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The future is created through research – Volkswagen Group Research is designing tomorrow's world

- **Volkswagen Group Research is a visionary, trend scout and technology driver**
- **Global innovation network, intensive cooperation with the brands in the Group**
- **“Innovations safeguard the future of our company and they are the focus of our attention,” commented Head of Research Axel Heinrich**

Wolfsburg, 30 June 2017 – The Volkswagen Group is taking a proactive approach to designing the mobile world of tomorrow through Group Research. Volkswagen Research is a visionary, innovation scout and strategic partner for all the brands in the Group – with an enormous bandwidth of topics and projects about potential mobility scenarios for the megacities of the world, autonomous driving concepts like Sedric, new drive technologies, and new materials and product technologies. The engineers and scientists in Wolfsburg give a small snapshot of their otherwise strictly confidential topics at the Media Day for the Future Mobility Days 2017.

Research has never been as important before as it is today. In a world where change is taking place with increasing rapidity, new technologies are impacting on lifestyles at breakneck speed and customer aspirations are being modified, any company needs to identify these trends at an early stage and adopt a proactive approach to structuring its own developments and offerings. Particularly when a manufacturer is operating with benchmarks on the global stage, a distinction needs to be drawn between trends and fashions. A company also needs to be in a position to assess the importance and significance of topics in different countries. Only then can it take the right decisions – and they also need to be implemented within the framework of the appropriate timing. Being first mover is not always the key factor. But being prepared for every situation is important. “Research is a core function for success and for the long-term existence of a technology company. The Volkswagen Group takes this function very seriously,” said Axel Heinrich, Head of Volkswagen Group Research. “Volkswagen is a highly innovative company and this will continue to remain the case in the future – particularly in times when change is rapidly gathering pace.”

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International Ideas Network

The centre of Group Research is located in Wolfsburg. However, research is also established on a global scale in the same way as the entire Group – with locations, research laboratories and subsidiaries in Germany and Europe, as well as the USA, in China, in Spain and in Japan. International trend and technology scouting is also part of the mission, along with addressing topics related to specific regions. The second level in the network of Volkswagen Group Research is formed by numerous cooperative ventures with teaching and research institutions all around the world. Prestigious universities in the USA and China, including Stanford and Tongji, are also integrated in projects, as are the Fraunhofer Society, the German Aerospace Centre (DLR) and the Max-Planck Institutes.

Consistent Cooperation with the Brands

“Cooperation and collaboration are core concepts for Volkswagen Research. This is not simply the case with external partners, but most importantly also with the twelve vehicle brands of the Group,” according to Head of Research Heinrich. Group Research is undoubtedly a visionary, trend scout, ideas generator and incubator, but most importantly it is a driver for innovations. This role is always carried out in cooperation with other technical development areas – whether it is manifested as a cooperative project or as a mission for one or several brands of the Group. This applies to commercial vehicles like MAN or Scania and for automobile brands like Audi or Volkswagen.

Many projects start with the proverbial blank sheet of paper, even though this generally equates to a blank screen in the modern world. Each project goes through a number of phases. Of course, the initial phase is scouting: What is the topic leading to? What is there relating to this topic elsewhere in the world? And what do we need in order to achieve our strategic targets? Stage two relates to research development: What paths will take us further? What technologies, devices, competences do we need to develop? Feasibility of implementation is phase three: Can the project be implemented for commercial use? What are the chances of success, where are difficulties and problems to be found? Stage four is finally the transfer, either to series development in one or several brands, or to a unit which will look after the issue for the entire Group.

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One example is autonomous driving. Volkswagen has a great deal of experience in this field. After all, the Group ranks among the pioneers in this area. As early as 2005, a team from Group Research was working together with a group of early-career specialists at Stanford University to upgrade a Volkswagen Touareg to the autonomous vehicle “Stanley” – and this vehicle went on to win the Grand Challenge for Robot Automobiles in the American desert. An autonomous Volkswagen Passat known as “Junior” was the second fastest car at the Urban Challenge in 2007. Since then, knowledge and experience have been consistently gathered – and finally melded into the Sedric research vehicle that was presented at the Geneva Motor Show in 2017. Group Research is continuing to work on many individual projects related to autonomous driving. Group-wide management in this area has now been assumed by Audi Intelligent Driving GmbH in Munich. This is a newly established company of AUDI AG.

Future is generated by Knowledge

The breadth of the projects being carried out by Volkswagen Group Research can easily be identified on the basis of its structure. Future Research forms its own division. Technology Intelligence is assisted here by digital support in carrying out investigations into systematic patterns in technology landscapes and areas of competence. Corporate Foresight strengthens the future capability of the Group through the transfer of future knowledge into strategic areas and processes. Future Communications is responsible for the presentation and communication of future themes within research and the Group.

Core functions of mobility research relate to analysis, documentation and transfer of comprehensive knowledge about developments in the mobility and transport system for future structuring of mobility.

Megatrend Urbanisation

One example of a universal trend across the world is increasing urbanisation. A burgeoning number of people live in cities. This means that urban areas are becoming more of a bottleneck, and this is particularly the case for traffic. Solutions need to be found here as a matter of urgency so we can make mobility within cities more efficient, safer and more environment friendly. Volkswagen Group Research has highlighted its vision of future urban mobility with a meaningful visualisation of many mutually complementary potential solutions. This scenario includes networked means of transport and well-informed road users. Autonomous driving and high utilisation of transport capacities increase efficiency. Synergies between transport and logistics help to cut down the number of journeys. These and other initiatives result overall in significantly improved traffic conditions compared with today. This yields advantages for road users and better quality of life for all the people living in cities.

Integrated Drive Strategy of the Group

The roadmap to carbon-neutral and sustainable mobility is the focus of the drive and fuel strategy. A key factor is efficiency enhancement of all drives with each new model generation. The portfolio comprising a range of different drives will increase significantly in the future, whether in the form of SI engines as diesel and petrol power units, hybrids and plug-in hybrids, electric vehicles powered by battery or fuel cells. Volkswagen is a company

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with global operations. Co-existence between “conventional” drives and electromobility is therefore the correct pathway so that the Group is always in the right position to offer the best solution for diverse customer aspirations in different parts of the world.

SI engines will continue to retain pivotal importance for the foreseeable future. A series of projects being carried out by Group Research demonstrate the enormous potential for improving efficiency that can be achieved over the coming years. However, vehicles powered by natural gas will also play an important role. Due to the chemical properties of the fuel, they intrinsically emit up to 25 percent less CO₂ than petrol engines. These vehicles therefore occupy a fixed place in the drive strategy and in the projects being pursued by Group Research.

Electric automobiles powered by battery will naturally be the focal point for the coming years, but many new ideas are also being explored in the area of hybrid drives. Hybrids and plug-in hybrids combine the best of both worlds. Plug-in hybrids are highly efficient SI engines with an electric range of around 50 kilometres. Volkswagen has some great opportunities with this combination of drive concepts. Customers in all vehicle classes can be offered electrification with equal capability for long-distance and local journeys. Confidence can be created in the new technology and this will help to achieve a breakthrough into the new technology and electromobility. The fuel cell will become an important topic for electromobility over the medium term and Volkswagen Research is working intensively on this issue.

The Safe Route to Autonomous Driving

The autonomous fully self-driving automobile belongs to the future. However, this future will not come overnight but will be developed step by step. Many of the latest driver assistance systems constitute essential steps towards enhanced safety on the roads. Very soon, the first series cars like the future Audi A8 will be driving down the motorway without any intervention on the part of the driver. The era of the fully autonomous vehicle will begin in some of the world’s metropolises within just a few years – probably in lanes and routes specially reserved for these vehicles.

Autonomous driving naturally ranks among the key themes for Group Research. Volkswagen was the first automobile manufacturer to present Sedic as the concept for an autonomous mobility system. But goods and cargos will also be transported by autonomous vehicles in the future. The utility vehicle brands in the Group – MAN, Scania and Volkswagen Commercial Vehicles – will also benefit from advances in this field and they too have launched their own projects.

The employees in Group Research are working towards a clear goal here – Vision Zero – the vision of accident-free driving, mobility without any traffic deaths. Consistently equipping vehicles with safety systems already available today and gradual introduction of automated driving will consistently reduce the number of accidents and their severity. Vision Zero is not a utopia. Volkswagen Research is absolutely confident of this.

Virtualisation and Digitalisation as Innovation Driver

Naturally, Group Research is engaging intensively with all the topics associated with virtualisation and digitalisation. Progress is also being made here in increasingly large strides. Concepts like Artificial Intelligence, Deep Learning and Big Data Cluster are pointing towards opportunities in future development and production of the automobile. Volkswagen Group Research is also working proactively in the disciplines of Virtual Reality and Augmented Reality. Current trends are being evaluated in the framework of the research area of Virtual Technologies and innovations are being initiated in this field. New methods and applications are also being researched and developed. They will be deployed in the specialist areas of development and production, as well as in service and customer service.

Innovation with Substances and Materials

In spite of all the rapid developments in electronics and software – the foundation of the vehicles and automotive manufacture continues to reside in the substances and materials. And there is more to this equation. The haptic and visual properties of the materials used communicate the product experience and determine the interpretation of brand quality in the Volkswagen Group. Research looks for the best possible material to meet each customer aspiration, each Group segment, each vehicle concept and each component – always with a view to innovative solutions.

Completely new materials are being tested over the entire bandwidth of mechanical, chemical and electrical properties – thanks to simulations techniques with an in-depth understanding of material behaviour down to the atomic level. Group Research also uses this know-how for flexible and efficient production processes. Innovative joining technologies give the Group new options in the material mix and with forming processes. The result is tailor-made, optimum materials and material combinations that meet the highest requirements for sustainability, cost efficiency, safety and appearance.

Responsibility for the Environment begins in Research

A dedicated area of Group Research is engaging with the effects and interactions between the automobile and the surrounding environment. This constitutes part of the Group's awareness of responsibility and extends well beyond the basic operation of the automobile. In fact, the conscientious approach starts with the raw materials for automotive production, continues through research activities relating to resource-efficient and low-emission production so as to reduce the environmental impacts of a factory as much as possible, and ends with all aspects of vehicle recycling and waste recovery. The operation of a factory can also be optimised with defined environmental factors. Selection of the correct materials improves the life-cycle assessment of an automobile as a function of its service life. Today, research already has to be carried out into the recovery cycle of future drive batteries. A lot of open questions need to be answered here and not just about digital models and simulations. One example is can the climate targets defined by politicians actually be achieved? What impacts do new transport solutions and mobility concepts have on our roads and the environment? Environmental research provides answers to these questions.

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Future Mobility Days

Presentation of the Group's future portfolio has a fixed place in the annual schedule of Volkswagen Group Research. Several thousand internal experts from the global Volkswagen World are given a concentrated overview of innovations at this high-tech event held at the Ehra-Lessien Test Track located north of Wolfsburg. This year, the Future Mobility Days are themed under the motto "Electrified", "Eco" and "Experience".

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