

# Research Campus ARENA2036

The innovation platform for mobility and production of the future

*The Research Campus ARENA2036 is a novel co-creative innovation environment. The proximity of researchers and developers from more than 50 partners within the 10,000 m<sup>2</sup> research factory enables higher speeds on the way from idea, to project, to transfer. Dr Clemens Ackermann, research coordinator at ARENA2036, explains that the goal of the Research Campus ARENA2036 is – based on excellent, interdisciplinary fundamental and applied research – to produce potentially disruptive and leap-frog innovations and to transfer them to industry.*

**A**RENA2036 (the Active Research Environment for the Next Generation of Automobiles) is a Research Campus founded by, among others, Daimler AG, Robert Bosch GmbH, Fraunhofer Gesellschaft, and the University of Stuttgart, providing a unique collaborative environment that enables industry and academia to work together on future-oriented topics. Named in anticipation of 2036, this innovation platform marks the 150th anniversary of the automobile as it provides sustainable automotive engineering for mobility of the future.

Dr Clemens Ackermann and Peter Froeschle from ARENA2036, together with Manuel Fechter from Fraunhofer IPA, discuss how ARENA2036 provides

a platform where more than 50 partners from industry and science are collaborating, exchanging ideas, and trying out new concepts in a pre-competitive environment. In addition to increasing the competitiveness of the business location Baden-Württemberg, already renowned for its automotive industry, the seamless transfer of research results into industrial application facilitates the creation of innovative business models, particularly for small and medium enterprises (SMEs).

#### INTERDISCIPLINARY APPROACH

Underpinned by its excellent interdisciplinary fundamental and applied research, ARENA2036 aims to produce potentially disruptive and leap-frog innovations that can be

transferred to industry and contribute to the transformation of work, mobility, and production. With partners in various disciplines such as aerospace technology, industrial science, textile and materials research, as well as the automotive industry, Dr Ackermann explains that the interdisciplinary and trans-institutional approach of the various fields is an essential component of the Research Campus. This interdisciplinary linking of the diverse stakeholders is reflected in the close cooperation of all actors under the umbrella of ARENA2036.

Moreover, the proximity of researchers and developers from more than 50 partners within the 10,000 m<sup>2</sup> research factory shortens the interval between the conception of an idea and its transfer to industry. While combining various stakeholders and their ideas is of great value, another unique selling point of the ARENA2036 Research Campus is the sharing of risk among all participants. This creates an opportunity to research issues that do not necessarily have to be included in the next model cycle, as they can potentially 'reach far into this century' (Ackermann, Fechter & Froeschle, 2021).

#### INDUSTRY 4.0

The Fourth Industrial Revolution, known as Industry 4.0, has emerged with the emphasis on taking digital technology to a new level. Originating as a national strategic initiative from the German government, it focuses on driving digital manufacturing forward by increasing digitisation and the interconnection of products, value chains, and business models. It is also

aimed at supporting research and encouraging the networking of industry partners along with standardisation. Using smart technology, Industry 4.0 brings the Internet of Things (IoT) into manufacturing with the ongoing automation of manufacturing and industrial practices. Intelligent manufacturing environments are proposed through the development and implementation of Cyber-Physical Production Systems made up of cooperative independent elements that are integrated into the Industrial Internet of Things to create Smart Factories. ARENA2036 is setting the pace for Industry 4.0, offering an interlinked and holistic approach to manufacturing.

#### DATA INTEROPERABILITY

The partners are using common data modelling and standardised communication parameters to ensure data interoperability and transparency. They are also employing uniform information models and semantic parameters to describe various application demands within the automotive industry use-case. Asset administration shells, in the form of standardised interfaces, extend the conventional physical assets to interconnected production. Data for all products and production resources are potentially accessible to every user and asset within the ARENA2036 Research Campus. In providing both data transparency and interoperability, ARENA2036 is enabling new data-driven business models in smart production as well as new marketplaces for virtual data properties in the product domain.

Researchers are also exploring data interoperability within the domains of product development and production system design, aiming to significantly reduce the time taken by product development and market introduction. This has particular importance for the ongoing transformation processes within the automotive industry that require increasingly flexible manufacturing processes. These are characterised by the incorporation of new product and production technologies into serial production at ever shorter intervals and present immense challenges for product design alongside corresponding production systems.

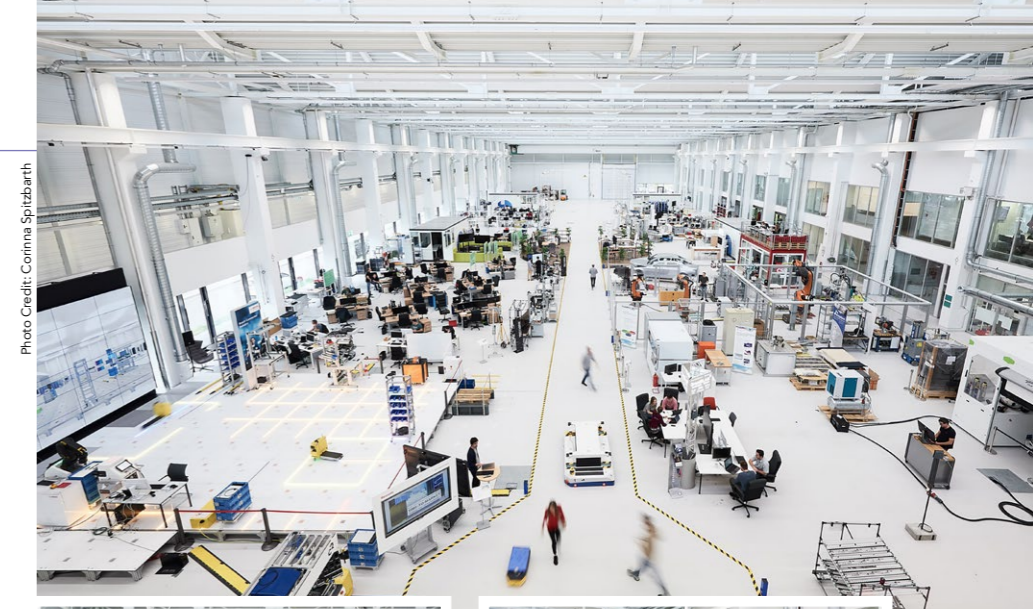


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ARENA2036 brings the Internet of Things into manufacturing to create Smart Factories.

#### HOLISTIC SEMANTIC MODELLING

Dr Ackermann describes how the basic ideas of innovation design incorporated at the Research Campus ARENA2036 offer a platform for joint research in a pre-competitive environment. These joint research projects are the foundation of ARENA2036 and enable all partners to pave the way for the mobility of the future. The holistic semantic modelling of integrated product and production development, particularly in the joint research projects Fluid Production and Digital Fingerprint, exemplify

decisions relating to conventional, rigidly linked production lines. These production systems no longer meet the requirements of today's changeable demands, growing numbers of product variants, ever-decreasing product lifecycles, and unpredictable technological developments. Fluid Production draws on an analogy between a fluid adapting its shape according to the pressures acting on it, and a cyber-physical production system optimally adapting to current requirements and demands. Fluid

## The interdisciplinary and trans-institutional approach of the various fields is an essential component of the Research Campus.

this. Furthermore, these projects demonstrate an approach to production that emphasises the need for constant flexibility, together with anthropocentric reconfigurability that focuses on the role of humans as designers of their production environments.

#### CYBER-PHYSICAL PRODUCTION SYSTEMS: FLUID PRODUCTION

The Fluid Production project addresses the challenges confronting production engineering design regarding planning, configuration and investment

Production enables the system, design and set-up to be moved as close as possible to the start of production, thereby minimising the uncertainties involved in forecasting market demands and applied technologies. It also reduces possible discrepancies between product design and production.

Fluid Production involves all production facilities being broken down into location-flexible modules. These modules are designed with an anthropocentric focus so that, with

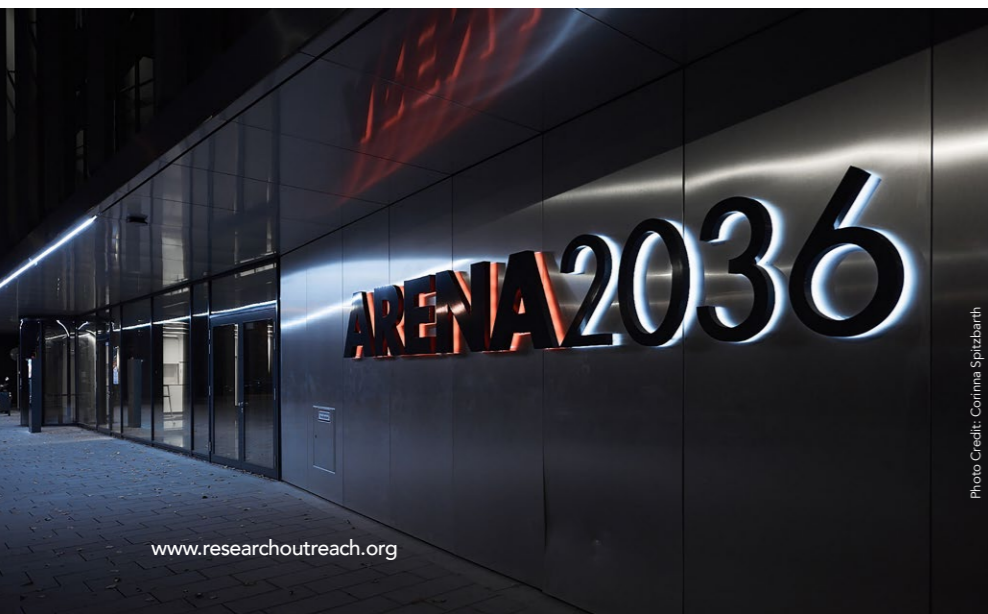


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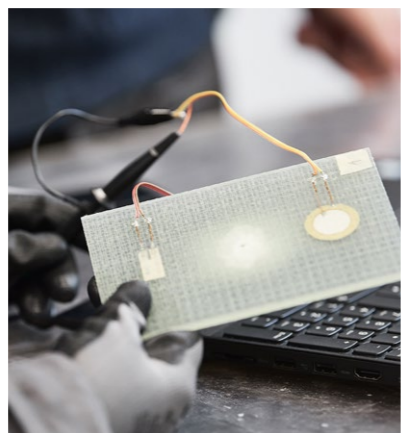


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ARENA2036 aims to produce potentially disruptive and leap-frog innovations that can be transferred to industry.

## The Digital Fingerprint delivers a foundation for Industry 4.0 applications and provides a link between all ARENA2036 joint projects.

the help of new approaches in work organisation and the use of data-driven assistive systems, every operator can implement, commission, and qualify assembly processes. This results in a new, highly flexible production system that places the employee at the centre of production design. Fluid Production's anthropocentric production system can react to changing production requirements within a few hours without the need for additional expert knowledge.

**CYBER-PHYSICAL PRODUCT DESIGN: DIGITAL FINGERPRINT** Partners working on the Digital Fingerprint joint project are developing new methods to continuously describe product parameters from conception and design through production and final quality inspection. This gathering of information continues in-service to inform possible improvements for future

products. A digital fingerprint of each component stores and smartly links this data, which is collected using integrated sensors. The digital fingerprint upgrades a component to an Industry 4.0 component, creating the necessary basis for the intelligent value chain that



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ARENA2036 offers a variety of spaces and formats to actively support trans-institutional communication.

describes the steps required to produce the components of the future. The project delivers a foundation for Industry 4.0 applications and provides a link between all ARENA2036 joint projects.

### FlexCAR

The impacts of cyber-physical product and production practices are demonstrated in the all-new modular cyber physical vehicle concept: FlexCAR. FlexCAR is a joint project which aims to develop a new vehicle concept. Here, participating partners can create added value at any time throughout the product's lifecycle. The first stage of this collaboration involves the development of a rolling chassis platform. This is a universal modular base for future mobility applications (for both software and hardware). FlexCAR merges product design system integration and production together with the benefits of cyber-physical systems throughout the product's lifecycle. FlexCAR's rolling chassis is a paradigm for the semantic modelling approach of ARENA2036. In addition to being a customised road vehicle, the modular rolling chassis can – over the course of its production – also replace automatic guided vehicles by navigating the production autonomously, transporting goods to workstations, and delivering energy supply to remote production applications. The rolling chassis concept offers new solutions for transport and production within an automotive factory.

### TOWARDS THE MOBILITY OF TOMORROW

ARENA2036 is facilitating co-creation within the automotive industry and the delivery of smart, integrated solutions. The success of ARENA2036 is evident in the growing network of partners together with the steadily increasing number of projects. Dr Ackermann credits the dynamics created at the Research Campus ARENA2036 to 'the proximity of basic science, application-oriented industrial research and the tinkering spirit of the start-up scene'. This combination of industry and academia unites the most diverse competencies in a co-creative innovation environment, making 'it possible to actually develop innovative potential in such a way that disruption becomes conceivable'.

# Behind the Research



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## Research Objectives

The Research Campus ARENA2036 is a novel co-creative environment that enables innovative research and the seamless transfer of research results into industrial applications.

## Detail

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### Bio

Dr Clemens Ackermann has worked as a research coordinator at ARENA2036, where he is also the deputy managing director, since 2017. Before joining ARENA2036, he taught at numerous universities and universities of applied sciences

in Germany and abroad. He received his PhD from Northwestern University, Illinois.

Peter Froeschle is the managing director of the Research Campus ARENA2036 and co-founder of the start-up accelerator STARTUP AUTOBAHN. Previously, he worked in development at Daimler AG. Among other things, he was responsible for Strategic Energy Projects & Market Development Fuel Cell / EV.

Manuel Fechter studied mechanical engineering at RWTH Aachen University. Starting in 2014, he worked as research associate and Head of Business Unit Automotive in the area of human-robot collaboration and new production concepts at Fraunhofer Institute for Production Engineering and Automation IPA and ARENA2036.

### Funding

The Federal Ministry of Education and Research, Germany (BMBF)

## Personal Response

**What is the most significant development to date that will shape the mobility of the future?**

“Surely, the diffusion of ‘mobility as a service’ has a major impact on the mobility of the future. To begin with, it changes the product development process, the production, and the scenarios for use, since the final product – and the OEMs accordingly – will eventually have to master the tight-rope walk between individual and institutional customers. Even the individual customer, who demands ever higher degrees of customisability, slowly gravitates towards highly flexible, needs-based solutions.”

## References

Ackermann, C, Fechter, M, Froeschle, P, (2021) Thinking Innovation Ahead – Joint Semantic Modelling for Integrated Product and Production at the Research Campus Arena2036. In K Dröder und T Vietor (eds), *Technologies for economic and functional lightweight design: Conference proceedings 2020*, 59–68. Heidelberg, Deutschland: Springer Berlin Heidelberg. [doi.org/10.1007/978-3-662-62924-6\\_6](https://doi.org/10.1007/978-3-662-62924-6_6)

**ARENA2036**



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