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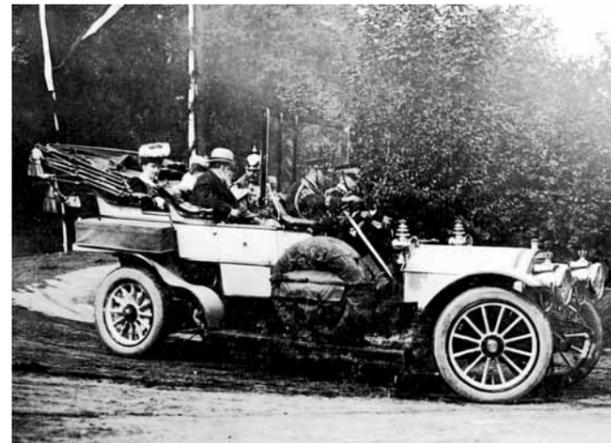
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High-Tech Region Stuttgart: Automotive

“There’s no future in automobiles. Horses are the way forward.”

(Kaiser Wilhelm II, 1859 – 1941)



Kaiser Wilhelm II in a 1904 Mercedes Simplex 17/22 PS



A-Class F-Cell, Daimler AG

Engineering the Future

The Stuttgart Region's Strengths

- Europe's leading high-tech region with a strong export orientation (source: Eurostat)
- Situated in the economic powerhouse between Frankfurt, Munich and Zurich, with excellent road, rail and air links to key population centres. 21 million people live within a 200-km radius of the city
- Outstanding skills in automaking, engine manufacturing, electrical and general engineering, toolmaking, and IT
- Companies are located close to suppliers, customers and partners – important regional market with close relationships between players at all stages of the supply chain
- Highly motivated and highly skilled workforce with expertise based on hands-on experience
- Comprehensive research infrastructure comprising numerous universities and an extensive network of centres for knowledge transfer, conducting basic and applied, market-driven research
- Regional competence and innovation centres, e.g. for mechatronics, simulation technology, fuel cells and technical textiles

“There's no future in automobiles. Horses are the way forward.” (Kaiser Wilhelm II, 1859–1941)

When German Kaiser Wilhelm II uttered this damning verdict at the turn of the last century, the automobile was still in its infancy. As we now know, his prediction couldn't have been more wrong. Little did he suspect the far-reaching effects this invention was to have on individuals, society and economies – effects that are particularly evident in the Stuttgart Region, the birthplace of motor vehicles.

Over many years, a world-leading cluster of tightly networked automotive companies and institutions has developed within the Stuttgart Region – pooling the expertise of manufacturers, system and component suppliers, service providers, engineering companies, and numerous research establishments.

Today, the automotive industry is continuously searching for technologies that will help master the challenges of tomorrow. These include reduction of carbon dioxide and other harmful emissions, greater energy efficiency, enhanced vehicle safety, new industrial materials and alternative engines.

Home to major players

Maybach

Every Maybach is manufactured using a combination of cutting-edge technology and traditional craftsmanship. Opened in autumn 2002, the 21,000 m² Maybach Manufaktur production facility is an integral part of Daimler's Sindelfingen plant. Close to the Centre of Excellence, 330 highly skilled specialists put the finishing touches to an average of just five new luxury saloons each day. It takes a good four weeks to shape the high-quality materials into an automaking masterpiece – a painstaking manufacturing process. And every vehicle is one of a kind.

The Stuttgart Region is the heart of the German automotive industry. Not only do major global players, including Daimler, Porsche, Bosch, Mahle, Behr, Beru, Eberspächer, Mann+Hummel, Getrag and Recaro, have their headquarters in the area; subsidiaries of the world's largest components suppliers, such as TRW, Lear Corporation, BOS, Valeo, Hirschmann and Kaliko (Continental AG), are also based here. Moreover, the region is home to over 400 highly innovative small and medium-sized suppliers whose customers include automotive companies – for example, Bernd Kussmaul GmbH in Weinstadt, Sitronic GmbH, and CeramTec AG, to name but a few. And Audi AG operates one of its key production facilities in Baden-Württemberg – just outside the Stuttgart Region. The area's pivotal role is further underscored by the close alignment of local general engineering firms with the automotive sector. Engineering firms in the region include transfer-line specialist MAG Powertrain Eisligen (formerly Ex-Cell-O AG), press manufacturer Schuler AG, and paint-systems expert Dürr.

Daimler AG

The history of automaking giant Daimler goes back over a century. In 1883, Gottlieb Daimler secured the first patents for a gas engine with hot-tube ignition and for the regulation of engine speed through control of the exhaust valve. These paved the way for the first high-speed combustion engine. Today, the company registers over 4,700 patents annually – ensuring it remains at the cutting-edge of technology.

Dr. Ing. h.c. Ferdinand Porsche AG

The Porsche legend was born on 25 April 1931 – when Ferdinand Porsche founded his own design-engineering office at Kronenstrasse 24 in Stuttgart, laying the foundation for what has become a major global player. Today, Porsche is one of the smallest but most successful automotive manufacturers in the world.

Robert Bosch GmbH

The name Bosch goes hand in hand with automotive technology. With good reason: the company is the world's largest automotive component supplier, and manufactures a wide range of products including fuel systems, electronics, and body systems. It's hard to imagine that Robert Bosch could have foreseen these technologies when he invented the spark plug in 1906.



CeramTec investment-casting cores for casting pistons

Component suppliers

Allgaier Werke GmbH, Utingen
www.allgaier.de

The company specialises in systems for the international automotive industry, and manufactures pressed parts, ready-for-installation components, and tools for manufacturing car bodywork parts.

Behr Industrietechnik GmbH & Co. KG, Stuttgart
www.behrindustry.com

World-leading original equipment manufacturer for the automotive and aerospace industries. Behr's core competencies are air-conditioning and engine cooling.

Beru AG, Ludwigsburg
www.beru.com

Beru specialises in ignition technology for petrol engines and diesel cold-start technology.

BOS GmbH & Co. KG, Ostfildern
www.bos.de

The German subsidiary of the international BOS Group develops and manufactures parts and systems for vehicle interiors. The company's development and prototype facilities are in Ostfildern, near Stuttgart.

GETRAG Getriebe- und Zahnradfabrik Hermann Hagenmeyer GmbH & Cie KG, Ludwigsburg
www.getrag.de

The Ludwigsburg-based company is one of the foremost manufacturers of transmission and drivetrain systems.

Hirschmann Car Communication GmbH, Neckartenzlingen
www.hirschmann.de

Hirschmann produces communications systems, contact elements and connectors for automotive manufacturing.

J. Eberspächer GmbH & Co. KG, Esslingen
www.eberspaecher.com

The Eberspächer group focuses on three key areas: exhaust systems, vehicle heaters and glass construction.

MAHLE GmbH, Stuttgart
www.mahle.com

MAHLE is one of the world's top manufacturers of high-quality components for the vehicle and engine manufacturing industries. Products include piston systems, cylinder components, valve-train systems, and filter systems.

The role of automaking in the Stuttgart Region

110,000 people in the region are employed in the automotive sector. And when enterprises that are not directly involved in automaking, but that generate significant revenue from the industry, are taken into account, this figure rises to almost 200,000.

Almost 45 per cent of the Stuttgart Region's total manufacturing revenues come from the automotive sector.

60 per cent of the Baden-Württemberg automotive industry's revenues are generated within the Stuttgart Region. And 64 per cent of the area's automotive products are sold outside Germany – testifying to the sector's strength as an exporter.

Mann+Hummel GmbH, Ludwigsburg
www.mann-hummel.com

The original equipment manufacturer develops, produces and markets components for the automotive industry, including Mann+Hummel filter and air-intake systems.

Modine Europe GmbH, Filderstadt
www.modine.com

Modine is a leading developer and manufacturer of heat-transfer, cooling and air-conditioning systems. Its European headquarters are in Filderstadt, where 140 of the 360-strong staff work at the company's development centre.

NuCellSys GmbH, Kirchheim u. Teck
www.nucellsys.com

NuCellSys GmbH, a joint venture of the Ford Motor Company and Daimler, develops fuel-cell systems, and in future will supply vehicle engines based on this technology.

Recaro GmbH & Co. KG, Kirchheim u. Teck
www.recaro.com

Recaro has proven expertise in all aspects of seating. Many major automakers – including Audi, BMW, Toyota, Renault, Volkswagen and Porsche – deploy Recaro products.

TRW Automotive, Alfdorf
www.trw.de

TRW Automotive is the world market leader in disc brake systems, electronically assisted steering systems, safety belts, and airbags.

Valeo GmbH, Bietigheim-Bissingen
www.valeo.de

Based in Bietigheim-Bissingen, Valeo develops, manufactures and markets products including wiper systems, interior controls and security systems.

Vector Informatik GmbH, Stuttgart
www.vector-informatik.com

Vector Informatik delivers tools, software components and services for the creation of electronic vehicle systems.

Visiocrp Deutschland GmbH, Schwaikheim
www.visiocrp.com

Visiocrp Deutschland GmbH is the world-leading manufacturer of car mirrors.

40 years of electronic petrol injection from Bosch, press photo no. 1-GS-14276

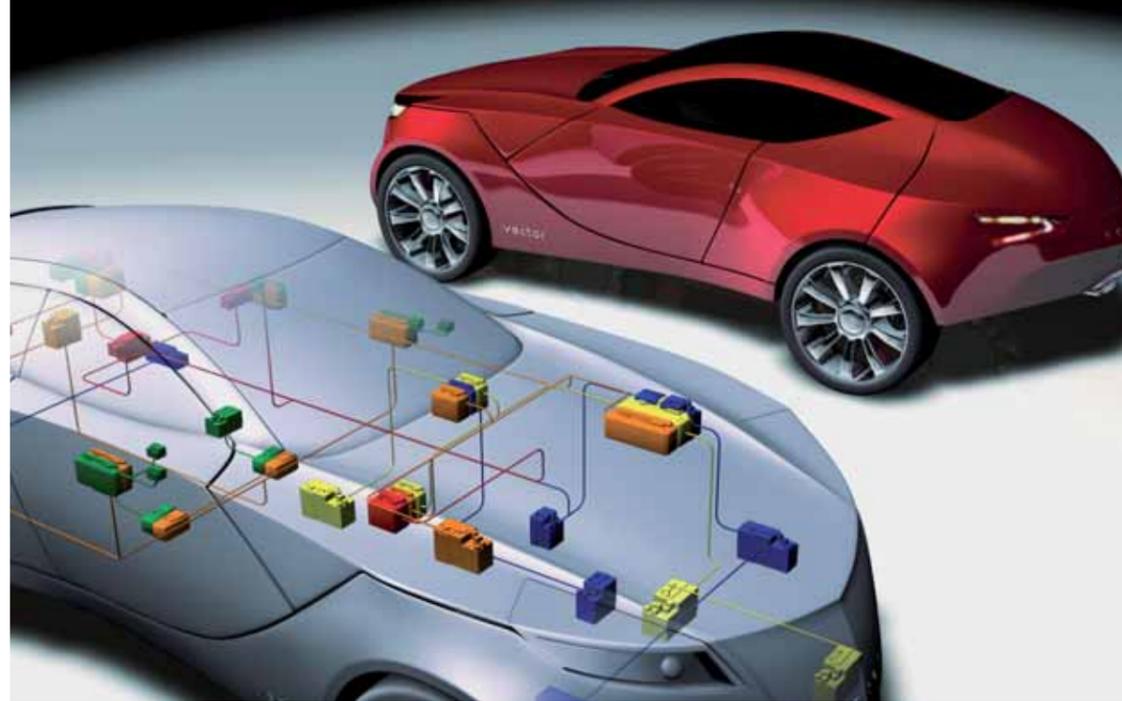


Intake manifold from Mann+Hummel

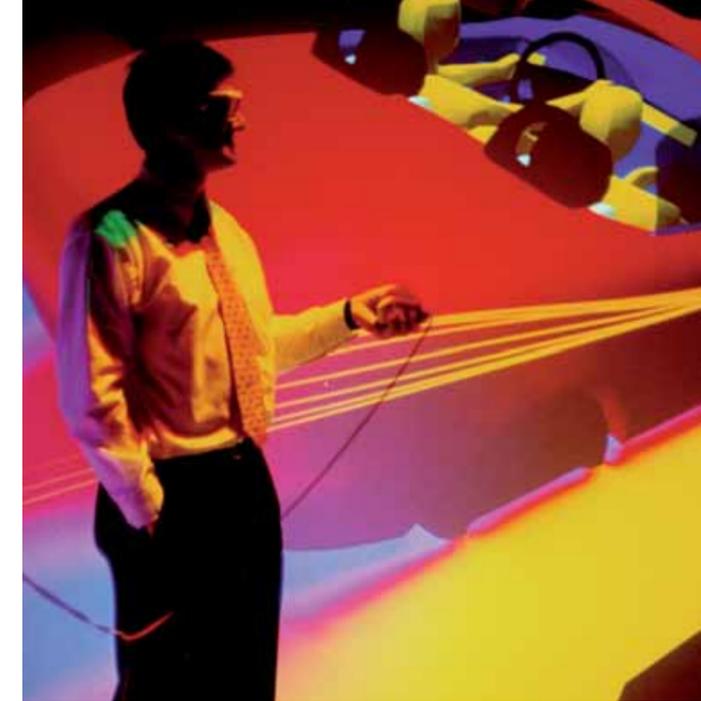


How Ferrari came by Stuttgart's emblem

Everyone knows the Ferrari emblem – a black horse on a yellow background. There are several theories regarding its origins. According to one, it was the symbol of Baron Francesco Baracca, an Italian World War I pilot, who served in the same unit as Enzo Ferrari's brother, Dino. The story goes that Baron Baracca originally copied the horse from a German airman shot down in battle – whose plane bore the very similar Stuttgart coat of arms. So a Stuttgart pilot passed on the city's emblem to the Baron, and ultimately to Ferrari.



Network comprising a variety of electronic systems



Flow simulation

A strong location for research and development

Major investment in R&D

Enterprises in the Stuttgart Region invest five billion euros on research and development annually – some 15 per cent of Germany's total private-sector R&D expenditure. Three quarters of this investment is earmarked for vehicle manufacturing. With R&D spending equivalent to 6 per cent of gross domestic product, companies in the Stuttgart Region are well ahead of the national average.

The Daimler and Porsche development centres are located in the Stuttgart Region. Porsche Engineering Services GmbH offers a comprehensive portfolio of services for third-party vehicle manufacturers, as well as for non-automotive companies.

In addition to its Schwieberdingen R&D facility, Robert Bosch GmbH has a new development and application centre in Abstatt, between Stuttgart and Heilbronn. Other innovative automobile suppliers with large-scale development activities in the Stuttgart Region include Allgaier, Behr, Eberspächer, Getrag, Mahle, Mann+Hummel, Visiocrp, TRW and Valeo.

Local providers of development services, such as Bertrandt AG and NuCellSys GmbH, contribute significantly to the Stuttgart Region's technology leadership. They not only enhance manufacturers' and component suppliers' own R&D facilities; they also benefit from the trend towards outsourcing development tasks – which has fuelled average annual market growth of 15 per cent in recent years.

In addition to companies, university research establishments in the Stuttgart Region universities play a key role in R&D. The University of Stuttgart's many institutes offer the automotive industry comprehensive expertise in both basic and applied research.

The University of Stuttgart's Institut für technische Verbrennung (Institute of Technical Combustion) for example, works hand in hand with major players including Daimler, Ford, Volkswagen and Volvo. And the German Aerospace Center has established a dedicated Institute of Vehicle Concepts in Stuttgart, specialising in new industrial materials, lightweight design, and fuel-cell systems. Focusing on real-world applications, universities of applied sciences play a central part in research and training within the region. Local facilities include the Institute for Management in the Automobile Sector in Geislingen, and the Automotive Engineering faculty at Esslingen University of Applied Sciences, where some 650 students are enrolled on courses.

Research and development in the Stuttgart Region

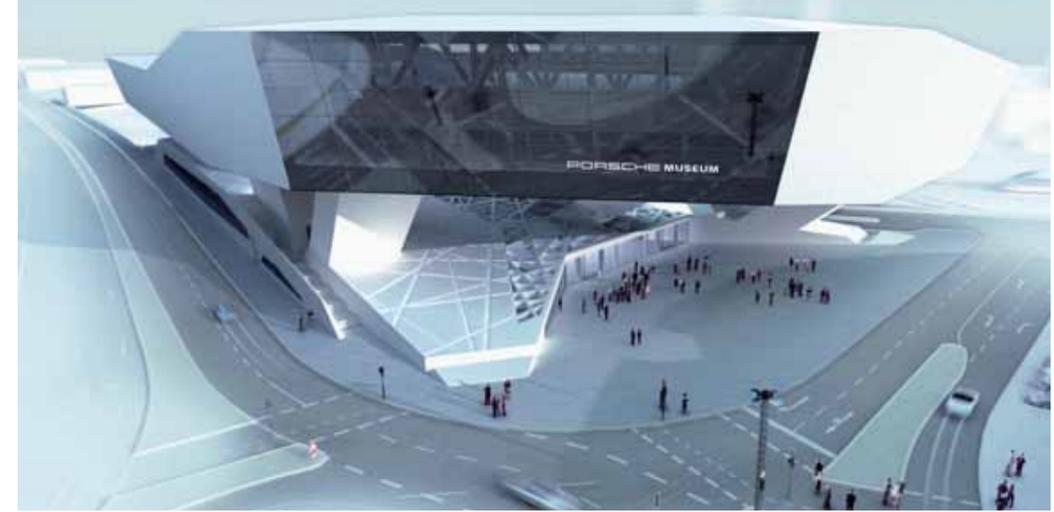
Nürtingen-Geislingen University, Institute for Management in the Automobile Sector (IFA)	www.ifa-info.de
Esslingen University of Applied Sciences, Automotive Engineering Faculty	www.hs-esslingen.de
Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Stuttgart	www.ipa.fhg.de
Fraunhofer Institute for Industrial Engineering (IAO)	www.iao.fhg.de
Fraunhofer Technology Development Group (TEG)	www.teg.fhg.de
Süddeutsches Kunststoffzentrum (South-German Plastics Centre), Stuttgart office	www.skz.de
Institut für Mikroelektronik (Institute of Microelectronics, IMS), Stuttgart	www.ims-chips.de
Research Institute for Pigments and Coatings (FPL), University of Stuttgart	www.fpl.uni-stuttgart.de
Institute of Structures and Design (IBK), Stuttgart	www.st.dlr.de/BK
German Aerospace Center, Institute of Combustion Technology, Stuttgart	www.dlr.de/vt
German Aerospace Center, Institute of Vehicle Concepts, Stuttgart	www.dlr.de/fk
Max-Planck-Institut für Metallforschung (Institute of Metals Research), Stuttgart	www.mf.mpg.de
Research Institute for Precious Metals and Metals Chemistry, Schwäbisch Gmünd	www.fem-online.de
FKFS – Research Institute of Automotive Engineering and Vehicle Engines Stuttgart, University of Stuttgart	www.uni-stuttgart.de/fkfs (German only)
Networks for Mobility (FOVUS), University of Stuttgart	www.uni-stuttgart.de/fovus
Institute for Road and Transportation Science (ISV), University of Stuttgart	www.isv.uni-stuttgart.de/ (German only)
Institute for Polymer Testing and Polymer Science, University of Stuttgart	www.ikp.uni-stuttgart.de (German only)
Institute for Metal-Forming Technology, University of Stuttgart	www.ikf.uni-stuttgart.de/ifu
Institute of Internal Combustion Engines and Automotive Engineering (IVK), University of Stuttgart	www.ivk.uni-stuttgart.de (German only)
High Performance Computing Center (HLRS), University of Stuttgart	www.hlrs.de



Mercedes-Benz Museum



Turbine at the University of Stuttgart's wind tunnel



Computer visualisation of the new Porsche Museum

Relevant courses of study for automotive manufacturing

Highly skilled workforce

Automotive players in the Stuttgart Region can draw on a vast pool of skilled employees. The proportion of engineers, scientists and technicians in the local population is among the highest in Europe. Over 90,000 students in Baden-Württemberg – almost half the total student population – study business and economics or engineering. Many universities within the state offer special degree courses focusing on aspects of mobility, including design engineering and process engineering, vehicle technology and industrial design.

University of Stuttgart

- Vehicle and engine technology
- Materials science
- Electrical engineering
- Industrial automation
- Mechanical engineering
- Physics

www.uni-stuttgart.de

Esslingen University of Applied Sciences

- Automotive engineering
- Industrial engineering and management
- Mechanical engineering
- Mechatronics and electrical engineering

www.hs-esslingen.de

Stuttgart University of Cooperative Education

- Mechanical engineering
- Industrial engineering and management
- Mechatronics
- Electrical engineering

www.ba-stuttgart.de

Wilhelm-Maybach-Schule

Vocational training college offering courses in automotive technology, mechanical engineering, foundry technology. Its automotive department is one of Germany's largest.

www.wilhelm-maybach-schule.de
(German only)

Fuel-cell test facility

Esslingen University of Applied Sciences: training today's engineers for tomorrow's challenges

The faculty of Building Services, Energy and Environmental Engineering at Esslingen University of Applied Sciences is working hand in hand with private-sector partners including Ballard, Daimler, and the Fraunhofer Institute for Solar Energy Systems, to establish a fuel-cell test facility at the university. Hydrogen for the fuel cell is provided either in the form of compressed hydrogen, by reforming methanol (mobile applications), or via natural gas (stationary applications). The primary goal is to incorporate the test facility into teaching at the university, as there is expected to be great demand for skilled engineers in the near future.

Automotive highlights in the region

Automobile industry exhaust-gas centre

The centre – a joint venture involving Audi, BMW, Daimler, Porsche and VW – was launched in 1996. It focuses on developing exhaust-gas after-treatment technologies for use in low-emission passenger-car engines.

www.abgaszentrum.de (German only)

The University of Stuttgart wind tunnel

The Stuttgart wind tunnel is one of the most up-to-date and powerful facilities of its kind in the world. It supports realistic simulations of the aerodynamic and aero-acoustic characteristics of driving at speeds of up to 250 kilometres per hour. Moving steel belts simulate the road, enabling analysis of the interaction between road surface and vehicle. The wind tunnel is available for use in manufacturing development and for basic research conducted by universities.

www.fkfs.de/kraftfahrwesen/windkanalbetrieb (German only)

Mercedes-Benz-Museum

The legendary Mercedes marque and the fascinating history of the automobile are brought together in a spectacular building that sets new architectural standards. The Mercedes-Benz Museum is one of the Stuttgart Region's most popular attractions – and not just for automotive enthusiasts.

www.museum-mercedes-benz.com

Porsche Museum

The premium automaker's new museum will give the public a single point of access to comprehensive information on all things related to Porsche – from the past to the present day. The centrepiece will be a large-scale exhibition space that will showcase impressive vehicles.

www.porsche.com/uk/aboutporsche/porschemuseum

Innovations from the Stuttgart Region

1885	Gottlieb Daimler / Wilhelm Maybach: First motorcycle with petrol engine
1885/	Gottlieb Daimler:
1886	First four-wheeled vehicle
1887	Robert Bosch: Magneto for combustion engines
1906	Robert Bosch: Spark plug for internal combustion engines
1927	Robert Bosch: Injection pump for diesel engines
1935	Ferdinand Porsche: VW Beetle
1952	Bela Barenzy: Rigid passenger cell with deformable crumple zones
1971	Mercedes-Benz: Airbag
1979	Heinz Leiber: ABS
1984	Porsche: Tiptronic
1988	IBM Deutschland: Mainframe chip using CMOS technology
1996	Mercedes-Benz: Distance control, Tempomat cruise control
1998	CAA: Car PC
1999	DaimlerChrysler: Active Body Control
2001	Robert Bosch: Electronically controlled direct gasoline injection
2003	DaimlerChrysler: On-road testing of world's first fleet of fuel-cell vehicles.
2005	DaimlerChrysler: Night-vision system
2006	Robert Bosch: CAPS (Combined and Active Passive Safety)
2007	DaimlerChrysler: Mercedes-Benz Citaro bus with diesel/electric hybrid drive system

Initiatives and competence centres

The technology of the future

In the future, many mechanical and hydraulic vehicle components will be replaced by mechatronics technology, comprising mechanical elements, electronics and software. This brings a host of benefits – including lighter components, improved energy management and greater eco-friendliness. Today's auxiliary vehicle systems, such as air-conditioning, fuel, water and oil pumps, brake boosters, power steering, and automatic transmissions, need to be continuously powered via belts and cogs. Innovative solutions that shut down and restart the engine when a vehicle is stationary for short periods, or convert kinetic energy generated during braking into other useful forms, promise potential savings. But they also call for intelligent control technology – technology that is already being successfully developed and manufactured in the Stuttgart Region.

Stuttgart Region Automotive Cluster initiative (CARS)

Launched by the Stuttgart Region Economic Development Corporation (WRS), the CARS initiative aims to promote and strengthen the Stuttgart Region as a leading international location for auto-makers and other providers of new, mobility-related services and technologies. The WRS's tasks include managing and fostering collaboration between stakeholders and provision of information tailored to specific target groups. Over 250 enterprises and institutions have been actively involved in the initiative during recent years.

The activities of the CARS initiative are grouped under four key areas:

1. Provision of information, awareness-raising, and training
2. Streamlined communications within the automotive cluster – not only between businesses, but also between enterprises, universities and research establishments
3. Site selection and investor support services – helping companies find suitable real estate
4. Marketing the Stuttgart Region internationally

CARS cooperates closely with key automotive cluster initiatives run by other regions within the scope of the European Automotive Strategy Network (EASN) – and also coordinated the BeLCAR project, supported by the European Commission's Directorate General for Enterprise and Industry.

www.cars.region-stuttgart.de
(German only)

Virtual Dimension Centre in Fellbach

Established by Visenso and the WRS, the Virtual Dimension Centre (VDC) specialises in virtual reality and cooperative engineering. Its aim is to foster the Stuttgart Region's skills in these areas. What's more, it provides services that allow small and medium-sized enterprises (including automotive components suppliers and engineering companies) to access associated technology. The VDC pools the expertise of businesses, universities and research establishments – enabling the region to maintain and enhance its position as an international technology leader for years to come. Thanks to the centre, the vision of digital product development can be put into practice for the first time in the Stuttgart Region.

www.vdc-fellbach.de

Mechatronics competence centre – it's all about contacts

Mechatronics systems are an indispensable element of today's manufacturing industry – and are extensively deployed in auto-making. The Göppingen region, some 40 kilometres east of Stuttgart, is home to many enterprises that develop, manufacture and market mechatronic products. What's more, Esslingen University of Applied Sciences' mechatronics facility in Göppingen is one of the most highly regarded of its kind in Germany. In 2001, 28 founding members established the Göppingen mechatronics competence network, to pool regional mechatronics expertise. Today, the competence centre offers a variety of services, and the number of members has increased to 75.

www.mechatronik-ev.de (German only)



Silver arrow, Mercedes-Benz Museum

Baden-Wuerttemberg Fuel-Cell Alliance (BzA-BW)

The BzA-BW - Fuel Cell Alliance Baden-Wuerttemberg provides a central information and communications platform for fuel-cell players focusing on research and real-world applications. Its mission is to enhance responsiveness to changing market demands by creating a network of specialists that provides information and initiates activities. This is particularly relevant for the automaking industry and its component suppliers, which play such a key role in the region.

www.bza-bw.de (German only)

Technical textiles competence centre (Denkendorf)

Technical textiles offer the region's textile industry considerable potential for growth. The competence centre taps into existing opportunities, and develops new products and processing technologies.

The Denkendorf-based experts' activities focus primarily on the automobile industry, as well as on the emerging biotechnology, environmental-protection and healthcare markets.

www.itvd.uni-stuttgart.de

The story of the Silver Arrows

The story goes that the legendary Silver Arrows were the result of accident, rather than design: To reduce the weight and power of grand prix racing cars, the international motor-sport governing body imposed a maximum vehicle weight of 750 kilograms, from 1934 onwards. Until then, high-calibre racing cars like the Bentley Blower and the Mercedes SSKL (aka the White Elephant) packed up to 300 hp – but were often huge, tipping the scales at around two metric tons. When the Mercedes-Benz team submitted their newly developed W25 for scrutiny in the run-up to the spring 1934 Eifelrennen at Nürburgring, it weighed in at 751 kg. Racing manager Alfred Neubauer and his driver Manfred von Brauchitsch were initially at a loss, but then came up with the idea of stripping the white paint from the bodywork. This revealed the glistening aluminium – and helped the car make the weight. Manfred von Brauchitsch went on to win the race. And the press christened the cars Silver Arrows.