

# QUALITY IN MOTION

## Exploring ahead in electric automotive advancements



As we progress on our sustainability journey, we embrace a culture of continuous improvement. Feedback from customers and stakeholders is meticulously gathered and analysed, driving ongoing enhancements, digital innovation and refinements to our sustainability initiatives.

To enhance our impact, we've formed strategic collaborations with suppliers, research institutions, and tech firms. This collaborative approach speeds up the creation of innovative solutions, pooling diverse expertise and resources, and propelling automotive excellence forward.



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# WELLBEING BEHIND THE WHEEL

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Throughout our history, we have always prioritised customer wellbeing, inviting them to join us on a journey towards enhanced health. Our goal is to create an oasis of wellbeing in our cars so that drivers and their passengers feel even better after a journey than before it began.

**Comfortably positioned to meet wellbeing needs**

Luxury and comfort have been at the heart of our brand for over 100 years, demonstrated through our award winning in-cabin noise refinement and passenger experience. All products offer best-in-class options including massage features, cabin noise refinement and heated and cooled seats, arm rests and cup holders. Our focus on technology and design means that we have been able to create exceptionally comfortable vehicles to drive or be driven in.

**Bentley airline seat specification**

In 2022, we released our pinnacle wellbeing offering, the [Bentley Airline Seat Specification](#). With its advanced postural adjustment technology and 22 ways of adjustment, it is the most advanced seat ever fitted to a car. Wellbeing and user experience factored into everything from design to manufacturing, with our team making sure the seat’s colour, texture and tactility all helped customers relax and unwind, as well as looking at ergonomics, temperature, gravity and acceleration.

This led to the seat having automatic climate control, which senses and adjusts temperature and humidity with an accuracy of 0.1°C, and six independent pressure zones that can provide 177 adjustments every three hours. Alongside other features, this will improve comfort, help with travel sickness and increase blood circulation.

These features have proved popular with Bentley EWB customers and are selected by approximately half of our customers.

In 2023, we continued this focus on customer wellbeing by including our customers and wider stakeholder groups in conversations about wellbeing.

We are keen for our products to provide a luxury experience that improves wellbeing, but never at the expense of customers’ safety,

➔ **Which we cover in the next section.**



# PRODUCT QUALITY AND CUSTOMER HEALTH AND SAFETY

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We are keen for our vehicles to not only comply with the relevant regulations and keep our customers safe, but also to be sustainable. To do this, we are involved in the development and use of sustainable materials in various components of our products that continue to meet our high-quality standards and requirements.

### Testing our future materials

As we develop our campus, we are investing in facilities that support innovation for future products. This includes facilities for testing sustainable materials, as well as vehicle testing facilities so we can test and validate all aspects of our products, including protection of our assets supported by investment in our cyber security capabilities.

### Quality policies and processes

Our engineering safety development and certification follows our internal and Group processes and policies. For example, we comply with the International Automotive Task Force (IATF) standards, the highest quality management systems available for the automotive industry. The standards cover design, development and manufacture of luxury motor vehicles. We have held IATF certification since 2003, audited by the [British Standards Institution](#), an accredited audit body. This certification verifies our quality management system to the different markets in which we operate.

We also follow statutory, administrative and other legally binding standards. In line with the Bentley Operating Policy, BOP 004 Product Safety and Compliance policy and BOP 045 Automotive Cyber Security Management System, we maintain a system

for active and passive product monitoring for items released to the market. The system includes a Product Safety Committee and Cyber Security Board, providing a structured approach to Field Action Decision Making. It allows us to proactively identify and address potential hazards associated with our products, ensuring they are safe.

The Product Safety Committee is supported by other committees, including the TCG (Technical Forum), EG-Circle (R&D Approval Committee) and Technical Conformity Steering Committee. This ensures that topics escalated have a clear direction and receive appropriate input for decision making.

All our vehicles align with ISO 26262, which covers possible hazards present in electrical and / or electronic safety-related systems, including malfunctions resulting from interactions between these systems. This area will become increasingly important as we transition to BEVs and increase the interconnectivity of our in-car systems.

### Group product safety policies

We also adhere to Group's Product Safety policy and operate a rigorous process to manage product safety. We apply the Group's Design Failure Mode and Effect Analysis process, which we have adopted at a

component level and which we use when testing our charging process. As we transition to a BEV fleet, we will extend the principles and processes we use to test ICE cars accordingly.

We inspect all of our vehicles throughout the manufacturing process. When they reach the end of the production process, we complete a rigorous and extended quality audit to ensure continual improvement.





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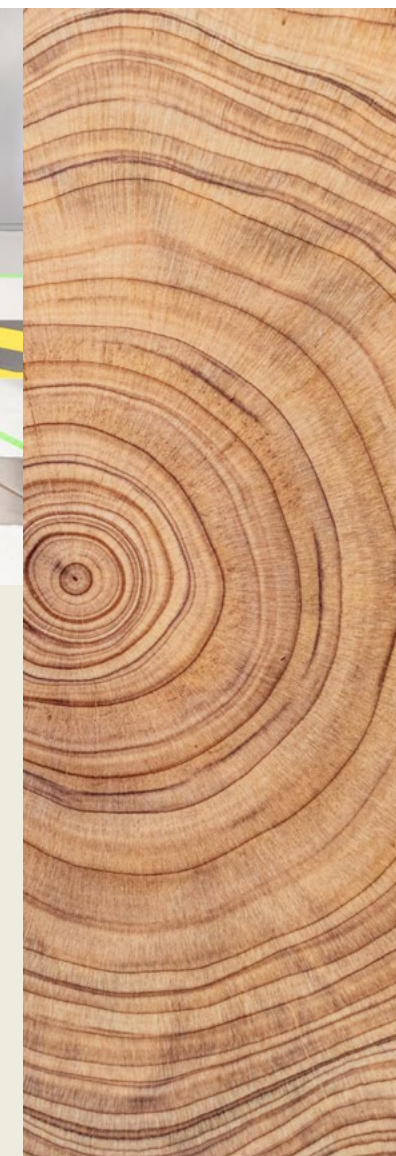
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### Product safety testing

We test our products in a range of ways:

- We carry out daily sample quality testing as part of our product audit, to make sure our vehicles are of the required quality and conform with regulations
- We use our rolling road facility ahead of road testing the vehicles
- We carry out product safety tests on-site where possible, including for: crashes, seatbelts, child restraint anchorages, tyres, braking and pedestrian protection. This reduces the amount of external quality testing required across the world, ensuring a more sustainable approach

- We use sunshine testing to explore the durability of our products by evaluating the impact of high temperature, UV levels and humidity on the vehicle's components. This ensures that our vehicles are not adversely affected by harsh environmental conditions
- Our vehicle reliability process verifies our vehicles' lifetime performance and reliability in a compressed time period, to simulate the vehicles' life cycle
- Our on-site vehicle emissions and certification centre has capability to test all major worldwide emissions standards including internal and external emissions, which allows us to test the full emissions of our cars and component parts. This allows us to comply with regulations on volatile organic compounds (VOCs) that come into force in any jurisdiction without the need for external testing

- Across our vehicle production processes, we carry out both 100 per cent and sample inspections for all aspects of the vehicle's parts and processes. We also carry out sample checks (Conformity of Production) across all models on an annual basis, thus ensuring that our products meet our high standards as well as any mandatory certification standards. This control plan is audited by relevant authorities worldwide as required.

Testing our vehicles comprehensively will only become more important as they integrate technology more deeply.

➔ **Learn more about how we are doing this in the next section.**

# DESTINATION DIGITAL

We are increasingly becoming a technology company rather than just a manufacturing one. As we embrace the exciting opportunities of integrating technology more deeply into our vehicles, we must stay alert to overcome the challenges that stem from it, from customer data to self-driving cars.

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## Cyber security – measures

Our Product and IT Security team are responsible for making sure we have the right controls in place, and that we operate them effectively and in line with policy. To ensure this happens effectively, they have rolled out online product cyber security training and other IT security and cyber courses for all colleagues.



## Cyber security – product security

To fully integrate cyber security into our complete product life cycle, we have set up a dedicated Product Security team within R&D. It is made up of 46 colleagues from across our functions and is closely aligned to Audi, Porsche and Group.

We have also invested in resources to create a Virtual Security Operations Centre to deal with the first point on contact Product Cyber Security Incidents in IT, under the Chief Information Security Officer.



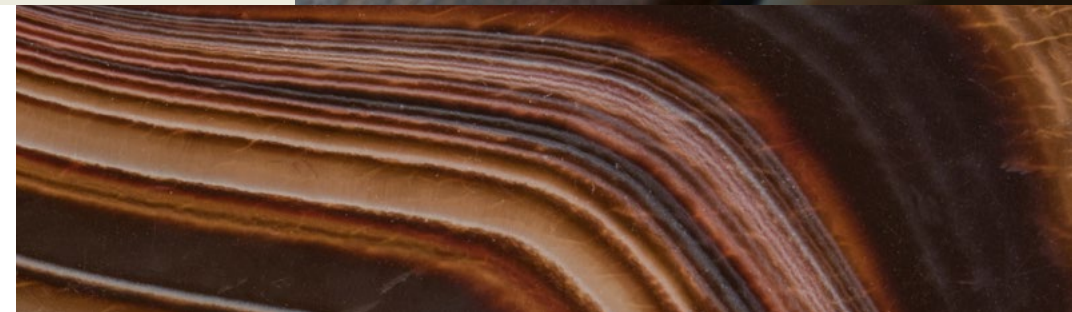
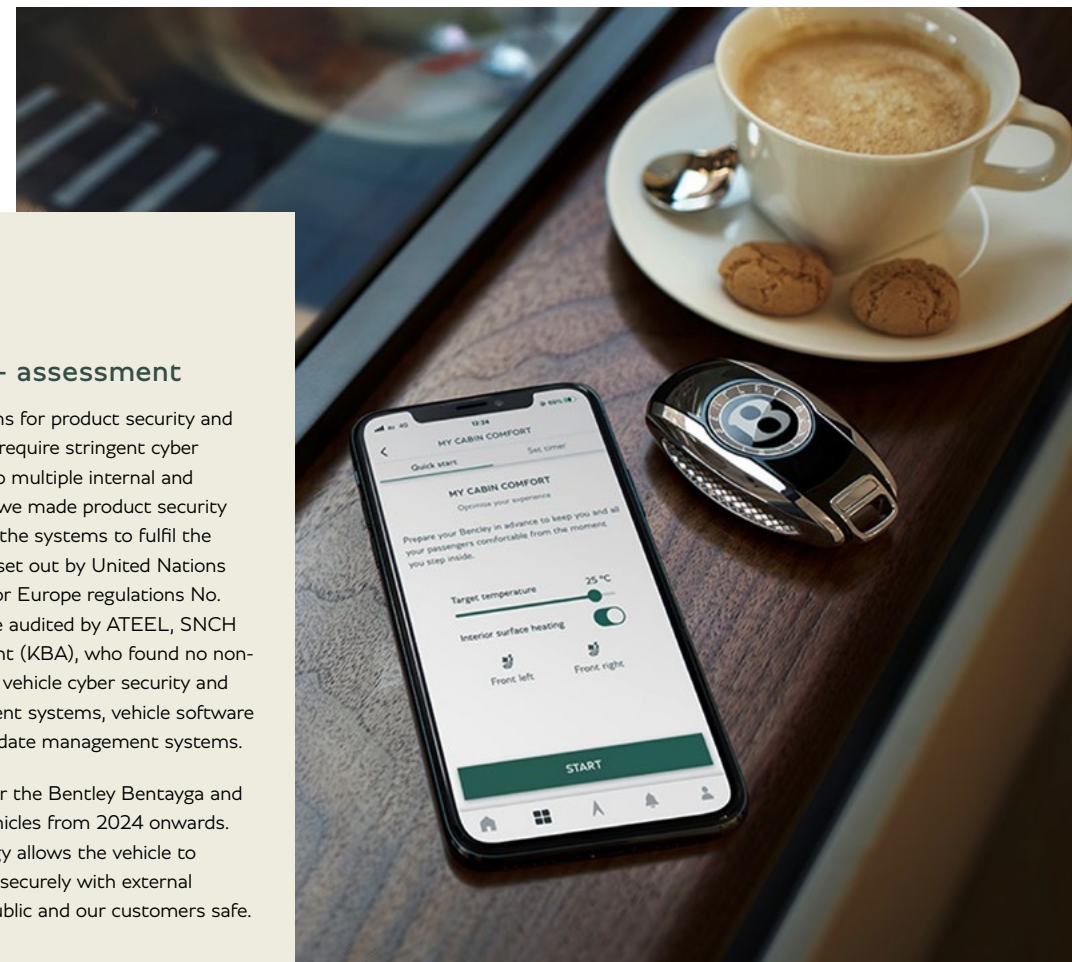
## Cyber security – assessment

Our management systems for product security and software updates, which require stringent cyber security controls, undergo multiple internal and external audits. In 2023, we made product security and software updates to the systems to fulfil the regulatory requirements set out by United Nations Economic Commission for Europe regulations No. 155 and 156. These were audited by ATEEL, SNCH and Kraftfahrt-Bundesamt (KBA), who found no non-conformities. This covers vehicle cyber security and cyber security management systems, vehicle software updates and software update management systems.

This first approval was for the Bentley Bentayga and will be extended to all vehicles from 2024 onwards. Connected Car technology allows the vehicle to integrate seamlessly and securely with external interfaces, keeping the public and our customers safe.

Although our IT systems are self-contained within Bentley, we have also closely aligned our cyber due diligence with Audi, Porsche and the Group.

We had our first 2024 Model Year type approval for R155 and R156 and a successful surveillance audit with ATEEL to demonstrate our successful completion of operationalising all our processes. We also had a single surveillance audit with ATEEL.





### Improving sustainability through technology

We are continuously looking for innovative ways to use technology to increase the sustainability of our business. Our initiatives in 2023 covered four main areas:

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#### IT estate

The costs and complexity of our IT systems landscape has been analysed and we have set a target to reduce the complexity of this by 55 per cent by 2025. This will ensure we are aligned to deliver the capabilities that our business needs, through simplified end-to-end data flows for key processes, upskilling our people, consolidating our systems landscape, modernising our infrastructure and streamlining our data solutions and apps.



#### Vehicles

In 2023, we began work to enhance our charging ecosystem and develop intelligent data solutions to help customers optimise the performance of their vehicles while maintaining sustainability.



#### Connected car

Our cars interface with the world in multiple ways and Connected Car is our software solution for bringing external data points into our vehicles. Over the coming years, we will further integrate the communication and connections within our cars, which will allow customers to plan their journeys in our charging ecosystem and book charge points to optimise routes and vehicle charging throughout their journeys.



#### Pilot testing rig

Previously, we shipped our cars to various markets for testing, which was inefficient and costly. To address this, we are developing a novel concept that uses a mobile testing rig, enabling us to remotely verify the data integrity of our cars. This concept will undergo testing throughout 2024 / 25 to validate data readiness for the 2026 Model Year.

Integrating technology into our cars is just one part of how we are innovating at Bentley.

[↪ Find out more in the next section.](#)



# INNOVATION

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For over a century, innovation has propelled Bentley forward. This will continue for the next 100 years and beyond. Research and collaboration have been the catalysts for our exploration of new production techniques and materials, as well as our adoption of sustainable solutions, including BEVs.

Innovation is at the heart of Bentley, demonstrated by our culture of continuous improvement and collaboration, by our timeless new designs, and brought to life in every car we create.

### Customer-focussed innovation

For us to be the most sustainable luxury brand, innovation must be an integral part of everything we do. It must also focus on our customers, and we must ensure that the new ideas we adopt are solely aimed at enhancing what we do and how we do it for them. We determine our priorities based on the themes that distinguish our products and align with our values. There are some examples of innovation for customer wellbeing on page 54.

### Sharing ideas with customers

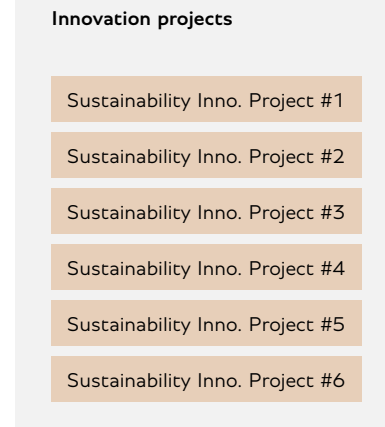
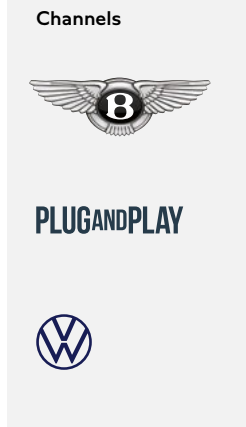
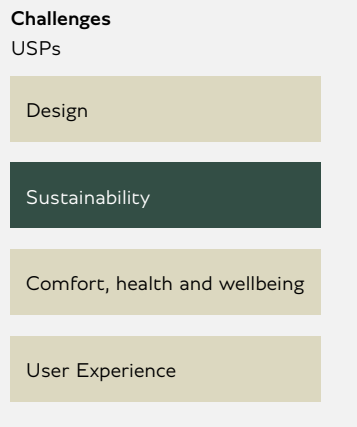
We believe that innovation cannot happen in isolation. We encourage all our colleagues to collaborate, not only with each other but also with external partners. This approach strengthens and enriches the collective knowledge accessible to all. Our Research and Development department and Product Strategy team are entrusted with the responsibility of fostering open innovation.

We use our innovation portal to crowdsource ideas to tackle our strategic business challenges. The portal is supplemented by innovation immersion events with our Board and senior colleagues in every region where we operate.

Externally, we have tested new concepts directly with High Net Worth Individuals (HNWI) around the world, to gather valuable insights to better shape our innovation. In 2024 and beyond, we will continue with this approach and we also plan to introduce hackathons with trusted partners, to find innovative ways to enhance our products and services. We will also use 'design thinking' workshops to explore strategic opportunities, especially for sustainability.

### Our main innovation channels are:

- Our Research and Development department
- The Group's Innovation network, including the individual brands of the group
- Open Innovation using Plug and Play and Group investment arms





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**Assisted and autonomous driving**

In 2023, we introduced the remote parking function within the MyBentley app, a technological leap forward which will enhance the customer experience of our entire range in 2024. The user-friendly app allows customers to seamlessly park and unpark their vehicles (from the outside of the vehicle) using their smartphones.

Anticipating new regulations in the UK and EU, including the General Safety Regulation 2, we are proactively integrating features to meet forthcoming industry standards into our vehicles. These may include visual and auditory warnings to alert drivers if they go over the speed limit, emergency braking systems and advanced driver monitoring.

As we look to the future, we are exploring autonomous driving for our new BEVs. However, we remain committed to safety over convenience, so we will only use technologies that have been proven to keep our customers, their passengers and other road users safe.

**Exploration through collaboration**

2023 marked the third year of our collaboration with the [Hypromag](#) and [Innovate UK](#) on our Rare-earth Recycling for E-machines research project. This initiative is working to sustainably source rare-earth magnets by recycling battery materials for use in BEVs and PHEVs.

This circular economy approach to urban mining – extracting rare metals from electric / electronic waste – is a more sustainable and environmentally friendly exploration than mining ore.

**The OCTOPUS research project**

The OCTOPUS (Optimised Components, Test and simulatiOn, toolkits for Powertrains which integrate Ultra high-speed motor Solutions) research project concluded in 2023, marking the end of a three-year study. The study aimed to develop a highly efficient, compact, rare-earth magnet and copper-free motor to help address the challenges of raw material supply sustainability, supply chain, unit cost and end-of-life recyclability that electric vehicles face. The outcome of the project was a demonstrator powertrain for a BEV based on innovative and sustainable motor technology.

The project, funded by the Office for Low Emission Vehicles (OLEV), now known as the Office for Zero Emission Vehicles, demonstrates how collaboration between Innovate UK, Bentley Motors, UK small and medium-sized enterprises, and research institutions is improving the sustainability of the UK automotive industry. Bentley presented the OCTOPUS Project and technology to the wider Group, leading to several commercial projects for consortium partners with other Group brands.

For more information please [click here](#).

Although the project has concluded, we are committed to continuing our work in this area, and together with Audi and Porsche, we have continued to work with [Advanced Electric Machines](#) (AEM).

**Driving towards electrification**

A major milestone on our electrification journey was building and launching the Engineering Test Centre, christened 33 Pyms Lane, in Crewe. This state-of-the-art facility allows us to certify against global emissions standards, such as those set by the United Nations Economic Commission for Europe, for some of the most stringent test regimes in-house, delivering reliable and high-quality certification more efficiently.

The two-storey, 4,600-square metre facility began operations in December 2021 and testing in mid-2022. The new structure includes 773 square metres of office space, and 1,550 square metres for the installation of a climate-controlled chassis dynamometer. It houses over 100 colleagues in our Technical Conformity department, which is responsible for the compliance of all our products.

Highlights of the facility include the ability to conduct ‘real world’ simulations across temperatures ranging from -20°C to +50°C, and a highly-advanced rolling road that will allow our engineers to simulate different hill steepnesses, and measure exhaust emissions from ICE cars and electricity consumption for PHEVs and BEVs.



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### Travelling even farther

The Engineering Technical Centre is another major investment and exciting stepping stone on our way to creating our Dream Factory. But we are not done yet. In 2023, we broke ground on two major, new, state-of-the-art facilities to help us make the transition to an electric future.

Costing £35 million to construct, our new Launch Quality Centre and Engineering Technical Centre form part of a £2.5 billion, 10-year investment programme in our future products and factory.

The new Launch Quality Centre has two 4,000-square metre floors. Our Metrology team will work on the ground floor, and the second floor will be home to a complete production proving ground, with a laboratory for future materials testing and a mini assembly line to test future BEV assembly.

The Engineering Technical Centre is even larger, with two floors covering a total of 13,000 square metres. It will house a prototype workshop for models of the future, materials development and a software integration centre.

### Virtual 3D to real life

Since 2017 we have invested £4 million in Additive Manufacturing (also known as 3D printing), including £1 million on new metal and resin printing machines in 2023. The Additive Manufacturing team's new home in the Engineering Technical Centre will increase the team's capacity significantly by giving them three times as much floor space and the ability to operate 12 printers for six different technologies, including metal.

Metal 3D printing uses metal powder dispersed in an organic binder instead of the pure powder of a more traditional metal printing process. Our new machine will allow us to design, print and test metal parts ourselves for the first time, increasing sustainability, and decreasing delivery time and cost for a wide range of development applications and, in the future, vehicle parts too.

We can currently produce functional parts for prototype vehicles, as well as jigs, fixtures and manufacturing aids for our in-house manufacturing operations. In 2024 we will be starting to use our existing printers to personalise parts using recycled polymers. This will help us minimise waste, cut development time and avoid transporting parts from off-site locations. It also cuts CO<sub>2</sub> use, as we no longer need to create, use and dispose of tooling.

Finally, the new machines allow our Aftersales team to offer parts that we could previously no longer manufacture for older models. This will keep vehicles on the roads for longer, contributing to the circular economy.

2023 was our most productive year for material throughput. Our production of car parts was around the same as in 2022, but we processed a slightly higher volume of materials (about 2.279 million cubic centimetres which is equal to the size of 35 solid W12 engines). We were pleased to do this more efficiently as well, with fewer production runs than in 2022.

In 2023, we unlocked our ability to offer printing with recycled polymers for certain applications on some of our machines. This will be a big step for us in sustainability for 2024. Our intention will be to switch a large portion of parts we print that would ordinarily use virgin plastic to use recycled polymers instead. More information will be included in our 2024 report.

### Virtual tools and simulation

We continue to lead on using virtual tools and simulation techniques to not only streamline product development but do it sustainably. By completing some vehicle builds and tests virtually instead of physically, we have substantially reduced the need for resource-intensive construction and operation of physical prototypes, cutting our environmental impact.

In 2023, we continue to deliver all vehicle programmes with reduced physical properties and maximised virtual tools. We remain committed to further developing and applying virtual tools, especially in the early phases of development, for future products.

We always design our vehicles around our most important stakeholders: our customers

➔ Learn more about how customer experience in the next section.