

Baden-Württemberg Is to Maintain Its Leading Position under Conditions of Changing Mobility: The State Pools Its Competencies in the “High Performance Center for Mobility Research”

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The strong wish for mobility, increasing transportation of goods, and sustainability make the challenges faced in the transport sector increasingly complex. As a response, the State of Baden-Württemberg funds the Karlsruhe High Performance Center for Mobility Research. On Friday, May 10, 2019, the “core phase” of the Center’s work started officially. As a “one-stop shop,” the Center is to be the first contact point for companies, planners, and political decision-makers dealing with new mobility concepts. For two years, more than 9 million Euros will be made available for interdisciplinary research projects. The topics range from autonomous driving to social changes to new, environmentally friendly fuels.

Mobility in the Focus of Societal Issues

Problems and discussions of society increasingly focus on our mobility. Too high emissions, driving bans, long traffic jams, or valuable parking space in the city are juxtaposed with hardly any public passenger transit offers in rural areas in particular. At the same time, the adolescent generation’s relation to the own car is changing. The need for mobility is high, the ways to reach this objective, however, are of minor importance.

Parallel to these societal changes, technical innovations take place, such as changed drive trains and fuels. Massively progressing digitization opens up entirely new opportunities, such as networked and autonomous driving. New mobility services are offered on the market every day.

State Minister of Economic Affairs, Dr. Nicole Hoffmeister-Kraut: “Technological and structural changes are associated with new challenges for the industrial chain of values added. We wish to maintain systems competence and values added for the vehicle and mobility in Baden-Württemberg. The Karlsruhe High Performance Center for Mobility Research, hence, is an important element for the success of this transformation.”

Thanks to its excellent education, research, and innovation communities, Karlsruhe takes a leading role in responding to urgent mobility problems. For this to remain like that, research institutions have joined the High Performance Center for Mobility Research in Karlsruhe. “Collaboration with regional and supraregional partners from industry is aimed at pushing transformation of the mobility sector by

sustainable mobility solutions, intensifying dialog with society, and advising politics,” says Professor Thomas Hirth, Vice-President for Innovation and International Affairs of Karlsruhe Institute of Technology (KIT). After a pilot phase of three years, the High Performance Center for Mobility Research Karlsruhe now enters the next funding phase with new projects.

Prognosis for Mobility in 2030

“My prognosis for mobility in 2030 is that the variety of differentiated mobility concepts competing with each other and finding various application niches will further increase,” says the Scientific Spokesperson of the Karlsruhe High Performance Center for Mobility Research and Head of the KIT Institute of Vehicle System Technology, Professor Frank Gauterin. He thinks that drives based on combustion engines will continue to exist, but consumption and emission will be reduced significantly, e.g. by downsizing and synthetic fuels. In parallel, use of electromotive drives will increase. In between, degrees of hybridization will differ. This is reflected by current efforts of German automotive industry and the climate goals for the transport sector. Our traffic infrastructure will become smarter and increasing digitization of mobility by automation and interconnection of vehicles will open up major potentials, including new business models, services, and technical solutions of startups. Private transport in the city will be determined even more than today by smaller actively or electrically driven mobility solutions. In future, transport on the first or last mile and new public passenger transit offers or shared use of vehicles and infrastructures will gain importance.

Major Changes in the Important Mobility Market Segment

The upcoming major changes in this market segment that is of highest importance to Baden-Württemberg and Germany have prompted the two state Ministries of Science, Research, and the Arts and of Economic Affairs, Labor, and Housing to jointly fund the Karlsruhe High Performance Center for Mobility Research. “Our problems and tasks are gaining complexity,” Frank Gauterin says, “this can no longer be managed with the excellence required by a single research institution.” For this reason, the four Fraunhofer Institutes ICT, ISI, IOSB, and IWM in Karlsruhe, the FZI Research Center for Information Technology, Karlsruhe University of Applied Sciences, Karlsruhe Institute of Technology (KIT), and 20 other institutes have established the High Performance Center for Mobility Research. Both ministries provide funding in the total amount of EUR 4.75 million. The partners and industry will contribute about the same amount, such that in the next two years collaborative projects in the total amount of more than EUR 9 million will be carried out.

Projects of the Karlsruhe High Performance Center for Mobility Research

Six projects are executed to make the region fit for the future:

The *implementation scenarios for cooperative, networked driving* are to analyze applications and the technologies required to enable profitable automated and networked driving at small penetration rates of the fleet. When introducing this technology, person-driven vehicles and (partly) autonomous vehicles will exist in parallel for quite a few years, such that this transition period will have to be adapted accordingly. Various scenarios of cooperative driving with close-to-series technology will be analyzed from the technological, economic, legislative, and societal perspectives. Practical recommendations and commercialization potentials will be derived.

To ensure viable mobility and enhance acceptance of autonomous vehicles, driving functions have to be safe and reliable. Within the *virtual test field for the verification of networked and autonomous driving functions*, manufacturers of components, systems, and vehicles and the licensing inspectorates, such as TÜV, Dekra, and GTÜ, will be supported in studying problems relating to functional safety and IT security as well as misuse of automated and networked driving functions by humans.

Mobility is important to economic development and social participation. To cope with present challenges, new mobility offers, forms of mobility, and low-emission drives adapted to the customers' needs have to be developed and used to bring about change. *Changing urban mobility* covers social aspects and needs of the different user groups. Based on the needs identified, appropriate solutions will be developed.

Development of viable lightweight traction battery systems will focus on technical solutions. Ultraquick charging systems with charging rates of up to 350 kW are under development already and will be available for customers from 2020. This high power will result in new requirements to be met by the cooling system of batteries for electric motors. For efficient and integrated cooling of the battery system, cooling structures will be incorporated in or attached to the battery module. For the manufacture of battery systems, various lightweight construction methods will be combined.

Development of a drive train based on regenerative fuels free of aromatic substances will focus on how combustion engines can be operated optimally with regenerative fuels and which fuels are suited best for this purpose. Special chemical composition and production from regenerative sources will enable greenhouse gas-neutral and practically pollutant-free operation of combustion engines. Problems that still remain to be solved are the fuels' compatibility with the polymer sealing, effects of new fuels on tribology of conventional drive systems, and aspects of flammability and flame core formation.

Efficiency increase of hybrid drive trains by optimizing thermal economy is aimed at increasing the electric range of vehicles with a hybrid drive by an optimum operation strategy and to reduce CO₂ emissions by an increased overall efficiency. Many options exist for combining electric drive and combustion system. For developing an optimum strategy, the drive train will be studied in all detail, starting with the characterization of the thermal behavior of battery cells to waste heat of engines and electronic systems to the potentials of using waste heat from the exhaust gas.

For more information on the High Performance Center for Mobility Research, click <http://www.profilregion-ka.de/index.php/en/>.