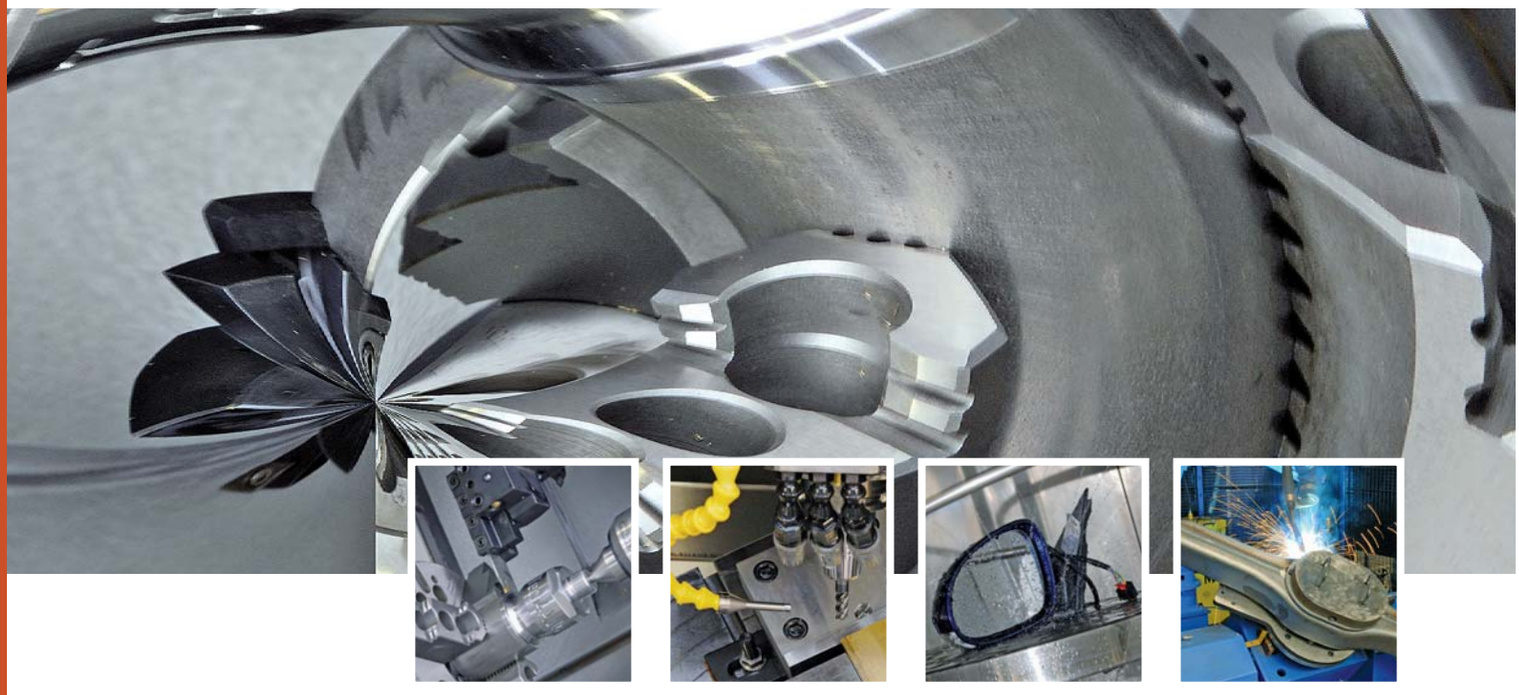
JRET

REGIONAL UNIVERSITY
KNOWLEDGE CENTER
FOR VEHICLE INDUSTRY
SZÉCHENYI ISTVÁN UNIVERSITY GYŐR



Annual Report 2008

Péter Pázmány program

Established by the support of the National Office for Research and Technology.

NKTH
Nemzeti Kutatási és Technológiai Hivatal

OUR PARTNERS

SZÉCHENYI ISTVÁN UNIVERSITY
GYŐR

Széchenyi István University
9026 Győr, Egyetem tér 1.
www.sze.hu

RÁBA

RÁBA Axle Ltd.
9027 Győr, Martin út 1.
www.raba.hu

Borsodi Műhely Ltd.
9027 Győr, Juharfa u. 8.
www.borsodimuhely.hu

visiocorp

Visiocorp Hungary Lp.
9245 Mosonszolnok,
Szabadság u. 35.
www.visiocorp.com

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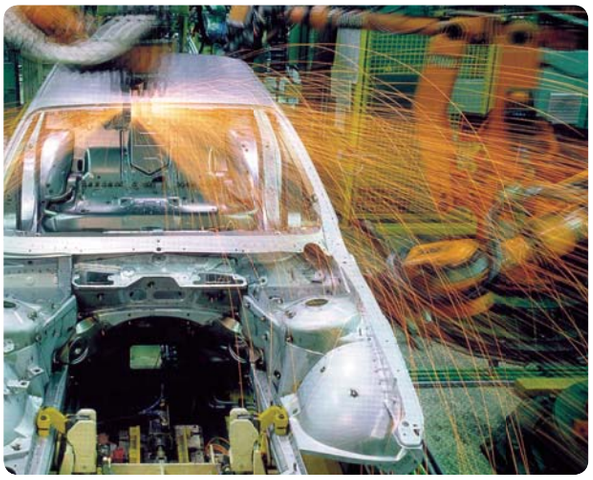
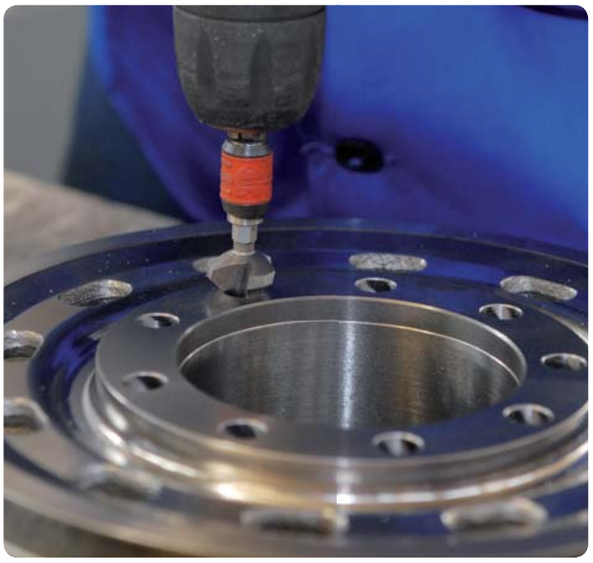
Mission statement of the Regional University Knowledge Center for Vehicle Industry

The mission of the Knowledge Center is to act as a scientific and technological innovation center in the field of vehicle industry in cooperation with the economic sector, to operate an outstanding research and development network in the region and thereby to enhance the country's competitiveness and to support the region's economic development.The Knowledge Center offers a research infrastructure and human resources that are available for every enterprise in order to develop and implement new technologies as well as to create competitive automotive products.
In the long-term the organization intends to operate as a center of excellence, which is one of the determinant factors in automotive innovations in the Austrian-Slovakian-Hungarian border region.

Széchenyi István University's mission statement

Széchenyi István University wishes to take on an initiative and innovative role in the great challenge of the 21st century, in the deployment process of the knowledge society. Their establishment was primarily based on the future social and economic needs of the development in Upper Transdanubia. Their greatest ambition is to become a knowledge center that serves its region – and thereby the country – with its vast educational, research and development on offer. They assume an initiative role in enriching the cultural and scientific life in Győr and its surroundings. In the interest of their mission:





With the results of their scientific activities and with experiences acquired through their application they contribute to the fact that the students acquire the most modern knowledge, which is also applicable in practice and thereby building a strong base for their professional career.

By creating the efficient conditions for life-long learning, they offer numerous opportunities for continuing education in order to maintain the competitiveness of the knowledge already acquired. Through their doctoral schools and other scientific and artistic workshops, they systematically improve their lecturers' and researchers' scientific and artistic preparedness, respectively. They make sure that the community of lecturers and researchers is renewed and its structure is adapted to the ever-changing tasks. By expanding their international relations and through their activities, they integrate into the domestic and European scientific community and the institutions of higher education.They maintain constantly expanding, intensive relations with the economic sector. With their scientific activity, they support the development of their manufacturing or service activities and help reinforce their competitiveness. They actively participate in acquiring the resources necessary for their activities by offering research services and by maximally utilizing international tenders and other opportunities.

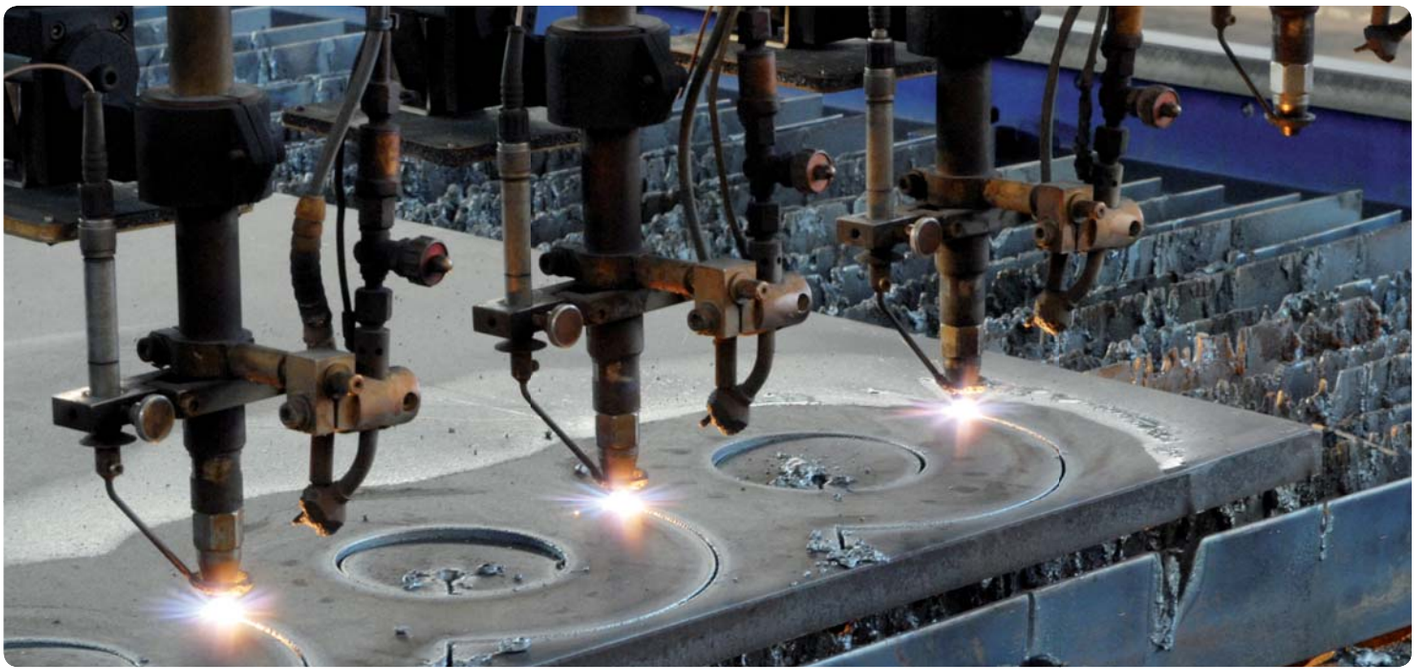
Based on their quality development program, they constantly make sure that there is an effectively and economically operating organization serving the students' and partners' needs to the maximum.

Overall aims (strategy)

The Regional University Knowledge Center for Vehicle Industry serves the research and development needs of the automotive industry belonging to the economic catchment area of Győr. This concentration has a nationally outstanding role as 57% of those employed in the domestic automotive industry work in the Central and West Transdanubian region. Within this, the activity of Győr-Moson-Sopron County in the vehicle industry is 4.7-fold compared to the national average.
Internationally the production of the Central Eastern European car manufacturers will continue to increase. At the same time there is expected to be a strategic reorganization in the division of labor between the end product manufacturers and the suppliers for the benefit of the latter, which will mean an especially favorable position for the small and medium enterprises involved in the supply chain. Concerning Győr and its catchment area, these tendencies of development are expected to result in an even more dynamic boom, which will generate a considerable need for R&D activities. In line with the development of the regional and European vehicle industry, the Knowledge Center considers the predominance of three key aspects as its goal: safety, environmentally friendly operation and economical manufacturing. The research of modern materials and technologies related to vehicle manufacturing and the indication of new possibilities in mechanical constructions both serve the realization of these aims. The technological research realizing the overall aims embrace the most important primary shaping technologies and finishing processes used in the vehicle industry. Among the primary shaping processes, polymer molding and metal forming operations, and plastic parts manufacturing technologies have a considerable role.

In secondary processes, the key areas are high-speed cutting, hard machining as well as heat treatment and surface techniques. The research on the application of modern surface treatments focuses primarily on tools. The whole scope of the manufacturing process is also represented in the research profile, including production management and logistics. The research related to constructions includes the theoretical bases of developing vehicle part-units and the concrete realization of several prototypes as well. Within this, the research on gauging bearings and gears including the search for solutions resulting in minimum noise emission are paid special attention. Vehicle unit development is oriented towards new axle solutions and their main fields of application are agricultural power machines and vehicles. Computer simulation plays a key role in both technology development and construction, which is highly useful in both modeling technological processes and in solving complex problems connected to flow and thermal conduction that take place in vehicles. The complex simulation laboratory implemented at the university moreover the corporate laboratories that demonstrate a new quality in technology development and in the realization of “design for manufacturing” constructions aim to applying and further develop these techniques by integrating the CAD, CAM and FEM procedures. The strategic aim of the center is to create world-class research potential in the outlined research field with the knowledge base of Széchenyi István University, with 8-10 full-time researchers, the university’s

lecturers and students, as well as modern research tools and methods. It helps the consortium partners and the companies connected to the Knowledge Center to develop and manufacture products that are competitive on the world market and have high value added. Besides, it is one of the Knowledge Center’s most important goals that with its emanative effect, it should promote education at the university and life-long professional education for companies. Special attention is paid to the aim that the applied technologies, the new methods and instruments should efficiently promote undergraduate, graduate and doctoral education, and the scientific workshops should provide an ideal framework for educating young researchers. These goals related to university education are supplemented by achieving excellence in knowledge and technology transfer towards the companies.

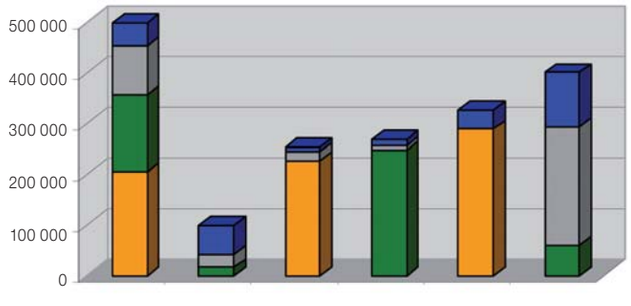


Overview of the 3-year operation of the Regional University Knowledge Center for Vehicle Industry

The professional results of the three-year research program were included in the annual reports. The aim of this summary is to present the overall results that the partners achieved during the implementation of the project and that demonstrate the effect of the Knowledge Center on the region and the domestic vehicle industry.

The appearance of the Regional University Knowledge Centers established as a result of the Pázmány Péter Program strengthened the research activity in every field and promoted the achievement of numerous valuable results. The two Knowledge Centers for vehicle industry, the EJJT operating at the Budapest University of Technology and Economy and JRET established by Széchenyi István University – complementing each other and cooperating mutually – both became places of research recognized by the industry. The commonly founded and published periodical, A Jövő Járműve (The Vehicle of the Future) is delivered to every automotive company and creates a professional forum for publicizing the innovative results achieved within the industry.

Utilization of the project partners' resources by cost types (HUF thousand), research year 2008



	Personal Government grants	Personal Own funds	Material Government grants	Material Own funds	Investment Government grants	Investment Own funds
Visiocorp	46 438	57 305	8 910	10 945	37 774	106 661
Borsodi	97 550	25 798	18 450	10 716	0	232 328
Rába	150 000	15 887	0	246 430	0	60 697
SZE	204 923	0	224 693	0	287 642	0

Going further from the general evaluation of the Pázmány Péter Program to the activities of JRET, according to external opinions, the Knowledge Center has become a key research base for domestic vehicle manufacturing. The research infrastructure and human resources of Széchenyi István University efficiently satisfy the demand of not only the consortium partners but the other automotive companies as well. The new technologies, products, manufacturing and research instruments developed and introduced during program implementation have resulted in a concentration of knowledge, which will be able to operate effectively in the future, too. A further achievement of the project is that university research has become substantially more result-oriented than it had been before.

The application of the new production and testing capacities, technologies and planning methods implemented at the corporate partners has considerably increased competitiveness in the case of all three consortium members. A significant achievement of the project is that research activity has become a part of the companies' lives, which nowadays does not only serve their own production base but has also become an externally marketable service. As a result of the common research activity, the three corporate partners could considerably increase their revenue in the market of modern products and technologies. All this has led to the growth in employment and as an extra positive effect the number of research staff has increased more than the average. As a part of the program, **Rába Axle Ltd.** developed a brand new software supporting bearing dimensioning and bearing selection, and did research on the opportunities to further develop the dimensioning methods for fatigue, which are extremely important in the vehicle industry. They have achieved significant results in the field of simulation modeling of forging technologies where they are able to

optimize the individual shaping steps already in the design phase by adapting software purchasable in the market. It is also the forging plant that will benefit from the results of the subproject aiming at increasing tool lifespan, in which area advancement has been made through advantageous tool design, the improvement of tool lubrication and the application of special surface coatings. The firm has expanded their pool of measuring instruments and purchased new design-aiding software in order to achieve the ever more important noise reduction of the axles' spiral conical wheels. The developed methods can be applied during daily activities, too. However the results most evident to outsiders have naturally been born from the product development subprojects. They have developed new axle types for road and off-road trucks for the two largest Russian vehicle manufacturers and have launched new off-road military axles in North America. They have solved an axle-mounting problem as a result nearly 300 trolleybuses equipped with Rába axles are used with satisfaction in hilly San Francisco. They have designed, tooled, tested and have been delivering the front axle I-beams of semi-low-floor buses to one of the largest Japanese utility vehicle manufacturers. Last but not least, they have further developed two agricultural axles to suit the overload resulting from larger wear, mass and engine power. The rubber tie-beam tractor axle, delivered to the American market, has been further developed for a 530 HP engine power and bigger steering force because of the bigger axial distance. In Europe the axle pair built into the 360 HP 4x4 and four-wheel-steering Claas Xerion tractors had to be considerably reinforced while the dimensions of the product could not be increased. In this axle pair, further cost-reducing constructional changes have also been implemented with respect to the brake system and the differential locks. In the meantime the engineering calculation knowledge has also been expanded in this area with respect to the power flow of the complicated agricultural axle power transmission systems, the lamella brakes and the heat load of differential lock operating systems.

Visiocorp Hungary Bt. (Visiocorp Hungary Lp.) have strengthened their leading position in mirror manufacturing within the Schefenacker Group and based on the objective set in the JRET program they established a development center and a complex test laboratory in Győr. Through the operation of the two new units, the research activity of this domestic company has increased substantially.

In the framework of the program, **Borsodi Műhely Ltd.** has considerably expanded their machining selection in the area of multi-axle and hard machining, and furthermore have also reinforced its laboratory background. In connection with the JRET program they have carried out a significant investment in the field of heat treatment, which has further strengthened their position as an aircraft supplier. The relationship among the partners has been harmonic throughout the whole project and the developed operational model can serve as an example of company-university and inter-company research cooperation, respectively. The imminent effect of JRET also motivated other companies in the region to innovate. The **Tech4Auto** conference and exhibition serving as a technology transfer forum attracts more and more visitors every year. Their number already exceeded three hundred in 2008. The companies could get acquainted with the university's and the partner companies' products, services, research results in the open laboratory events and there are more and more who take advantage of them. To summarize it can be stated that the project has achieved all its set goals and as a result, the region's competitiveness and the market access of products with higher value added have increased. The success of the project is also confirmed by the fact that the consortium – in a nearly unchanged composition – has obtained a new substantial grant for the following three years thereby the activities already started can be continued at a higher level.

Executive summary of the activities performed in 2008

The three-year program of the Regional University Knowledge Center for Vehicle Industry is based on the theory of gradual build-up. The focal point of the first year was competence development: acquiring the comprehensive knowledge related to the research topics, establishing the research infrastructure and achieving initial research results. In the second year, relying on the advanced research infrastructure and expertise, industrially utilized results and new applications were created then in the third year, as a continuation of these developments, new and internationally acknowledged procedures and equipment were developed. They allow the launch of new domestic and international projects, developing new procedures and patents and the self-supporting operation of the Knowledge Center.

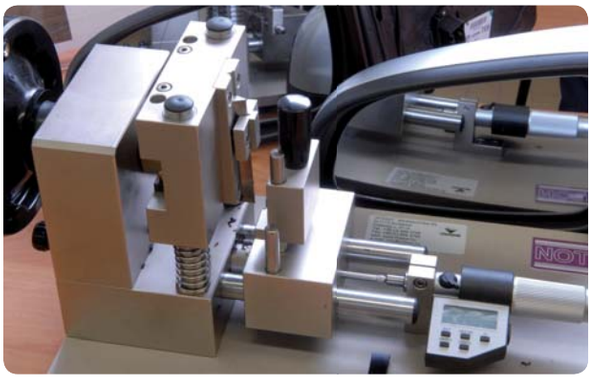
In the third year of the program, the research infrastructure continued to expand at Széchenyi István University and new development results were achieved in line with the set goals. The submicron technologies have appeared in research and testing, furthermore the machine pool of multi-axle machining has also expanded. Thereby the ability of the labs to support research and the region's economic sector has expanded further and it is able to satisfy higher and higher levels of needs. The instrument pool intended for computer simulation of the technologies has been supplemented by software that is able to serve the increased corporate demand.

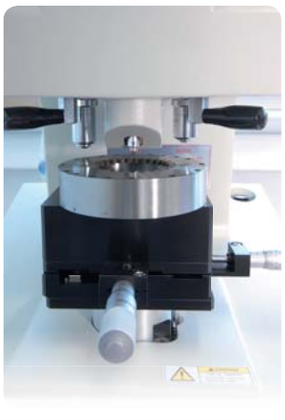
The three consortium partners have also fulfilled their research tasks planned for 2008. After adapting the hard machining technologies, Borsodi Műhely Ltd. carried out the development of the measurement laboratory and the naturalization and application of new examination testing techniques. Rába Axle Ltd. cooperated in developing primary shaping technologies and managed the complex activity called "Developing modern vehicle constructions" as the project leader. In this framework, the costs of several modern agricultural power machine axle part units have been optimized and heavy truck axles have been

developed. Visiocorp Hungary Lp. further optimized the gas-assisted injection molding technology and implemented the results of the research on the recycling process in operational practice based on the cooperation with the university and on the modern laboratory background developed within the framework of the project.

The human resource development of the Knowledge Center had already been achieved in the first year, in the second year it was further expanded and in the third year six full-time researchers, seven part-time project leaders, 19 university lecturers and engineers were employed through private contracts and 14 students per semester can be considered as permanent staff, this was complemented by further lecturers involved in the implementation of projects when necessary. Project management is performed by three full-time employees in cooperation with the university's administrative/economic organization.

From the summary it can be stated that the professional aims of the third year's activity plan have been achieved according to the scheduled program. The expedient and more focused continuation of the project will be assured by a grant of HUF 906 million obtained via the TECH-08 tender. It will be realized through the Integrated Automotive Product and Technology Development System Research (IJTTR_08) project.





Organizational structure and management

The Regional University Knowledge Center for Vehicle Industry operates as an individual business unit of Széchenyi István University and belongs to the Rector's sphere of authority. It is directly supervised by the Vice-Rector for Innovation and Development.
The Founders' Assembly, made up of the top managers of the consortium members, is the primary decision-making body of JRET. The Steering Committee, commissioned by the Founders' Assembly is responsible for completing the whole project. The president of the Committee oversees the fulfillment of the research tasks. His work is supported by the Scientific Committee, which due to its name, defines the main directions of research and development activities and assesses the results achieved.
The management leader of JRET is the managing director, whose work is supported by a project manager and an economic administrator. Financial settlement is integrated into the university's economic organization with the coordination of an independent financial administrator. The research projects are overseen by project leaders, who involve the university's lecturers and students as well as external experts in the realization process.

THE COMPOSITION OF THE INDIVIDUAL BODIES IS AS FOLLOWS:

FOUNDERS' ASSEMBLY:

Dr. Tamás Szekeres - Rector - Széchenyi István University
István Pintér - Managing Director - Rába Axle Ltd.
László Borsodi - Managing Director - Borsodi Műhely Ltd.
Zoltán Ódor – Production Manager - VISIOCORP Lp.

STEERING COMMITTEE:

Dr. Imre Czinege – Professor, President of the Steering Committee – Széchenyi István University
Dr. Károly Kardos – Vice-Rector for Innovation and Development – Széchenyi István University
Dr. Károly Szőcs – Director for Business Development – Rába Axle Ltd.
Szabolcs Horváth – Technical Manager – Borsodi Műhely Ltd.
Viktor Fekete – Head of the Injection Molding Plant – VISIOCORP Hungary Lp.

SCIENTIFIC COMMITTEE:

Dr. Tamás Réti - Professor, President of the Scientific Committee - Széchenyi István University
Dr. Csaba Koren - Professor, Vice-Rector - Széchenyi István University
Dr. Károly Kardos – Associate professor, Vice-Rector - Széchenyi István University
Károly Falvi – Scientific Advisor - Rába Plc.
Dr. Gábor Dogossy – Assistant professor - Széchenyi István University
Dr. Tibor Bercsey - Professor, Institute Director - Budapest University of Technology and Economics
Dr. Tibor Czigány - Professor, Head of Department - Budapest University of Technology and Economics
Dr. Miklós Tisza - Professor, Head of Department – University of Miskolc

JRET MANAGEMENT:

Péter Tamás Szilasi – Manager Director– Széchenyi István University
Ildikó Kóbor – Project Manager – Széchenyi István University
Viktor Nagy – PR Manager – Széchenyi István University
Mária Peterka Németh – Economic Administrator – Széchenyi István University


Dr. Tamás Szekeres


István Pintér


László Borsodi


Zoltán Ódor

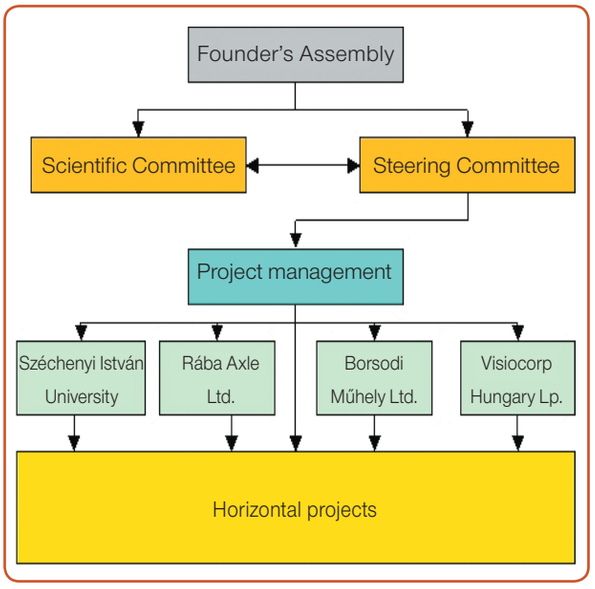

Dr. Imre Czinege

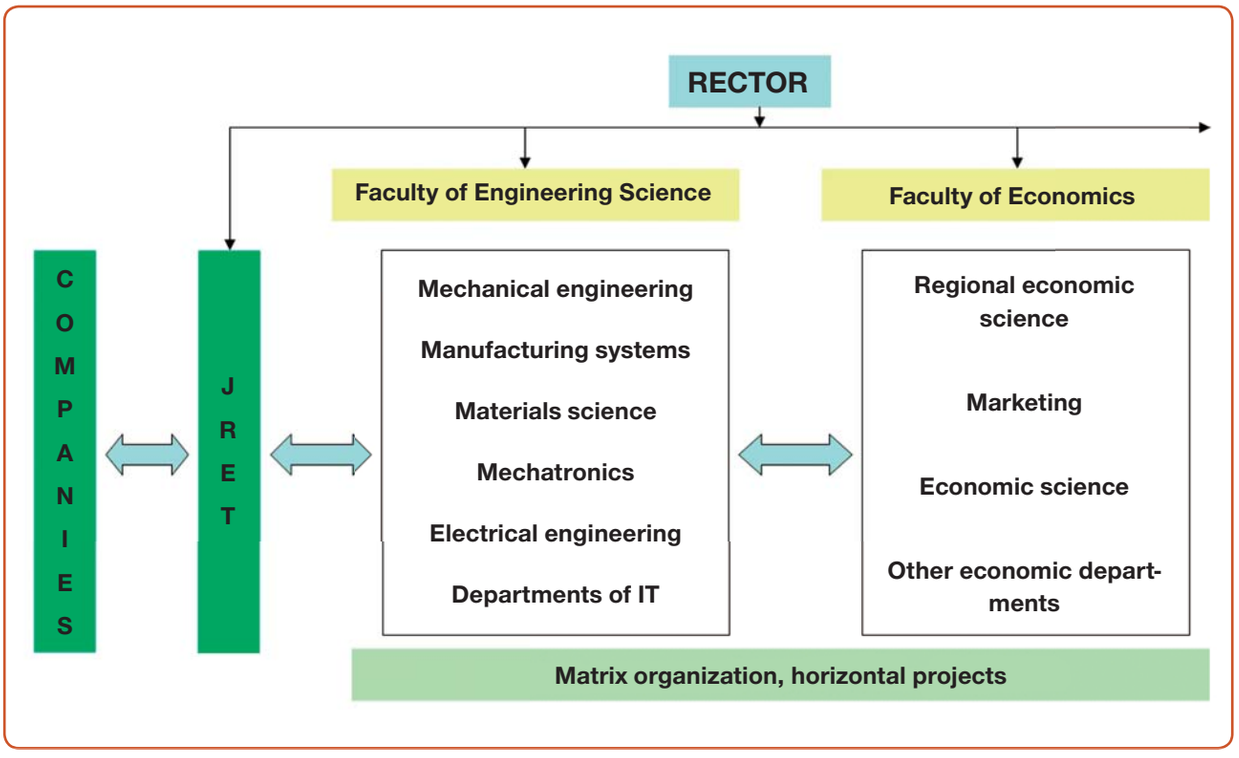

Dr. Tamás Réti


Dr. Károly Kardos


Péter Tamás Szilasi

The relationship between the managing bodies of the Knowledge Center and the organization carrying out the research activities is depicted by the following organizational charts.





Consortium partners:

The leader of the consortium, **Széchenyi István University**, is involved in engineering, economic, law, nursing, social work and music teacher education. The university's intellectual capacity and the ratio of lecturers holding scientific degrees make the institution suitable for high standard research and development activities. As a result of the above, the university is a dominant institution of the West-Transdanubian region, outstandingly developed compared to the national average, and is closely connected to the economy of Győr and its region, which has the second strongest potential for income production after Budapest. Its main specializations rely on the electronic and vehicle industry, which are remarkably strong in the region, moreover on infrastructural development and operation and on the management and international relations of the companies and public institutions working in this field. The university's infrastructural facilities, supplemented by the planned developments, are suitable for the educational and research tasks in the long run. The corporate partners of the Knowledge Center are the region's significant companies in the vehicle industry, which represent the whole cross-section of the vehicle industry's supplier structure due to the differences in their ownership structure and company size.

As a traditional large Hungarian company, the traditions of **Rába Axle Ltd.** in research and development go back to the beginnings of the hundred-year-old Hungarian vehicle manufacturing. They keep their development activity at a high level still today, which is justified by several innovation awards. The company, employing two thousand people, is present on the world market in several significant product groups. The firm manufactures axles and their components, respectively, for medium-size and heavy trucks, buses, and agricultural and power machines. The product scale includes the front, the rear, the driven and non-driven, the steered and non steered and portal axles, their most important components, main units or head assemblies, the differential gears, their gears, the I-beams and the knuckles.

As a Hungarian-owned, stable developing medium enterprise, **Borsodi Műhely Ltd**. cooperates in technological development and applications in an efficient way based on their supplier experience in high technology. Their main strength lies in high-level cutting technology, precision assembly and measurement. Their profile is constantly expanding and through their activities, the aircraft industry also appears as a target field in the work of the Knowledge Center, in addition to the ground vehicles.

Based in Mosonszolnok, **Visiocorp Hungary Lp.** (in the first two years, it was called SAPU Lp.) supplies internal and external rearview mirrors to almost all significant companies in the automotive industry. Their largest customers are MERCEDES, OPEL, AUDI, VW, Ford and BMW. Assembly technology has been developed for 12 years and the painting of plastic covers in large quantities for 3 years at the firm. As a member of the consortium, they are involved in adapting and further developing modern polymer shaping technologies. Visiocorp Lp. has developed an independent rearview mirror development basis within the company group. In this framework, they have created 13 workplaces for researchers and developed a testing laboratory operated by a 3-person staff.

Research programs (2006-2008)

R&D PROGRAM NO. I:

Research on the manufacturing technology and tools of highly complex, high-quality components for the vehicle industry

Part task I/1.: Developing modern primary shaping technologies and tools
Implementers: Széchenyi István University, Rába Axle Ltd., Visiocorp Hungary Lp.

Part task I/2.: Developing modern cutting technologies and design algorithms
Implementers: Széchenyi István University, Borsodi Műhely Ltd.

Part task I/3.: Research on technological solutions for increasing the life-span of components and tools in the vehicle industry
Implementers: Széchenyi István University, Rába Axle Ltd.

R&D PROGRAM NO. II:

Developing modern vehicle main units and researching their diagnostic methods

Part task II/1.: Research on optimized construction procedures
Implementers: Széchenyi István University, Rába Axle Ltd.

Part task II/2.: Developing special axle constructions for agricultural power machines
Implementers: Széchenyi István University, Rába Axle Ltd.

Part task II/3.: Developing special axle constructions for utility vehicles
Implementers: Széchenyi István University, Rába Axle Ltd.

Part task II/4.: Analyzing the energy flow of the vehicle main units, revealing the correlations between manufacturing technology and reliability
Implementers: Széchenyi István University, Rába Axle Ltd.

R&D PROGRAM NO. III:

Technology and knowledge transfer

Part task III/1.: Educational and training program
Implementers: Széchenyi István University

Part task III/2.: Activities supporting R&D tasks
Implementers: Széchenyi István University, Rába Axle Ltd., Borsodi Műhely Ltd., Visiocorp Hungary Lp.

The results achieved by the projects in 2008

Research in the third year of the project was again organized around two professional programs: technology and construction. Its results are disseminated to the two most important user groups – students and corporate professionals – through the educational and technology transfer project. The most important results of the professional programs will be detailed in the following sections.

In the course of the research on manufacturing technology of automotive components, a surface technique involving quality improvement and an increase in tool lifespan has been introduced as a result of the research coordinated by Széchenyi István University. The participants of the research program were FH Zwickau, IST Braunschweig (member of the Fraunhofer research network) and Rába. As a result, the lifespan of the forging tools has considerably increased at Rába Axle Ltd. Visiocorp Lp. has developed a faulty product recycling process for all material types that can be found in the factory and has checked the processes continuously. They apply molding simulation before launching new projects in order to make the tools as efficient as possible. In the field of alternative material research, the selection of materials conforming to the car manufacturers' needs has been tested using the polymer lab built in 2006. The research on cutting technology focused on the measurement methods of hard machining: as a result, Borsodi Műhely Ltd. developed the measurement procedures focusing on parts with increased precision and those manufactured for the aircraft industry. The firm's production facilities were complemented by a modern heat-treatment plant in the summer 2008, which considerably contributed to making the parts manufacturing process complete. These activities generated a significant surplus of revenue for the consortium partner. During the development of the testing background of technologies, Széchenyi István University primarily focused on surface topological research.

On the topic of modern vehicle main units development considerable results have been attained both in the applied research serving as a basis for the construction work and in the creation of the new main unit. In the theoretical basic research, a new computer-aided bearing dimensioning software has been put into application and the application of a finite element technique in the creation of new constructions has been substantially developed. With respect to experimental techniques, novelty has been represented by

the heat conduction processes going on in the axle units, which experiments have been complemented by computer simulation. During the main unit development of agricultural power machines and utility vehicles, new products have been developed and development preparations have been made for further products. The new products have already been sold, generating a surplus revenue of HUF 544 million for Rába Axle Ltd. In connection with HCCI engine development, two patents have been applied for. The most spectacular result of the technology transfer activity was the **Tech4Auto** international automotive conference and exhibition that has been organized for the third time, where Knowledge Center and its partners presented the development results achieved in 2008. The staff of the Knowledge Center reported the research altogether in 37 publications and conference presentations; out of these 15 were articles published in foreign periodicals and presentations delivered at international conferences. The key element of the educational program was to reinforce the scientific background for the MSc degree programs launched in 2007 and to support talented students in all degrees of education.

Among the indices characterizing the summary results of the research it is worth highlighting that 9 new workplaces have been created out of which 1 is a research position. Thirty-two new products, services and technologies have been created; the surplus revenue generated by the research is HUF 3.847 billion out of which HUF 1.585 billion is export. In parallel, the consortium partners achieved a cost reduction of HUF 61 million. All these results demonstrate that the project achieved its most important goals in the third year and reinforced its position in the R&D market.

I/1-1: Modeling and experimental analysis of primary shaping processes

Project leader: Dr. Ernő Halbritter (SZE-AJT)

Subproject leaders: Attila Buczkó, Krisztián Tóth, Gábor Dogossy, Levente Solecki (SZE-JRET), Ferenc Tancsics (RÁBA), Zoltán Ódor (VISIOCORP)

OVERVIEW

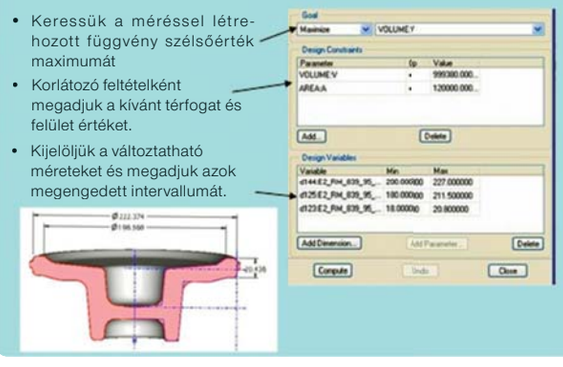
In the year 2008, the researchers used the software of the computer simulation laboratory serving technological and construction development for basic and applied research as well as for operational experimental development. The technological process simulation software was complemented by the MoldFlow Insight program and thereby the optimization toolbox of the sheet shaping, forging and plastic shaping technologies has become complete. The finite element software analyzing the thermodynamic and flow processes (Hypermesh, Fluent) were used during the development of Visiocorp Lp. and Rába Axle Ltd. whereas the research on manufacturing process optimization was realized based on the Technomatix software. The details thereof can be found in the individual research projects.

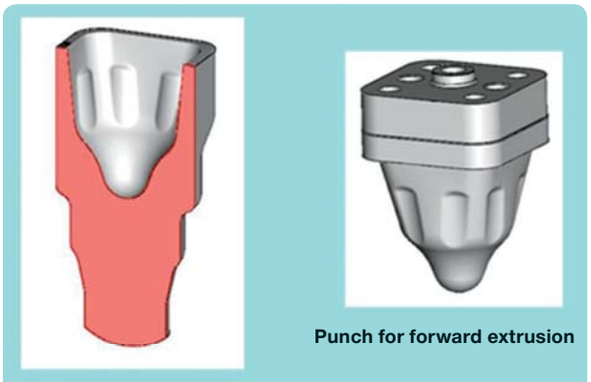
ACTIVITIES COMPLETED

Based on the previous three years' data, the evolvement of costs was examined with respect to forged pieces. The results justified the continuation of the research on decreasing the need for work of forming. During the further development of the method, the available CAD and finite element (Deform, Super Forge) software were applied

Limited extreme value calculation using Pro/Engineer software

- Keressük a méréssel létrehozott függvény szélsőérték maximumát
- Korlátozó feltételként megadjuk a kívánt térfogat és felület értéket.
- Kijelöljük a változtatható méreteket és megadjuk azok megengedett intervallumát.

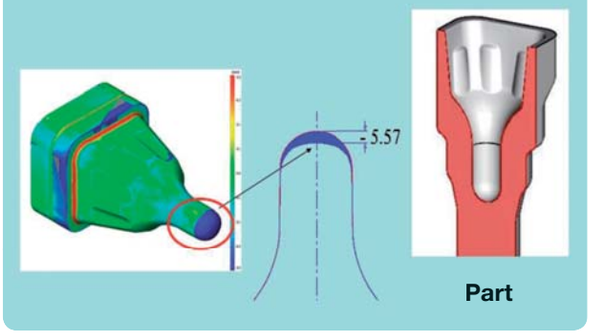




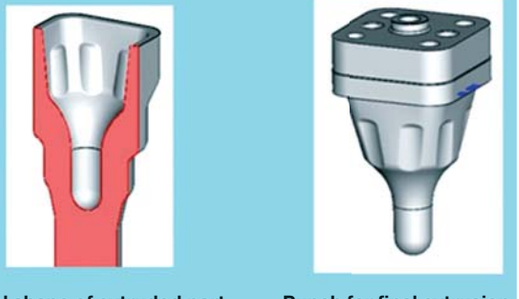
Forward extruded part

Punch for forward extrusion

Wear of uncoated punch for final extrusion



Part



Final shape of extruded part

Punch for final extrusion

and the Mathcad mathematical and the Pro/Engineer CAD software were connected in a two-directional associative way. The simulation of the plastic injection molding process was applied at Visiocorp at the launch of each new product. In terms of thermodynamic and hydrodynamic research, theoretical work has been done.

RESULTS

It could be observed that in the case of multi-hollow forging, the suitable pre-shape can be efficiently selected among the constant-volume pre-shapes based on the expected value of the pre-shape surface. The method suitable for selection is limited extreme value calculation. An experimental calculation was prepared for the application of the limited extreme value calculation within the Pro/Engineer software, which was then applied at Rába Axle Ltd. By simulating the injection molding process, the injection molding of faulty products has significantly decreased at Visiocorp.

FUTURE TASKS

The project will continue as the main research area no. 1 – Research on computer-aided design and product development (CAD-FEM) – of the IJTTR_08 research program.

I/1-2: Research on primary shaping technologies and tools

Project leader: Dr. Károly Kardos (SZE-AJT)
Sub-project leaders: Dr. Imre Czinege (SZE-AJT), Ágnes Böröcz (SZE-JRET), Attila Buczkó (SZE-JRET)

OVERVIEW

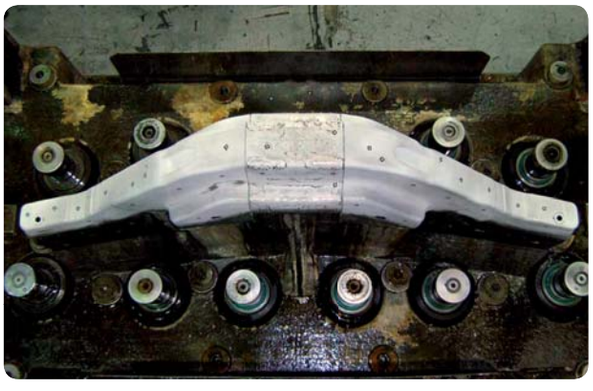
Based on the work carried out in the first two years, the development of sheet metal forming technologies and tools, as well as the testing of sheet metals led to new research results in 2008. The sheet metal testing equipment developed in the framework of the project was used for the research on the behavior of light metal alloys under high temperature. They could also be applied in the solution of industrial tasks complemented by tensil tests and measurements of the coefficient of thermal expansion carried out at high temperature as well. In addition to the integrated sheet technological development system developed earlier, an integrated production testing system has been developed as well, which was also used by researchers and corporate professionals for solving industrial tasks.

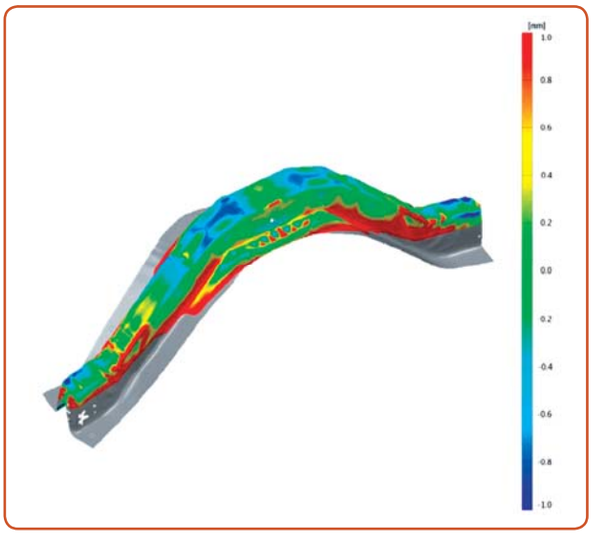
ACTIVITIES COMPLETED

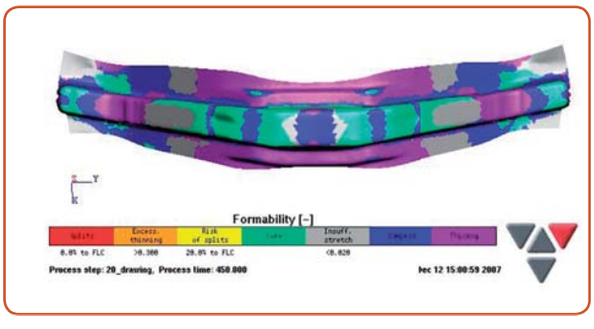
The shaping characteristics of light metal alloys (aluminum, magnesium) applied in the vehicle industry experienced at high temperature have been tested. The operability of the integrated production testing system could be tested in relation to the activity of the domestic parts suppliers. In connection with the research on sheet formability, a new method has been developed in which the extent of local deformation can be analyzed with digital optical methods while the incised test pieces are subjected to uniaxial tension.

RESULTS

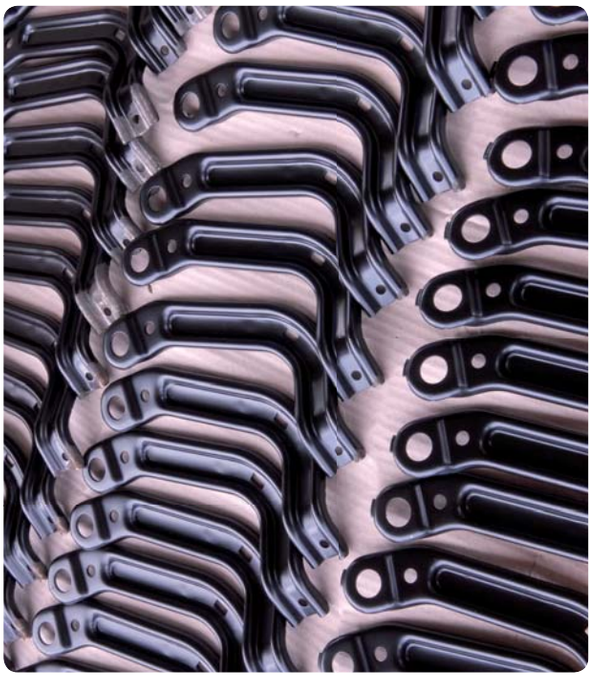
The sheet metal testing equipment and the other equipment purchased in the framework of the project have been continued to be applied in the complex testing of the strength, anisotropy and formability of sheets used in the automotive industry. The two most significant industrial partners in this issue have been Audi and Suzuki. The integrated technological development

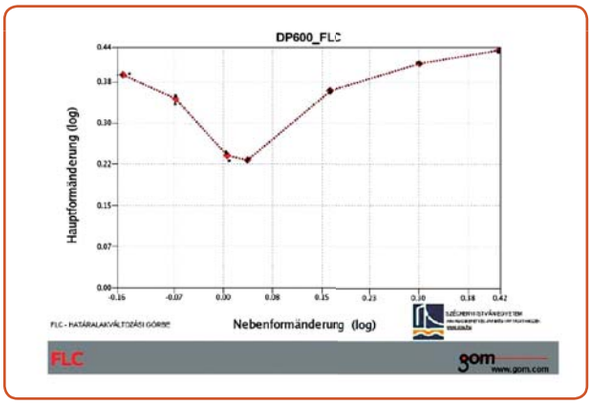


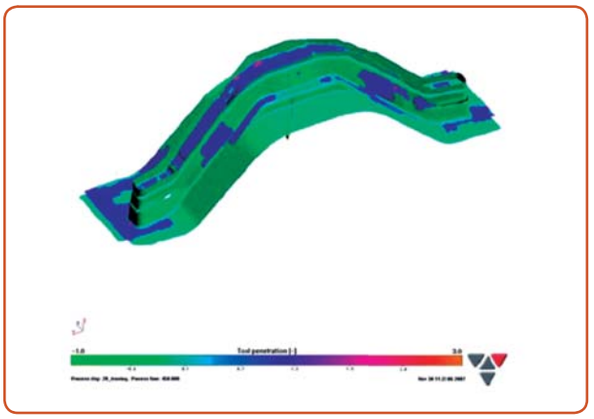


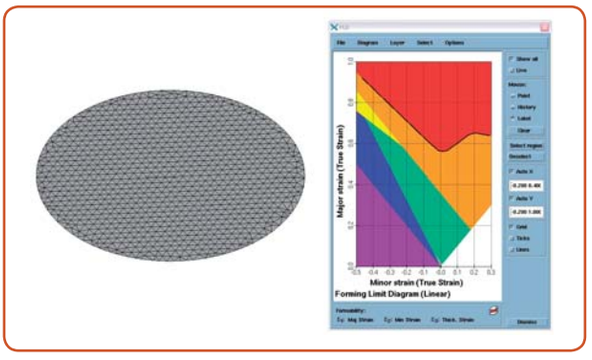


system has been successfully tested at Pridgeon & Clay and at Ajkai Electronics Ltd. As a continuation of the tool life-span research, which closed in 2007, the university has been working on launching new projects together with their partner, the Metal Forming Institute of the University of Stuttgart (IFU).









FUTURE TASKS

The developed analysis technique and technological development know-how will continue to be applied in a self-sustaining way for solving industrial tasks. It will be possible to develop new technologies of analysis and complex material features in the main direction of technological research of the newly starting IJTTR_08 project. Furthermore it will still be a priority to search for opportunities of participation in new international projects.

I/1-3: Research on the production technology of polymer components

Project leader: Viktor Fekete (VIHU)
Sub-project leaders: Dr. Gábor Dogossy assistant professor (SZE-AJT), Péter Stasztny (VIHU)

OVERVIEW

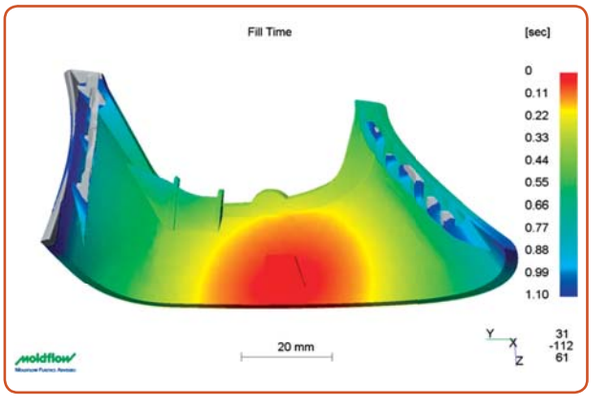
This year we continued to do research on the possibilities of recycling the faulty products generated at the firm. We expanded the research to all material types used. We researched the optimal implementation possibilities of new projects by further applying injection molding simulation. In order to reveal the reasons for the faulty products, we used the polymer laboratory established in 2007.

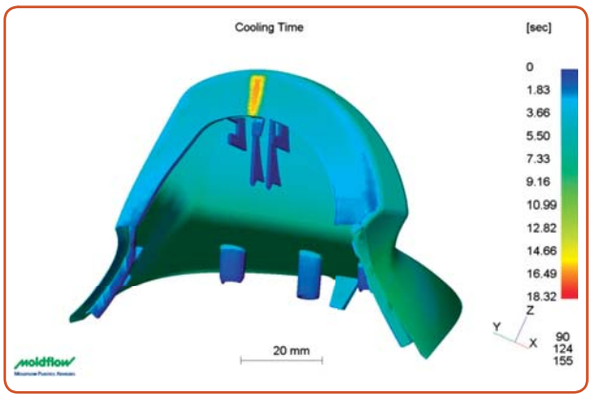
ACTIVITIES COMPLETED

With the measurements and examinations carried out in 2007 we determined the opportunities to recycle the faulty products (unvarnished, varnished) generated in different ways. Using these results, we developed a recycling process that we implemented for every material type found in the plant. We were controlling the process continuously. In the framework of a pilot project, we examined the economic efficiency of applying injection-molding simulation during the implementation of new projects. With regards to researching alternative materials, using the polymer laboratory built in 2007 we examined the potential materials (tests in climatic chamber, salt and fog chamber, rain and dust chamber) as to whether they meet the car factories' requirements. By examining the faulty products generated during varnishing, we developed a method in order to verify whether the fault can be traced back to injection molding or varnishing. With the help of a scanning electro-microscope we identified the stains found on the surface of the pieces.

RESULTS

During the control of the recycling process we observed that the selective collection of the different wastes and their monthly transportation is in line with the firm's needs. The production cost of these second-

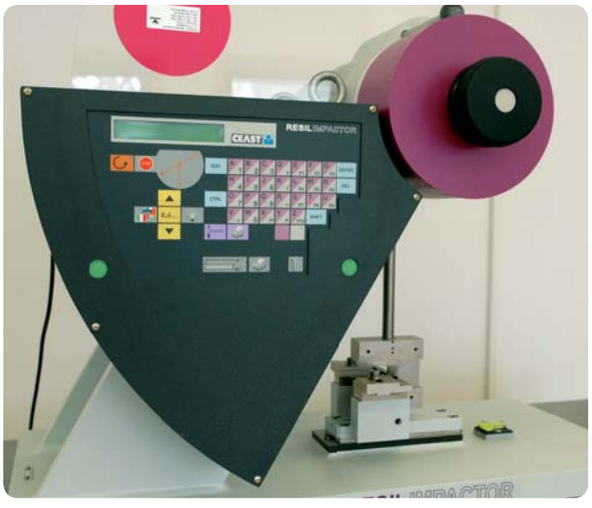


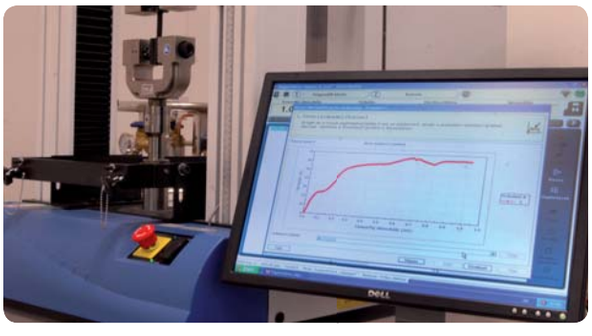


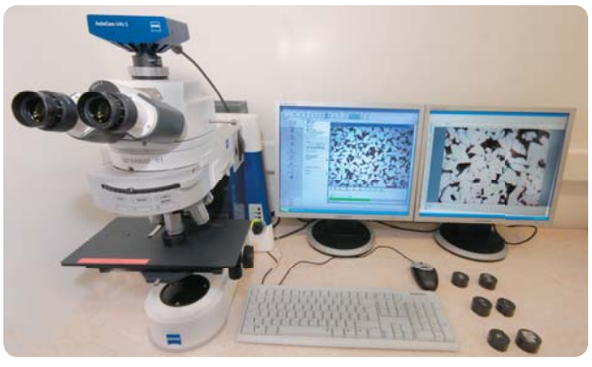
ary raw materials is lower than purchasing new materials. After assessing the pilot project we stated that injection-molding simulation could make the launch of new projects more economical. Thus during future projects, simulation will be an organic part of the planning process as well. As a result of the research on alternative materials, we have selected those basic materials that are economically advantageous and also meet the requirements set by the car factories. In the course of implementing new projects, we will be able to use these materials thereby increasing efficiency. When examining the faulty products generated during varnishing, we classified the different types of faulty products. With the help of microscopic photos we proved that the reason of the faults could mostly be traced back to varnishing because a significant portion of the stains can be found above the base varnish. With a scanning electro-microscope we identified the origin of the spots found on the surface of the unvarnished product.

FUTURE TASKS

The project has successfully ended. Some parts of it will continue in the framework of the MTMV (Mold Tool Management by VISIOCORP) program in a further developed form.





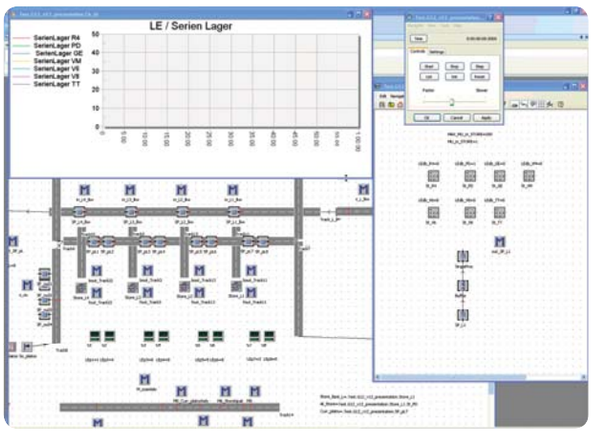


I/2-1: Research on cutting technologies

PROJECT LEADER: JÁNOS JÓSVAI SCIENTIFIC OFFICER (SZE-JRET)
SUB-PROJECT LEADERS: MRS. FERENC CSIZMAZIA DR. (SZE-AJT), SZABOLCS LENDVAI (BORSODI)

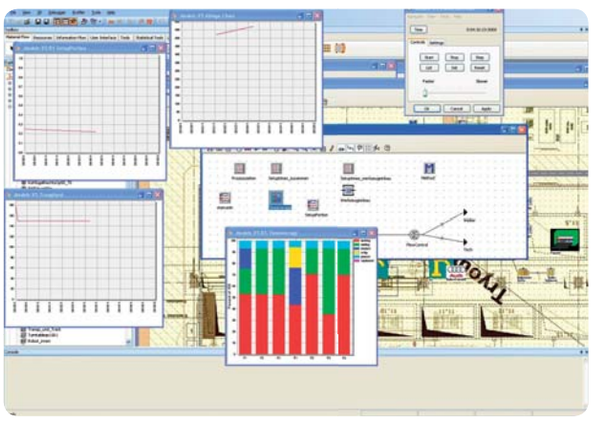
OVERVIEW

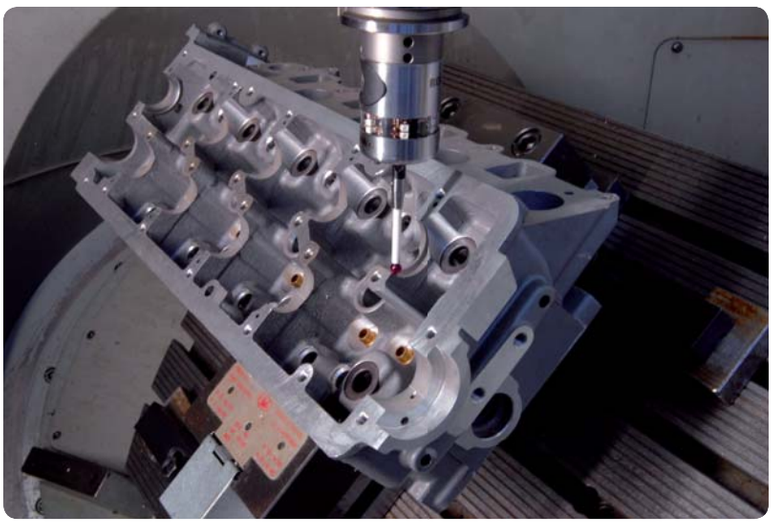
During the 2008 research on cutting technologies, in the field of researching aircraft technologies and materials heat treatment experiments have been carried out in cooperation with Borsodi Műhely and SZE with special attention paid to the aircraft industrial application of vacuum heat treatment and to the modern procedures of surface treatment. In the partial area of machining process simulation and research on manufacturing process planning algorithms and software, specific corporate applications have been developed based on previously obtained knowledge.



ACTIVITIES COMPLETED

A laboratory meeting the requirements of the aircraft industry has been set up, the instruments have been put into operation and the staff has been trained. The heat treatment experiments have been evaluated in a parallel way in the laboratory of the company and of the university. The concordance of the results has proven the reliability of the measurements. In the course of the research on simulation procedures, assembly line optimization tasks have been examined theoretically and practically. A procedure has been developed whereby the optimization of the assembly line can be controlled by an algorithm connected to the Technomatix software.



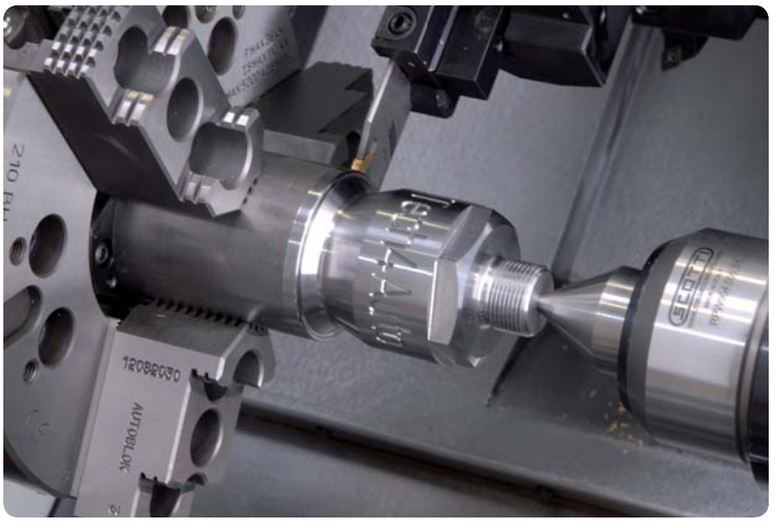


RESULTS

An examination testing technique has been created for operational application. The technology applicable with respect to heat-treating the materials used by the aircraft industry has been experimented on. The procedure serving the optimization of the production process planning has been tested and has led to positive results. In the field of simulation, the modeling of small-scale production has continued with new applications. With respect to the corporate application of the logistic system, three projects have been developed.

FUTURE TASKS

The part of the project dealing with heat treatment technology will continue in the IJTTR_08 project called “Research on the measurement procedures of heat treatment processes”. The optimization of the manufacturing process will continue in the project entitled “Research on the computer simulation of manufacturing processes”.



I/2-2: Further development of hard machining and aircraft technologies

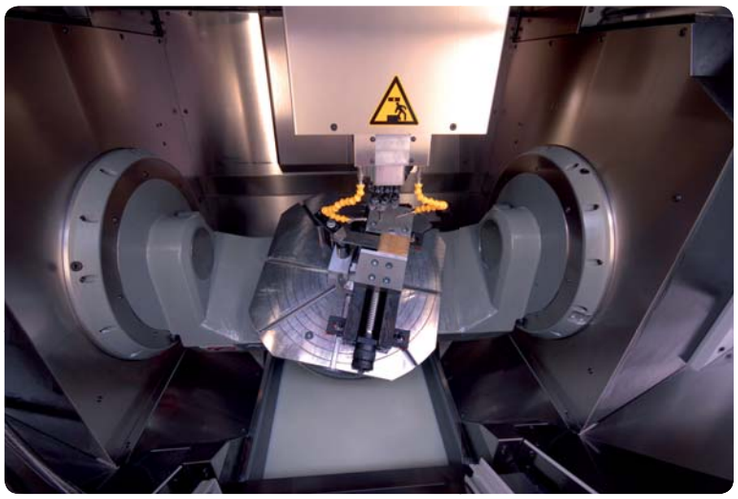
Project leader: Szabolcs Horváth (BORSODI)
Sub-project leaders: Zsófia Kőhalmi, Gábor Ónodi, Szabolcs Lendvai (BORSODI)

OVERVIEW

In 2006 Borsodi Műhely Ltd. established a test environment for carrying out 8-axle cutting experiments. Having acquired the technological know-how, the equipment has been running continuously. The research task for the year 2007 was to develop a test environment and a technology for hard machining. In the current work phase of 2008, based on the previous results of implementing 8-axle machining and hard machining technologies, they were applied and adapted for the experimental production and quality control of air vehicle test parts according to the special requirements of the aircraft industry.

ACTIVITIES COMPLETED

Developing an experimental program of the parts necessitating the application of hard machining, tool selection and the optimization of technological parameters. Carrying out cutting experiments on tool steel materials used in the aircraft industry. Recording a heat map during cutting, qualifying the forged components Processing and assessing the results of the technological experiments. Based on the results, developing a database of the optimal technological parameters. Based on the experimental results, indicating the directives of cutting technological planning and the methods of defining the technological parameters in the firm's documentation system. Designing the heat treatment and material testing methods to be applied to hard machining, developing their processes and providing professional support for the necessary investment.



RESULTS

Developing the optimal cutting technology of characteristic aircraft industrial parts materials and summarizing the experiences of experimental machining. Justifying the efficiency of the technologies by machining reference parts, extending the own-profile and supplier activities to the area of aircraft industrial parts manufacturing. A special 3D measurement method based on scanning has been realized in a test environment and it has been built into the special aircraft industrial quality management system (AS9100).

FUTURE TASKS

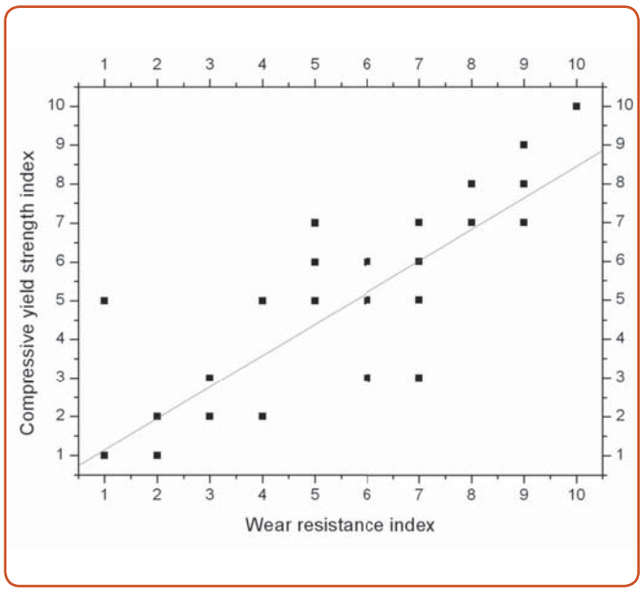
The development will continue in the framework of the IJTTR project in 2009-2012. The aim is to extend the circle of machinable parts with the newly developed cutting technologies and to acquire new markets. To introduce, to develop and to implement the computer aid of modern and special technologies in the fields of parts and production tool design (CAD), machining (CAM), quality management (CAQ) and their integration (CAE, integrated product development: IPD). It is also worth mentioning that a new development project has started, dealing with the material testing and heat treatment development with regards to aircraft industrial and special vehicle industrial parts manufacturing. For the realization of the project, a grant has been obtained in the framework of the Economic Development Operative Program of the New Hungary Development Plan (GOP-2007-1.3.1) for 2008-2010. The two parallel development projects (IJTTR and GOP-131) will complement and support each other.

I/3: Research on surface technologies

Project leader: Dr. Tamás Réti (SZE-AJT)
Sub-project leaders: Levente Solecki (SZE), Ferenc Tancsics (Rába)

OVERVIEW

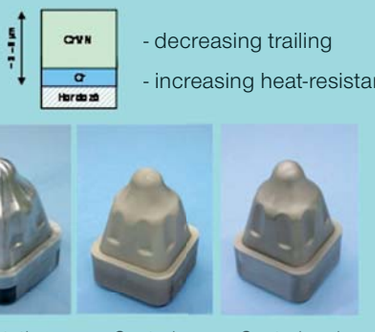
The two main fields of application of surface technologies in the vehicle industry are the surface treatment of vehicle structure elements and of the tools manufacturing the components. In the first year, research was focused on compiling a scientific database that contained the main coating types and surface treatments, respectively, as well as their optimal application. In the second year, the database was completed with a full range of cold-forming tools and with data containing their heat treatment parameters and characteristics. Moreover a selection strategy was also prepared for determining the optimal tool material and coating. In the third year the authors introduced the developed software at several international conferences and based on these experiences the software has been further developed. In parallel, research has been done in Rába's forging workshop with respect to the wear and surface treatment of hot-forming tools.



ACTIVITIES COMPLETED

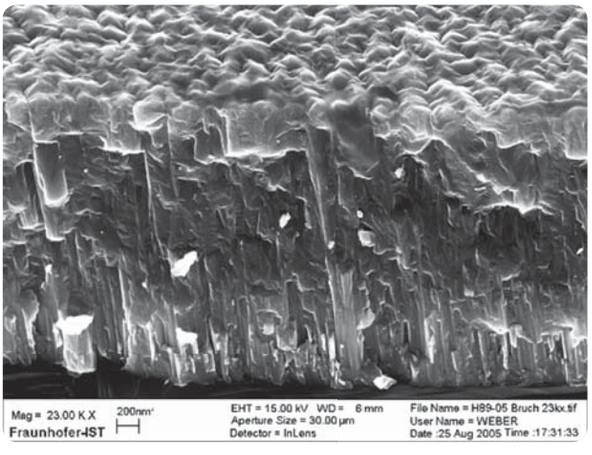
Further development of the selection rule system of the surface techniques and the coatable tool components, testing the software in education and via practical application. Increasing the lifespan of forging tools through the common application of plasma nitriding and Cr-CrVN coating. Wear analysis, numerical characterization of the wear process with surface topological and digital optical methods. Developing a replica technique to follow up on the wear process of the cutting tool.

Coating of punch for forward extrusion



- decreasing trailing
- increasing heat-resistance

Transportation condition | Coated | Coated and polished



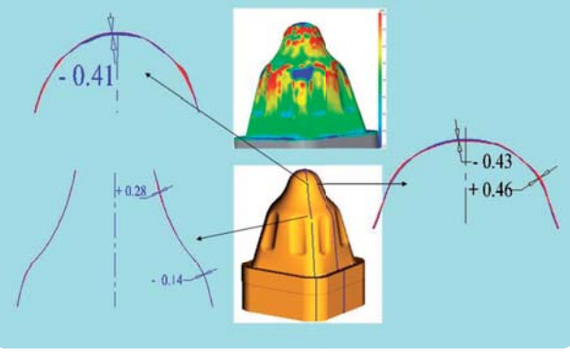
RESULTS

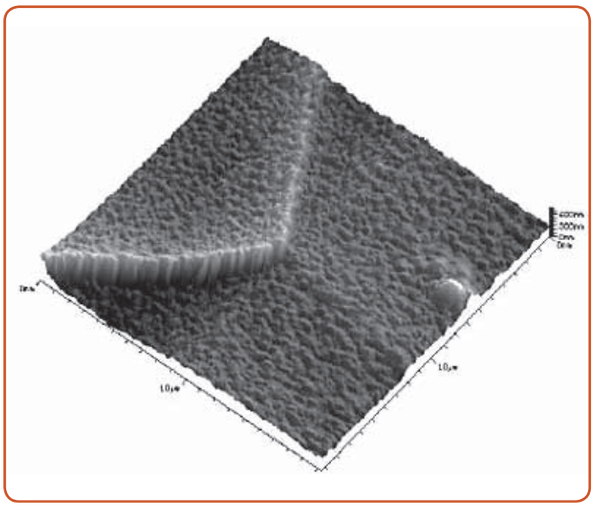
The test results of the developed decision support system show that after integrating further quantitative features into the database, it can be developed into a marketable product. By coating the forging tool (take-off shaft pre-extruding and final-extruding drift), its lifespan has increased four-fold without post-machining and the quality of the product has also improved.

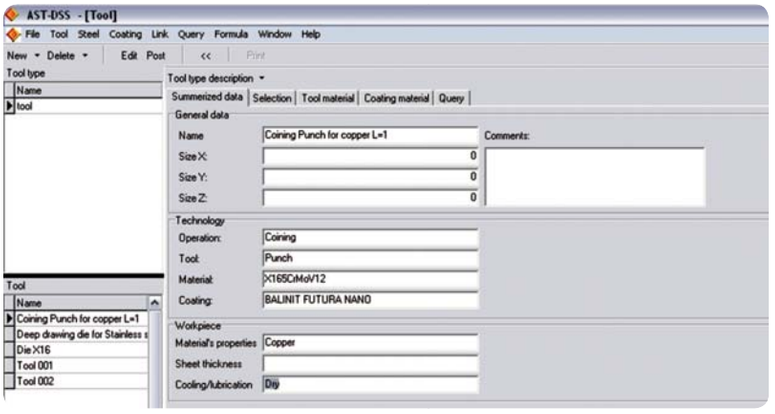
FUTURE TASKS

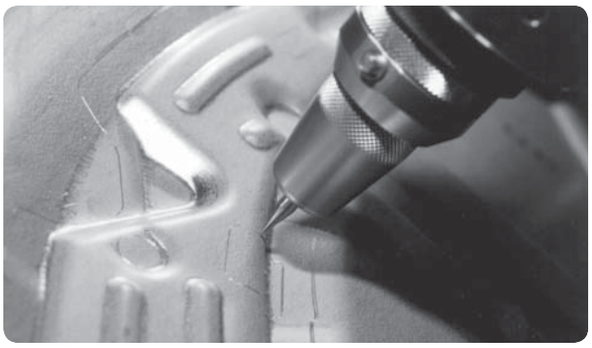
To expand the developed knowledge base to new fields of application, to further test the selection algorithm through operational experiments. To extend the lifespan of forging tools and to decrease tool costs by advantageously matching the tool material and the surface technology. This research is all featured in the new IJTTR_08 project.

Wear of punch for forward extrusion with crVN coating till first reset









II/1-1: Research on optimized construction procedures for sizing vehicle main units

Project leader: Imre Herczeg (RÁBA)

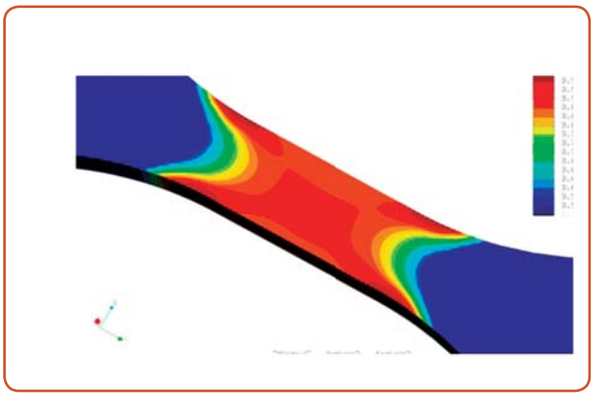
Sub-project leaders: Dr. Ernő Fülöp, László Légmán, István Molnár, László Varga (Rába), Dr. Péter Horváth (SZE-MGT)

OVERVIEW

The project is aimed at the significant improvement in three areas: optimized selection of bearings, more accuracy in dimensioning for fatigue in a finite element environment and the further reduction of the noise level of spiral cone disc wheels.

ACTIVITIES COMPLETED

The new version replacing Rába Axle Ltd.'s previous bearing dimensioning and selection software – obsolete from both technical and IT points of view – had already been developed in the first two years of the project, using Rába's professional input and executed via university software development activity. In the third year, the program has been tested, the necessary errors have been corrected and the database has been finalized. In the third year of the fatigue project, the pulling fatiguing tests and the test pieces have been optimized based on the experience gathered from previous examination tests. The examination tests have been carried out on several test pieces of the same quality material but with different technologies. By analyzing the places of fault, the attained cycle numbers and the manufacturing technologies together, the maximum stress that can be allocated to the cycle numbers and survival probabilities required in the RÁBA RFVE 02 test could be determined. These enable a more accurate finite element result analysis related to the model simulating the examination test. In the last year of the gear project, the prototypes of the new-cogged gears have been produced in several versions, which were then mounted into the vehicle in order to test and analyze the noise and vibration levels. Based on the results of the measurement carried out in the vehicle, we have determined the best cog type version; this will begin serial manufacturing in the future. The variable-load test bench has also been prepared where we can also carry out loaded noise and vibration tests within laboratory circumstances. In the test bench we have defined the examination protocol and the conformity to parameters.

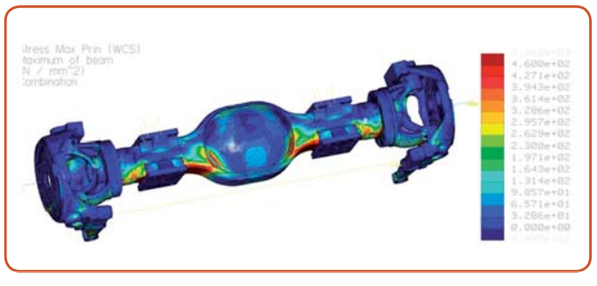


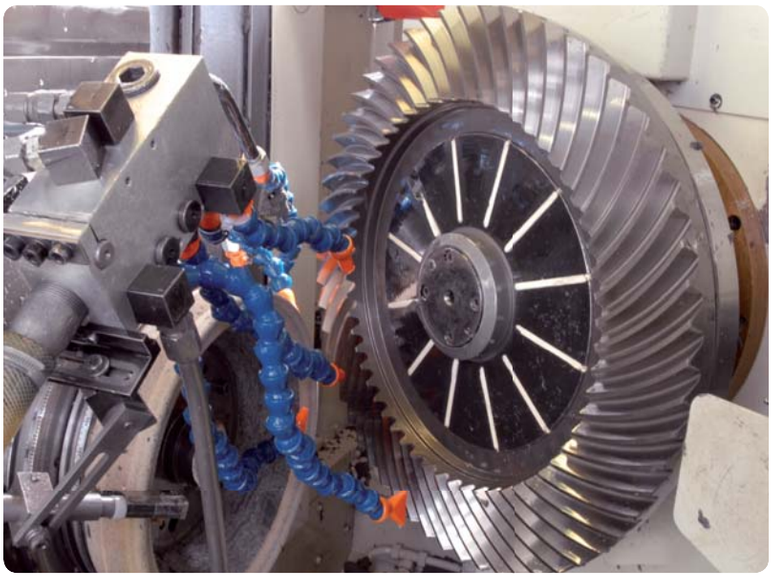
RESULTS

The ready bearing dimensioning software put into use makes it possible to dimension and define the lifespan of both pre-stressed and back-lash bearings. It has also solved the calculation of the triple-bed construction. It is suitable for taking the various correction factors (e.g. cleanliness factor, lubrication status, SKF factor, etc.) into consideration. The software enables the necessary input data to be retrieved from the database in a user-friendly way in a Windows environment. The stress maximum determined through the fatigue tests enable a more accurate result assessment in the finite element models simulating the test, with special regard to dimensioning the axle housings of the drive axles. In the case of the two types of conical wheels involved in conical wheel development, we attained a noise level reduction of 5-8 dB depending on revolutions per minute. We have mastered the cog development procedure aiming at noise reduction. The instrument of loaded axle noise testing (test bench) and the method to define the qualification parameters are both available.

FUTURE TASKS

We will continuously expand the database of the bearing selection program to conform with the new construction mounting applications and will follow up the potential changes and refinements related to bearing dimensioning procedures. As a continuation of the fatigue project, the fatigue stress values can be determined for new material qualities as required and the available database can be extended. We will extend the cog development procedure specified during the gear project to other mass-produced conical wheels meant for noise-sensitive application, for which we have launched an internal corporate project. Furthermore we will also determine the conformity to values in the case of other axles in the test bench realized in the framework of the project.





II/1-2: Research on optimization algorithms of vehicle main units

Project leader: Dr. Zoltán Horváth (SZE-MSZT)
Sub-project leaders: Tamás Gergye, Ádám Fejes (SZE-JRET)

OVERVIEW

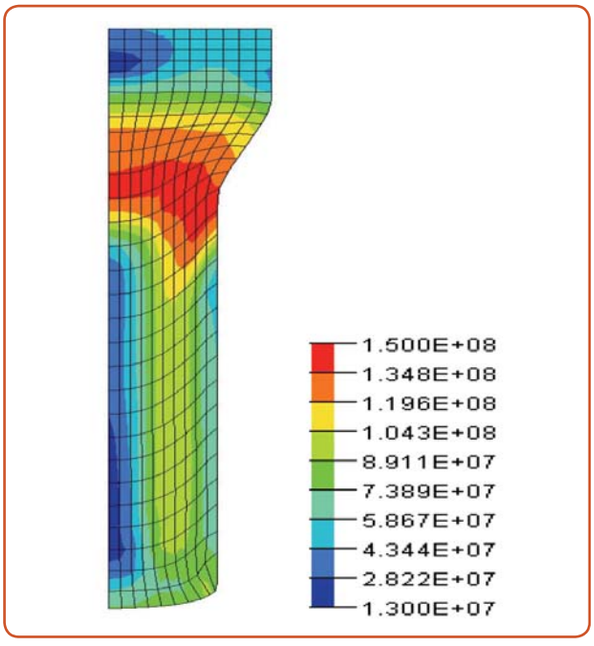
During this year, the research result attained in connection with the construction development implemented in the previous years via automated and integrated finite element simulations has been further developed. In addition to this research, the computer simulation related to the heating of the lamella brake systems has also been completed for Rába Axle Ltd. We have attained significant theoretical results connected to the optimization of assembly line scheduling on the topic of research on manufacturing processes, too.

ACTIVITIES COMPLETED

During the year, in addition to the integrated thermodynamic and hydrodynamic Ansys Fluent CFD software tried so far in applications, the Abaqus finite element software, the market-leading product in automotive application of non-linear mechanics, has also been applied. Thereby our simulation and optimization system has been considerably expanded beyond the thermodynamic and hydrodynamic tasks. We are also capable of assuming automated optimization tasks connected to non-linear, behaving to the material law, flexi-dynamic, and static models. In addition we have examined the heating of Rába's lamella break system in cooperation with Rába Axle Ltd. The industrial part of the research was led by Rába and the FEM analysis was carried out in the Pro/Mechanics thermodynamic module of the Pro/Engineer CAD system.

RESULTS

On the topic of integrated applications, the optimization framework system has also been developed, which resulted in the safer operation of the system. The essence of automated optimization is the construction development steps based on computer simulation, namely the integration of the "CAD-modeling – finite element analysis– optimization" development cycles. Via the developed procedure, we managed to integrate Abaqus into our system. In the course of the common thermodynamic research with Rába, a comparative analysis was



prepared – at the university – for the same task with the Fluent software as well. From the comparison it could be observed that Pro/Mechanics can accomplish the task with an accuracy that is satisfactory for industrial practice but for more accurate analysis, it is necessary to apply Fluent or similar software. The optimization of the manufacturing processes was carried out by using genetic algorithms, a general-purpose method of optimization. The partial task was closed with significant results: by optimizing the conventionally designed machining order, considerable improvement – a saving of one shift worth of working time per week – could be attained with respect to the industrial task taken as an example.

FUTURE TASKS

The research results accumulated within the project are evidently satisfactory so we can adapt our automated optimization procedure for conditions of industrial application. This will be possible within the IJTTR_08 project.

III/2: Developing special axle constructions for agricultural power machines

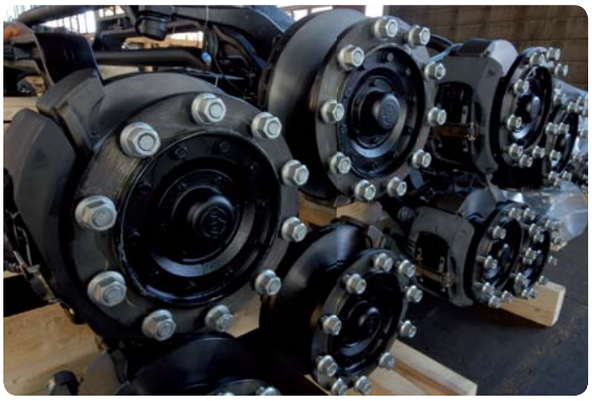
Project leaders: Andor Opitz, Andrási Mátyás (RÁBA)
Sub-project leaders: Jenő Petőfalvi, László Simon (RÁBA), Dr. Zoltán Varga (SZE-KVJ)

OVERVIEW

The main task for 2008 was to optimize the costs of the brake system of the 576/577 axles. In this interest, we significantly improved the hydraulic system operating the brakes. Furthermore another goal of the project for this year was to reduce the costs of the differential lock of RÁBA's patented agricultural axles.

ACTIVITIES COMPLETED

In the framework of the project, we further developed the hydraulic operation of the brake system. As a part of the development process, we performed several iteration steps in order to comply with the strict technical instructions, assembly and manufacturing requirements with regards to the brake system and to meet the significant cost reduction goal as well. With the help of VISIOCORP Lp. as consortium partner, for the first time ever in Rába's history, we also developed a climatic chamber test procedure for testing the sealing of the brake system and performed the examination test. We also submitted the new brake system to vehicle tests by the user. In order to reduce the costs of the differential lock, we developed a new comparative examination procedure. We performed the examination tests and gathered data. With the help of the data, we developed a thermodynamic finite element model for simulating the processes.

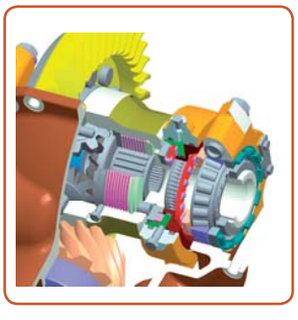


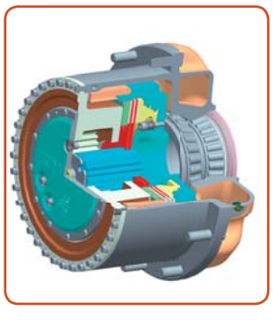
RESULTS

The new cost-optimized brake system proved to be satisfactory in the functional brake and vehicle tests. As a result of the climatic chamber test, it became necessary to reexamine the quality of the material of the sealing system. The examination tests were completed successfully and we achieved a cost reduction of 200 Euros per axle. The thermodynamic model developed by using the results of the examination test has led to encouraging results from the viewpoint of solving similar future tasks.

FUTURE TASKS

The axle development for agricultural power machines will continue in the framework of the IJTTR_08 research.





II/3: Developing special axle constructions for utility vehicles

PROJECT LEADER: KÁLMÁN RÁKÓCZY (RÁBA)

SUB-PROJECT LEADERS: LÁSZLÓ HÓDOS, LÁSZLÓ LÉGMÁN, ZOLTÁN MÉSZÁROS, JÁNOS SAMU, (RÁBA), DR. ZOLTÁN VARGA (SZE-KVJ)

OVERVIEW

The task of the project for 2008 was to develop a rear, driven tandem axle family for a 26-ton 6x4 truck of one of the largest Russian truck manufacturers, for a 2x10 ton and later for a 2x13 ton axle load.

ACTIVITIES COMPLETED

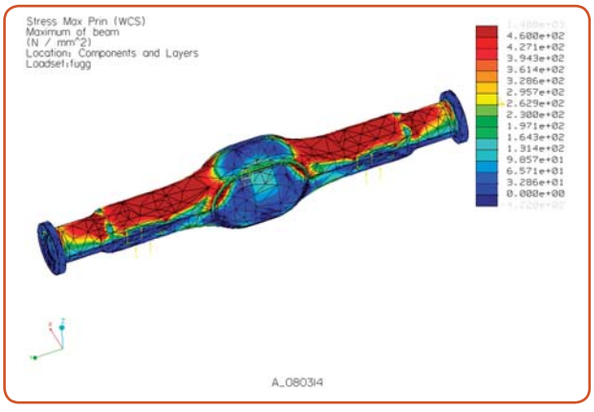
The construction of the product suiting the customer's requirements was created based on the modular principle by selecting and combining existing and sub-systems of proved value (axle housing, head assembly, wheel ends). The axle housing of the axles and the load-bearing units were tested with the finite element method for the 13-ton load (so there was an opportunity for further development). We developed the driving chain elements suitable for the given engine power and the total rolling mass. The construction and technological documentation were prepared. We developed the necessary laboratory examination tests (vertical fatigue, transversal fatigue) and executed them.

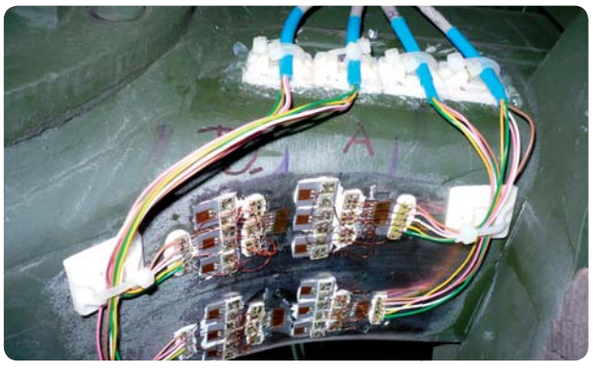
RESULTS

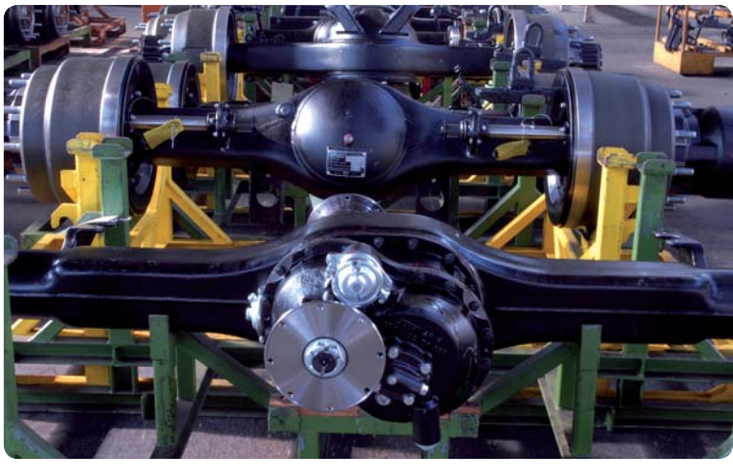
The sample axles were prepared and the bench tests gave satisfactory results. The axles have been delivered to the user, they are soon going to be built in the sample vehicle and the vehicle is going to be tested for several months. After an expected positive testing period, a new market segment can be entered.

FUTURE TASKS

Within the framework of the IJTTR_08 project, Rába Axle Ltd. will participate in the assessment of the vehicle tests to be performed by the customer. As a result, this development will come to an end and continuous delivery can start. With further development, the developed axle can be made to be integrated into the customer's bigger, 33-ton model as well.







II/4: Analyzing the energy flow of utility vehicle main units, revealing the correlations between manufacturing technology and reliability

Project leader: Dr. Zoltán Varga (SZE-KVJ)
Sub-project leader: Dr. Csaba Tóth Nagy (SZE-KVJ)

OVERVIEW

The first sub-program of the project for 2008 dealt with the theoretical and experimental examination of the friction of the modern wet disk brake lamellas used by Rába and more particularly with the process of heat generation. The second sub-program was a continuation of the research launched in 2007, in the framework in which a new HCCI (homogenously charged compression ignition) engine was developed. In 2008 the engine's prototype was prepared and it has begun testing.

ACTIVITIES COMPLETED

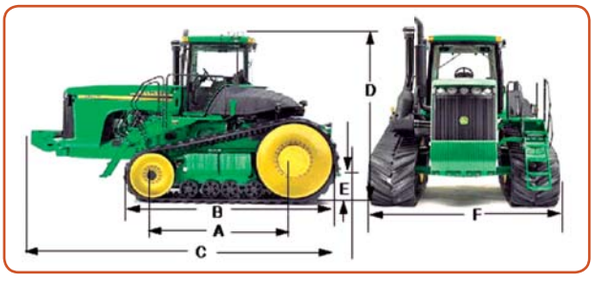
In order to analyze the power flow taking place in the rubber tie-beam tractors manufactured for John Deere, a dynamical MATLAB-Simulink model has been created and run, and the calculation results have been interpreted. Analyzing the momentum connections of the driving system of the pulling force exerted at the caterpillar-belt. Calculating the pulling-braking couple creating the turning momentum necessary for steering. On the topic of engine development, in 2007 the mechanical operation of the engine was computer simulated, the engine usable for the experiments was purchased, the HCCI engine was designed and the parts were manufactured. In 2008 the assembly ended and the engine testing began. For this purpose, a special test bench was developed.

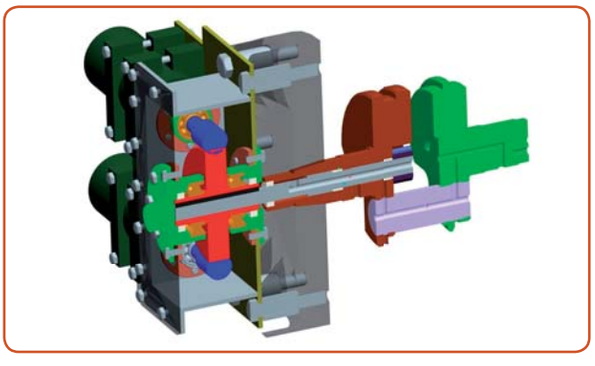
RESULTS

As a result of the research and simulation related to the rubber tie-beam tractor it could be stated while steering there is no load distribution generated that would cause a significant overload of the axle, not even in the case of a tow. However steering has a large power need, which Rába took into consideration and they developed their new constructions based on this fact. The mechanical simulation of the HCCI engine was closed with positive results. Two patent applications have been submitted with regards to the structure of the passively controlled VSE engine and to the structure of the engine and the adjusting mechanism.

FUTURE TASKS

The research connected to agricultural power machines will continue in the framework of the IJTTR_08 project. On the topic of engine development the final phase of the testing and the utilization of the results of engine development will be carried out at Rába's own costs.





III/1: Educational and training program

Project leader: Dr. Imre Czinege (SZE-AJT)

Subproject leaders: Persons responsible for the specializations and the subjects (SZE)

OVERVIEW

The educational and training project embraces the transfer of the results of the research and infrastructure development going on in JRET into undergraduate, graduate and doctoral education as well as into corporate trainings. In 2008 JRET announced a talent program, which was offered to all degrees of education. The system of professional relations of the Doctoral School for Multidisciplinary Engineering Sciences and of JRET have been expanded further. In the second year of the MSc in Mechatronic Engineering program, the subject entitled “Surface Technologies” is being taught, the newly developed curriculum, which strongly relies on JRET research carried out on a similar topic. A supplementary activity was to involve the students in the implementation of JRET projects in the framework of final theses, scientific student work or part-time employment. The Knowledge Center sponsored an independent student tender in connection with the student competition “Széchenyi Run”, where they provided spare parts and part units for two vehicles developed by students moreover, supported the further development of the vehicle entered by the Railway and Road Vehicles Department for the purpose of experiments.

ACTIVITIES COMPLETED

In connection with the “Computer Science” specializations, professional support has been provided to two third-year and three second-year doctoral students. Making the infrastructure of JRET available for the students of the Doctoral School. Involving doctoral students in the implementation of specific projects. Developing the full curriculum of the course entitled “Surface Technologies” for the MSc in Mechatronic Engineering program. Supporting the accreditation of the MSc in Vehicle Engineering program. Involving graduate students in research. Presentations organized for students in order to present the activity of several industrial companies. In order to promote research mobility, expert tasks have been ensured for university scholars at our corporate partners.

During the year, the University Senate approved the “Industrial Mathematics and Computer Simulation 1-3” subjects to be included in the BSc and MSc in Mechanical Engineering and Mechatronic Engineering programs with the intention that the practice gained in the framework of JRET should be passed on to the students and thereby the number of participants able to complete a simulation could be increased. In the second semester of the 2007/08 academic year the students – altogether 15 persons – learned how to prepare simulations and in

the current first semester of the 2008/09 academic year, they are learning the finite element simulation analysis of the elasticity exercises. Now it can already be seen that with the help of the simulation practice carried out during the summer in the engineering offices, at the end of the educational program we will have more well-educated engineers being able to carry out simulations within industrial conditions.

RESULTS

JRET has developed three new research topics, which PhD students can work on as an individual doctoral topic. The subject called “The simulation of metal forming processes” is already taught in three semesters. The subject entitled “Alternative-drive vehicles” has started as an elective course taught in English. We have continuously been involving students in the activity of the Knowledge Center; the average headcount is 14 persons. The graduate students on research placement have successfully completed their individual work related to the research projects. In connection with the research activities of JRET 21 final theses were generated altogether, of which 8 were linked to university projects, while 13 were primarily linked to corporate research activity. The alternative-drive car supported by JRET won first place in its category at the Shell Marathon competition.

FUTURE TASKS

Broadening the collaboration with the Doctoral School and the launching of common doctoral topics by the companies and the university has been a continuous task. Within the “MSc in Mechatronic Engineering” and “MSc in Automotive Engineering”, the aim is to acquaint the students with modern measurement processes and instruments, to start the Industrial Mathematics specialization under preparation and to develop proposals for final theses. To transmit the publishable results generated by the research projects into undergraduate education. To expand student activity and to supplement it with even more individual assignments. To further support self-motivated student groups in the preparation for the “Széchenyi Run”, the “Shell Marathon” and the “Formula Student” competitions.

III/2: Activities supporting R&D tasks (Technology transfer, demonstration activities)

Project leader: Péter Tamás Szilasi (SZE-JRET)
Subproject leader: Ildikó Kóbor (SZE-JRET)

OVERVIEW

During the first two years of the project, the technology transfer activity related to the project was focused on four main areas, which was complemented by one further task in the third year of the JRET project. The first one within the traditional activities supports the utilization of the research results and the flow of technological information. The second key task is to evolve and enhance the relations among the region's economic actors and the third one is to participate in the working out of the development concepts in connection with the city and the region. The fourth activity is to realize the corporate research initiated by JRET through the university's departments, relying partly on the intellectual capacity of JRET. With the closure of the JRET project approaching, special attention needs to be paid to the preparation of the propagation of the organizational results achieved during the project and their application at a university level. The primary utilizers of all aspects of the technology transfer activity are the region's companies, primarily those with automotive activities. All these together contribute to enhancing the region's competitiveness and to attracting new activities of high value added.

ACTIVITIES COMPLETED

Since the beginning of the project, we have been assuring a high-quality platform for introducing the results of the project by publishing the periodical called "The Vehicle of the Future", established together with the Knowledge Center of the Budapest University of Technology and Economics (EJJT). In the final year of the project we reported on JRET's activities and results in two double issues sent free of charge to our partner list containing some 500 addresses of companies and professionals. Our colleagues assume an active role in the publication activity on the research carried out in the Knowledge Center even beyond the opportunities offered by our own periodical. In the aim of publicizing the results of JRET, we prepared a series of 5-minute thematic films promoting research and we published it on one of the local news portals. Based on the cooperation agreement concluded with the Hungarian Patent Office in 2007, the PATLIB center operating in the framework of the Knowledge Center made their services continuously available to both university researchers and students, and to the region's enterprises during the 2008 research year as well. We maintained and based on need updated the Knowledge Center's webpage continuously (www.jret.sze.hu) where we also made an electronic version of our periodical, "The Vehicle of the Future", available to visitors. Furthermore we sent a bi-weekly electronic newsletter to our partners. It has been already the third time that we organized the Knowledge Center's primary professional event, the **Tech4Auto** conference with an exhibition and open laboratory presentations. As a result of our international relationship building we organized a two-day, common automotive technological workshop together with the German Fraunhofer institutes. Beyond our self-organized events in which we aimed to establish an efficient automotive research network, we also participated and presented at the conferences of several partner organizations (e.g., Pannon Automotive Cluster,

Chamber of Commerce and Industry for Győr-Moson-Sopron County) thereby facilitating the enhancement of relations among the region's economic actors. In the framework of the third listed activity, JRET closely cooperated in shaping the economic policy of Győr Town of County Rank, in shaping the strategy of the AUTOPOLIS concept, and in the promotion of the latter. The harmonization of the town's and the university's development plans, furthermore the coordination of the university tender projects aiming primarily at improving the automotive competence and the offer of educational, research and technology transfer services has already assured the afterlife of the JRET project and the maintenance of its organizational form. Beyond the extension of the knowledge transfer activity at the university level, the tender projects of corporate cooperation ensures the necessary conditions to continue the research activity done within JRET have also been prepared.

RESULTS

Through our periodical "The Vehicle of the Future" and our electronic newsletter service, the news of JRET is regularly disseminated to more than half a thousand addressees. We have published several scientific articles in professional periodicals and we have disseminated our research results by delivering presentations to more and more well-known domestic and foreign events attended by a large number of professionals. We have presented our research activities, the successful operation of our extensive system of corporate relations and the most important results of our research activities in ten short thematic films. The Knowledge Center and the results of its operations have appeared in several TV and radio programs broadcasted by national media. In addition to a number of meetings held with small enterprises and individual inventors, the effective operation of the PATLIB consultancy office of intellectual property rights is obviously proven by the two patent applications submitted based on the Knowledge Center's research results. Our scientific conference and international technological workshop with nearly 400 participants and 30 exhibitors were the region's noted and renowned professional events. Through the close relationship and cooperation maintained with the Győr Municipal Development Ltd., responsible for developing and coordinating the AUTOPOLIS program, several key projects highlighted in previous years have taken shape in specific tenders. Via this cooperation, the project plans were prepared supporting one another, along a unique concept of economic development. As a result of this activity, Széchenyi István University's tender was submitted and a grant was obtained in the framework of the TIOP 1.3.1

support program. Within this project, we are planning to reinforce the university's technical and scientific educational and research activities and to further develop the Knowledge Center for Vehicle Industry. The concept plan of the university's new Knowledge Management Center (a technology transfer office with an expanded function) was also prepared in the framework of this same activity. By reinforcing corporate research cooperation and developing projects, the three members of the JRET consortium – complemented by a new member, HNS Ltd. – submitted a successful application to the tender called for within the framework of the National Technology Program. Further regional tender projects have also been prepared in the field of research on alternative drive. As a result of this activity, a tender resource of some HUF 2 billion has been mobilized in the field of tool R&D tool and R&D connected to the vehicle and transport industry, which are complemented by further generated surplus R&D revenue of some HUF 3.847 billion.

FUTURE TASKS

Through their conscious communications carried out in the framework of the JRET project, Széchenyi István University has substantially enhanced their reputation and recognition among the region's research and corporate community. The university shall continue with such communication independently of closing the JRET project. Using the available tender resources and other university funds, the university wishes to maintain the periodical "The Vehicle of the Future" and also wishes to organize the **Tech4Auto** exhibition and conference annually. They are planning to support several events contributing to the reputation of the university (e.g., Széchenyi Run, Conference of Mechanical Engineering Students, participation at the Shell-Ecomaraton competition) in the interest of reinforcing the image of the institution as a center of excellence for the vehicle industry.

Cooperation with the industrial partners, technology transfer

The rate of cooperation with the industrial partners is included in the tender work plan of the individual projects. In this report, the participating persons represent the common work of the consortium partners. As a result of the research work carried out together, the following important progress has been experienced with respect to the corporate and university R&D&I activities:

- A stable relationship of partnership has evolved among the companies and the university.
- The common research activity has substantially increased the activeness of corporate research.
- The university's lecturers and researchers have become active members of the research market.
- The complex nature of the research projects stimulated the close collaboration between the university's and the corporate research teams – the common application of theory and practice when completing the tasks.
- The university and the consortium partners have appeared as research, technology development and measurement service providers in the regional market.

The most important consequence of these main statements is that each party has acquired something positive from the other partner. The corporate staff received dynamic motivation for the research activity and as a result they have regarded their participation in the project as an honor and took a very active part in it. So it was also due to this positive attitude that the management of the partner companies considerably increased the research and development staff. The research activity of the university lecturers has grown to a similarly significant extent as well.

The multiplicative effect of JRET projects can also be observed in the short run as at the companies, their successful completion reinforced the R&D elements in the case of outside activities as well. In the same way, the demand has arisen to participate in new tenders and to expand the research activity. As a result, the IJTTR_08 project and other corporate GOP projects were born.

The managers of the project activity and the leaders of the individual projects are presented in the following table

Person Responsible	Consortium member	Time spent on the project	Position
Dr. Imre Czinege	SZE (1)	30%	President, Steering Committee
Dr. Tamás Réti	SZE (1)	20%	President, Scientific Committee
Dr. Károly Kardos	SZE (1)	20%	Leader, R&D program I.
Dr. Károly Szőcs	RÁBA (2)	10%	Leader, R&D program II
Péter Tamás Szilasi	SZE (1)	100%	Leader, R&D program III
Szabolcs Horváth	BORSODI (3)	80%	Consortium member, project leader
Viktor Fekete	VISIOCORP (4)	40%	Consortium member, project leader
Dr. Ernő Halbritter	SZE (1)	30%	Research project leader
Dr. Gábor Dogossy	SZE (1)	50%	Research project leader
János Jósvai	SZE (1)	80%	Research project leader
Dr. Ernő Fülöp	RÁBA (2)	90%	Consortium member, project leader
Dr. Zoltán Horváth	SZE (1)	50%	Research project leader
Mátyás Andrási	RÁBA (2)	50%	Research project leader
Kálmán Rákóczy	RÁBA (2)	50%	Research project leader
Dr. Zoltán Varga	SZE (1)	30%	Research project leader
Dr. Csaba Tóth-Nagy	SZE (1)	30%	Research project leader

Publications

I. **R&D program no. I: Research on the manufacturing technology and tools of highly complex, high-quality components for the vehicle industry**

1. Ernő Halbritter, Ferenc Tancsics, Tamás Gergye: Optimization of the need for shape-changing work in cutting with CAD-CAE methods, The Vehicle of the Future, 2009 – under publication
2. Ernő Halbritter, István Kozma, Levente Solecki: Optical digitalization – Geometrical models and their usage, electronic lecture notes, Széchenyi István University, 2008, p. 180.
3. Dr. Ernő Halbritter, Dr Levente Solecki, Ferenc Tancsics: The effect of the pressing plate's surface roughness on sticking, ISSN 1454 – 0746, Technical Review – XVI. OGÉT 2008, Brasso (Romania), 2008, pp. 155 – 159.
4. Ernő Halbritter, Ferenc Tancsics, Levente Solecki, Tamás Gergye, Balázs Kiss: Optimization of forging processes, presentation, Tech4Auto2008 Regional R&D Conference and Exhibition on Vehicle Manufacturing Technology, Széchenyi István University, Győr, September 24-26, 2008
5. Dr. Károly Kardos, Dr. Matthias Kolbe, Dr. Levente Solecki, Ferenc Tancsics: Examination of tool wear and tear in the hot extrusion punch, High-tech research in the service of product and process development affecting the competitiveness of the vehicle industry, presentation, Fraunhofer Workshop, Győr, September 15-16, 2008
6. G. Dogossy, Z. Ódor, Z. Kocziha: Material change of a mirror frame, JRET-Visiocorp project results, BeLCAR Visiting Scheme & Matchmaking Event, Győr, February 19-20, 2008
7. G. Dogossy: The research activity of Visiocorp Hungary in the framework of the JRET projects between 2006 and 2008 (poster), Industria 15th International Industrial Exhibition, Budapest, May 27-30, 2008
8. G. Dogossy: Research on plastic technologies within the JRET consortium, 9th Technical Conference on Utility Vehicles, Balatonvilágos, September 4-5, 2008
9. G. Dogossy, N. Németh, B. Tóth: Research on the manufacturing technology of plastic parts, Tech4Auto Regional R&D Conference and Exhibition on Vehicle Manufacturing Technology, Győr, September 25-26, 2008
10. G. Dogossy, N. Németh, B. Tóth: Research on the manufacturing technology of plastic parts, The Vehicle of the Future, under publication
11. Dr. Imre Czinege, Mrs. Ferenc Csizmazia dr., Dr. Levente Solecki: Testing laser-honed surfaces, "Material Testing in Practice" Conference, June 4-5, 2008
12. I. Czinege, T. Réti and I. Felde: Selection of Tool Materials for Cold Forming Operations Using a Computerized Decision Support System. 2nd International Conference on the Heat Treatment and Surface Engineering of Tools and Dies. May 25-28, 2008, Bled, Slovenia
13. I. Czinege: The past, the present and the future of cars, "100 years of Ford Model T" Conference, Budapest, October 28-29, 2008
14. K. Kardos, J. Jósvai: Komplexe Untersuchung der Produktions- und Logistikprozessen. Fraunhofer Workshop, Győr, September 15-16, 2008
15. I. Czinege: Development Trends in Sheet Metal Forming of Car Body Components. Fraunhofer Workshop, Győr, September 15-16, 2008
16. T. Réti, E. Bitay: On the classification of 3D periodic polyhedral cellular systems, Materials Science Forum, Vol. 589 (2008), pp. 341-348.
17. E. Bitay, T. Réti: The analysis of the combinatorial structure of fullerene, In: E. Bitay (ed.) Technical Scientific Papers: 13th Scientific Conference for Young Technical Engineers, Cluj Napoca (Romania), Múzeum Association of Transylvania, 2008, pp. 191-202.
18. I. Felde, A. Borsi, Zs. Kovács, P. Meizl, T. Réti: Introducing a heat treatment decision-support system at ISD Dunaferr, ISD DUNAFERR Technological and Economical Announcements, Vol. XLVIII, No. 1 (2008), pp. 11-16.
19. T. Réti, I. Czinege, I. Felde: Computer-aided Selection of Tool Materials and Coatings Using a Decision Support System, Proceedings of the 17th IFHTSE Congress 2008, Kobe, p. 236.
20. C. Canavides, J.E. F. Bugna, C.S. Sarmiento, G.E. Totten, I. Felde, T. Reti: Thermo-mechanical analysis of railway wheels during braking, Proceedings of 2nd International Conference on DISTORTION ENGINEERING 2008, Bremen (2008) p. 451-459.
21. T. Réti, I. Czinege, I. Felde: Decision support system (DSS) for the selection of tool materials and surface coatings, The Vehicle of the Future, under publication

22. T. Kovács, L. Solecki: The relationship between the fabric structure and resistance to wear and tear in the case of steels, In: E. Bitay (ed.) Technical Scientific Papers: 13th Scientific Conference for Young Technical Engineers, Cluj Napoca (Romania), Múzeum Association of Transylvania, 2008, pp. 155-158.

II. R&D program no. II: Developing modern vehicle main units and researching their diagnostic methods

1. P. Horváth: Advanced method for lifetime calculation of taper roller bearings. Proceedings of conference "Gépészet 2008", Budapest, May 28-29
2. P. Horváth: Optimal pre-stressing of tapered roller bearings. GÉP (article accepted, under publication)
3. Imre Herczeg, Péter Horváth, Attila Nagy, László Légmán, Kálmán Rákóczy, Dezső Szekendy: Developing a modern computer program of bearing dimensioning for the bearing selection of utility vehicle axles and power-transmission equipments. The Vehicle of the Future, (under publication)
4. Mátyás Andrási, Dr. Károly Szőcs: Off-highway Achskonstruktionen. ATZ extra (ATZ off highway) – June 2008
5. Mátyás Andrási, Dr. Károly Szőcs: Moderne Achsenkonstruktionen und Applikationen für den geländegangigen Lastwagen, 2008, Stuttgart
6. Z. Horváth: Generalizations of Positivity and Strong Stability Preservation. Society of Industrial and Applied Mathematics (SIAM) Annual Meeting, San Diego, CA, USA, July 7-11, 2008, Mini-symposium "Strong Stability and Applications"
7. Z. Horváth: Stability and positivity of dynamical systems. International Conference on Differential and Difference Equations, July 14-17, 2008, Veszprém, Hungary
8. Z. Horváth: Comparison of solvers for shape optimization with PDEs. 79th Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM), March 31, 2008 – April 4, 2008, Bremen, Germany
9. Z. Horváth, J. D. Pintér: Global Optimization with Expensive Model Functions: A Comparative Computational Study. The Veszprém Optimization Conference: Advanced Algorithms will be held at the Regional Centre of the Hungarian Academy of Sciences in Veszprém (VEAB), Hungary, December 15-17, 2008
10. Zoltán Horváth: Optimization research on hydrodynamic processes. Tech4Auto 2008 Regional R&D Conference and Exhibition on Vehicle Manufacturing Technology, September 24-26, 2008, Győr, Széchenyi István University
11. Zoltán Horváth: The invariant sets of a dynamic system and its discretizations, Scientific Session of the "Mathematical Analysis and its Applications" Work Committee of MTA VEAB, Veszprém October 29, 2008
12. C. Tóth-Nagy: The development and implementation of a vehicle engine construction with variable compression conditions, The Vehicle of the Future, JRET, Győr, 2008
13. B. Pántye, C. Tóth-Nagy: Simulation study of a variable stroke engine, OGÉT conference, Brasso, 2008
14. C. Tóth-Nagy: Variable stroke engine, patent, application no. P0800420
15. C. Tóth-Nagy: Variable stroke engine motor with passive adjustment, patent, application no. P0800608

III. R&D program no. III: Technology and knowledge transfer

1. Péter Tamás Szilasi: The university of the future – Higher education in the service of economic development; Széchenyi Alumni Magazine, Summer 2008
2. Péter Tamás Szilasi: Knowledge Center in AUTOPOLIS and for AUTOPOLIS; AUTOPOLIS Press, September 2008
3. I. Czinege, G. Horváth: Cooperation between Audi Hungaria Engine Ltd. and Széchenyi István University. DANUBIA RECTORS CONFERENCE, Knowledge and Technology Transfer, Budapest, September 26, 2008
4. I. Czinege: The renaissance of vehicles in cars. The car of the renaissance and the renaissance of the car, Kocs, July 12, 2008
5. Z. Horváth: What is mathematics and who are the mathematicians? Open day on the Celebration of Hungarian Science, Rényi Alfréd Institute of Mathematics, Hungarian Academy of Sciences, Budapest, November 10, 2008, 15:00-17:00

Final Theses

1. János Süveges: Developing the Allison WT transmission test bench
2. László Kósa: Examination of the form accuracy of plastic parts in function of temperature and humidity
3. Tamás Szigeti: Technological design of axle-box manufacturing
4. Ernő Kiss: Designing and manufacturing a window-positioning device for the windows of the AUDI TT Roadster, TT Coupé and A3 Cabrio
5. Csaba Bubernik: Production technological analysis of the coaching unit of a upper track welding robot
6. Richard Gondos: Examination of the form accuracy of pieces pulled with plastic tools

7. Gábor Kónya: Technological design of FL-type brake key manufacturing
8. Zsolt Ölveczky: Machining of heat-treated aluminum crankcases with high silicon content
9. Gábor Pándorfalvi: Examining the dependability of the boundary form modification curves defined according to ISO/WD 12004, in the geometrical function of the test piece
10. Norbert Tóth: Constructional and manufacturing design of the doors of the ANTRO SOLO alternative-drive car
11. Viktória Németh: CAD design of a logistic warehouse carriage at Magna Steyr ECH Ltd.
12. Zoltán Lampérth: Mechanical machining of cylinder heads with technological level change
13. Róbert Felpéczi: The production-maintenance system of the Global Engine 4-valve Otto engine
14. Zoltán Berger: Implementation of an optical measurement system
15. Tamás Kormos: Technological design of camshaft part unit manufacturing
16. Zsolt Lascsik: Assembly technological examination of the front axles of utility vehicles
17. Balázs Pajor: Examination of the boring and tapping technology with cooling and lubrication and minimum lubrication
18. Tamás Szalók: Production optimization in the E-46 field
19. László Egyedi: The process of product approval at Payer Industries Hungary Ltd.
20. János Rigó: Managing the quality defects arising in the extraction manufacturing process
21. Tamás Györkös: Quality assurance of mass production on the TOYOTA assembly line at Continental Hungary Ltd.

Scientific Student Conference papers

1. Tamás Gergye: The application of the Pro/Engineer CAD software, the Mathcad mathematical software and the Deform finite element software in the design of a reduction tool, Scientific Student Conference, Széchenyi István University, November 27, 2007. Consultant: Dr. Ernő Halbritter
2. Tamás Gergye, Balázs Kiss mechanical engineer (BSc): Optimization of the tool profile in pre-extrusion and final-extrusion, Scientific Student Conference, Széchenyi István University, April 9, 2008. Consultant: Dr. Ernő Halbritter
3. Balázs Pántye, mechanical engineer, 3rd year: Simulation analysis of a variable stroke engine, Consultant: Dr. Csaba Tóth-Nagy associate professor
4. Gábor László, mechanical engineer, 3rd year: Analysis of modern valve arrangement, Consultant: Dr. Csaba Tóth-Nagy associate professor
5. Gellért Juhász, mechanical engineer, 3rd year, Designing the main axle of the variable stroke engine, Consultant: Dr. Csaba Tóth-Nagy associate professor
6. Dávid Czeglédi, technical teacher 4th year, Designing a vehicle body for the Shell Ecomarathon, Consultant: Dr. Zoltán Varga associate professor
7. Péter Homlok, mechanical engineer, 3rd year, Developing the steering equipment of an Öho racing car, Consultant: Dr. Zoltán Varga associate professor
8. Edina Erős, Szilvia Timár, technical managers, 3rd year: Analysis of the gauge examination test of bore-holes. Consultant: Dr. Levente Solecki
9. Péter Süly, mechanical engineer (BSc), 3rd year: The possibility of sheet metal machining with five-axle milling cutter. Consultant: Dr. Ernő Halbritter
10. Tamás Gergye mechatronical engineer (MSc), 2nd year, Balázs Kiss mechanical engineer (BSc) 6th year: Optimization of tool profiles in pre-extrusion and final-extrusion. Consultant: Dr. Ernő Halbritter
11. Máté Bősze environmental engineer, 4th year: The possibility to establish a central cutting-drying centrifugation station. Consultant: Dr. Géza Nagy retired college professor
12. Bálint Borsodi mechatronical engineer (BSc) 1st year: Examination of large mass production with the application of simulation. Consultant: János Jósvai PhD student
13. G. László: Valve in valve – the analysis of innovative valve arrangement, TMDK paper, Győr, 2008
14. B. Pántye: Simulation analysis of a variable stroke engine, TMDK paper, Győr, 2008
15. G. Juhász: Dimensioning the main axle of the HCCI engine, TMDK paper, Győr, 2008

Events, Presentations

1. February 19, 2008: Péter Tamás Szilasi: Education, Research and Services to support local economic development, BELCAR EU FP6 project Workshop, Győr
2. March 13, 2008: Péter Tamás Szilasi: Research activity on the vehicle industry at Széchenyi István University Introducing connected project development; "From concept to realization" conference, Győr
3. May 23, 2008: Péter Tamás Szilasi: Complex development at the Széchenyi István University to support AUTOPOLIS, the program of integrated knowledge-intensive development of Győr and its region; Conference on EU's Cohesion Policy; Győr

4. July 11, 2008: “Győr – AUTOPOLIS” Center of an automotive region - Engine of the regional economy; Irish-Hungarian Business Day, Győr
5. August 15, 2008: Operation of vehicle industrial research organizations at Széchenyi University and their effect on regional innovation; Roundtable discussion on innovation in the NFÜ tent; Sziget Festival 2008, Budapest
6. September 25, 2008: Péter Tamás Szilasi: The role of Széchenyi University in developing the research and innovation activities of the region’s enterprises – Introducing JRET’s 3-year program and results, evaluation; Tech4Auto Conference; Győr
7. September 26, 2008: Péter Tamás Szilasi: Opening-up the black box - Development strategy to enhance institutional fit to new challenges of the network-economy; Danube’s Rectors Conference; Budapest

Media Appearances

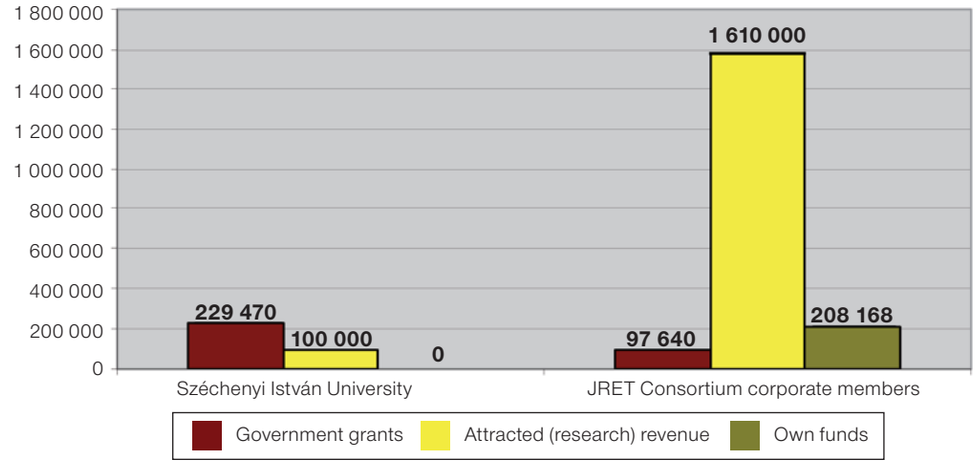
1. Is the future for ad-hoc knowledge units instead of departments? Usable knowledge in focus– University role in economic development, Interview with Péter Tamás Szilasi, JRET Manager Director, Széchenyi Alumni Magazine, Autumn 2007
2. Let us protect what is valuable – Cooperation with the Hungarian Patent Office, PR article, Széchenyi Alumni Magazine, Winter 2007
3. On plastic for professionals – MŰSZAK Club of Plastic Industry Professionals, PR article, Széchenyi Alumni Magazine, Spring 2008
4. Viable solutions – The companies also won at the student competition, Széchenyi Alumni Magazine, Summer 2008
5. An opportunity to break out from our shy world – The success of a Széchenyi student at the world competition of energy-efficient cars, Széchenyi Alumni Magazine, Summer 2008
6. Alternative story – The alumni team also develops a vehicle for the university, Széchenyi Alumni Magazine, Summer 2008
7. Rolling ideas: 2 in 1 – Student creativity in focus, Széchenyi Alumni Magazine, Summer 2008
8. The relationship-builder – To teach through a lifetime, Interview with Dr. Imre Czinege, Széchenyi Alumni Magazine, Summer 2008
9. Where knowledge meets practice (video), Interview with Dr. Imre Czinege, Steering Committee President of JRET, Hírcity, June 13, 2008
10. Value-creators in the Knowledge Center (video), Interview with Szabolcs Horváth, Technical Manager of Borsodi Műhely Ltd., Hírcity, July 9, 2008
11. RÁBA: new ways in surface treatment (video), Interview with Dr. Károly Szőcs, Director for Business Development at RÁBA Axle Ltd., Hírcity, July 14, 2008
12. General Motors are interested in the knowledge of the Győr university (video), Interview with Andor Paizer, Managing Director of GM Powertrain Hungary Ltd. and Gábor Gerencsér Director, Hírcity, July 17, 2008
13. Decision support software in the service of vehicle manufacturing (video), Interview with Dr. Tamás Réti, Professor at Széchenyi University, Hírcity, July 18, 2008
14. The consortium led by RÁBA has won a HUF 1.3 billion project (video), Interview with Dr. Károly Szőcs, Director for Business Development at RÁBA Axle Ltd., Hírcity, July 28, 2008
15. Interview with Péter Tamás Szilasi, MR1 – Kossuth Radio, “I come from Hungary”, August 30, 2008
16. Together in research development: SZE-Audi HM Ltd. relations (video), Interview with Richárd Rozmann Director of Human Resources at AHM and Gábor Horváth, Manager for Higher Education Relations, Hírcity, September 10, 2008
17. Tech4Auto – the secrets are revealed (video-invitation), Interview with Péter Tamás Szilasi, JRET Manager Director, Hírcity, September 22, 2008
18. Tech4Auto: the university is a partner of the economy, Interview with Dr. Imre Czinege, Steering Committee President of JRET, Hírcity, September 24, 2008
19. University and town – “Operative relationship foreshadowing progress”, Interview with Dr. Rudolf Ottófi, Vice-Mayor of Győr and Dr. Tamás Szekeres, Rector of Széchenyi University at the opening ceremony of Tech4Auto; Hírcity, September 25, 2008
20. Documentary film on the HCCI engine in the program “Eureka, I have found it!” of Duna TV

Main financial indicators, summary tables

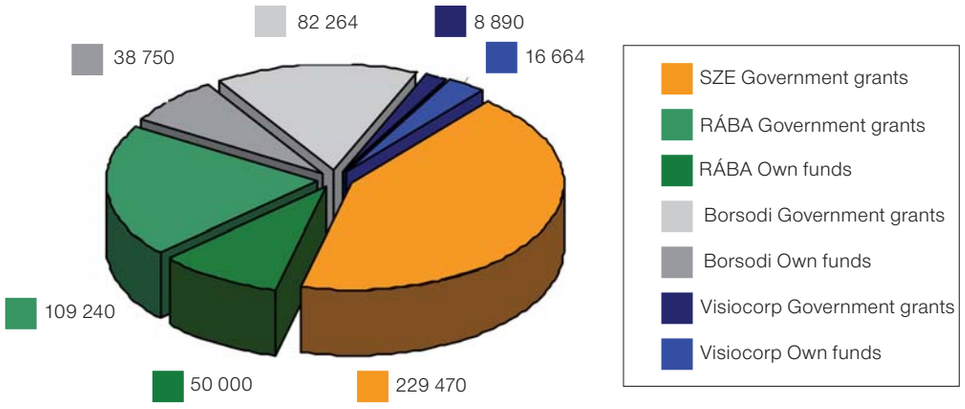
THE DEVELOPMENT OF PERFORMANCE INDICATORS

	2008		2006-2008	
Result	2008	Plan	Fact	Plan
The exploitable result of the project				
Developed new*				
products (piece)	26	24	73	64
services (piece)	2	3	6	8
technologies (piece)	4	1	6	4
applications (piece)	8	1	12	5
prototypes (piece)	40	34	87	80
Scientific results				
Publications (including presentations)				
Domestic (piece)	43	14	152	42
International (piece)	21	7	66	21
Human resources				
Are the project results utilized in education/training? (Y/N), in what form?	Yes	Yes	Yes	Yes
Number of persons involved in the project				
university students (person)	14	11	44	33
PhD students (person)	2	5	11	11
young researchers (person)	1	6	9	6
Number of researchers having gained a scientific degree due to the project (person)	1	3	2	3
Number of workplaces created due to the project				
at enterprises (piece)	8	3	19	18
at research entities (piece)	1	1	11	7
Out of this: researcher workplace (piece)	1	2	14	9
(Note: in full-time equivalence)				
Economic utilization				
Number of participating entities in the center's activities				
number of research entities (piece)	1	3	8	3
number of enterprises (piece)	9	3	21	3
Number of firms utilizing the results (piece), contact data	11	8-10	24	8-10
Financial results achieved as the result of the project				
Surplus revenue (HUF million)	1 710	40	4746	105
out of this, export revenue (HUF million)	1 585	20	2214	45
Cost reduction (HUF million)	61	150	233	400

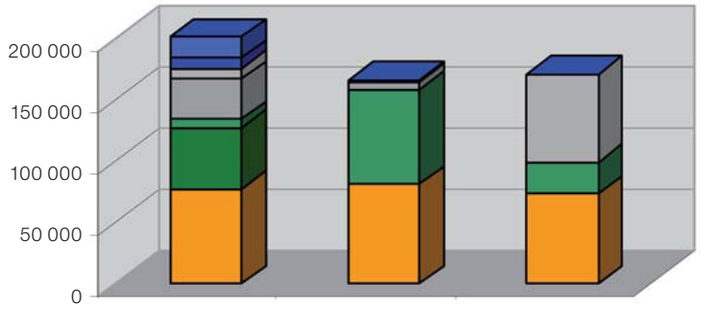
Financing structure of the Regional University Knowledge Center (HUF thousand2008)



JRET tender cost distribution by project partner (HUF thousand), research year 2008



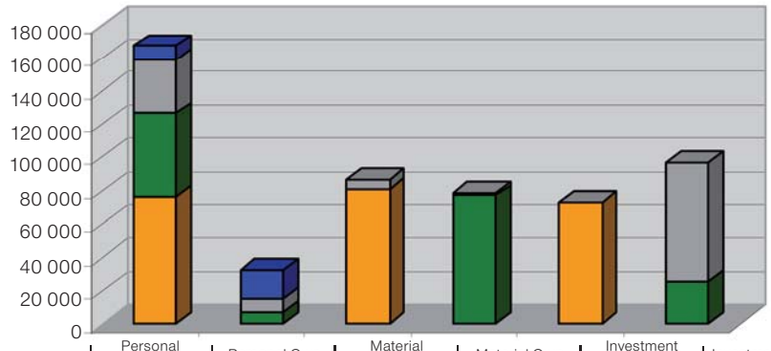
Utilization of the project partners' resources by cost types (HUF thousand), research year 2008



	Personal	Material	Investment
Visiocorp – Own funds	16 664	0	0
Visiocorp – Government grants	8 890	0	0
Borsodi – Own funds	8 600	2 043	71 620
Borsodi – Government grants	32 550	6 200	0

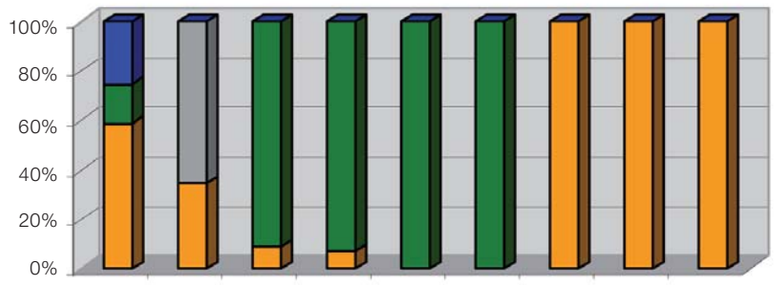
	Personal	Material	Investment
RÁBA – Own funds	6 955	76 659	25 626
RÁBA – Government grants	50 000	0	0
SZE – Own funds	0	0	0
SZE – Government grants	76 246	80 497	72 727

Utilization of the project partners' resources by cost types (HUF thousand), research year 2008



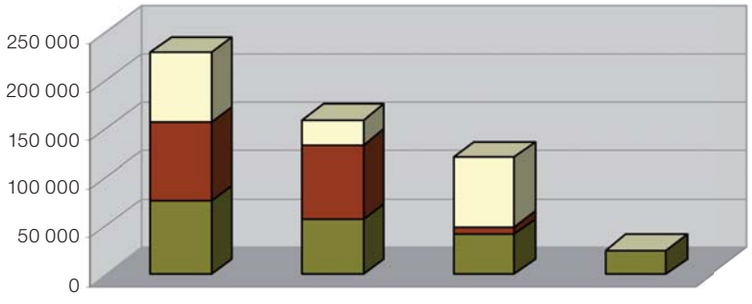
	Personal Government grants	Personal Own funds	Material Government grants	Material Own funds	Investment Government grants	Investment Own funds
Visiocorp	8 890	16 664				
Borsodi	32 550	8 600	6 200	2 043	0	71 620
RÁBA	50 000	6 955	0	76 659	0	25 626
SZE	76 246	0	80 497	0	72 727	0

Research year 2008 – The proportion of the JRET consortium partners' participation in the individual research projects (in %)



	I. 1.	I. 2.	I. 3.	II. 1.	II. 2.	II. 3.	II. 4.	III. 1. and III. 2.	Manage-ment
Visiocorp	2 555,4	0	0	0	0	0	0	0	0
Borsodi	0	12 1013,4	0	0	0	0	0	0	0
RÁBA	16 358	0	20 298	48 255	24 561	49768	0	0	0
SZE	60 044	63 955	1 976	3 778	0	0	12 836	41 475	45 406

Project cost distribution by project partner (HUF thousand), Research year 2008



	SZE	Rába	Borsodi	Visiocorp
Investment	72 727	25 626	71 620	0
Material	80 497	76 659	8 243	0
Personal	76 246	56 955	41 150	25 554

The persons participating in research and development and their actual working time spent with the project

Person	Consortium member	Sub-project number	Time spent on the project (day)	Time spent on the project (%)	Function
Dr. Imre Czinege	SZE (1)	I/1.	54	30%	Pres., Steering Committee
Dr. Tamás Réti	SZE (1)	I/3.	36	20%	Pres., Scientific Committee
Dr. Ernő Halbritter	SZE (1)	I/1.	54	30%	Research project leader
Dr. Károly Kardos	SZE (1)	I/1.	36	20%	Leader, R&D program I.
Dr. Gábor Dogossy	SZE (1)	I/1.	90	50%	Research project leader
Ágnes Pálfiné Böröcz	SZE (1)	I/1.	180	100%	Researcher
Attila Buczkó	SZE (1)	I/1.	180	100%	Researcher
Zoltán Kocsárdi	SZE (1)	I/1.	165	90%	Researcher
Iván Tarcsay	SZE (1)	I/1.	54	30%	R&D supporting staff
János Jósvai	SZE (1)	I/2.	150	80%	Research project leader
Sándor Ollé	SZE (1)	I/2.	180	100%	Researcher
Dr. Zoltán Horváth	SZE (1)	II/1.	90	50%	Research project leader
Tamás Morauszki	SZE (1)	II/1.	30	100%	Researcher
Krisztián Tóth	SZE (1)	I/1. II/1.	150	100%	Researcher
Ádám Zoltán Fejes	SZE (1)	II/1.	105	100%	Researcher
Dr.Péter Horváth	SZE (1)	II/1.	54	30%	Researcher
Dr. Zoltán Varga	SZE (1)	II/2. II/3. II/4.	54	30%	Research project leader
Dr. Csaba Tóth Nagy	SZE (1)	II/4.	54	30%	Researcher
Péter Tamás Szilasi	SZE (1)	III/1. III/2.	180	100%	Leader, R&D program III.
Dr. Károly Szőcs	RÁBA (2)	I/1; I/3, II/1, II/2, II/3	18	10%	Leader, R&D program II.
Zoltán Bognár	RÁBA (2)	II/3.,II/2	54	30%	Researcher
László Varga	RÁBA (2)	II/1.1; II/1.2	54	30%	Researcher
Mátyás Andrási	RÁBA (2)	II/2.; II/3.,I/1.1	90	50%	Research project leader
Antal Horváth	RÁBA (2)	II/2.; II/3.	54	30%	Researcher
László Nagy	RÁBA (2)	II/1/2.	36	20%	Researcher
Imre Szinger	RÁBA (2)	II/1.1; II/1.2.	54	30%	Researcher
Imre Tripolszki	RÁBA (2)	II/3.	54	30%	Researcher
Jenő Petőfalvi	RÁBA (2)	II/1/2.; II/2	54	30%	Researcher
Kálmán Rákóczy	RÁBA (2)	II/1.1; II/1.4; II/3.	90	50%	Research project leader
László Légmán	RÁBA (2)	II/2	90	50%	Researcher
István Molnár	RÁBA (2)	II/1.1; II/3.,II/2	54	30%	Researcher
Miklós Ács	RÁBA (2)	I/1.; I/3.	54	30%	Researcher
István Csáki	RÁBA (2)	I/1.; I/3.	54	30%	Researcher
László Simon	RÁBA (2)	II/2.	54	30%	Researcher
Ferenc Tancsics	RÁBA (2)	I/1.; I/3.;	90	50%	Research project leader
Attila Polgár	RÁBA (2)	II/1.2;	54	30%	Researcher
Ernő Fülöp	RÁBA (2)	II/1.2; II/1.4	90	50%	Research project leader
Miklós Bavolyár	RÁBA (2)	I/1.; I/3.	54	30%	Researcher
Zoltán Mészáros	RÁBA (2)	I/1.; I/3.	54	30%	Researcher
Zsuzsanna Körmendi	RÁBA (2)	I/1.	54	30%	Researcher

Lajos Szüts	RÁBA (2)	I/1; I/3, II/1, II/2, II/3	36	20%	Researcher
Imre Baráth	RÁBA (2)	I/1., I/3	54	30%	Researcher
Miklós Losonczy	RÁBA (2)	I/1., I/3	54	30%	Researcher
Szabolcs Horváth	BORSODI (3)	I/2.	155	86%	Consortium member, project leader
József Bánhalmi	BORSODI (3)	I/2.	56	30%	R&D supporting staff
Gábor Boda	BORSODI (3)	I/2.	44	25%	R&D supporting staff
József Borbély	BORSODI (3)	I/2.	111	60%	R&D supporting staff
István Boros	BORSODI (3)	I/2.	44	25%	R&D supporting staff
Péter Borsodi	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Tamás Budai	BORSODI (3)	I/2.	67	37%	Researcher
Zoltán Dániel	BORSODI (3)	I/2.	11	6%	Researcher
Ádám Erdélyi	BORSODI (3)	I/2.	89	50%	R&D supporting staff
Alfréd Fehérvári	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Andrea Rita Gál	BORSODI (3)	I/2.	67	37%	Researcher
Mónika Horváthné B.	BORSODI (3)	I/2.	22	12%	Researcher
IFJ. László Borsodi	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Károly Jukli	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Alexandra Kovács	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Zsófia Kőhalmi	BORSODI (3)	I/2.	33	18%	R&D supporting staff
Szabolcs Lendvai	BORSODI (3)	I/2.	67	37%	R&D supporting staff
Norbert Magyar	BORSODI (3)	I/2.	111	60%	R&D supporting staff
Róbert Miklós	BORSODI (3)	I/2.	67	37%	R&D supporting staff
Emőke Monár	BORSODI (3)	I/2.	111	60%	R&D supporting staff
János Nagy	BORSODI (3)	I/2.	22	12%	Researcher
Gábor Ónodi	BORSODI (3)	I/2.	67	37%	Researcher
Endre Ősz	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Ferenc Pártl	BORSODI (3)	I/2.	111	60%	R&D supporting staff
Gábor Pongrácz	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Bálint Pozsgai	BORSODI (3)	I/2.	22	12%	Researcher
Gábor Szabó	BORSODI (3)	I/2.	56	30%	Researcher
Győző Szabó	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Csaba Szűcs	BORSODI (3)	I/2.	22	12%	R&D supporting staff
István Szűcs	BORSODI (3)	I/2.	44	25%	R&D supporting staff
László Unger	BORSODI (3)	I/2.	22	12%	R&D supporting staff
Ádám Vesztergom	BORSODI (3)	I/2.	33	18%	R&D supporting staff
Viktor Fekete	Visiocorp Hungary (4)	I/1.	95	40%	Consortium member, project leader
Zoltán Kocziha	Visiocorp Hungary (4)	I/1.	48	20%	Researcher
Gábor Ferencz	Visiocorp Hungary (4)	I/1.	95	40%	Researcher
Éva Nagyné Szalai	Visiocorp Hungary (4)	I/1.	143	60%	R&D supporting staff
Lajos Tóth	Visiocorp Hungary (4)	I/1.	95	40%	Researcher
Róbert Nagy	Visiocorp Hungary (4)	I/1.	143	60%	R&D supporting staff
Zoltán Deák	Visiocorp Hungary (4)	I/1.	143	60%	R&D supporting staff
Péter Stasztny	Visiocorp Hungary (4)	I/1.	48	20%	Researcher
Total:			**5741,7**		

Research workforce converted into full work time: 33 persons

The instruments of significant value procured in the framework of the project

Széchenyi István University	
AXIO Imager Microscope based analysis system (VDA 19 / ISO16232)	I/1-2
ProgRes C5 Digital microscope camera	I/1-2
Gildemeister CTX 310 4-axle CNC-controlled lathe centre	I/2-1
Rába Axle Ltd.	
VarioCAM universal portable thermographic camera	I/3
Borsodi Műhely Ltd.	
METRIS, Evolution 3D 10-10-8 CNC Coordinate Measuring Machine	I/2-2

List of abbreviations

SZE-JRET – Széchenyi István University, Regional University Knowledge Center for Vehicle Industry
IT – Steering Committee
TT – Scientific Committee
VIHU – Visiocorp Hungary Lp.
SZE-AJT – Széchenyi István University, Faculty of Engineering Sciences, Institute of Informatics, Electrical and Mechanical Engineering, Department of Materials and Vehicle Manufacturing
SZE-MGT – Széchenyi István University, Faculty of Engineering Sciences, Institute of Informatics, Electrical and Mechanical Engineering, Department of Machine Design and Mechanics
SZE-KVJ – Széchenyi István University, Faculty of Engineering Sciences, Institute of Informatics, Electrical and Mechanical Engineering, Department of Automotive and Railway Engineering
SZE-MSZT – Széchenyi István University, Faculty of Engineering Sciences, Institute of Informatics, Electrical and Mechanical Engineering, Department of Mathematics and Computer Sciences
SZE-FKT – Széchenyi István University, Faculty of Engineering Sciences, Institute of Informatics, Electrical and Mechanical Engineering, Department of Physics and Chemistry
CAD – Computer Aided Design
CAM – Computer Aided Manufacturing
CAE – Computer Aided Engineering
FEM – Finite Element Methods
GID – Gasinnendruck – Gas-assisted (injection molding)
TDM – Tool Data Management
BMF-BGK – Technical College of Budapest, Bánki Donát Faculty of Mechanical Engineering
PVD - Physical Vapor Deposition
EJJT – Advanced Vehicle Control Knowledge Center
IDDRG – International Deep Drawing Research Group
FEA – Finite Element Analysis

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