we have established a quality assurance procedure: each of the Pneumobile competitors gets an official Drive & Control Certificate, which can be attached to any professional CV. This year's event was also witnessed by Gerhard Pfeifer, director of Sales and Marketing for the Pneumatics Business Unit at Bosch Rexroth AG., who was thoroughly taken by what he saw. I see the future of the contest in permanent innovations, so we are recently looking for a way of taking the 2011 event to an even higher level.



## István Gödri

General Manager  
Bosch Rexroth Pneumatics Ltd.

At last year's closing discussions I drew people's attention to the fact that the levels of achievement witnessed

at that particular event would not be enough to win in 2010. And so it turned out. The improved results in each of the categories were testament to the quality of the solutions the teams came up with, and the technical innovations that were made. As for the planning and the hosting of the event I would like to say a big thank you to all the volunteers in our enthusiastic and well-organized Eger-Budapest team, whose well co-ordi-

nated efforts once again meant the event was carried off with great panache. It was indeed a great honour that the town of Eger was willing once again to allow us to use the pleasant surroundings of the Érsekkert for the competition. I see one of the greatest benefits of the Pneumobile competition being that it raises young people's awareness in the importance of alternative energy sources and the possibilities lying within them. The US president Barack Obama himself has made the point of saying that those countries reliant on other states for their energy supplies could in future find themselves utterly dependent on them. The next generation of engineers could make an important contribution in tapping alternative energy resources, what might make Hungary less reliant on others.



## Géza Mátrai

General Manager  
Bosch Rexroth Pneumatics Ltd.

Looking in from the outside it's probably the enormous amount of preparation that goes into putting on the

Pneumobile competition that probably crosses people's minds when they survey the scene. But even then they couldn't imagine the efforts that were made by the hardened professionals, the respected colleagues at Rexroth's Hungarian companies, much of whose free leisure time over the previous six months had been sacrificed in the preparations for the event: from the drafting of the competition rules, through the professional consultations with the students, to the logistics involved. Then there is the two-day event itself, where the work is non-stop, and where problems both big and small crop up all the time. The greatest reward arising from all these efforts is the knowledge that, according to the feedback we get from teachers, those students who take part at the contest benefit enormously from the experience: their professional interests and knowledge deepens, their motivation increases, and during the course of the project they learn to think and work as a team.



## Endre Tamás

Main Organizer  
Bosch Rexroth Pneumatics Ltd.

While drawing up the specifications for the 2010 competition many discussions took place concerning the possibility of increasing the

technical performance of the pneumobiles, and establishing limits that would continue to guarantee safe racing conditions. For my part it was reassuring to see that the 30% increase in speed levels was accompanied by the competitors' decision to maintain both their vehicles' stability and the safety of the critical elements. One can sense the beginnings of a more subtle style of design, in which efforts are being made to get the very most out of the smallest propulsion possibilities. I feel that once again we have taken some significant steps in reaching our primary goal - namely the encouragement of even closer ties between our companies and the universities. I would like to take the opportunity to say thank you to all those Eger and Budapest colleagues, whose selfless and conscientious efforts were so important in enabling us to put on an event that was so successful and conducted in such a good spirit.



### Nikolett Menkó

Head of Marketing and Communications  
Main Organizer, Bosch Rexroth Ltd.

This year was the second at which I had the pleasure of following the progress of this prestigious and, also from a spectator's point of view, extremely exciting technical event. Looking back to its beginnings, I think it would be fair to say that the event has come an awfully long way, and not just from a technical point of view. For the 2010 Pneumobile we had a fully-rounded image, a new website, some spectacular programmes, great presentation of Rexroth products as well as photo and video competitions accompanying the main competition itself. Because of the increasing interest shown in the event in 2010 we also had to invest more time and effort into our communication. There were a number of promotional events leading up to the Pneumobile, one of which was our compressed-air theme evening on the 100 Wonders exhibition. It was an event that was attended by almost thousand people, most of whom we were to see again in Eger. Thanks to the great media attention this year there were a number of TV reports and newspaper articles devoted to the competing teams. I hope that we will go on with this tendency next year, and there'll be even more fans cheering on their university teams.



### Ferenc Bolyki

Technical Manager  
Bosch Rexroth Pneumatics Ltd.

Just looking at the designs that were being sent in you could see the general improvement: the youngsters were managing to put new ideas into practice, and that was also reflected in the final results. As for the competition itself it was just as exciting and dynamic for the third time round as it was the very first time we hosted it. Certainly the pins and needles in my feet were just as evident by the end of the event as in previous years. But it was a pleasant kind of fatigue, and one accompanied by the feeling of a job well done. In fact we are already thinking of how we can improve the Pneumobile competition even further, and we are examining a number of alternatives. One thing is for sure, we'll have to change some technical specifications: putting more emphasis on safety, as the competing machines are getting ever faster, and the drivers ever more daring.



### László Szabó

Member of the Jury, Bosch Rexroth Ltd.

I have to admit that I am totally biased when it comes to the Pneumobile competition. I have been taking part in the work of the professional jury for three years now, and in that time I have seen some enormous improvements, and met some talented students and some dedicated teachers along the way. The game has gradually begun to assume a more serious character, and the task has become even more complex, as the knowledge of pneumatics increasingly has to be accompanied by a grasp of electronics, mechanics and vehicle technology. The level of necessary knowledge is well reflected in the increasing number of competing students who are writing their undergraduate theses on topics related to the Pneumobile. And to mention some interesting facts: while there was a 6% difference of performance in the vehicles coming first and second in the endurance race, there was only a 2% difference between the first two in the speed race, and only 1% in the acceleration competition!



### Dr. András Kakucs

Support Teacher  
The Sapientia Hungarian University of  
Transylvania

As we didn't have much time to prepare, we didn't have time to remodel the frame. We concentrated instead on building a new engine. The event was run in the professional manner to which we have become accustomed. I think we can be satisfied with the results (two third places: one in the endurance event, one in the speed competition), although we did in fact win the endurance race last year. Our backdrop can be attributed to a misunderstanding that took place in the middle of the race, and to the fact that we didn't have enough time to carry out the testing on the car. This year the team was made up of students in their final year. Next year we will have some younger competitors carrying on the tradition.



### Antal Szabó

Faculty of GAME, Kecskemét College

The Dömpör, the Tűzgép and the Kecskeméti Fűtőlős team vehicles just managed to be ready in time for the competition, and unfortunately all of them missed the testing period. It was for this reason that we had to rely on creative solutions and previous measurements. As in previous years we witnessed great engineering precision, and an extremely correct attitude and approach, something we have come to expect from Pneumobile competitions. It was a great honour to be awarded with the title "Most successful technical institution" before we had to say goodbye to the organizers and our fellow competitors.

## The History of the Pneumobile - From a Three-Year Perspective

The initial idea came at one of Bosch Rexroth Pneumatics Ltd's company training courses four years ago, when one of our colleagues suggested building a vehicle run on compressed air.

While Ferenc Bolyki's idea was greeted enthusiastically by his colleagues it was general managing director István Gödri, who suggested that it would be fun to organize a competition between the various universities to actually build one. István Ács, Bosch Rexroth Ltd's managing director liked the idea, and so it happened that in 2008 the two companies organized the first competition. The Pneumobile, Hungary's first major compressed-air vehicle competition, has been held every year since then.

The engineering students at the universities and colleges liked the idea immediately. The first-ever event was held on the premises of Bosch Rexroth Pneumatics Ltd. in Eger. Eighteen teams entered for the competition, sixteen of which actually made it to the starting line. The tracks were marked out on the smooth asphalted surfaces of the service roads in the factory precincts, and it was upon these tracks that the early pneumobiles competed in the speed and endurance competitions. Even though it was a car race, none of the vehicles bore the slightest resemblance to a Ferrari or a Porsche. Nobody actually minded, as it was more a test of the engineers' ingenuity in exploiting an alternative energy source than a quest for horsepower. The first compressed air-powered cars tended to look something like this: three or four bicycle wheels attached to a steel frame, upon which a plastic seat rescued from the student hostel scrap heap and a safety belt were attached. Behind the seat was the air-driven engine and its appendages, and somewhere amongst it all a standard ten-litre gas canister, into which two cubic metres of air had been compressed. It goes without saying there were all kinds of bicycle parts in evidence apart from the wheels: gears, breaks, cables, frame elements, even a bell in one case. In addition there were references to bodywork here and there, the chosen aesthetivarying from the wheelchair and the classic motorbike to the Mars-mobile style. Although in the intervening



two years much refinement has taken place in the technical sphere, the municipal dump school of car design has continued to predominate.

The hands-down winners in the I. Pneumobile Competition was the team of the University of Debrecen team, DE-AMTC. They won the endurance competition, covering more than seven kilometres on their one bottle of compressed air. The fastest vehicle, GAMF SZPSZ, belonged to Kecskemét College, which managed a speed of 25 km/h in competition, although it had reached speeds of 28 km/h in practice. The construction award went to one of the teams, the Gyalogkakukk, representing the Budapest University of Engineering and Economics, while the BME's other team, Villanyos, won the spectators' prize, which went to the team cheered on the loudest by those present. The volume of the cheers was specially recorded using a special measuring device.

The II. Pneumobile Competition in 2009 was accompanied by many innovations. There was a new venue, the event moved from the factory courtyard to the Érsekkert situated right in the heart of city. Although the baroque park had never previously hosted a car race, Bosch Rexroth gained permission to put one on. After all, the quiet compressed-air powered vehicles emit air rather than carbon monoxide. Thirty teams competed in the 2009 event, accompanied by 131 dedicated team members. The competition went international, as four teams arrived in Eger from Tîrgu Mureş and Oradea in Romania. The organizers, the competitors and the spectators were all curious to discover how far the rationally designed, yet bizarre-looking vehicles could push the frontiers of technology. The records for 2009 were a speed of 30.8 km/h and a distance of 8.46 km, which were achieved of course by two machines. The main prize was once again won by the Széllövagok team from Debrecen, who also proved to be the fastest team as well. The team that got the furthest was the Aratók team from Tîrgu Mureş, while the acceleration contest has been won by the Tűzgép team from Kecskemét. The award for the most original design went to the BME's Gyalogkakukk team. The vehicle that stood out from the rest was a bright red two-seater sports car from Kecskemét going by the name of Lecsó, which won of course the spectators' prize.



# Spectacular Technical Solutions in 2010: Rocking Plate and Bottom Steering

**The competitive atmosphere that reigns at the Pneumobile events means that the participants are constantly forced to improve and innovate: their vehicles are getting faster and more economical by the year, and the technical solutions are all becoming more accomplished. We asked Ferenc Bolyki, who is responsible for technical matters at the event, to summarize the technical solutions seen at the 2010 competition.**

There was indeed a rich variety of solutions on show this season. Let's look for example at the two ends of the scale. The smallest piston displacement engine this year was put together by the Dömper team from Kecskemét. Although the two-cylinder, 300 cubic centimetre power source was built into an ultralight frame, it didn't produce the results the constructors had hoped for. At the other extreme end was EMKA's one cylinder, 7605 cubic centimetre engine working on conventional principles. They failed to end up on the winner's podium too, but finished in the top eight.

## So what's the ideal size for the engine?

Those machines occupying the leading positions used 2500-4000 cubic centimetre engines. It would appear therefore that this size is best suited to guarantee efficient propulsion.

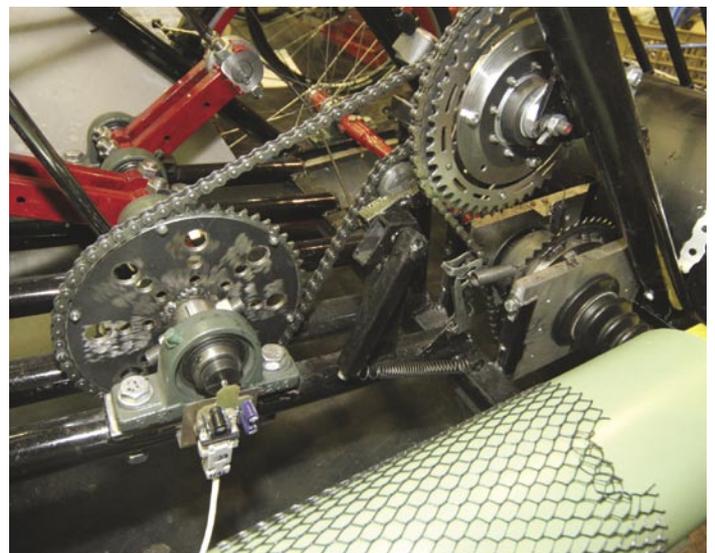
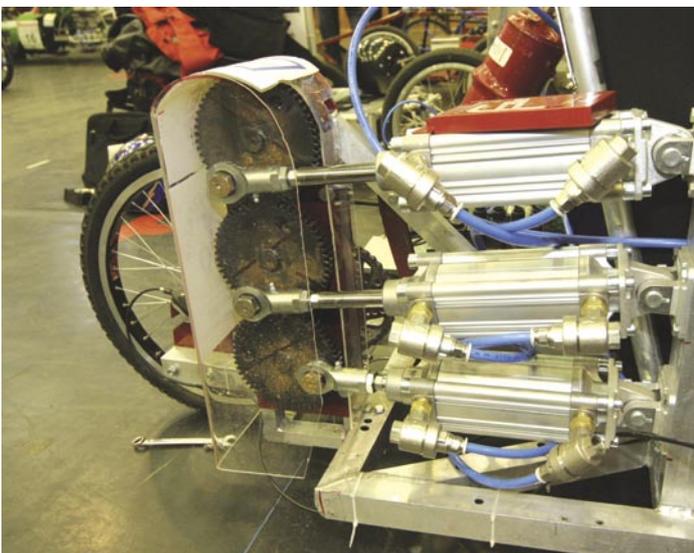
## What engine types did you come across this year?

You could find examples of just about all the engine types featuring in the teaching manuals. Eighteen teams went for some form of alternate propulsion, while the others settled for series, boxer, star and axial piston motors. One new innovation was the Székhámos team's rocking plate motor. A new tendency could be observed in so far as more and more teams have been paying serious attention to the development of electronic steering. There

appears to be enormous potential here, as intelligent steering enables you to fine-tune numerous elements on the propulsion chain in such a way that the 0.5 kW of energy stored in the bottles of compressed air can be used most efficiently. At the same time, a new phenomenon is that more teams have realized that air expanding from ten bars is enough to push back the piston to its starting point, even without filling the cylinders completely. In this way it is possible to save energy in the long distance events. More and more teams are using PET bottles as motor buffers as these cheap and light items are easily able to cope with ten bars of pressure, and with the building in of the necessary storage capacity, teams always have enough air for the speed and acceleration events. One unique solution was DF Pneumatika's pneumobile, which was steered by the driver shifting his bottom either to the left or the right. Although this solution is very unusual, there is no doubt that it worked.

## What kind of interesting technical features did the overall-winning Széllövagok team's machine have?

It was propelled by a two-cylinder, 3900 cubic centimetre engine. The division of the engine and the chassis was solved with a Trabant fixture. The driver was able to send additional air into the cylinders when starting, which ensured good momentum and acceleration on a small turning circle as well. They also used PLC steering, although it still has only a limited number of functions, primarily measuring the supplies of compressed air, thanks to which the team was able to make fine adjustments. The Széllövagok team's vehicle was well conceived and elegantly built. Its low point of gravity and massive wheels meant it negotiated corners easily, its good weight-performance ratio and the way the vehicle was specially designed to complement the power of the engine also contributed to the Debrecen team's victory in the 2010 Pneumobile competition.



# Machines in the Rain

Thirty-two vehicles, more than in any previous year, arrived for the technical handing over of the machines on Friday afternoon, when the strict professional jury made sure that all the compressed-air powered vehicles entered for the III. International Rexroth Pneumobile Competition met all the technical specifications.



In the hours leading up to the official parade at four o'clock, the Ferenc Kemény Sports Hall was a hive of activity: right up to the very last moment the teams were busy drilling and sawing. It was behind a band of majorettes that the teams and their vehicles paraded across the Érsekert, scene of the following day's competition, to Dobó Square, where, as part of the official opening ceremony, all the teams were presented to the general public. There were a lot of curious spectators, eager to see the special vehicles close up, although their inspections were interrupted by two torrential downpours. Fortunately the organizers had prepared for such an eventuality, and the cars and their teams were able to seek refuge from the storm under the large plastic covers provided. Unfortunately two of the pneumobiles' electronic steering got so wet that they were unable to make it to the starting line the following day. The parade was followed by more tinkering around on the vehicles. After the evening meal, participants either returned to their hotels for some rest, or headed out to experience Eger's night life. Some left the disco straight for the depot, which at 6am was just coming to life. It was then that work continued on the cars in preparation for the 10 o'clock start.



# Faster, further!

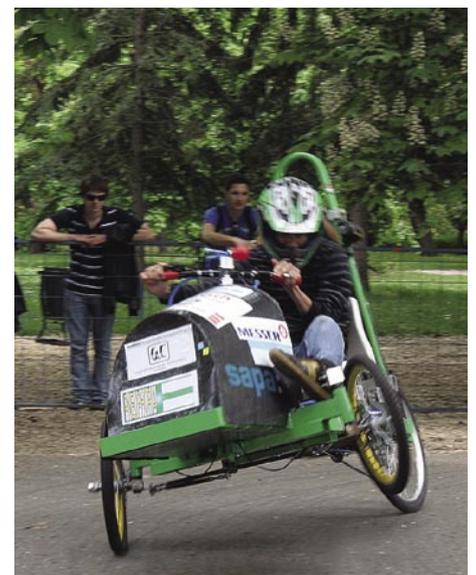
Let's take a quick look at some of the stories behind the III. Pneumobile Competition



Engineering students are not the kind of people who rest on their laurels, and with a good deal of work and effort they have further improved their machines, with the result that last year's records were broken in all categories. The weather proved extremely pleasant for competitors and spectators alike. Indeed, people came in great numbers to witness the events from the side of the track. The growth in interest in the event was also reflected in the number of accredited journalists present. Gerhardt Pfeifer, director of Sales and Marketing for the Pneumatics Business Unit at Bosch Rexroth AG., also flew in to give the opening address to greet the competitors.

The races were brightened up further by some supplementary programmes: the Hungarian Formula Student racing team was intro-

duced to the spectators, and mathematician and physicist Pál Tóth's spectacular and unconventional physics lesson proved that science can not only be interesting, but entertaining as well. The automatic cocktail-making machine, which was constructed out of the same Bosch Rexroth manufactured parts used in the pneumobiles as well, was also very popular. The speed and acceleration races proved that this was a no holds barred contest. The drivers weren't afraid to take risks, and drove their vehicles to their limits, and in some cases even beyond. Will they be able to keep up the tempo next year? Will they be able to increase the distance that can be done with a bottle of compressed air? The organizers are already curious to find out what kind of results will be reached at next year's event, the IV. International Rexroth Pneumobile Competition.



# The Entered Teams



1. Gyalogkakukk



2. Szélhámosok



3. Aratók



5. Luftgeist



6. Pneubullet



7. Csitíri Mobil Team



8. Szélvész



9. Mechtech



10. Kecskeméti Füttyülős



11. Dömper



12. Tűzgép



13. The Flying Conrods



14. Sze-Air-Kó



15. Sze Air Soft



16. Légierő



17. Debreceni Széllövagok



18. Flux-Gate



19. VFTS



20. AirCraft Team



22. Pneuphoria



23. Műszakiak



24. Pneulógusok



25. Air Force



26. EMKÁ



27. Lezs-Air



28. Entrópia



30. EMTIK



31. Aether



32. Felix



33. Lotus



34. DF Pneumatika



35. Velosziti



# The 2010 Competition Results

Category	Position	Team Name	Start Number	Team Members	Result
<b>Rexroth's Best Pneumobile</b>	<b>Main Prize</b>	<b>Debreceni Széllövagok</b> University of Debrecen Faculty of Engineering	17	Ábrahám Szabolcs Morvay Levente Sándor Szendrei László Török Zoltán	As decided by the Technical Jury and Company Management

<b>Construction Originality</b> (Bosch Rexroth and the OKM Prize)	1.	<b>Debreceni Széllövagok</b> University of Debrecen Faculty of Engineering	17	Ábrahám Szabolcs Morvay Levente Sándor Szendrei László Török Zoltán	As decided by the Jury
	2.	<b>Szélhámósok</b> University of Miskolc Faculty of Mechanical Engineering	2	Faragó Tamás Kelemen László Bodnár Zsolt Szűcs László	As decided by the Jury
	3.	<b>Luftgeist</b> University of West Hungary FWS	5	Szijártó Tamás Simon Attila	As decided by the Jury

<b>Endurance</b> (Bosch Rexroth Prize)	1.	<b>Debreceni Széllövagok</b> University of Debrecen Faculty of Engineering	17	Ábrahám Szabolcs Morvay Levente Sándor Szendrei László Török Zoltán	9348 m
	2.	<b>EMTIK</b> University of Szeged Faculty of Engineering	30	Csikós Sándor Bíró Oszkár Barát Tibor	8796 m
	3.	<b>Aratók</b> The Sapientia Hungarian University of Transylvania	3	György Zoltán Kajtár Róbert Simó István Szabó Zoltán	6601 m

<b>Speed</b> (Bosch Rexroth Prize)	1.	<b>Kecskeméti Fűtűlős</b> Kecskemét College Faculty of Mechanical Engineering and Automation	10	Vörös Zoltán Ruzsonyi Gábor Slezák Szilárd Váradi Andrea	Best lap time: 42.386 secs
	2.	<b>Debreceni Széllövagok</b> University of Debrecen Faculty of Engineering	17	Ábrahám Szabolcs Morvay Levente Sándor Szendrei László Török Zoltán	Best lap time: 43.211 secs
	3.	<b>Aratók</b> The Sapientia Hungarian University of Transylvania	3	György Zoltán Kajtár Róbert Simó István Szabó Zoltán	Best lap time: 47.050 secs

<b>Acceleration</b> (Bosch Rexroth Prize)	1.	<b>Tűzgép</b> Kecskemét College Faculty of Mechanical Engineering and Automation	12	Balogh Ádám Bakó Szilárd Kis Tamás Péter Balabás Gergely	27.772 secs (36.1 km/h)
	2.	<b>Kecskeméti Fűtűlős</b> Kecskemét College Faculty of Mechanical Engineering and Automation	10	Vörös Zoltán Ruzsonyi Gábor Slezák Szilárd Váradi Andrea	28.006 secs (39.8 km/h)
	3.	<b>Velosziti</b> Dunaújváros College	35	Tápai Ádám Kassai Dániel Tóth David Hajás Tibor	28.841 secs (38.5 km/h)

<b>Estimated Distance</b>	<b>Special Prize</b>	EMKÁ	26	University of Szeged
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<b>Estimated Maximum Speed</b>	<b>Special Prize</b>	EntRóPia	28	University of Miskolc
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<b>Most Creative Construction</b> (Eger Council Prize)	<b>Special Prize</b>	<b>Szélhámósok</b> University of Miskolc Faculty of Mechanical Engineering	2	Faragó Tamás Kelemen László Bodnár Zsolt Szűcs László
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<b>GTE Special Prize</b> (Institute of Mechanical Engineering Prize)	<b>Special Prize</b>	<b>Debreceni Széllövagok</b> University of Debrecen Faculty of Engineering	17	Ábrahám Szabolcs Morvay Levente Sándor Szendrei László Török Zoltán
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<b>ECO-Shape Design Prize</b> (Bosch Rexroth Prize)	<b>Special Prize</b>	<b>AETHER</b> University of Oradea Faculty of I.M.T.	31	Canalas Florin Letai Laszlo Buzguta Petru Pop Ovidiu
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<b>Most Successful Support Teachers</b> (Bosch Rexroth Prize)	<b>Special Prize</b>	<b>Dr. György Juhász</b> University of Debrecen
		<b>Dr. Tibor Szabó</b> Budapest University of Technology and Economics
		<b>Antal Szabó</b> Kecskemét College

<b>The Most Successful Teacher 2010</b> (Bosch Rexroth Prize)	<b>Special Prize</b>	<b>Dr. György Juhász</b> University of Debrecen
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<b>The Most Successful Institute of Further Education 2010</b> (Bosch Rexroth Prize)	<b>Special Prize</b>	<b>Kecskemét College</b>
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► Debreceni Széllövagok



► Tűzgép



► Kecskeméti Fűtűlős



► Szélhámósok

## “We learned how to deal with a project and work as a team”

The Széllövagok from Debrecen have managed to win the overall prize in all three Pneumobile competitions. One of those behind the success has been Zoltán Török: organizer, designer and constructor of the Debrecen team.

### How did you come to be part of this success story?

I saw the poster at college, and the event immediately captured my imagination. When I discovered that the participants would be relieved of doing one course my mind was set. Within a matter of days I found myself part of a six-man team. We soon managed to find two bicycles among the junk we had at home, and it was from these that we welded together the frame for the pneumobile. We built two engines for our vehicle, one for the speed event and one for the endurance test, one powerful, one efficient. We built our first pneumobile for 20 thousand forints, and made a deliberate decision to avoid any electronics in an attempt to reduce the likelihood of error or malfunction. We nevertheless almost missed the competition, as one of the wheels broke during the course of the final Friday evening practice. Fortunately we managed to find a replacement that night in Eger.

### Did you expect to win?

Our supervising teacher, dr. György Juhász, told us that we were going to Eger with the intention of winning, and that was something we did believe. Nevertheless, it still came as a huge surprise when we won indeed.

I presume that victory spurred you on ...

Indeed, it did, we were keen to defend our title successfully. As the invitations to participate in the second competition were sent out in October, we had much more time to design and construct. We prepared our designs using the Solid Edge 3D design programme, and worked out an algorithm allowing us to trace how the changes in the volume and the transmission were likely to effect consumption. We also got some sponsorship for the 2009 model, the “iron on wheels”, which had a performance of about 2kW, and a momentum of 220 Nm, which proved enough to win for a second time.

### How did you go about maintaining your advantage when designing your third racing car?

The target we set ourselves was to design a car capable of winning every category of the competition. We knew of course that this would be impossible, but it proved to be just the motivation we required. In the end we won the endurance and the constructor categories, came second in the speed race and seventh in the acceleration competition. Put together this was enough for us to defend our overall title for a second time. The reason for our relatively poor performance in the acceleration can be explained

by the fact that those competitors using motor buffers were always in possession of a little extra low pressure air that enabled them to release extra energy for acceleration purposes. As we completed the design and the construction work relatively quickly we were able to devote a lot of time to testing and fine-tuning. I believe this contributed enormously to our victory.

We covered seventy kilometres in our vehicle prior to the event, and we were able to experiment with the settings in such a way that we managed to leave the rest of the field behind.

### Are you already preparing for the next Pneumobile competition?

As I'm finishing the university in the winter I won't be able to compete in the fourth Pneumobile competition. The same goes for my fellow team members. So we need to assemble a completely new team. Fortunately there is no shortage of applicants, as students are showing an ever greater interest in the competition. My current contract at Bosch Rexroth Pneumatics Ltd. lasts until the end of January, and I'm hoping that once I graduate I'll be able to stay at the company. If that turns out to be the case I would willingly become involved in next year's programme in the organizer's role.

### What has the Pneumobile competition given you?

At the present time the teaching of engineering is all theoretical, and students don't have the chance to use their skills in practice. Thanks to the competition we have been able to accompany the evolution of a product from its birth on the drawing board through the construction to its performance on the track. In the process we have learned an awful lot. For example it was through the Pneumobile that I learned 3-D design. To that one you can add logistics, material acquisition, team work, a project mentality and management skills: just the kind of areas a practising engineer is likely to meet during the course of their work, yet do not feature in our formal training. So, the Pneumobile competition has helped to turn me into an all-round professional, who is able to hold his own even when working in a team. The great thing is that I have the chance to prove all this at Bosch Rexroth.



# Teams that won the Ecoshape Design Award



One new element in the competition specifications for the 2010 event was that the more experimentally inclined teams were invited to use elements from the Rexroth EcoShape product family when constructing their racing cars. With the help of the EcoShape elements it is possible to build the frames for machines, assembly cells, and production lines simply, easily and reliably. The light yet strong aluminium profiles can be put together in many different combinations. Indeed the accessories are ideally suited to the building of the body work of pneumobiles. The most creative usage of the Ecoshape family

was found in the vehicles put together by the AETHER, Székhámosok and the SZE AIR SOFT teams. The professional jury decided, however, that the University of Oradea's AETHER team had been the most creative of all, and it was they who took the plaudits in the EcoShape Design category. The Hungarian special award formed part of the German market launch campaign, which involved the winners automatically winning the right to take part in the Freestyle category of the German Ecoshape Design Competition. At the Rexroth International Ecoshape Competition two Hungarian teams were awarded. The absolutely winners were the Székhámosok, whose prize was the opportunity to travel to Germany. The award was presented on September 13th at the MOTTEK international trade fair.



# European Union Recognition for the Pneumobile

News of the Pneumobile competition has also reached as far as the offices of the European Union, where the Hungarian Bosch Rexroth companies' efforts to draw university and college engineering students' attention, and indeed that of the general public to alternative energy sources, has been recognized.

Further evidence has come in the form of a certificate, issued by Patrick Lambert, the director of the European Commission's Executive Agency for Competitiveness and Innovation (EACI) in March 2010. The document officially recognizes the Pneumobile competition as an official European Alternative Energy Campaign event, while at the same time praising its communicational, educational and promotional values.

The certificate also recognizes at the very highest level the activities undertaken by Bosch Rexroth Ltd. and Bosch Rexroth Pneumatics Ltd. in the field of sustainable development in the interests of the community.



# Pneumobile Study Trip with Rexroth Headquarters and Other Places of Interest

The III. International Rexroth Pneumobile Competition category-winning students and their supervising teachers took part in a four-day study trip.

The destination for the 50-man team was again Germany, where among other things they visited some Bosch Rexroth facilities. Apart from the official activities there was also time to do some sightseeing, and to watch the World Cup final. It came as a great relief for the participating gentlemen that the bus got to the hotel just in time for the beginning of the match, and so it was that after a day's journey the competition winners could watch Spain and Holland slug it out in a restaurant in the company of a nice glass of cold beer.

During the course of the first day the participants visited Rexroth Training Center in Würzburg. Although Bosch Rexroth's international educational and training centre is used primarily for teaching hydraulics and pneumatics courses of various levels and types to the company's clients, it also turned out that it is also open to teachers of Hungarian higher education. After the theoretical input in the morning the participants were invited in the afternoon to sit in on a number of pneumatic- and hydraulic-based activities, gaining first-hand practical experience of the kind of work that is going on at the headquarter. Supper was followed by an excellently planned and interesting programme: an evening tour of the town in the company of a tourist guide dressed up as town crier. Although the guide was initially greeted with rather quizzical looks, it wasn't long before everybody got in quite a good mood. The evening ended in a pub where the high spirits continued.

The programme for the third day started very early indeed, and it was scarcely dawn by the time the Hungarians were on their travels. They took an ICE train to Hannover, which took less than two hours, at a speed in the region of 240 km/h. The destination was



Rexroth's pneumatics factory in Laatzen not far from Hannover, where the travellers observed with great interest the work going on at the ultra-modern warehouse.

After lunch another exciting programme followed, the visit to the VW Autostadt of Wolfsburg. It was here that the visitors learned not only about the history of production at Volkswagen, but also got the opportunity to visit the two special revolving towers, where the cars are stored before they are taken for delivery. The job of getting the cars in and out of the almost 50 metre-high warehouse complexes is carried out by robots. A train delay meant that the journey back had its problems, but the team finally slept safely in their beds in Würzburg. The next morning the bus took them back to Hungary, almost non-stop.

The high-spirited study trip, with its professional inputs and cultural experiences proved to be a suitable end to the III. International Rexroth Pneumobile Competition.

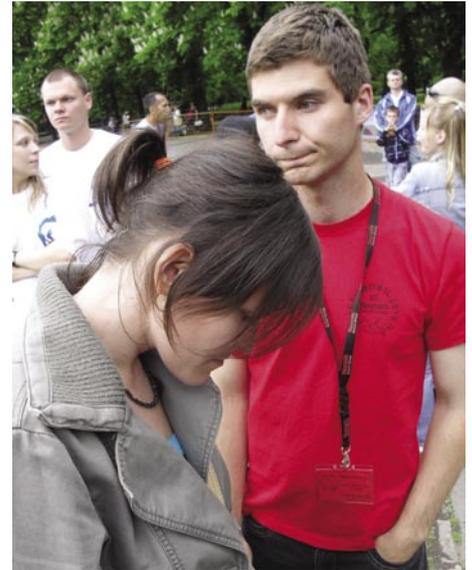


# Competitions for Big and Small

This year the organizers called for the first time for photo and video competitions for adults and a drawing competition for children on the official Pneumobile website to accompany the competition.



►Viktória Tuska: Victory



►Mária Tarnai: "Don't cry dear, we'll win something next year."

For the photo competition fourteen people sent in their portfolios. It was the job of the jury made up of representatives of Bosch Rexroth to choose the winning pictures from the forty shots. The prize for best photo went to Viktória Tuska for her picture entitled "Victory", which immortalizes the Debrecen Széllovagok victory celebrations. Viktória's other pictures also stood out from the rest of the field. The jury also recognized Sándor Kádár's photos, whose use of the motion-blur technique meant that he was able to capture the feeling of speed experienced by the spectators at track side, and Mária Tarnai, whose study of the reactions of those teams not fortunate enough to make it onto the winning podium, was entitled "Don't cry dear, we'll win something next year."

The video competition was a challenge to those involved with making films: they had to say something interesting, exciting, entertaining about the Pneumobile competition or the participating teams in just one minute. Three works were handed in to the competition. The etude called 'Pencil' shows the designing and construction of the pneumobile done by the Air Force team from the point of view of a design pencil. The sketch about the Debrecen Széllovagok used the tools of a quick interview and of speeding up the film to introduce all pneumobile experiences in one single minute. The video of SZE AIR SOFT featured a collage done out of photos to show the team and the process of construction. In terms of creativity these teams came up to their vehicles, all three videos were really smart and artful. The jury made up by the managers of Bosch Rexroth finally decided to give the first prize to the production titled 'Pencil'. The videos can be seen at the official website of Pneumobile.



►Sándor Kádár's picture

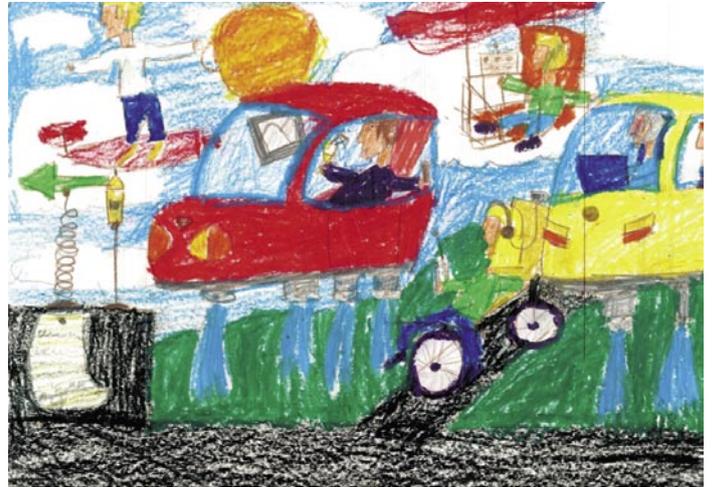


► Antal Szabó: Yellow vehicle

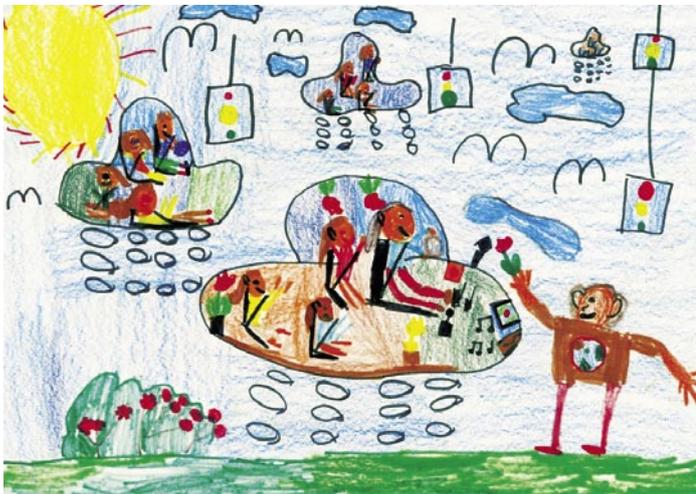
# The Future through the eyes of a child

The organizers advertised also a drawing competition for school children of Eger covering two topics:  
How will we travel in a hundred years' time?  
How can we help to save the world?

Children were asked to give drawn answers to these questions. From the works that can also be seen on the website it is obvious that according to children air will play a big role in the transport of the future. Rather than supplying the power propelling the machines, it will provide the environment in which vehicles will travel: in fact almost every single entrant drew a flying machine of one kind or another.



► Komáromi-Nagy Márton



► Marczis Gréta



► Hüse Alexandra



► Molnár Csenge



► Szíva Bendegúz - Tiecez Attila

# The Competition in the Media

The media's interest in the Pneumobile competition has been growing, something you can see in the number of articles that were written about it this year. We decided to have a look at some of things we found in the printed and electronic press.

## Racing, pneumobile, love

When that point comes when the Earth's oil supplies appear to be showing the first signs of drying up, scientists frantically set their minds to the task of finding other more environmental-friendly solutions. With the support of the Bosch Rexroth companies Hungary has managed to create an ever bigger stage for those wishing to experiment with the possibilities of compressed-air driven vehicles. At this year's event nearly 130 competitors took part with 33 pneumobiles, representing 15 universities and colleges.

<http://www.egriszin.hu>

## The pneumobile is on its way

Finally a piece of imaginative design, where you can see your plans and ideas come to life! At university it tends to be the case that the student's role ends when the designs are handed in. According to the young men involved the acts of creation and execution are all part of one and the same experience for which it is well worth sacrificing the time and effort invested in one or two one-night stands.

Autópiac, 20th April, 2010

## Competitive Spirit from a Bottle

It is at the centre of operations in the town's sports hall that the strict jury checked whether the cars entered met all the technical criteria. It was here too that those teams that got a clean bill were given their starting numbers. From there it was a question of following the majorette band, and accompanying the military band to Dobó tér for the official opening ceremony. I told a number of teams to take a plastic sheet with them, as there were dark clouds arriving from the north, which in Eger means only one thing: heavy rain. It goes without saying, they didn't heed my warning. Fortunately, however, the organizers also had some sense, and were able to distribute plastic covers when the rain finally came down in the closing minute of the ceremony. Whether they had plastic sheets or not, two teams' sensitive steering devices got soaked. They weren't particularly happy when they spent most of the night working on their vehicles while most of the field went off to karaoke at a nearby disco.

<http://totalcar.hu>

## The pneumobiles warm up for the event with a parade

There was a wide choice of compressed-air vehicles to choose from this year. In weight they varied from ten to eighty kilograms, one had a boxer motor, but there were also traditional four-cylinder engines as well. Many put their faith in tricycles, there was even one designed in the shape of a rain drop. In his opening address István Gödri general managing director of Bosch Rexroth Pneumatics Ltd. in Eger pointed out that the Bosch Group's firms are the second most popular among the country's engineering students. Bosch invests ten per cent of its income in research and development, for the purpose of educating the next generation of engineers.

<http://heol.hu>

## Are pneumatic vehicles the future?

Just as in any other motor race, the machines put a strain on the ear drums of spectators. However, here it's rather the sound of huge gasps of air than a roaring engine that you can hear. Occasionally the sound of groaning engine parts resulting from the pressure exerted on the cylinders, or the clattering of the gears, adds a bit of variety to the steam concert. Or even caused by some supporters who use compressed air in an alternate way to blow their horns...

<http://www.vezess.hu>

