

RINSPEED

microSnap



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microSnap

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**TECHNISCHE DATEN /
TECHNICAL DATA**

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RINSPEED

CES Las Vegas 2019:
Rinspeed presents the further advanced "Snap"
ecosystem with the "microSNAP"

"HONEY, I SHRUNK THE "SNAP!"

With the "Snap," presented at the CES in Las Vegas in early 2018, Swiss powerhouse of ideas Rinspeed for the first time presented a vehicle, where the chassis ("Skateboards") and bodies ("Pods") can be swapped out at any time.

"Think mighty micro!" is now the new Rinspeed motto at the CES 2019. Company head Frank M. Rinderknecht has shrunk the "Snap" into the "microSNAP" with the dimensions of a Renault Twizy. And for the first time, Rinspeed demonstrates a fully automated robot station that joins and separates chassis and bodies autonomously. Experts refer to this step in car production where the chassis and the body come together as the mating of an automobile, except here it is not for good, but only for the time of the intended purpose.

As far as the Swiss automotive visionary is concerned, the days of large delivery vehicles that serve customers in sequence like pearls on a string over the course of the day are over. Because online business is booming and now includes the fresh food sector as well, the Swiss national believes in small autonomous vehicles that swarm out and bring their goods to the customer without detours and 'just in time.' It couldn't be faster or more simple - even refrigerated or heated. However, his vision also includes two-seater 'robo units', which take the shortest route to convey their passengers to their destination efficiently and in comfort. Rinderknecht is certain: "Customers increasingly want prompt deliveries and many passengers are unwilling to use shared taxis, which have to take time-consuming detours by design."

A startup is now on the drawing boards and talks with investors are underway to put the "Snap" on the road. In fact, the response among automotive experts to the revolutionary "Snap" is tremendous and not without leaving its mark. Even one of the most renowned automakers was inspired by the Swiss and recently presented its own interpretation of the "Snap" systematics. And since imitation is generally considered the sincerest form of flattery, Rinderknecht takes it with a sense of humor and smiles: "Well now, who did invent it?"

Be it the "Snap" or the "microSNAP," the basic idea is the same: While the bodies last as long as a car does today, the chassis contain all the components that are subject to wear and aging, such as the computer technology for autonomous driving. "Skateboards" (chassis) and "Pods" (bodies) are only temporary companions for brief periods. Various types of bodies use whatever skateboards are currently available. The skateboards are recycled after a few years, because they will have reached the end of their service life. They thus elegantly avoid an expensive and complicated hardware update.

In keeping with an established tradition, the twenty-fifth concept car from Rinspeed was again designed at Swiss company 4erC and constructed at Esoro, which also handled the technical implementation. As always when

Rinderknecht is at work, the electric vehicle is chock-full of technical and visual treats contributed by a network of renowned companies from around the world.

The robotics system and the automated loading aid system come from Kuka in Augsburg. Osram supplies the entire lighting technology including the digital license plate and a micro-pixel LED, which makes dazzle-free high beams possible. The exterior lights communicate with other road users. The interior lights adapt to the driver's personal mood with the help of health-tracking functions. For the headlights of the "microSNAP," Rinspeed relies

on state-of-the-art LED technology as well as on the innovative product solutions from Prettl Lighting & Interior in Pfullingen. The propulsion of the "microSNAP" is provided by a 48-volt traction motor from the internationally leading development partner and supplier Mahle, whose integrated systems solutions are putting their stamp on the mobility of today and tomorrow across all types of powertrains.

Thanks to high-speed communication and short latency times, the connection to the Harman Ignite Cloud platform via 5G telematics ensures the efficient operation of the

autonomously driving "microSNAP." A host of other connected-car technologies of Harman - including sensor fusion, the Harman Shield Automotive Cybersecurity Suite and over-the-air updates (OTA) - makes many more things possible. The "microSNAP" uses multi-stage authentication and instant personalization to welcome every user as if he was sitting in his own vehicle. It is operated during the trip by giving commands in natural speech. The passengers can use whichever virtual assistant they are accustomed to, be it Bixby, Alexa, Cortana or Siri. The intelligent digital cockpit is able to adapt to the particular passenger automatically. In the case

of the compact "microSNAP," a curved 49-inch LED screen spanning the entire width of the vehicle provides the visual interaction. Acoustically, the two-seater pod can be divided further into two separate sound zones, so to speak. This Harman technology allows both passengers to listen to different music or entertainment programs at the same time, without either feeling disturbed. Ambionics Escape, another outstanding Harman sound technology, makes even the smallest space into a rolling open-air stage, concert hall or acoustic copy of the own living room. More individualization and personal comfort is hardly conceivable.





Luxoft contributes its expertise in the development of environment models and software platforms for highly automated driving. As a global software development partner, the company supports Level 2-5 projects with its own development teams and technologies for ground truth, modelling and validation. Bamboo Apps from Tallinn, Estonia, created connected-car apps and the UX/UI design for the futuristic human-machine interface (HMI), enriched with features of Level 5 autonomous driving.

A co-innovation team coordinates the digital services for the "microSNAP": MHP focuses on the intelligent mobility ecosystem for automated intermodal transport solutions, while SAP employs a software platform, which optimizes transportation through data analysis, machine learning and the IoT. Finally, EY Advisory makes automated use-based transaction settling among the ecosystem participants possible with its 'Tesseract' mobility platform based on blockchain technology. The "microSNAP" is a sensor monster. The US

company Gentex, for example, contributes the iris scanner for occupant recognition, the interior cabin monitoring system, and dimmable glass window elements in the doors. The same elements can also be found in the Boeing Dreamliner. The sensors from Ibeo Automotive Systems, the global technology leader for laser scanner sensors in the automotive field, ensure that obstacles and people on the road are detected early and accurately. The intelligent antenna from NXP ensures secure linking to the outside world for software updates, Car-2-X communication and infotainment. The 'BlueBox' is the brain for automated driving; the 'GreenBox' ensures the energy efficiency.

Also not an everyday thing for a concept vehicle: The "microSNAP" is equipped with a 'joysteer' drive-by-wire system from Swiss company Bozzio. Redundant steering and braking systems ensure maximum safety. The security of the transfer of data and information was verified by Dekra, a globally leading expert organization. And who sup-

plies the electricity in light of the numerous consumers? It is fed into the vehicle grid via quick-charging cable with high-voltage technology from the Harting Company based in Espelkamp in East Westphalia. Speaking of energy supply: Esslingen-based thermal management specialist Eberspächer controls the temperature in the "people pods" with its climate hardware and provides the suitable containers with powerful heating and cooling units for the "cargo pods" - in both cases with integrated connectivity solutions and always with independent energy supply.

Rinspeed attaches great importance to the wellness equipment of the interior. Foam-Partner is the perfect address in this regard. The company contributes the expertise for acoustically and thermally efficient foams. For years, the allies have relied on Strähle+Hess with its experts for innovative textile products, and for good reason. The knitted fabric used in the vehicle was made from sustainable PES/alpaca natural yarns supplied by hi-tech cotton mill Schoeller. Dutch chemical

company Stahl, the global leader for leather and various synthetic material surfaces in automotive interiors, contributes its surface finishing expertise. South Korean manufacturer Kolon Glotech adds highlights with its traditional Sanggam print for seats and trim panels.

The occupants make themselves comfortable on naturally soft leather from automotive leather specialist Bader in Göppingen, Germany. Lear, a globally leading automotive technology company, developed the 'ProActive Comfort' intelligent seat solution, designed for comfort, wellness and adaptability to individual passenger needs; and 'BioBridge', a smart, non-intrusive, biosensing technology to detect stress and drowsiness, helping prevent driver distraction and promoting safety. With Lenzing Automotive Interiors fibers in the 2019 "microSNAP" concept vehicle, the company is committed to the co-creation of an innovative future concept of transportation, which combines new ways to pursue sustainability efforts while offering new levels of

comfort. Gentherm, the global market leader and developer of innovative thermal management technologies, created an innovative and efficient heating and cooling system for the passenger seating. This personalized system creates an intelligent climate zone for each occupant in the car to ensure perfect levels of passenger comfort.

HFM specializes in functional safety systems, E/E architectures and user-centric design methods by means of virtual prototyping. At the heart of the company's developments are always the relevant requirements for homologation and type approval for the future of autonomous driving.

Of course, one thing is a must in a vehicle from Switzerland: a chic clock sporting the Swiss cross adorns the screen taking up the entire width of the vehicle.

The world premiere will take place in Las Vegas on January 7, 2019: The anniversary creation of Swiss automotive visionary Frank

M. Rinderknecht will be on display in the Harman venue at the Hard Rock Hotel during the CES 2019. In spring 2019 - right on the doorstep of the powerhouse of ideas from near Zurich, so to speak - the "microSNAP" can then be admired at the Geneva Motor Show - professionally staged by Kern advertising agency and print shop based in Saarland.

TECHNISCHE DATEN

MASSE BASISFAHRZEUG

Länge	2'626 mm	Length
Breite	1'335 mm	Width
Höhe	1'708 mm	Height
Radstand	1'686 mm	Wheelbase base vehicle
Leergewicht	app. 730 kg	Empty weight

ANTRIEB

Antrieb	Mahle 13 kW Drehstrom-Asynchron-Elektromotor Three-phase asynchronous electric motor	Power
Drehmoment	57 Nm	Torque
Kraftübertragung	Hinterachse / rear axle	Power train
Batterie	6.1 kW - Lithium-Ionen	Battery

WERTE

Höchstgeschwindigkeit	app. 75 km/h	Top speed
Reichweite elektrisch	app. 95 km	Electric range

FAHRZEUGAUFBAU

Karosserie	Composite Struktur mit Stahl-Chassis Composite with steel chassis	Body
Sitzplätze	2	Capacity
Sitze	Lear	Seats
Sitzkühlung-/heizung	Gentherm	Seat cooling and heating
Iris-Scanner	Gentex	Iris-Scanner
Innenraum-Design und -Materialien	Bader / Kolon / Lenzing / Schoeller / Stahl / Strähle+Hess	Interior design and materials
LED-Technologien	Osram	LED technologies
Frontleuchten	Prettl	Front lights

TECHNICAL DATA

MEASUREMENTS BASE VEHICLE

BEREIFUNG

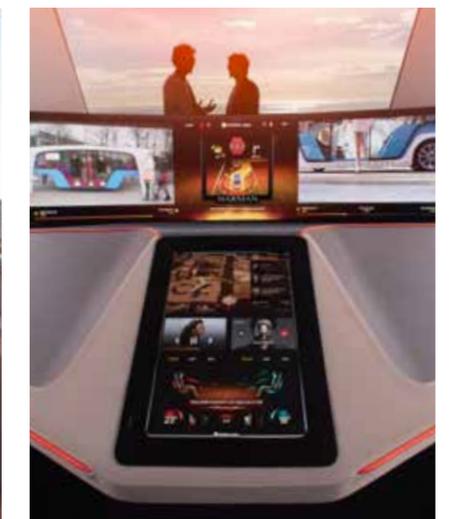
Bereifung vorne + hinten	195/40 - 17	Front and rear tires
Felgen vorne + hinten	AEZ 6.5 x 17"	Front and rear wheels

VERSCHIEDENES

Drive-by-Wire-System	Joysteer	Drive-by-wire system
Akustik- und Wärmedämmung	Foampartner	Acoustic and heat shielding
Speakers	Harman	Speakers
Thermomanagement	Eberspächer	Thermomanagement
Lidar-Sensoren	Ibeo	Lidar sensors
Funktionales Sicherheitskonzept	HFM	Functional safety concept
AD-Compute-Plattform	NXP Bluebox	Autonomous Driving Platform
AD Fahrsoftware	Luxoft	Autonomous Driving Software
Ladestecker	Harting	Charging plug
Prüfungszertifikate	Dekra	Testing certificates
Level 5 HMI-Design	BambooApps	Level 5 HMI design
Snap Eco-System/-Management	EY/ MHP / SAP	Snap eco system/-management

Alle Angaben ohne Gewähr

All data without guarantee





4ERC GMBH CREATIVE - CLEAN - CAR - CONCEPTS

the company of Peter Kägi.

For 18 years, Peter Kägi is the leading project manager and the technical father of the Rinspeed motor show projects, Frank M. Rinderknecht and him connect many creative moments.

For 30 Years, the owner of 4erC works with electric vehicles, the range goes from a power of a few kilowatts up to several hundred kilowatts.

The consulting and development company 4erC works on vehicle projects for OEM and industry. Focus on: concept, project management, package, lightweight construction and fiber composite.

Do you want to invest in this area and you have open question.

Ask us.

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B[®] BADER[®]

One of the oldest man-made material is leather, the tanned and preserved animal hide. The charm leather radiates has been preserved over thousands of years until today. We use leather for shoes, bags and furniture. Leather is also indispensable in a high-quality automobile interior. Leather is a unique natural product that stands for quality, durability and comfort. Above all, as a material for seat covers, it can fully exploit its advantages. No other material can achieve these special quality characteristics of leather.

BADER has been producing leather for 145 years and special automotive leather for over 35 years for all renowned OEMs worldwide. In order to be successful as a company, we must constantly face challenges and develop innovations. Participating in a concept car, such as the Rinspeed "MicroSnap", is a welcome contest for us to prove our competence. Especially when entering the era of autonomous driving and car-sharing mobility, the interior materials have to set new standards, both, in terms of comfort and serviceability as well as longevity. All materials used in automobiles will face superior challenges in the future, also in terms of ecology and sustainability.

After last years „Snap“, the new concept car „MicroSnap“ is the logical and complementary development of the visionary transport concept. This year BADER has developed two unique and very innovative leather articles for the interior of the „MicroSnap“. On the one hand, an advanced and improved sustainable leather - which we gave the name 'B-Green', on the other hand a new type of leather with a velvety and nubuck-like surface for the automotive use case.

The sustainable leather ‚B-Green‘, which is assembled in the seats at the "MicroSnap", BADER has developed a resource-efficient tanning with a new formula containing a mix of renewable raw materials and a share of waste from the food industry. The tanning process itself further reduced water and energy consumption. High demands are made on automotive leather. In order to fulfil these requirements, the leather surface is equipped with a so-called finishing. This is the only way to guarantee the specifications for abrasion, light-fastness, hot light ageing or perspiration resistance. Now, 'B-Green' leather applies a finishing increasingly established on renewable raw materials. The components used to be petroleum-based products are more and more replaced by rapeseed oil-based components. Thanks to the new more natural formula, the leather touch is directed into a warm and waxy direction. The finishing has been reduced to a minimum of thickness, which resulted in additional savings of chemical products. Typical leather features such as grooves, wrinkles and irregularities in the structure were used deliberately to accentuate leather as a natural material.

BADER's sustainable ‚B-Green‘ leather is used in the seats nicely in a leather and fabric combination and ensuring optimum comfort. The earthy, restrained coloring in combination with the fabric underscores the naturalness of the materials used. The separation

between fabric and leather emphasized by a red piping communicates the dynamic of the seat. In the center the leather was perforated to create active air ventilation, which additionally improves the comfort and well-being of the passenger.

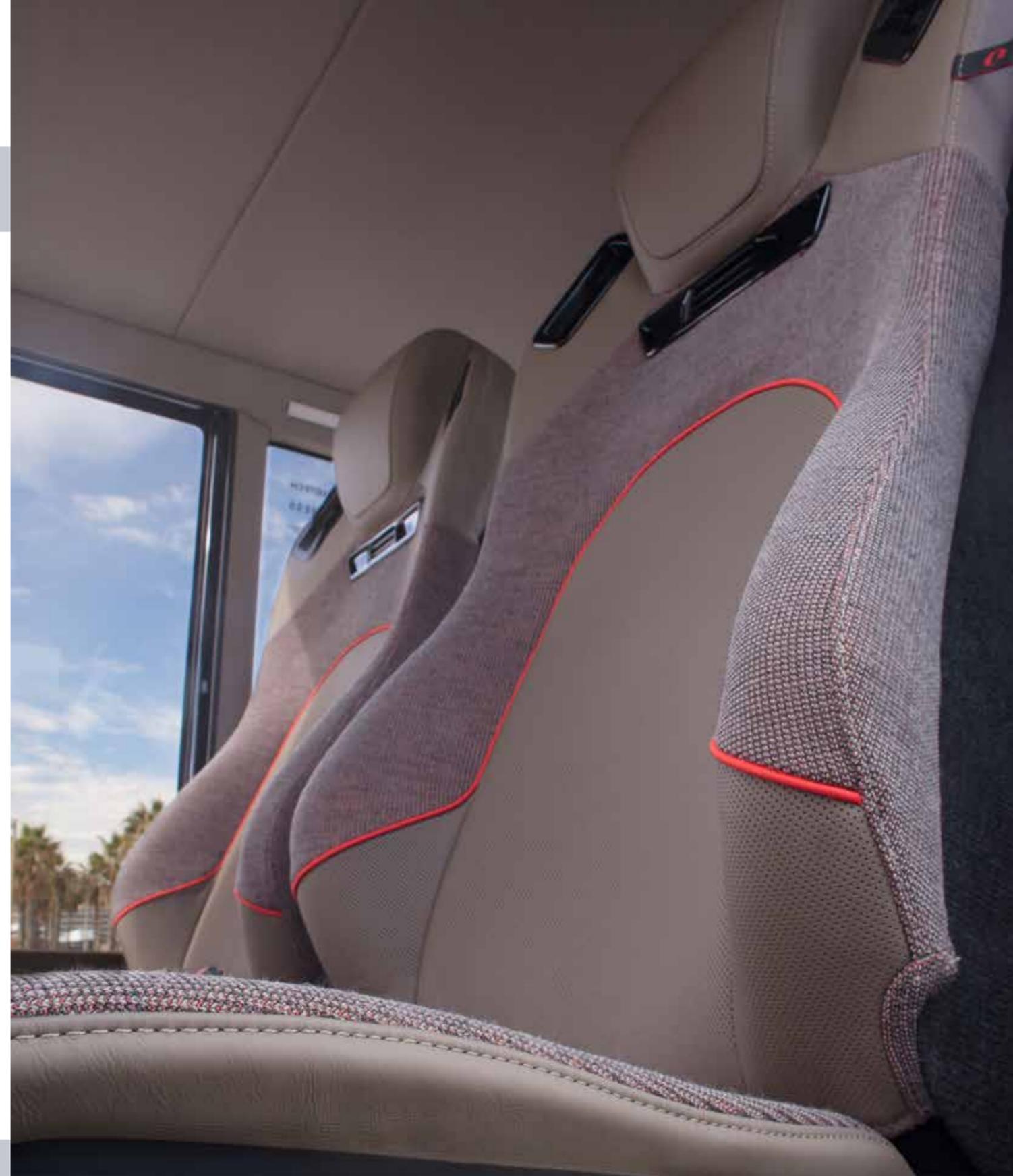
Along with the sustainable ‚B-Green‘ leather, BADER has developed a brand new leather with a nice velvety surface, which debuts in this concept car for the first time. This innovation is applied in the dashboard and trim panel of the doors. Using a leather technique that BADER uses for the first time in automotive leather production, innovative microstructures can be created on the leather surface that have a velvety and smooth feel. Consequently it is possible to give the leather surface properties, which were previously reserved for nubuck, suede or microfibre products - but now they pass fastness properties of the automotive industry. This innovative type of leather is not only suitable as a material for trim parts, but also can be used in seating areas.

In the case of the "MicroSnap" we designed and applied a brown-beige tone and created a continuous surface from the dashboard extended to the very end of the door, so to speak 'to enclosing the passenger'.

We thank Rinspeed and all participating partners for the inspiring and efficient cooperation and are proud that we were able to give our innovative input to this exciting concept car.

ABOUT BADER

BADER was established in 1872 in Goepingen as a shoe leather tannery and is a leading leather and seat cover producer in the global automotive market. Worldwide BADER employs over 12.000 employees located on five continents. Here, innovative ideas are transformed into designs and products, and new processes are researched and developed, and leather hides, die cut components, and seat covers are produced. Over time, much has changed at BADER. But the passion for leather and its processing is still the same today as it was 145 years ago.



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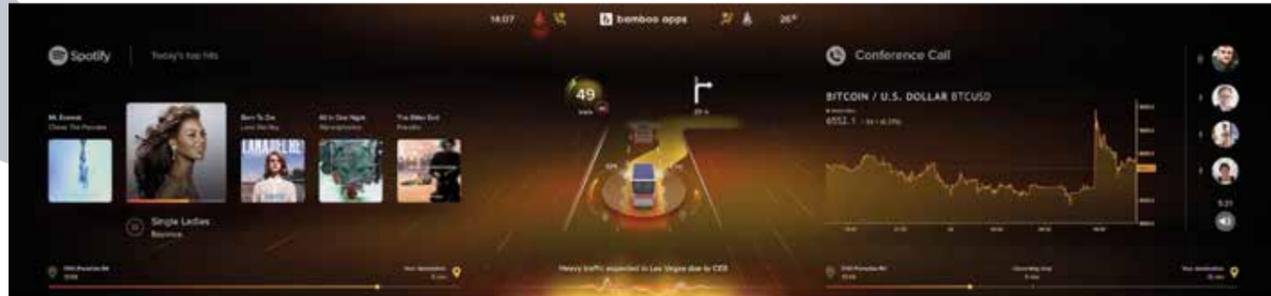


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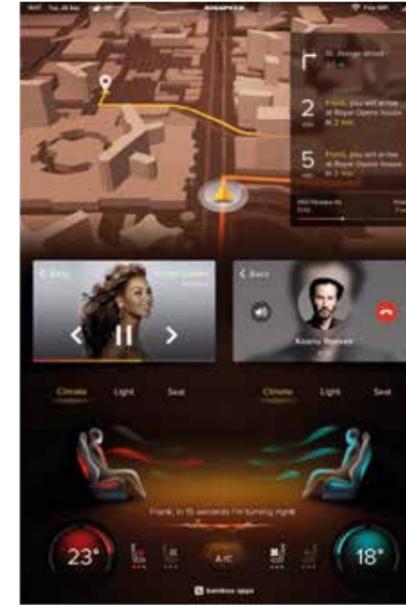
DIGITAL TRANSFORMATION PARTNER FOR AUTOMOTIVE AND MOBILITY WORLD

Bamboo Apps - your trusted software development supplier for delivering new and innovative connected car apps, infotainment services, HMI and UX/UI design. The company is proud to take part in a complete transformation of the automotive industry by challenging conventional thinking and supporting OEM's and mobility companies with the right resources. Bamboo Apps helped to deliver top-notch connected car solutions for some of the biggest car brands in UK and Europe.

ALTERNATIVE VISION ON COAST-TO-COAST DISPLAYS



Futuristic microSNAP HMI design for level 5 autonomy vehicles designed by Bamboo Apps is a long-term vision of how disruptions in the automotive industry will impact the users' experiences in cars. The goal we set for ourselves was to support changing cockpit architecture and rising topic of smart co-drivers.



STEERING WHEEL REDEFINED IN CONNECTED CAR CONTROL APP

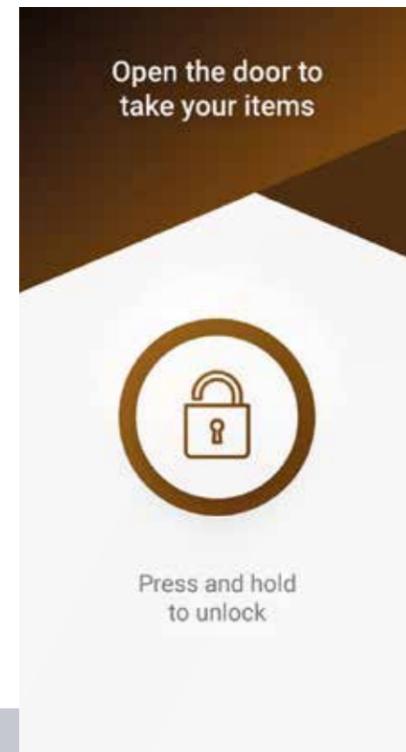
In the search for the best sharing economy user experience and to make the most of the smart mobility Bamboo Apps brings new "steering wheel" concept based on tablet display controls allowing to operate the car via connected car app interface. The solution connects robust in-car technologies with various mobility offerings and infotainment services within a single screen.

SMART PHONE DIGITAL ACCESS TO UNLOCK DELIVERY VEHICLES

To make the last mile delivery a holistic experience for the customer Bamboo Apps is blending e-commerce with secure connected car technologies to put fully digital customer journeys together. The next generation of businesses should make IoT and connectivity their competitive advantage, and delivery vehicles remote access app might become a key to their future success.

ABOUT BAMBOO APPS

Bamboo Apps is a part of BAMBOO GROUP OU, Tallinn, Estonia which was established in 2006 as a VAS (value-added services) provider. Today Bamboo Apps offers comprehensive agile software development and design services that enable OEM's and mobility companies to launch connected car services, infotainment products and mobile apps including PoC's, R&D, with various 3rd party integrations. Our approach involves 100% focus on automotive and mobility technologies, use cases, and business models.



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SAFETY FROM A SINGLE SOURCE

DEKRA has been committed to safety for over 90 years. What was founded in 1925 under the name "Deutscher Kraftfahrzeug-Überwachungsverein e.V." is today one of the world's leading expert organizations. More than 44,000 employees in more than 50 countries ensure safety – on the roads, at work and at home.

In all this, the "Internet of Things" is getting increasingly important. It is therefore no surprise that DEKRA is also on board again with the latest Rinspeed concept car "microSNAP". In this self-driving electric car full of IT systems, safety has to be ensured in a variety of ways. When it comes to autonomous and connected cars, aspects such as secure wireless connections, interoperability, electromagnetic compatibility, cybersecurity and functional safety are of paramount importance.

First, however, it is the product safety of the individual components which is independently tested and certified by DEKRA experts in their laboratories around the world.

ELECTROMAGNETIC COMPATIBILITY

In Europe as well as in East Asia, DEKRA runs a number of laboratories for testing the electromagnetic compatibility (EMC) of not only individual components, but also the vehicle as a whole. When it comes to the interaction of devices and systems within a vehicle and in communication between the vehicle and its surroundings, it must be ensured that the individual elements do not mutually impair each other's functioning, just as the system as a whole must not impair other products in the surrounding area. Checking this in advance is another of the core competencies of DEKRA's experts in the Product Testing and Certification business unit.

SECURE WIRELESS CONNECTIONS

The interconnected world depends on secure wireless connections. DEKRA offers – mainly from the site in Málaga, Spain – a comprehensive range of services for certifying and testing wireless connections. These cover a range of different technologies (among others GSM/GPRS/EDGE, WCDMA, HSPA, LTE, WiMAX™, Bluetooth®, Wi-Fi®, RFID and NFC) and include conformance, regulatory and interoperability tests.

FUNCTIONAL SAFETY

In addition to the individual analysis of various safety aspects, DEKRA experts also look at overall functional system safety in order to prevent injury risks caused by possible malfunctions of systems or controls. The focus here is on the interaction of hardware and software as a whole.

CYBERSECURITY

DEKRA has systematically expanded its range of cybersecurity and data protection solutions. The DEKRA 360°CyberSafe method helps businesses to guard against IT threats and data theft. As an expert organization, DEKRA enjoys a wealth of knowhow and experience in a diverse range of fields, as audits, consulting, product testing and training.

NEW TESTING AND INSPECTION CENTER AT THE LAUSITZRING

The Lausitzring in Brandenburg, which DEKRA took over in 2017, will soon be home to Europe's biggest independent testing and inspection center for automated and connected driving. Situated right next to the existing DEKRA Technology Center, the racetrack offers the perfect environment for testing the mobility of the future. The site will be a central element of DEKRA's

international test association for automated and connected driving.

It will be used as a future venue for testing the entire range of automated driving functions up to fully autonomous driving (level 5) – including the flexible city course, various country roads and a section of highway on the test oval at the DEKRA Technology Center. For testing 5G-based connected driving functions, DEKRA started a cooperation with Deutsche Telekom.

Automation and connectivity are becoming increasingly important for the safety of mobility. DEKRA takes its commitment to safety very seriously and offers its customers in the automotive industry comprehensive testing and development expertise for the mobility of the future.

A "THIRD PARTY" FOR EVALUATING VEHICLE DATA

The ever-increasing automation of the driving experience can lead to a conflict of interests or disputes in matters concerning responsibility and liability. In the future, it will be essential that the task of managing and evaluating the relevant data is in the hands of a neutral and reliable institution – a "third party". This has for decades been the role of DEKRA in vehicle inspections and expert analyses, and DEKRA is now looking to deploy its experts in other fields, too.

Take the following scenario, for example: A vehicle of the future is found to be breaking the speed limit. The authorities now have to clarify whether the vehicle was driving itself at that time or whether a driver was at the wheel. If it was a driver, then it's the driver that receives the punishment for speeding. The vehicle data required for evaluating such a situation has to be stored at a central, secure location. Only authorized bodies must be allowed to access



or query the data according to a strictly controlled procedure. DEKRA sees itself as pre-destined for setting up such a central facility.

Another important issue are over-the-air software updates. Given today's possibilities, there has to be independent verification which software version is active in the vehicle. Here, too, DEKRA can act as a "third party". The same goes for privacy management, i.e.: Which groups of users have access to which vehicle functions and which type of data?

NUMBER 1 FOR VEHICLE TESTING

Whatever future technological innovations we will see in the field of automation and connectivity, DEKRA's expertise in the "conventional" automotive sector will remain as important as it ever was. Even automated vehicles need functioning brakes, intact suspension systems and suitable

tires. In future, these will continue to be subjected to regular, independent testing. As the world's number 1, DEKRA conducts around 26 million vehicle tests every year.

Future testing procedures will increasingly include electronic components. Also, and above all, electronic safety systems have to function reliably over the entire lifetime of the vehicle. The nature of periodic vehicle inspections will continue to evolve to take account of vehicle technology.

The same applies to homologation and type-testing. DEKRA experts in many different countries ensure that new vehicle models comply with regulations and are safe to drive on the roads. That is something that they will continue to do in the future, under the new conditions arising around digitalization.

SAFETY FROM A SINGLE SOURCE

Whether homologation or periodic vehicle inspections, functional safety or electromagnetic compatibility, automated driving functions or secure wireless connections and cybersecurity, the DEKRA experts really do offer "safety from a single source" – and not just in the Rinspeed "microSNAP".

PERFECT CLIMATE OVER THE LAST MILE

He is still a man of big ideas, and his latest one focuses on something small: Mobility visionary Frank M. Rinderknecht is exploring micro transportation with his microSNAP. He is putting his microSNAP on the road in diverse combinations of "skateboards" (chassis) and "pods" (bodies), forming a maneuverable robotaxi, a quick-service delivery vehicle or a mobile charging station for electric cars with empty batteries. Rinderknecht and his Swiss think tank, Rinspeed, have developed systems that operate in the background and become active as needed. They include systems to provide a warm welcome for passengers entering the robotaxi or to ensure the correct temperature for goods that must be kept cool over the last mile as well. Thermal management specialist Eberspächer from Esslingen (near Stuttgart), a leading expert for heating and cooling solutions, provides both systems.

AUTONOMOUS HEATING AND COOLING

Eberspächer combines a space-saving split air conditioner with a latest-generation electric air heater for the two-seater, self-driving microSNAP taxi. The system components blow conditioned air into the interior through attractive air vents designed specially for the microSNAP. Cleverly integrated into the dashboard layout, they assist in effective air distribution in the passenger's cabin. Eberspächer's solution not only comprises the climate-control hardware for the taxi pod; the thermal-management specialist also ensures an autonomous power supply for the heating and cooling system: an ESS (energy storage system) unit behind the seats pro-

vides enough climate-control power at all times, independently of the traction battery. No additional load is imposed on the traction battery, ensuring a longer range.

The climate-control functions are naturally suitable for fleets as well, thanks to Eberspächer's connectivity solutions: For example, the microSNAP can be heated or cooled appropriately for any season or outside temperature before it collects its passengers centrally. This is a boon for comfort on hot summer days or in freezing winter cold. Passengers can also control the interior climate themselves during the trip. If Frank M. Rinderknecht has his way, this taxi solution conceivably could be updated to produce mobile "office pods" with all the necessary communication equipment – and a pleasant working climate provided by Eberspächer.

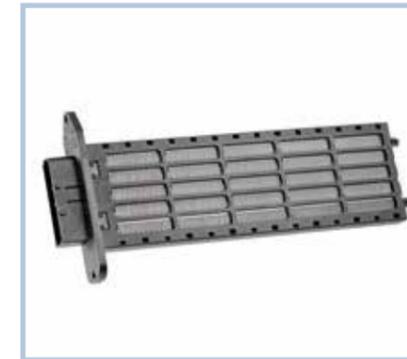
THERMAL MANAGEMENT FOR THE MOBILE MINI-SUPERMARKET

The microSNAP could also operate as a mobile mini-supermarket in future: Customers use an app to order food for delivery to their homes or workplaces – an ideal solution for target groups like single households, seniors, or people on a tight working schedule. In this second scenario, the microSNAP becomes a 21st-century catering kiosk on wheels. It offers beverages, ice cream and snacks near schools, office complexes or events or, like a milkman from days gone by, delivers fresh food to its customers on fixed routes following a fixed schedule. The microSNAP's delivery pod consists of a combined cooler/heater, which the customer opens with his ID

to take out the box of products put together just for him. Eberspächer is responsible for the entire on-board thermal management in this use case. This includes the heating and cooling units, the autonomous power supply and the connectivity system, as well as the cooling and heating containers, which Eberspächer manufactures from robust, rotomolded polyethylene. The advantage: this special production process prevents thermal bridges on the containers, and makes them particularly easy to clean.

ON-DEMAND POWER SUPPLY

Eberspächer supports its partner, Rinspeed, with suitable products for the microSNAP in a third application as well: converting the visionary concept vehicle into a mobile charging station for power on demand. As the number of electric cars on our roads increases, so also does the likelihood of some of them running out of charge in the worst possible place. Rinderknecht's vision for solving this problem simply involves calling a mobile charging station using an app.



Like in the other scenarios, the customer receives direct feedback from a control center about where the next available unit is located and when it will arrive. When the mobile power pod arrives, the customer opens the door with his ID, takes out the charging cable, and follows the spoken instructions on what to do next. As in the scenarios described above, this service is then electronically billed to the customer's account. Eberspächer provides the centerpiece of the mobile power supply unit: The 480 V/144 Ah lithium iron phosphate battery with the latest S2P tech-

nology can output up to 69 kWh, greatly extending the range of an electric car. Another conceivable use for the mobile power pod would be as a temporary, stationary power supply system for electric machines, equipment and all types of small, electrically operated vehicles.

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SWISS MADE

ESORO – your experienced and innovative engineering partner for product developments, lightweight composite parts and clean car developments for cars and trucks.

The “microSNAP” is the consequent step for the last mile, following the SNAP concept, which has been presented last year and consequently focused on the new possibilities and advantages of new technologies and their innovation speed and therefore divided the vehicle in a very clear manner in the dynamic rolling EV-chassis – the skateboard and the body structures – the pod's.

The intelligent “skateboard” integrates all drivetrain components as a rolling and fully automated chassis of the electric vehicle. The so called “pod's” on the other hand are very long-lived modules, which are not outdated quickly and are fully dedicated to their specific use, i.e. as a transportation pod or as a breathtaking fully connected passenger pod with all comfort.

“microSNAP” is a completely new vehicle of the size of a Renault Twizy, but based on an adapted production chassis. ESORO has been in charge for many of the engineering tasks and the complete realization of the concept vehicle.

“microSNAP” is the 20th project, which ESORO realized for Rinspeed. In detail ESORO has been responsible for the adaption of the chassis, all composite interior and exterior body parts of the pod's so as the frames and the door. ESORO has also been responsible for the adaption of the drivetrain and energy management system including the

harness of the vehicle so as several control units. Additionally, ESORO implemented and adapted several technologies and innovations of the project partners for the interior and exterior and has been responsible for the partly automated steering and drive system. Last but not least, ESORO was responsible for the final assembly of the interior and exterior of the “SNAP”.

ESORO has now 28 years of experience as engineering partner for product developments, concept vehicles and components focused on lightweight construction, alternative drivetrains and mobility. During this time ESORO has gained a well-deserved reputation for excellent efficiency and innovative solutions, which is demonstrated by numerous prototypes and serial products.

Since 1990 ESORO has been working intensively in the field of conception, implementation and tests of clean car concepts and drive systems. ESORO is thus one of the few companies in the world with well-founded experience in development and operation of electric, plug-in-hybrid and fuel cell drives. These activities are our core competence. ESORO therefore realizes EV projects in close cooperation with well known OEM's starting with the initial conception and the prototype through to the serial project phase. In addition ESORO also supports R&D departments of OEM's with it's experience for BEV and FCEV vehicles (cars and trucks).



In 2016 ESORO has developed for COOP world's first fuel cell truck in the 35t class (19t truck with a 16 t trailer) which has been presented on November 4th 2016 during the opening of Switzerland's first public Hydrogen fueling station, which is operated from COOP and get's delivered the Hydrogen from the close by CO2 free production from H2 Energy at a river power station. The ESORO 35t fuel cell truck has a range of 400 km and can be refuelled in less than 10 minutes. Therefore the truck can meet the very high requirements for the COOP logistics without CO2 emissions.

ESORO is also developing fiber reinforced components from initial conception up to pre-production samples. In-house specialists optimize the component properties and characteristics throughout the entire development process. Important steps are non-linear, orthotropic Finite Element Analysis and simulation.

Another development from ESORO is the E-LFT production technology developed for Weber Automotive. E-LFT makes large scale production of high-strength and lightweight composite parts affordable. E-LFT composite parts weigh more than 30 percent less than comparable steel parts. For the development of the smart fortwo tailgate,

which now has been produced 800'000 times with the E-LFT process, ESORO received the highly recognized JEC Innovation Automotive Award 2008.

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Building a better working world

DIGITAL FUEL FOR A MOBILITY ECOSYSTEM

We are all familiar with the various studies and scenarios dealing with autonomous driving. And while they differ in their estimations of maturity and potential market entry timelines, almost all of them come to the same conclusion: It is not a question of “if” but only of “when” Level 4 and Level 5 vehicles will be cruising on our streets.

The Rinspeed SNAP unveiled in January 2018 is a great example that can help stimulate the discussion around some of the key questions that the industry needs to tackle when it comes to the age of autonomous driving: How can the different lifecycles of hardware and software be synchronized? Or can they be decoupled? As software updates of digital processes in the car will not be sufficient to consistently ensure the desired level of safety, what will be the most efficient lifespan of sensors, control units and mechanical components in an autonomous vehicle?

Let’s have a closer look at the idea of not upgrading but completely replacing the drivetrain and IT hardware – all bundled in the “skateboard” – at the end of a shorter service life. What would be the impact of a shorter usage of valuable hardware parts and assets that are prone to aging?

Quite clearly, increasing utilization and operational efficiency will be the central levers for the cost equation to work. This will be more important given the question of whether a used car market will exist for autonomous vehicles or whether their residual value will be close to zero after their first period of use.

The recently released microSNAP also clearly shows what will be important going forward: Increasing efficiency will call for flexible use of the same hardware for different use cases, combining moving of people with logistics and other applications.

A future city with numerous microSNAP skateboards running 24/7 and moving around a large number of pods can be compared with an ecosystem that everybody knows from the smartphone: The hardware is the enabler, but the user benefit is created by the apps that are conceived, designed and provided by thousands of creative developers.

For such mobility ecosystems to operate successfully in a world of integrated, on-demand, personalized and autonomous transport, all players across the value chain will need to address some key challenges:



- Who will own and operate mobility assets such as skateboards, pods, batteries, charging infrastructure?
- With integrated A-to-B mobility, how do you provide a seamless journey for the customer? How do you integrate data, payments and experiences?
- In a “many-to-many” world of mobility provision, how do you establish mutually beneficial commercial models and create trust between different parties?

EY TESSERACT

EY Tesseract is our blockchain-powered platform designed to support an integrated and autonomous future of mobility. Single vehicles, fleets and other transport services and assets are available on the platform. Vehicles and trips are digitally logged on the blockchain, and transactions are automatically settled between owners, operators and third-party service providers through a single-source, usage-based payment system. As participants on a single platform, multiple stakeholders such as OEMs, mobility and transport companies, and cities and infrastructure providers, among others, will have the opportunity to create new value and

revenue streams. Tesseract can also help with electric-vehicle disaggregation through pooled leases of batteries and payments across OEMs and energy and fleet operators. It also addresses mobility-as-a-service issues such as payment integration, crypto currency and asset tokens (“mobility coins”).

If “skateboard” and “pod” become temporary companions – always depending on the mode of transport – then EY Tesseract can be a key connector. Rapid familiarization, rapid trust building and easy transactions – With the help of blockchain the short-term relationship of “skateboard” and “pod” can be organized individually, automated and safely to create maximum benefit for all stakeholders.

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microSNAP and FoamPartner: ON THE FAST TRACK WITH CUTTING-EDGE FOAM SOLUTIONS

If you don't want to be left behind, you need to move full throttle toward the mobility of the future using a visionary approach.

Sensors and artificial intelligence will soon take the wheel. Driving will become autonomous, connected, and electric. When people will no longer drive themselves in the future, road traffic and the perception of space and time will change completely. In order to shape the mobility of the future, we need to be ahead of our time today. So let's move into the fast lane.

As one of the world's leading specialists for polyurethane foam technology, FoamPartner is working intensively on the mobility of the future. The company, which is driven by innovation, began working on eMobility projects in early 2017, and now, together with RINSPEED, FoamPartner wants to take a step forward. As part of this collaboration, the companies will not only be developing the mobility of tomorrow, but rather of decades to come, while at the same time addressing the question of how to design solutions in a more innovative and efficient way. microSNAP, the RINSPEED concept study, offers some possible answers, and now FoamPartner will be contributing its cumulative expertise to the project in the areas of acoustics and thermal solutions.

BEST IN FOAM

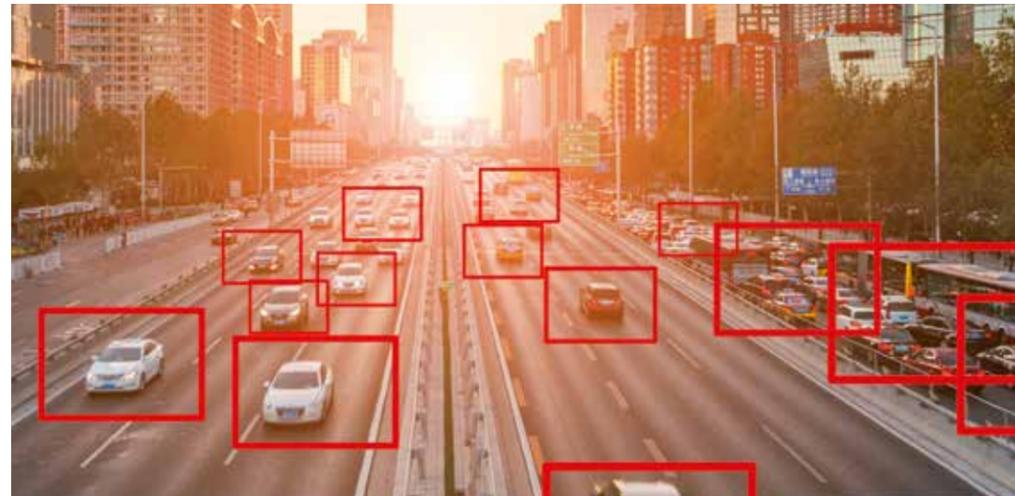
The FoamPartner Group's international success story is defined by over 80 years of foam expertise. With more than 13 locations

in Europe, Asia-Pacific, and the Americas, FoamPartner is one of the leading companies offering polyurethane foam solutions for industrial and automotive applications and for mattress and pillow manufacturers. The company, which has more than 1,100 employees, is primarily focused on its Global Business Units Acoustic & Thermal Solutions, Automotive Rolls, Systems, Specialties, and Living & Care. FoamPartner's comprehensive range of products comprises over 200 high-quality specialty foams.

The GBUs Acoustic & Thermal Solutions, Automotive Rolls, and Systems, which all fall under the Mobility division, specialize in the development and production of foams for acoustic and thermal insulation as well as vehicle interiors. Together with renowned partners from a wide variety of industries, this division develops tailored, first-class innovative solutions using foam and other functional materials for the automotive industries.

INNOVATIVE AND VISIONARY

To ensure that the foams developed and manufactured by FoamPartner meet the most specific individual requirements in terms of design and shape, the company uses a broad range of modern manufacturing processes and pioneering processing techniques. As a result, they are able to create new products and innovations that set the bar in terms of foam and foam hybrids.



For example, as part of a benchmark analysis, FoamPartner is currently working to optimize components for electric cars with the goal of establishing itself on the market as an acoustics provider for eMobility applications. The development of an interior package with optimized thermal insulation for vehicle interiors is also currently being developed at full speed - a technology that will significantly increase the range of electric cars. At FoamPartner, the mobility of tomorrow is here today.

In order to advance innovation and progress even further, talks between the global FoamPartner Group and RINSPEED began in 2017. For the Swiss automotive visionary, the comfort level of the interior of the microSNAP is a top priority, which is why FoamPartner is the perfect match for this project. With their GBU Acoustic & Thermal Solutions, FoamPartner can offer RINSPEED their expertise in the area of future-oriented, acoustically and thermally effective foam solutions. The GBUs

Automotive Rolls and Systems will also contribute to the development of the microSNAP. With prepolymer technology - a future driver in the area of vehicle interiors - Automotive Rolls could offer an innovative soft touch experience for all paneling elements and seating surfaces. Moreover, the GBU Systems could contribute to both the interior and the exterior of the microSNAP by providing components made of integral and soft foam systems. Together with RINSPEED, FoamPartner wants to move into the fast lane in terms of the mobility of the future, and set milestones with innovative foam solutions.

GBU ACOUSTIC & THERMAL SOLUTIONS

Acoustic and thermal management experts: with acoustically and thermally effective components and systems, the GBU Acoustic & Thermal Solutions is concentrated on vehicle acoustics, headliners and seals.

GBU AUTOMOTIVE ROLLS

Vehicle interior specialists: the core competences of the GBU Automotive Rolls are the development and production of high-quality polyurethane foams based on PUR ether and PUR ester.

GBU SYSTEMS

A highly flexible, solution-oriented manufacturer of PUR systems for innovative, high-quality two-component systems made of PUR foam - from soft to integral to rigid foams.

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TODAY'S FEATURES – TOMORROW'S TECHNOLOGY

Gentex Technology for microSNAP

- **In-Cabin Monitoring** – In-cabin cameras and environmental sensors that monitor passenger health and safety as well as vehicle cleanliness and air quality
- **Iris-Scanning Biometrics System** – Iris-scan camera that authenticates the driver and authorizes vehicle operation, cabin personalization, cloud-based services and in-vehicle payments
- **Vehicle-to-Home Automation** – Cloud-based home-automation services
- **Dimmable Glass Systems** – Dimmable glass panels for privacy and climate control

GENTEX CORPORATION

Gentex is a long-time supplier of electro-optical products for the global automotive industry. We supply nearly every major automaker with advanced electronic features that optimize driver vision and enhance driving safety. We have focused competency in digital vision, connected car, and dimmable glass systems.

Since our inception, Gentex has managed the evolution of rear vision. We've turned the mirror into a strategic electronic module – a delivery mechanism for advanced vision-related features, including cameras, displays, alerts, transaction modules, car-to-home automation systems, and security components.

As vehicle electrification and autonomous driving trends progress, our core technologies are converging to yield products that provide unprecedented advances in digital

vision and stand to become integral components in connected cars and future mobility systems.

IN-CABIN MONITORING

In the autonomous age, a myriad of interior cameras and sensors will be required to monitor passenger health and safety as well as vehicle cleanliness and air quality. The vehicle will need to oversee a virtually endless list of potential circumstances:

- Are passengers and children properly restrained while in transit?
- Did the correct passengers enter/exit the vehicle at their designated location?
- Did a passenger smoke, get ill or vandalize the vehicle?
- Did a passenger leave behind any belongings?

For Rinspeed's microSNAP, Gentex developed an in-cabin monitoring system that uses a

camera and environmental sensors to monitor passenger activity and well-being along with vehicle hygiene and air quality. System intelligence would alter vehicle operation and send alerts and notifications according to detected in-vehicle events.

IRIS-SCANNING BIOMETRICS SYSTEM

Automotive biometric systems measure and analyze various physical characteristics to identify and authenticate the driver prior to granting vehicle and/or information access. For microSNAP, Gentex developed an in-cabin biometrics pod that authenticates the driver and delivers customized security, comfort and convenience features. The system consists of a module housing near-infrared emitters, an iris-scan camera and system intelligence.

To be authorized to use a microSNAP vehicle, users would first undergo a brief enrollment



process, during which time the pod would scan their iris and map its unique pattern to a storable, algorithmic-based template. Users might also enroll using a cell phone and companion app with iris-scanning capabilities. Once enrolled, glances to the pod would authenticate the driver and assure the vehicle of his or her identity.

With the user identified, the system would allow the vehicle to operate and personalize setup by adjusting seat position, HVAC controls, music favorites, GPS locations, and other cabin amenities, according to user-determined presets.

The system could also sanction safe, secure access to a host of cloud-based, connected-vehicle services. For instance, in a ride-sharing scenario, an authenticated iris scan could grant the driver access to the vehicle and assign payment for vehicle usage. The system could also provide access to work files and virtual meetings, authenticate secure banking transactions, and provide security for in-vehicle, trip-related purchases like tolls, vehicle charging and parking.

VEHICLE-TO-HOME AUTOMATION

Gentex's HomeLink technology, which uses RF and wireless cloud-based connectivity to operate gates, garage doors, security sys-

tems, thermostats, home lighting and more, could also be controlled by the biometrics system. Once authenticated, drivers would be able to control all their home automation devices from within microSNAP using the HomeLink Connect app. The biometrics system would provide security and convenience for multiple passengers by activating the unique home automation presets of the vehicle's various authorized users.

DIMMABLE GLASS SYSTEMS

To help ensure passenger privacy, Gentex provided microSNAP with dimmable glass panels that darken on demand or in conjunction with sensor function. They can even assist the climate control system in maintaining a consistent temperature by darkening according to temperature and sunload sensors.

Gentex dimmable glass systems utilize electrochromics, which is the science of darkening a material using electricity. They contain a chemical formulation like that used in our automatic-dimming rearview mirrors, which are known for their time-tested chemistry and durable device construction. Gentex's electrochromic technology has the greatest opacity range from light to dark, the highest optical clarity, and allows for the most durable electrochromic devices in the market.

Gentex is a proud sponsor of Rinspeed's microSNAP. With core competencies in micro-electronics and vision systems, chemical development and coatings, software design, displays, glass processing, and automated assembly, we stand ready to help customers integrate today's features using tomorrow's technology.

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REIMAGINING PERSONALIZED THERMAL COMFORT FOR A BETTER FUTURE

Gentherm seat comfort products are, and have always been, at the forefront of industry trends and technology. With the Rinspeed microSNAP concept, Gentherm presents a personalized climate solution that offers vehicle occupants more opportunities and possibilities for personal comfort than ever before.

Designed to quickly transport passengers, the microSNAP concept moves beyond the current idea of shared and autonomous vehicles. As more individuals are unwilling to use shared taxi services that take extra time and stops to reach their end destination, they are looking for solutions that will quickly take them to where they need to go. Consumers want all of this without compromising comfort.

By working with the innovative Swiss think tank, Rinspeed, Gentherm developed an integrated thermal technology climate system for the microSNAP that provides the highest level of comfort for passengers and creates an exceptional travel experience.

ONE DEGREE OF COMFORT

One degree is all it takes to be uncomfortable, and finding comfort is more than heating or cooling. Better solutions come from a better understanding of an individual's needs. Decades of research and Gentherm's expertise in human thermophysiology have led to a deep understanding of how people perceive and react to temperature changes. Passenger comfort is incredibly important and Gentherm created an individualized experience for each occupant of the microSNAP.

INTELLIGENT CLIMATE ZONES

The Gentherm passenger experience in the microSNAP recognizes that it is about the person, not the seat. The solution is to provide an individualized climate system that delivers optimal comfort and redefines the travel experience in just moments after entering the vehicle. The result is unprecedented comfort and convenience for the occupant.

The microSNAP solution shapes the occupant's climate with smart sensors that deploy patented air moving devices, high power density heaters and convective heaters. The system combines active cooling, and passive air moving devices to address thermal asymmetry in the human body. Thermoelectrics located in the seat back and a passive air moving device in the cushion, provide additional cooling watts to counteract heat production and maintain overall thermal balance.

In hot climates or during long journeys, the climate control system will prevent sweating around the back and thighs, while allowing the passenger to individually adjust the seat temperature to best suit their personal preferences.

A neckwarmer is seamlessly integrated into the seat headrest that provides comfort, controlled heating and a warm thermal sensation to the passenger in seconds.



ABOUT GENTHERM

Gentherm is a global developer and marketer of innovative thermal management technologies for a broad range of heating and cooling and temperature control applications. Automotive products include variable temperature Climate Control Seats (CCS®), heated automotive interior systems (including heated seats, steering wheels, armrests and other components), battery thermal manage-

ment systems, cable systems and other electronic devices. Medical products include patient temperature management systems. The Company is also developing a number of new technologies and products that will help enable improvements to existing products and to create new product applications for existing and new markets. Gentherm has more than 13,000 employees in facilities in the United

States, Germany, Canada, China, Hungary, Japan, Korea, Macedonia, Malta, Mexico, United Kingdom, Ukraine and Vietnam.

By taking technology to the next degree Gentherm is reimagining personalized thermal comfort in the microSNAP concept vehicle. For more information about Gentherm's latest technologies, visit www.gentherm.com.



INTELLIGENT MOBILITY FOR PERSONAL MICROCOSMS

While humanity in urban centers of population is having to squeeze ever closer together, there is an increase in the desire for individuality, self-determination and more manageable structures. The Rinspeed microSNAP, with its modular construction based on a skateboard and pod (in principle, the little brother to the Snap presented in 2018), innovatively accommodates both of these megatrends and showcases HARMAN as the number-one technology and integration partner for innovative mobility ecosystems. The HARMAN technologies that enable the Rinspeed microSNAP make our rides safer, more sustainable, more comfortable and, not least, more personalized – today, tomorrow and the day after.

Technological developments are becoming noticeable and usable in major cities at an increasingly rapid pace, often leaving those living in more rural areas feeling distanced from these trends. Be it superfast fiber internet or alternative means of transport, new technologies are primarily implemented where hundreds of thousands of customers promise the prospect of good business. Thanks to the HARMAN technologies used in and around the Rinspeed microSNAP, this problem could be elegantly avoided in future.

BUY AND SHARE!

Buying a microSNAP and then sharing it easily and profitably with lots of others is no problem at all. The connection to the HARMAN Ignite Cloud platform and services enables booking, monitoring and payment of rides and also takes care of efficient operations. Planned maintenance and unscheduled repairs, timely charging, cleaning ... the Cloud controls all this for the owner. And because the microSNAP drives autonomously, it is able to intelligently avoid the problems of conventional car-sharing services. It is always in the right place at the right time and ensures optimum capacity utilization completely on its own. The Rinspeed microSNAP functions like Airbnb on wheels and can be a source of continuous income for its operator. The benefit is that the networking of many results in a whole fleet of vehicles that can also service the needs of areas with low population density that are possibly beneath the radar of major operators. Alongside buy local or decentralized energy supply, drive local could become a next step towards regional independence and manageability.

PERSONAL ASSISTANT AND INDIVIDUAL COMFORT ZONE

But the Rinspeed microSNAP can do much more than that. Thanks to multi-level and biometric authentication and instant personalization, it welcomes each and every user as if they were sitting in their own vehicle. Be it their preferred interior temperature, seating position, display configuration, entertainment program or sound settings, everything is perfectly adjusted to their personal needs even before they set off. The vehicle is equipped with a True Level 5 User Experience based on the HARMAN Digital Cockpit Platform, which also supports automaker

brand differentiation. Operation during the ride is via natural voice commands. Passengers can use their familiar voice-based assistants in the microSNAP – Bixby, Alexa, Cortana or Siri. The intelligent cockpit can adapt automatically to each passenger while connecting their entire personal Internet of Things – in the case of the compact microSNAP, a curved, 49-inch LED display provides visual interaction across the entire width of the vehicle. An HMI designed specifically to suit the needs of children or the elderly is a further option as are differently personalized displays for both passengers.

From an acoustic standpoint, the two-seat pod can be subdivided into two separate units. The HARMAN Personal Sound Zones allow both passengers to enjoy different music or entertainment programs without disturbing the other. And Ambisonics Escape, another outstanding HARMAN sound technology, transforms even the tiniest interior as desired into an open-air stage on wheels, a concert hall or an acoustic copy of the listener's living room. It's hard to imagine a greater degree of individualization and personal first-class service. Customers will happily return time after time.



FULLY CONNECTED, SAFE, SECURE AND AUTONOMOUS

While passengers sit back and relax, microSNAP uses advanced driving technologies to navigate autonomously to its destination. Cameras and sensor integration from HARMAN deliver full 360-degree monitoring of the entire vehicle surroundings and interior. Taking care of connectivity with the outside world and the cloud is the HARMAN 5G Smart TCU, which also handles V2X (vehicle-to-everything) communication, i.e. the exchange of information with other road users and the infras-

tructure. The Conformal Antenna combines up to 14 transmission/receiving units in a single package installed flush with the roof of the microSNAP. The vehicle is continuously updated over-the-air, and because every connection with the outside world obviously represents a potential entry point for hackers, the microSNAP is also protected by HARMAN SHIELD – probably the world's most advanced cybersecurity solution.

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Pushing Performance

FAST CHARGING PUSH FOR THE „microSNAP“ CONCEPT VEHICLE

The HARTING Technology Group has been in successful partnership with Rinspeed for many years. The visionary Frank M. Rinderknecht and HARTING with its innovative solutions for Connectivity for Industrial Things and Infrastructure & Cloud are a perfect match. Following the integration of the new fast-charging technology in 2018, we will now jointly show an automated charging solution with the robot specialist KUKA at the next Rinspeed project „microSNAP“, thus consistently expanding the e-mobility infrastructure.

The breakthrough for e-mobility depends heavily on how long it takes to charge and how user-friendly the charging infrastructure is. Long charging times and unwieldy heavy connectors are putting car owners off converting to e-vehicles.

Fast charging technology with a DC charging plug (combo) is a must to ensure that, in future, vehicles can be charged sufficiently in minutes, not hours. Automatic charging solutions are also becoming increasingly important, as the handling of larger charging infrastructure systems is difficult and there simply isn't enough space to fit them into most car parks, fleet parking spaces or garages.

Fast DC charging is becoming particularly vital for e-vehicles in regional transport and logistics sectors in order to comply with future requirements for delivery times and fleet availability. As online trade is booming and the fresh food sector has now become involved, Frank M. Rinderknecht believes in small autonomous vehicles that can deliver their goods to the customer 'just in time' without detours. These vehicles must therefore be rechargeable within the shortest amount of time possible. One of the best options would be for charging to run while the e-transporter is loaded with packages and other materials.

HARTING and its partner KUKA show such an automatic charging solution: the e-charging assistant provides optimum guidance for the DC combo 2 connector into the charging socket on the vehicle. After charging, the robot removes the connector, including cable, and the vehicle is ready to go shortly afterwards. The powerful DC supply is adapted optimally to the charging assistant. In addition, HARTING supplies the charge assistant with data, signal and power.

STRONG GROWTH FOR HARTING AUTOMOTIVE

The HARTING Automotive subsidiary has experienced strong growth in recent years. The company has long been at home in the automotive supplier industry market and recently recorded a sharp rise in demand for e-mobility solutions. Based on its decades of experience in connection and transmission technology, the company develops and produces charging equipment for electrical and plug-in hybrid vehicles. The fast charging technology is a convincing example of growing market demand and has led to the continual expansion of the relevant range of products and components. The fast charging technology premiered at the 2016 Geneva International Motor Show. The company has

long been a competent and reliable partner to almost all national automotive manufacturers as well as major OEMs in other European countries. At the end of 2016, HARTING became a direct supplier to the VW Group for a specific e-mobility solution. HARTING supplies a range of charging equipment for various Group brands. HARTING is also a Tier 1 supplier for the BMW Group.

EQUIPMENT FOR ALL RELEVANT MARKETS

HARTING Automotive offers charging cables for all standards around the world, for charging currents from AC to three-phase and DC, from 230 to 1000 volts. This includes Mode 2 charging cables with integrated temperature monitoring and DC residual current detection and Mode 3 charging cables in different versions. The automotive manufacturer has shown that HARTING can provide the right customised solutions for all relevant markets.

SUCCESSFUL COOPERATION BETWEEN HARTING AND RINSPEED

Rinspeed and HARTING have been working together successfully since 2016: MICA, which garnered HARTING the prestigious HERMES AWARD at the HANNOVER MESSE in April 2016, was integrated into the „Etos“ vehicle for auto-



nomous emission and condition monitoring. In 2017, HARTING used its miniMICA – another component from the evolutionary MICA ecosystem – to support Rinspeed's „Oasis“ car. In 2018, HARTING provided the fast charging technology for the „SNAP“.

MID TECHNOLOGY OPTIMUM SOLUTION

In addition to innovative charging infrastructure systems, the HARTING Technology Group offers further optimum solutions for the automotive sector with MID technology. HARTING 3D-MID technology can be used to integrate complex electronics solutions that require very little space into vehicles. MID technology is developed and produced by HARTING Mitronics, based in Switzerland. Such miniaturised system components can be used in interior lighting systems, proximity sensors or light sensors, for example.

In this way, HARTING underscores its ambition to be an innovative driver of technological development. The HARTING Technology Group, based in Espelkamp (Minden-Lübbecke district), is a visionary, pioneer and driver of this development. The owner-managed family business develops and produces electrical, electronic and optical connection, transmission and network technology and software. Services and products for all levels are created under one roof and in line with customer requirements – from innovative components to specific applications and services, through to integrated system solutions. HARTING operates 13 production sites and 44 sales companies around the world. With around 5000 employees, it achieved revenues of EUR 762 in 2017/18 (30 September), a good 13% more than in the previous year.

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Hanseatische Fahrzeug
Manufaktur GmbH

FUNCTIONAL SAFETY E/E-ARCHITECTURE, HOMOLOGATION VR INTERIOR DESIGNS

We develop and integrate highly complex mechatronical systems

Hanseatische Fahrzeug Manufaktur GmbH (HFM) specializes in the development of highly complex mechatronics systems for electric and autonomous vehicles. The company based in the German state of Schleswig-Holstein focuses not only on the technical feasibility, but also on compliance with all the requirements for type approval and homologation within the framework of existing and future legal provisions. This includes the development of end-to-end electrics and electronics architectures (E/E) from the sensors and driving-dynamics control systems to the actuators. They form the basis for a functional and a technical safety concept, which are indispensable for the type approval and homologation of future self-driving vehicles.

To underscore the expertise of the company in this field, HFM has developed a proprietary product named "Motionboard®." This flexibly adaptable vehicle platform from HFM demonstrates how such a safety concept with multiple redundancy can be integrated and realized in existing and future automated or autonomous vehicles under practical aspects.

The scalability of this modular Motionboard® platform allows adapting the vehicle to existing needs, both in terms of length and width as well as with regard to the battery capacity. The unique selling point of the Motionboard® platform is the fact that it meets the requirements for homologation in Europe as an M1 class vehicle, defined as vehicles for passenger transport with a maximum of eight seats plus the driver. The Motionboard® was designed with the goal of homologation from the start. This also includes a complete development documentation in line with the applicable legal provisions. This competence of the company in the integration of the different vehicle systems into a functioning overall system that meets all the requirements for homologation makes HFM a key figure in the development of future electric and autonomous vehicles of a wide range of levels of development.

The E/E architecture in modern vehicles ties all electrically and electronically controlled vehicle components together, from the motors and engines to the steering and brakes, from the battery and the control units to the sensors, actuators and the lighting systems. As a result, HFM is the central hub that pulls together all threads that conduct electricity. In addition to the systems integration and development of E/E archi-

tectures and platforms for passenger transport, HFM offers further engineering services in this context. This also includes a proprietary virtual reality tool. This tool developed by HFM enables customers from a wide range of sectors such as, for example, public transport companies, private enterprises or other institutions, to evaluate interior designs in real time, revise them quickly and easily, and check them for practicability. There is no need for customers to start from square one. Rather, they are able to examine designs that HFM creates based on their requirements profiles. These range from simple and robust interiors for intra-company passenger transport to luxurious interiors with lounge character, refrigerator and the finest seating. In addition to the aforementioned use cases, this concept also allows realizing self-driving advertising billboards. Another main focus in connection with autonomous mobility is the development of vehicles for people with physical disabilities, who will particularly benefit from the introduction of self-driving vehicles.

ABOUT HFM

The company headquartered in Holm in Schleswig-Holstein was founded in 2008 by Wolfgang Bern and is an automaker certified in accordance with ISO 9001:2015. Together with his team, the engineer and entrepreneur with a degree in business management develops highly complex mechatronics systems for electric and autonomous vehicles. In particular, the company's areas of expertise include:

- Drive-by-wire systems with triple redundancy and fail-safe design
- Virtual reality design of interior, exterior and components
- Design of vehicles for people with limited mobility
- Tailor-made realization of designs based on virtual reality technology
- Powertrain integration
- Development of driving-dynamics-related vehicle functions
- Integration and interlinking of highly advanced driver assistance systems
- Development of vehicle-specific control units and sensors
- Development of actuators, e.g. for emergency brake and brake cylinder control
- Validation and systems testing
- Development of safety concepts for highly automated vehicles
- Homologation of special-purpose vehicles
- Development and manufacture of prototypes and concept vehicles
- Design of high-voltage powertrains and prototype integration.



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IBEO AUTOMOTIVE SYSTEMS: EYES AND BRAIN FOR RINSPEED microSNAP

Ibeo's 3D Solid State LiDAR sensors are the eyes of Rinspeed microSnap's skateboard. The Ibeo LiDAR sensors enable a 360° field of view for reliable perception of the static and dynamic environment around the vehicle platform in 3D resolution. Thus, microSnap is not only able to recognize other vehicles while driving long routes on highways, but it is also capable to perceive complex inner city scenarios with many traffic participants such as bikes and pedestrians. Rinspeed microSnap is a Level 5 Automation Vehicle, which means that no human driver is necessary anymore. To realize Level 5 Automation, Ibeo provides the software for the fusion of several „Ibeo NEXT“ Solid State sensors as well as autonomous driving and localization functions. The autonomous driving functions are the brain of the vehicle since they control the lateral and longitudinal functions, and thus they direct the vehicle's actuators. microSnap also uses Ibeo's localization approach which is more precise than standard GPS localization. In this approach, a digital map is applied containing land-marks which are recognized by the LiDAR sensors for ego positioning. This means that the environment perceived by the LiDAR sensors is permanently matched with the landmarks in the map to determine the vehicle's exact position.

ABOUT IBEO:

Ibeo Automotive Systems GmbH is the specialist for automotive LiDAR sensor technology located in Hamburg. In addition to the state of the art laser scanners, Ibeo develops software for environmental detection, referencing tools for Highly Automated Driving and Autonomous Driving (HAD/AD) systems as well as Highly Automated Driving and Mapping & Localization applications. Since the company's founding, the engineers and software developers at Ibeo have been promoting LiDAR technology and developing new software applications for automated and autonomous driving to make driving a more relaxed activity and to increase road safety for all traffic participants. In August 2016, the German automotive supplier ZF Friedrichshafen AG acquired a 40 % stake in Ibeo. This stake was then incorporated in Zukunft Ventures GmbH, a subsidiary of ZF, to pave the way for the serial production of a new generation of 3-D solid state LiDAR sensors without a rotating mirror. A second project is the fusion of various sensor technologies for even more sophisticated environmental perception to establish a basis for Autonomous Driving.



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JOYSTEER INSIDE!

The best drive-by-wire steering system

IT IS THE INVISIBLE YET SAFE AND RELIABLE STEERING SYSTEM OF THE MICROSNAPE. SIT BACK, FORGET THE STEERING COLUMN AND PLACE YOUR TRUST IN AUTONOMOUS DRIVING THANKS TO THE JOYSTEER DRIVE-BY-WIRE STEERING SYSTEM. BOZZIO AG PROVIDES A NEW DRIVING EXPERIENCE WITH ITS JOYSTEER PRODUCT.

100% SWISS MADE!

joysteer convinces on the world market

Headquartered in the Switzerland Innovation Park Biel/Bienne, Bozzio AG is surrounded by state-of-the-art technologies, in particular in the area of additive manufacturing. joysteer is 100% Swiss made and is produced with the highest quality standard. All the technological knowledge is in-house. The core competence of Bozzio AG lies in the development and marketing of safety-critical applications.

As the patent owner, Bozzio AG markets the drive-by-wire technology internationally. Thanks to its approval for road use, joysteer is sold in Europe, USA, Canada, Israel and New Zealand.

Bozzio AG is active in two lines of business:

1. Drive-by-wire steering systems for people with physical disabilities.
2. Drive-by-wire steering systems for industrial applications in the after-market segment.

A LITTLE PIECE OF FREEDOM!

The steering system for people with disabilities

joysteer can - thanks to its modular and parameterizable design - individually adapt the operation of steering, brake and throttle to the customer needs. An extensive range of input devices (e.g. joysticks) makes versatile and individual solutions possible in mobility for the disabled.

Thanks to the integrated dynamic force feedback, driving is safe and enjoyable - especially at high speeds.

LET GO OFF THE WHEEL!

The drive-by-wire system for automated driving

The drive-by-wire technology also is the basis for autonomous driving. The signals are transmitted to the wheel fully electronically ("by-wire" technology) without a mechanical backup. This means there is no steering column. joysteer transfers the GPS and sensor data to the wheels with minimum latencies and maximum dynamics.

joysteer is the basis for a finely tuned control loop and the key to the success of a good autonomous system. joysteer is installed as an after-market product in the area of agriculture, forestry, special-purpose machines and defense.

In the microSNAP, joysteer is the integral steering system of the "intelligent chassis."

BE SAFE. BE SURE!

Now you can sit back and relax

We are not there yet on a daily basis. Autonomous driving requires the driver to intervene in case of doubt. The driver is the backup. Sitting back and safely turning your attention to other things is therefore not (yet) possible. Why not? Because the redundancy is lacking!

Not so with joysteer. Two redundant strands are designed to monitor each other. In the event of a fault, the affected strand shuts down safely. The healthy strand is dimensioned to be able to provide the full functionality on its own. As a result, steering is always ensured - so-called "fail-operational" safety.

TO THE POINT!

Key features of joysteer

- Drive-by-wire technology without mechanical backup
- Redundant system for "steering and braking function" at the ASIL D level
- Integrated electrical throttle system at the ASIL C level
- Driving with joysticks
- Integrated dynamic force feedback
- Driving with digital interfaces (autonomous or remote-controlled)
- Functional safety in line with ISO 26262
- Approved for the vehicle categories: M1, M2, M3, N1, N2, N3
- Approval for road use as per ECE R79 (steering) and ECE R13H (brake)
- "Swiss made" with the highest quality standard

SNAP-in joysteer and enjoy a new driving experience.



Steering actuator



Drive-by-wire module



Driving with joysticks



Brake actuator



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kern GmbH

FOCUS ON THE FUTURE

Now run by the sixth generation of the family, Kern GmbH relies on state-of-the-art technology and processes. Over 100 employees work on an area spanning 7,000 square meters to produce media products in offset, digital and large-format printing. Over the course of our company's history lasting more than 150 years, Kern has successfully transitioned from being a small family-owned business to an industrial full-service provider. Modern machinery from technology pioneers and a high degree of in-house training represent one of the cornerstones of our ongoing success which also puts us in an optimal position to meet the challenges of the future.

CUTTING-EDGE OFFSET PRINTING

Using state-of-the-art machinery, Kern generates high-quality media products in runs of up to millions. We are proud to be a reference customer of the renowned Heidelberg Druckmaschinen AG. The latest technologies not only contribute to assuring the quality of your products, but also continuously enhance the production process in terms of cost efficiency and resource-friendliness.

A NEW DIMENSION IN DIGITAL PRINTING

"Print on demand" is the motto we work by. This implies a fast and flexible operation without any detours involving platesetting or complex adjustments to the printing machine. It applies both to small and large print runs.

HYBRID MAILING PRODUCTION

As a Performance Partner of Deutsche Post, Kern processes all address data. Since we deal with over 20 million mailings a year – either in envelopes or as selfmailers – the Deutsche Dialogmarketing Verband (DDV), the largest national association of dialogue mar-

keters in Europe, reviews our data protection management on a regular basis and certifies it with its quality seal 'Lettershop'.

COMPLEXITY - LARGE FORMAT ADVERTIZING THAT STRIKES THE EYE

Thanks to the latest machinery of technology pioneers, we are able to give shape to your ideas. In addition to roll material, we print and process plates of up to 40mm in thickness. We print on paper, cardboard, textile, plastic, wood, and metal. After printing, we can contour cut, perforate, or mill your substrate. This enables us to produce complex product packaging, labeling, signs, and display systems.

EVERYTHING FROM A SINGLE SOURCE

We perform finishing tasks such as foil lamination, hot-foil, relief, and blind embossing, letterpress printing as well as bookbinding techniques including cutting, folding, collecting, stitching, and binding on our premises. In our very own logistics center, we take care of the entire shipping process for you. We manage all of your fulfillment tasks, enabling you to concentrate on your core business. On approximately 2,000 square meters of storage space, we are able to store your printing products and manage your inventory. Our 'Kern Closed Webshop' is an interface which allows you to manage your inventory levels, retrieve your products and ship them directly.

FULL-SERVICE AGENCY

In addition to planning and designing your printing products, Kern offers comprehensive agency services. We'll strictly stick to your corporate design, unless you request otherwise in which case we'll provide you with a completely new brand image. From the conception and design through



programming and installation all the way to maintenance and service, 'Kern IT Services' provides you with a comprehensive range of services to assist you in realizing your individual web presence. If requested, we will also organize the hosting of your website. Kern IT Services combines the expertise of marketing, media design, and information technology.

QUALITY AND RESPONSIBILITY

A standardized media production carried out in accordance to ISO 9001 for quality management and ISO 12647 Process Standard Offset (PSO) guarantees a steady and high level of quality. As a Performance Partner of

Deutsche Post and a member of the Deutsche Dialogmarketing Verband (DDV), Kern's strict data protection guidelines are regularly reviewed by external parties.

Our motto "Kern goes green" stands for sustainable use of resources. By applying the environmental management system EMAS III (ISO 14001), Kern fulfills its responsibility as a paper processing company. We also print on FSC®- or PEFC-certified paper from exemplary forestry. Greenhouse gas emissions resulting from production can be calculated and compensated with offset certificates. We have managed to make the shipping of printing products almost completely climate-neutral.

Kern accepts its responsibility and continuously works on reducing the environmental effects, not only with the goal of enabling the company to exist another 150 years, but also as a way of ensuring that life on our home planet remains worth living.

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LIFESTYLE INNOVATOR

In the future, state-of-the-art technologies such as IoT and autonomous driving will change the structure of the conventional automobile market, and transform our lives as they relate to cars. People will feel the most change in how they utilize transportation and their use of time. A new pod concept, presented by Rinspeed and its partners, will change our perception of residential spaces, and even enable a new

form of nomadic lifestyle that will transform our residential environment altogether.

Last year, KOLON GLOTECH presented a completely new design by creating logos on leather seats using the inlay technique inspired from traditional Korean ceramics in SNAP. We also utilized Geonic technology, which gives a luxurious and comfortable feel to areas that had weak design

elements such as the back of seats and display devices. And this year, KOLON GLOTECH is proud to be working with Rinspeed once again to present our technologies developed for various interior elements of the microSNAP.



GEONIC

“Bringing a designer’s imagination to life”

As a lifestyle innovator, KOLON GLOTECH offered various solutions for creating people-centric spaces. Geonic is a technology that makes it possible to control depth, color, texture, and design simultaneously by layering materials. It is capable of achieving mass-customization to meet the design expectations of individual users. Taking advantage its vivid colors, depth, and design freedom, Geonic can be altered into various patterns as well as images depending on the customer’s request. Following the Best of the Best award in 2013 Reddot Design Award, Geonic was awarded as the IF Winner in 2014 and A’DESIGN ‘Bronze’ A’DESIGN award ‘Bronze’ in 2018.

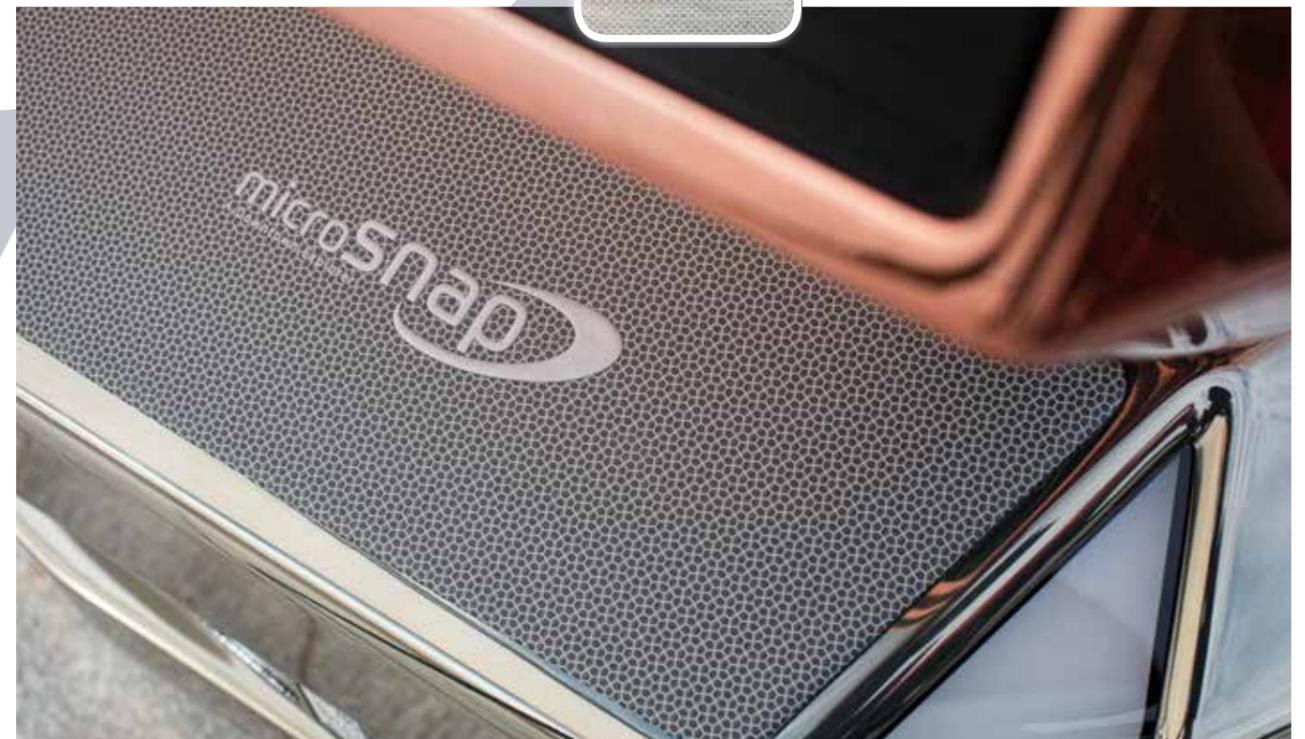
Geonic can be used in wide range of applications ranging from lifestyle products such as clothing, furniture, and interior decorations to seats and automobile trims. Application of Geonic technology is not limited to textiles and fabric manufactured by KOLON GLOTECH. IT can also be applied on surfaces requested by other customer to create elegant designs.

Geonic was applied to the display housing, certain areas of the dashboard, and skateboard of the microSNAP. In the case of the headliner, Geonic technology was used on an STRÄHLE+HESS textile.



TEXKIN “Hybrid Sensibility”

Texkin is KOLON GLOTECH’s proprietary technology and product that creates leather-resembling textures on textile. It preserves various textile patterns while offering outstanding durability, stain resistance, and waterproofness. It can be used in a wide range of applications, ranging from seats and trims to various interior parts in automobiles. It was used under the dashboard and seat of microSNAP.



ABOUT KOLON GLOTECH

Kolon Glotech, established in 1987, is a manufacturing company with a diverse portfolio of automotive, life, and high-tech materials. We produce car seat modules and fabrics, artificial turf, polypropylene staple fiber, and bi-component staple fiber. We are equipped with systematic production processes and have attained various quality standard certifications. In order to supply products on time and optimize our

production efficiency, we have established production centers not only within Korea, but also in China, and have established local corporate sales units in the American and Mexican markets. Kolon Glotech will continue to focus on eco-friendly, lightweight functional material development as a new growth engine.

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TRANSFORMING THE VEHICLE EXPERIENCE THROUGH TECHNOLOGY

Today, the gap between concept and reality is razor-thin. Aligning with the increasing consumer demand for new technology, in-depth customization and essentially “having the world at your fingertips,” the automotive industry has become focused on increasing comfort, safety, convenience and especially personalization in the vehicle.

What this means for interiors and seating is that the notion of sitting down and buckling up, as the be-all and end-all of vehicle seating purposes, is changing. Today’s seat is engineered and designed with technologies that allow passengers to individualize their internal vehicle space. Intelligent safety functions take passenger protection to the next level, and connected and electrified capabilities provide limitless options for the future of autonomy.



RESHAPING THE FUTURE OF MOBILITY

Our Intu™ system, jointly developed by our Seating and E-Systems engineers, is essentially a smart seating device that adapts to your personal specifications and connects you to the world. Intu™ is comprised of a full suite of intelligent technologies: BioBridge™, ProActive™ Comfort, Modular Heat & Cool, SoundZone™ and Dynamic Safety. These innovations demonstrate the steps we have taken to enhance passenger comfort, wellness, entertainment and safety.

We understand how important it is to create a driving experience that dynamically adapts to passengers as individuals. BioBridge™ is our smart, non-intrusive biosensing technology that utilizes Doppler and RF (radio frequency) sensing to read passenger heart and respiratory rates. It also detects stress and drowsiness and activates corresponding seating treatments, like heat and massage, to help prevent distractions and promote safer driving.

With preset modes like sport, comfort, wellness and more, our ProActive™ Comfort intelligent seat adjustment technology can be customized to changing preferences—all without fumbling around on the side of your seat to find switches. It is a simple, intuitive solution for optimizing passenger comfort.

Safety and comfort aren’t the only areas available for personalization within vehicles: a tailored audio setup is also a paramount part of the passenger experience. Our Seating and E-Systems engineers have collaborated to create SoundZone™, a personal audio environment that provides each person in the vehicle with their own isolated, connected space to listen to music, watch a movie or take a phone call.

Advanced connectivity among vehicles, infrastructure and pedestrians helps make cities smarter and car rides safer. Our Dynamic Safety system anticipates a safety event before it happens. Utilizing our ConnexUs™ V2X communication technology, vehicles can sense an impending collision, which activates intelligent seat mechanisms to properly position the occupant to minimize injury.

With autonomous driving on the horizon, Lear’s EXO Correction Service—a proprietary GNSS (Global Navigation Satellite System) solution—is designed to meet the demand of the future and drive change through increased accuracy and reliability in vehicle positioning.

Our electrification technologies pave the path for cleaner, more efficient mobility with our deep knowledge of high power electric distribution systems that extend to battery chargers, battery management systems and charge cord sets.

Our reconfigurable rail system solution, ConfigurE+, makes seating easily adjustable, removable and electrified. With numerous possibilities in seat arrangements, ConfigurE+ speaks to individual lifestyles and many different passenger purposes, including face-to-face work mode, cargo mode and entertainment mode—creating many opportunities for integration in shared mobility. This powered rail system enables electrified features such as heat/cool, power recline and charging for smart devices that provide passengers with maximized function in an untethered solution.

Autonomous driving and other mobility trends won’t just change the way we move from A to B, but will completely redefine the in-cabin experience and what we’re able to do in that space. As a global automotive technology company with the goal of turning concepts into solutions that improve the human experience, we’re motivated by the mantra “Where Passion Drives Possibilities.” We’re reshaping the way people think about transportation, applying a new frame of reference and pushing the boundaries for what’s possible.





Innovative by nature

Buckle up for a sustainable revolution with LENZING™ for Automotive Interiors

In 2018, the Lenzing Group (Lenzing) unveiled LENZING™ as the all-new specialty industrial brand, offering smart solutions from botanic origins that are made in environmentally sound production processes. The LENZING™ brand covers a wide variety of industrial applications, ranging from agriculture to automotive interiors and engineered products, packaging to protective wear and workwear. As the automotive industry continues to foster ways to reduce its environmental impact, Lenzing expanded its collaboration with Original Equipment Manufacturers (OEMs) in the automotive industry. The collaboration intends to produce automotive interior components with LENZING™ branded fibers under **LENZING™ for Automotive Interiors**, which is powered by REFIBRA™ technology and Eco Color technology that will enhance the environmental footprint of the new vehicles.

Rinspeed's core business is focused on building visionary mobility concepts that combine innovation and sustainability and enabled by a comprehensive network and stated competencies in world-wide communications. This resonates well with the mission of the LENZING™ brand, which strives to offer sustainable solutions for industrial applications and focus on innovations that make a valuable contribution to building a better world. Both Lenzing and Rinspeed share the same ambition to revolutionize the automotive industry through innovation. This shared vision has empowered the successful collaboration between Rinspeed and Lenzing through the adoption of LENZING™ for Automotive Interiors fibers in the 2019 concept vehicle "microSNAP". LENZING™ for Automotive Interiors fibers were introduced to the car seat fabric of microSNAP, offering greater comfort, quality, and reliability to consumers, while driving sustainability in the automotive industry.

THE RISE OF SUSTAINABLE FIBERS FOR GREATER COMFORT

While it is important for the interior of a car to look good, it is even more important to enable the driver and passenger to feel good. LENZING™ Lyocell and Modal fibers are derived from renewable raw material wood sources and are manufactured under environmentally responsible production processes and certified as compostable and biodegradable under industrial, home, soil and marine conditions. Through the adoption of LENZING™ Lyocell and Modal fibers in car seat fabrics, it offers an alternative sustainable material for automotive interiors. Leveraging world-class innovation with exquisite softness and smoothness, consumers can enjoy car seats made for a premium touch and greater comfort. Due to their body temperature regulating properties, the fibers offer effective moisture management, and can regulate the absorption and release of moisture, in turn enhancing fabric breathability and supporting the body's natural thermal regulation. In addition, due to their ability to absorb moisture, the fibers are conductive and show antistatic behavior, allowing a more pleasant experience. Moreover, with Lenzing's Eco Soft technology, elemental chlorine-free bleaching is used in an integrated pulp-to-fiber process that has high recovery rates of process ingredients and generates very low air emissions.

DRIVING CIRCULAR ECONOMY WITH INDUSTRY BREAKTHROUGHS

Lenzing strives to safeguard resources for future generations by leading the pursuit of sustainability and being an enabler of the circular economy in the industry value chain. One of the key aspects of LENZING™

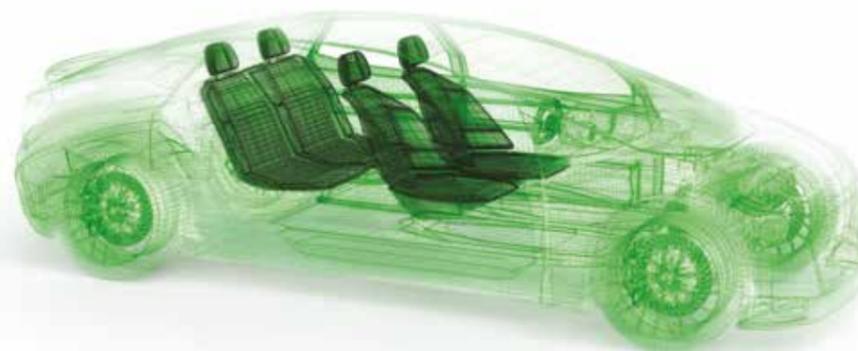
for Automotive Interiors is the LENZING™ Lyocell fiber with REFIBRA™ technology. Lenzing's REFIBRA™ technology involves upcycling cotton scraps from garment production in addition to wood pulp, where raw material is transformed to produce new LENZING™ Lyocell cellulosic fibers, defining a new standard of sustainability and natural comfort for consumers. Combined with the innovative Eco Color technology, LENZING™ for Automotive Interiors fibers feature long-lasting colorfastness and are certified with the EU Ecolabel. Embedding color pigment in LENZING™ Modal fibers during the production process results in a lower environmental impact compared with a conventional resource-intensive dyeing process.

As consumers become more aware of sustainability and embrace sustainable lifestyles, the automotive industry is keen to align production processes more closely with the principle of sustainability and reimagine the future of transportation. Through collaboration with Rinspeed, Lenzing is committed to the co-creation of an innovative future concept of transportation, which combines new ways to pursue sustainability efforts while offering new levels of comfort.

CONTACT:

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LUXOFT AUTOMOTIVE – EMPOWERING THE MOBILITY REVOLUTION

It is a leap of faith to trust an automated machine, especially, if you're in it. Luxoft Automotive is working with leading OEMs and suppliers on autonomous driving and connected mobility to make it safe, secure and trustworthy. It is Luxoft's contribution to the promise of much greater road safety, mobility for all, and much better utilization of vehicles to reduce our carbon footprint and unblock our roads.

To achieve increasingly higher levels of automation quickly and safely, Luxoft focuses on series software development, as well as software platforms, development methods, and tools to teach a car how it can drive itself. For advanced driver-assistance systems (ADAS) and autonomous drive (AD) functions, we develop software for cameras, LIDAR, and radar, as well as central sensing and perception functions to create an environment model. The latter fuses the sensor data and consolidating the available information, enabling the vehicle to navigate itself.

Let us compare autonomous driving and human driving. The basic principles are the same: like a person that sees, understands, decides and acts, a car has corresponding functions such as sensing, perceiving, path-planning and controlling of the vehicle – just on a software level. The car has some advantages in that it is less susceptible to certain human physical limits and constraints, such as limited vision or endurance. On the other hand, the human also has key advantages, especially in contextual awareness stemming from instincts and

experience, parallel processing of visual information and the ability to learn continuously.

Level-2 ADAS functions such as adaptive cruise control or lane keep assist exploit the strengths of vehicle sensors and software while keeping the human driver in control of the more complex driving decisions. As we move to higher levels of automation (up to Level-5 for full automation), sensors and software need to overcome their limitations to close the gap to the human driver.

Luxoft turns increasingly sophisticated sensor-driven features and functions into software for electronic control units (ECU). Our ambition is to co-develop this software with our clients. We provide key software-development expertise and scale to enable our Tier-1 clients to deliver their sensor solutions to their OEM customers. We implement sensor algorithms, including testing and tooling as well as establishing functional diagnostics and qualification testing. The latter focusses on requirements engineering, establishing a software architecture and constructing the software. Here, we come full circle with testing the units, integrating the software and testing the systems.

For OEMs, Luxoft delivers software that creates an environment model. This software uses sensor data fusion to combine the inputs from cameras, lidars, and radars into a comprehensive image of the vehicle's surroundings. It includes recognition and classification of static

and dynamic objects, lane markings and free-space.

Testing such systems is a massive challenge. Even for Level-2 systems, Tier-1s and OEMs have to employ hundreds of people to label and categorize reference data (ground truth). Of course, this isn't scalable at all. For Level-5 systems, hundreds of Petabytes of data are needed. Luxoft combines computer-vision (CV) and artificial intelligence (AI) with manual annotation to deliver our Highly-Automated Data Annotation (HADA) solution at a fraction of the time and cost to generate ground truth while increasing quality.

A second pillar for testing is Virtual Validation. It is infeasible to drive Billions of Miles with real test fleets to collect sufficient evidence that Autonomous Driving functions match or outperform the human driver. Only virtual, cloud-based solution can deliver the necessary performance. Luxoft offers to virtualize sensor models and manage sensor data (real input), as well as map algorithms to cloud CPUs/GPUs to achieve critical efficiency.

Autonomous driving functions are only possible with high-performance computing and high-bandwidth communication inside the vehicle. To ensure proper interoperability for such new SW technology areas, the AUTOSAR consortium currently develops the AUTOSAR Adaptive Platform (AR-AP) – the high-performance counterpart to the existing AUTOSAR Classic Platform (AR-CP) that continues its life in deeply embedded microcontrollers.



Luxoft is working with different commercial AR-AP and OS platforms to create full development frameworks and SW factories, along with proof-of-concept work and demonstrators for new players in the AUTOSAR Adaptive space. We also work with leading OEMs to create Middleware on top of AUTOSAR Adaptive, and service-oriented communication over in-vehicle Ethernet (SOME-IP). Luxoft is a Premium Partner in the AUTOSAR consortium and is one of the fastest contributors to AUTOSAR standardization.

Complementing the new standards, we engineer tools and workflows designed specifically for our customer's requirements and development processes. Luxoft is a specialist in timing analysis to ensure critical software and systems run

in real-time, all the time. Our range spans from EE architecture, in-vehicle networking, to SDKs for middleware and hypervisors.

Last but not least, we're always working on innovative research to further autonomous driving today. This includes our Teleoperation, where vehicles such as passenger vehicles or industrial cranes can be operated remotely, and Infrastructure-based Autonomous Driving, where the infrastructure acts as the eyes and brains of a vehicle and is able to control the vehicle autonomously.

Let's be frank: Autonomous driving is feasible today in principle. Does it always work without fail? Absolutely

not. But, we're convinced we will get there and are focused on contributing our part to make sure it does, so you don't have to worry about being driven by an autonomous vehicle.



MAHLE

MAHLE: THE POWER BEHIND THE MICROSAP

In the microSNAP, a 48 V traction motor from MAHLE packs the right amount of punch for road traffic. It is one of many innovations and just part of a broad range of products: MAHLE develops highly efficient drive systems and power electronics for electric powertrain applications as well as customized thermal management solutions. Its systems solutions cover every kind of vehicle: from e-scooters and machinery to commercial vehicles and passenger cars. MAHLE is a leading international development partner and supplier to the automotive industry as well as a pioneer for the mobility of the future. The MAHLE Group is committed to making transportation more efficient, more environmentally friendly, and more comfortable by continuously optimizing the combustion engine, driving forward the use of alternative fuels, and laying the foundation for the worldwide introduction of e-mobility. The group's product portfolio addresses all the crucial issues relating to the powertrain and air conditioning technology—both for drives with combustion engines and for e-mobility. MAHLE products are fitted in at least every second vehicle worldwide. Components and systems from MAHLE are also used off the road—in stationary applications, for mobile machinery, rail transport, as well as marine applications.

MAHLE is represented in more than 30 countries with 170 production locations. At 16 major research and development centers in Germany, Great Britain, Luxembourg, Spain, Slovenia, the USA, Brazil, Japan, China, and India, about 6,100 development engineers and technicians are working on innovative solutions for the mobility of the future.



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A PORSCHE COMPANY

DRIVEN BY EXCELLENCE

MHP develops innovative services for microSNAP

Innovation is a game of utility. Regardless of how novel or smart your technology is, if it has no use in daily business, it will likely disappear. This is where MHP comes in. A subsidiary of Porsche, this Ludwigsburg-based consultancy is a leader in digital transformation. They offer a fusion of expertise: management, IT and processes. MHP operates internationally – driving innovation mostly in the mobility and manufacturing sector. They are pioneers in several areas, like building new business models, state-of-the-art system solutions, and digital services along the entire value chain.

MHP's footprint spans 13 locations in Germany, the UK, China, Romania, the USA and Switzerland. Their 2,500-strong workforce serves over 300 clients worldwide. For such demanding clients, one thing is paramount: Excellence. Take Rinspeed, a mobility think tank from Switzerland, for example. For many years, their close partnership with MHP has produced mobility innovations that are both ecological and economical. Their first shared milestone was developing the driverless concept car Snap. It premiered at the CES 2018 in Las Vegas, grabbing international attention. One year later arrives the next installment: microSNAP.

MOBILITY: ON DEMAND AND ON TIME

There is great potential for future mobility in last mile solutions, and MHP is exploring this. For microSNAP, MHP will again assemble a co-innovation team with SAP and EY Advisory. The vision is to deliver microSNAP as part of a multi-function ecosystem.

Just imagine. In the morning, microSNAP could ferry passengers to work in its passenger pod. By noon, it might deliver urgent packages be-

fore returning commuters back to the suburbs by evening. It could even transport groceries from store to home. With microSNAP, MHP has a platform for new and diverse business models. These fit the global trend of making mobility more efficient, customer-centric and greener. They also work for everyone involved – from operators to cities to users.

TURNING VISIONS INTO BUSINESS MODELS

Oliver Kelkar and Marcus Willand lead teams that identify trends for business and use cases. They also help to create an integrated business architecture – both for the operators of future microSNAP fleets, as well as clients from the service and retail space. In more detail, MHP performs business modeling for innovative services within the microSNAP ecosystem.

The teams realize concepts for strategic direction, marketing and implementation. For example: mobile medical clinics. How useful could these be in rural areas with few doctors? But costs and returns must be analyzed, as well as potential partners or competitors. It is the job of business architecture teams to examine all of this.

PARTNER FOR INTEGRATED TECHNOLOGY SOLUTIONS

MHP also develops and implements highly complex data and IT architecture, as well as service design – from first draft to international rollout. Of course, due diligence is paid to local and international laws, especially concerning data security.

Integrated solutions are in high demand, seamlessly connecting data from different sources and systems. In a retail scenario,

for example, a business might require deep digital interfaces for warehouses, transport vehicles, route planning, ERP platforms and shopping apps. MHP makes this harmonious.

CLOSE EXCHANGE WITH MICROSAP PARTNERS

MHP benefits from a long and intensive collaboration with SAP. These software specialists deliver the platforms to realize our visions. Such platforms include complex data analysis, self-learning systems and IoT connectivity. 'Tesseract', for example, allows MHP to create sustainable value with microSNAP. The block chain-based platform from EY Advisory enables an automatic, usage-based tally of all transactions. Of course, they also work carefully with all other microSNAP partners. This too is Driven by Excellence.

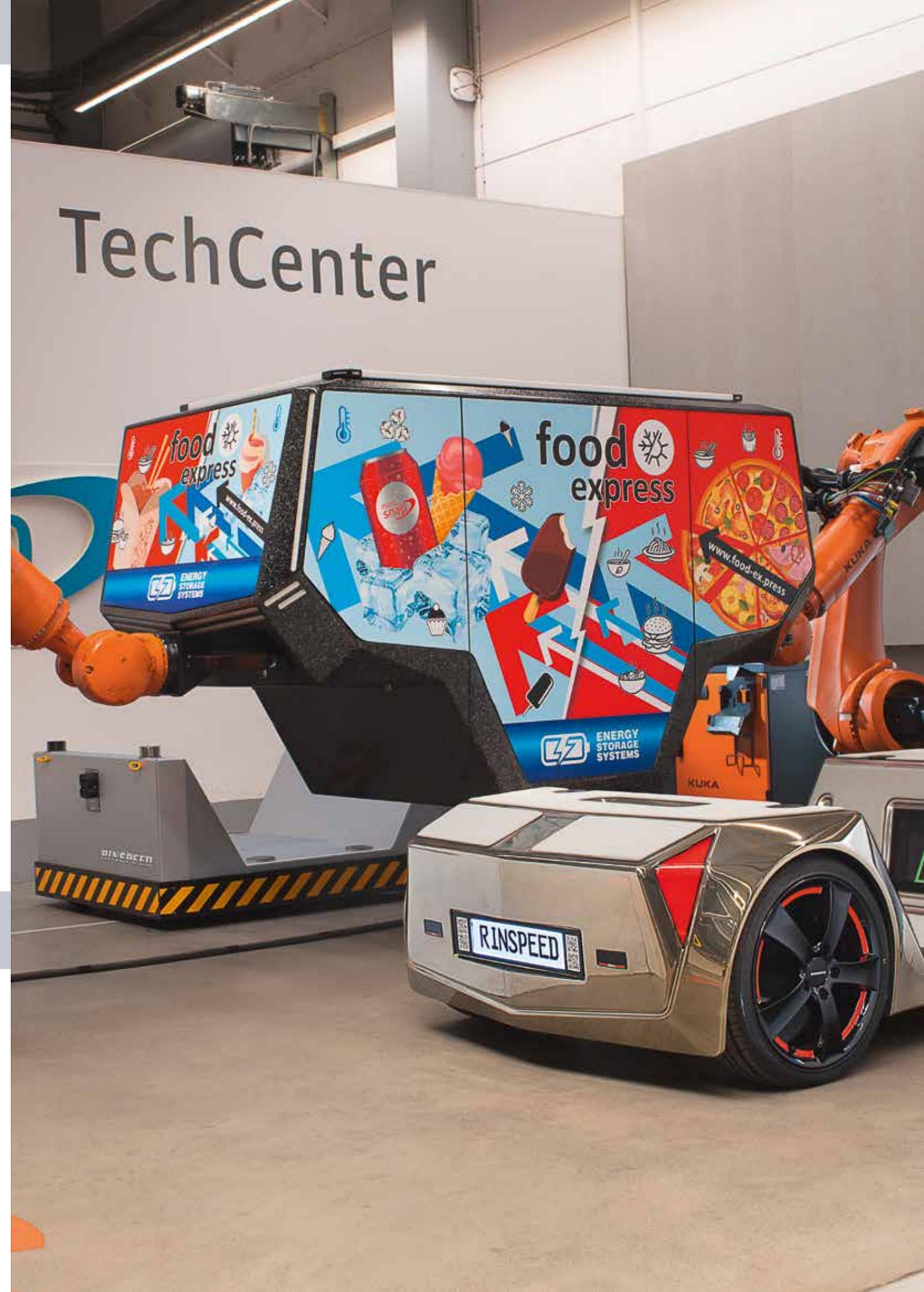
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 MHP - A Porsche Company





THE CAR THAT ADAPTS FOR YOU - AN EXPERIMENTAL CONCEPT FOR FUTURE VEHICLES

Thanks to state-of-the-art electronic components, future vehicles will be automated, electrically powered, and securely networked - and with interchangeable cockpits, they could also become convertible and flexible.

There's one connection in all vehicles that has remained untouched by many years of automotive change; the bond between a car's chassis and bodywork. Since the dawn of the Automotive Age, the chassis has always carried the gearbox, engine and suspension with the cockpit glued, welded or soldered upon it. This has been an accepted and unchallenged premise - up to now.

NXP and Rinspeed have challenged this fundamental thinking with a new experimental concept, one that allows vehicles to become as unique as the individuals that travel within them. The potential, enabled by domain-based architecture, could deliver a new wave of innovation and enable flexible and securely networked mobility. In this concept car's framework, the cockpit becomes a more personal reflection of an individual's lifestyle and a self-propelled chassis becomes a workhorse for the community and a model for new revenue.

In the new NXP and Rinspeed concept car the chassis and cockpit are separated. While the chassis remains the most durable component of the vehicle, the cockpit becomes a „pod“, an interchangeable capsule with vast potential for customization. A „Passenger Pod“ carries people to work in the morning, a „Food Delivery Pod“ transports food during the lunch hour, with its

own refrigerated freight room, and a „Cargo Pod“ drives at night with an extra-large loading area - all of these pods could share the same chassis through the course of a day.

New architectures that divide vehicle electronics into five domains provide the flexibility to make this bold concept possible. The domains, which span the various roles of vehicles including connectivity, driver replacement, powertrain and vehicle dynamics, body and comfort, and in-vehicle experience domains make reorganizing the ideas of vehicle design possible. Instead of letting the chassis and cockpit age together, both components can go their separate ways to enable optimum utility.

Through this concept, urgent traffic problems could also be addressed. For example, studies show that a standard family vehicle is in motion only five percent a day, but hangs around on streets the rest of the time, blocking valuable space in the inner cities. Wouldn't it be ideal to enable a 24/7 use of the chassis?

The modular concept could also reduce the number of vehicles on the streets and streamline traffic, while creating more room by eliminating the need for parking spaces as cars are kept in constant state of efficient motion. The chassis could even fit perfectly into a city's ecosystem by more efficiently managing energy. If required, the chassis could transfer energy back into the power grid or recharge autonomously if overcapacity is available.

This unique modular approach could also bring about new enhanced business opportunities. Imagine free rides in a booked pod that is financed by advertising or promotions. Can you conceive of interchangeable cockpits that evolve into fresh new lifestyle products that inspire the best designers in the world? A host of new and established designers could make their own marks on branded pods with furnishings, fabrics and interior flourishes as well as the design of user interfaces using the best in infotainment technology.

While the pod reflects the tastes of the individual, the chassis combines functions of autonomous driving: such as state-of-the-art sensors that accurately capture and interpret the vehicle's environment, an electric powertrain and smart antennas that securely connects the chassis to the outside world, the user, the cloud or other vehicles.

The electronics architecture of the fully electric, securely connected and fully autonomous car of the future must also be designed so that individual domains can be updated in the vehicle through over-the-air interface at any time and with maximum security and protection against security breaches, attacks and manipulation. This requires vehicle networks and gateways that are connected efficiently and securely.

NXP will be presenting this concept for the first time together with the Swiss think tank Rinspeed at the CES 2019 in the form of a two-person vehicle. The NXP and Rinspeed concept car is a look into the future, one that challenges our basic assumptions



about what a vehicle should be and opens fresh thinking on the flexibility offered by domain architecture and fresh design.

WHAT'S IN IT FROM NXP?

AUTOMATION:

The sensor fusion solution, NXP BlueBox, combines the environmental data from sensors such as radar, lidar and camera systems together for safe processing. The goal: high-precision sensors, fast processing for maximum safety in self-driving cars.

CONNECTIVITY:

A smart antenna ensures the secure connection to the outside world. It is based on the latest cybersecurity standards and can integrate automotive-grade WLAN for vehicle-to-vehicle communication, infotainment reception, cellular, ultra-wide-band and much more in the smallest of spaces.

ELECTRIC DRIVE:

Additional miles can be achieved through high-precision battery management and engine control. The Greenbox is NXP's development platform for this purpose.

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OSRAM

»MICRO« BECOMES »MIGHTY«: THE NEXT DIMENSION OF MOBILITY

OSRAM makes people's lives safer and better with the virtually limitless applications of invisible and visible light. We combine innovation and passion to match our technologies to the needs of users. And that in our four areas of competence: With light, we create more comfort and safety in road traffic. With light, we accompany people and bring them safely to their destination. With light, we connect people and technology. In addition, with light we improve people's health and well-being.

The concept vehicle by Swiss think tank Rinspeed once again showcases this wealth of experience and industry expertise. The jointly designed »microSNAP« shows what the autonomous vehicle of the future could look like.

This year's motto »Think micro, yet mighty!« reflects OSRAM's way of thinking: That's why the »microSNAP« is equipped with a large number of LED and laser components to ensure maximum safety and aesthetics – from start to finish.

The design of the interior creates an individually tailored driving experience: when entering the vehicle, the driver is reliably identified with the help of **3D face recognition**, **iris scanning** or **palm vein recognition**. Seat height, interior temperature and lighting are automatically adapted to personal wishes and habits. The intelligent ambient lighting not only takes into account the brightness and colour temperature preferences of the driver, but the music played also influences the interior lighting. To make the living room feeling perfect, content displayed on a screen in the center console (e.g. apps) can be moved to the front windshield, enlarged and controlled via **gesture control**.

For more safety while driving, the driver's vital functions are continuously measured with the help of **health tracking**. In interaction with **human-centric lighting**, the interior illumination can react to the mood of the passenger. For example, the light is adjusted to warm white to create a more comfortable atmosphere for the tired passenger.

When leaving the pod, **passenger monitoring** scans the entire interior for forgotten objects and either emits an acoustic signal or sends a message to the previous passenger. Moreover, the vehicle is disinfected with **UV light** and is afterwards ready for its next passengers.

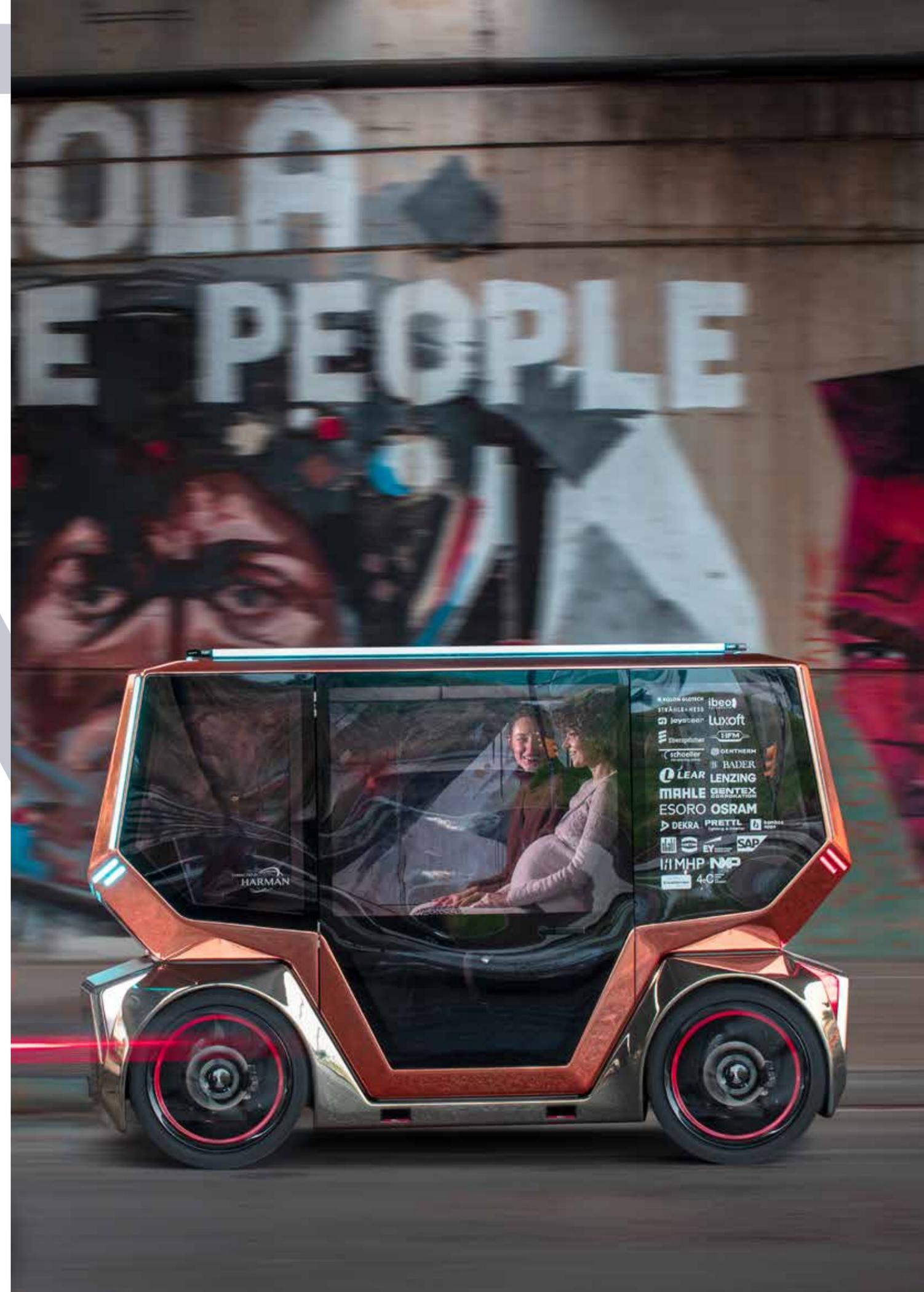
Intelligent LED solutions are also integrated into the exterior of the »microSNAP«: For example, if the intelligent headlamp system detects other road users at night, the exact pixels of the LEDs (**EVIYOS**) are dimmed or switched off that would dazzle oncoming traffic or the driver ahead. In addition, **EVIYOS** acts as a lane assistant and navigation device, projecting the proposed route onto the road. Furthermore, **EVIYOS** can use projections to summarize relevant information for the passenger when boarding and alighting.

LiDAR technology (light detection and ranging) has been integrated into the »microSNAP« as another OSRAM application. At very short intervals, a special infrared laser sends light pulses into the environment of the vehicle. If the light hits an object, it is reflected and finally registered by a sensor. The system can calculate the distance from the time it took for the light to reach the object and back and initiate appropriate actions such as braking. This not only increases safety for all road users –

LiDAR technology also marks a major step towards autonomous driving.

A situation-dependent **LED license plate** and **brake indicator** enable communication with the outside world and thus increase safety. These technologies are becoming increasingly important, especially in connection with autonomous driving: LEDs located along the »A-Pillars« of the pod as well as the front of the skateboard are dimmed from top to bottom during braking to indicate to pedestrians that the vehicle has recognized them and that they can safely cross the road.

Further information on new mobility concepts and our semiconductor solutions can be found at www.osram.com/os.



COMMUNICATION OF INTELLIGENT LIGHTING SYSTEMS

Interior and Exterior lighting applications in the automotive industry will take over great importance and new functions due to autonomous driving as well as e-mobility. Due to these new trends, the demands for lighting applications are changing. For example the visibility for other road users, especially with pedestrians. Of course, communication between the car and infrastructure is another important point.

Therefore, not only the lighting concept but also the application itself has to be rethought. This is why Rinspeed uses modern LED technology from Osram and innovative product solutions from PRETTL Lighting & Interior.

ABOUT PRETTL LIGHTING & INTERIOR

PRETTL Lighting & Interior (PLI) offers a complete package of sophisticated, high quality lighting and complex plastic modules and systems for vehicle interiors and exteriors. PLI serves mainly Tier 1 customers in the automobile industry.

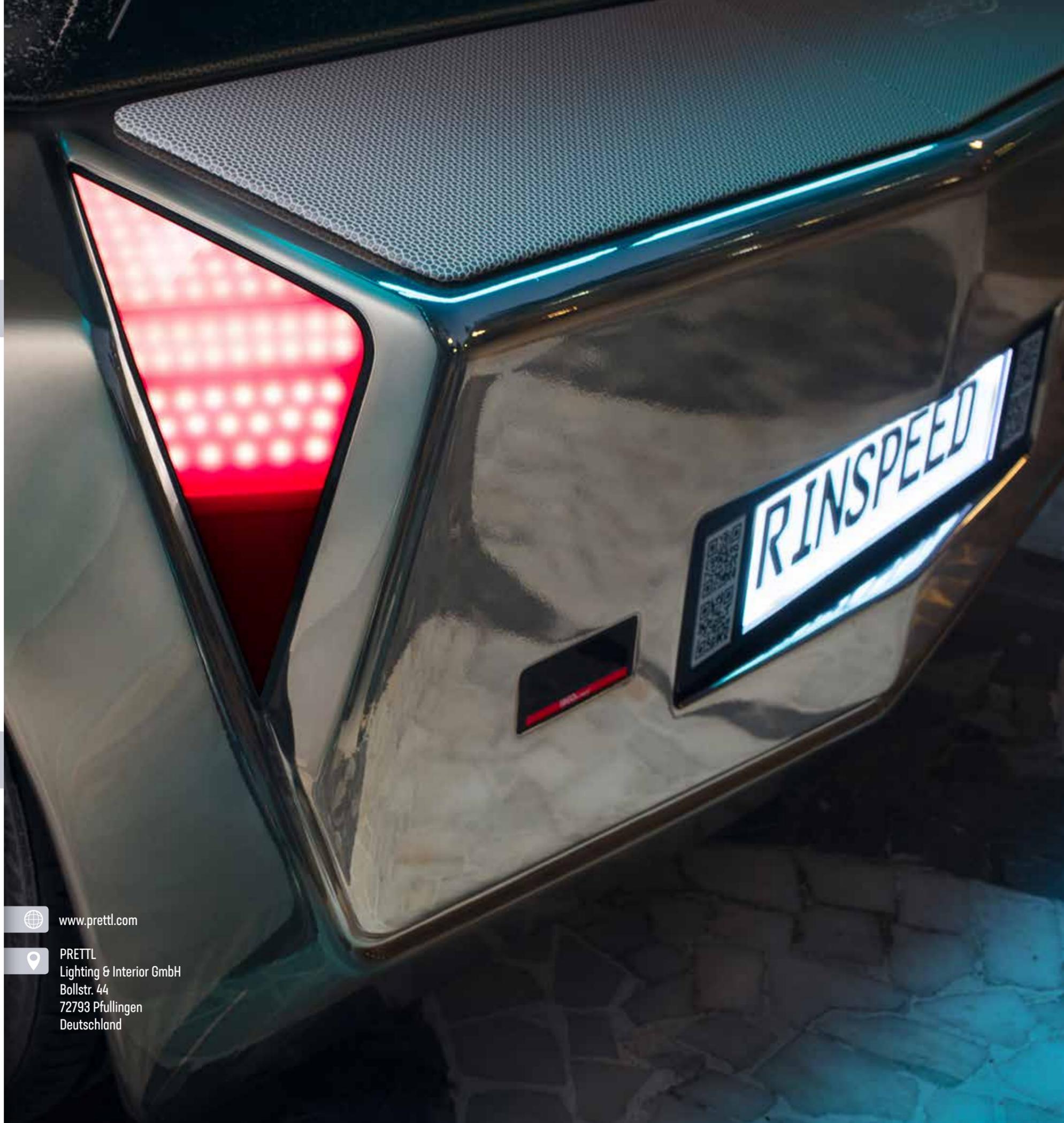
From the initial idea and design stages all the way through to series production and spare parts delivery. Every sector benefits from the expertise gained at every stage. This expertise makes itself especially felt in the effective way in which the various value-added processes combine together.

PRETTL LIGHTING & INTERIOR FOR YOUR SUCCESS

The core competences of the company are development and manufacturing, finishing as well as assemblies for automotive lighting applications for interior and exterior. The affiliation to the PRETTL Group provides us with unique possibilities of using its group synergies and make them accessible to our customers.

THINK GLOBAL. ACT LOCAL.

With the PRETTL Group you have a strong partner at your side - always and everywhere. Understanding cultural differences and the distinct features of regional markets is of vital importance for international activities. This understanding and the enjoyment we have in developing innovative technological solutions ensure our customers a competitive edge in national and international markets.



www.prettl.com



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Lighting & Interior GmbH
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72793 Pfullingen
Deutschland



INTELLIGENT MOBILITY ECOSYSTEM (Micro Yet Mighty)

The mobility revolution is well underway. Emerging technologies, changing consumer preferences, unsustainable vehicle usage and sector convergence are forcing players across the automotive and transportation value chain to transform the way they operate to stay relevant.

New market entrants, startups and IT companies are redefining the way we approach transportation. This is a world of integrated, on-demand, personalized and autonomous mobility. Alongside such opportunity, we also find incredible challenges. How do we collaborate effectively to provide seamless mobility experience for the end consumers? Who will own and operate mobility assets such as autonomous vehicles, shared buses, charging infrastructure and commercial vehicles? How do we integrate data, payments and experiences? How can we orchestrate intelligent and sustainable last mile delivery in urban areas?

The 2019 microSNAP project addresses the challenges of the new mobility ecosystem supported by intelligent software solutions from SAP. Think micro, yet mighty: autonomous micro transportation units create a unique possibility to fulfill the mobility and transportation needs in urban areas; to orchestrate the intelligent mobility ecosystem SAP provides 'mighty' solutions for mobility, transportation and supply chain management optimized by IoT, blockchain, machine learning and artificial intelligence.

COLLABORATION

Sustainable mobility will rely on complex and highly interconnected value networks. These include physical and digital platforms, which will be operated and used by a multitude of players from several industries. A blockchain network can process business transactions using smart contracts providing security, transparency and efficiency for all ecosystem participants.

The microSNAP demonstrates what is possible when stakeholders such as Rinspeed, SAP and others join forces to deliver an unprecedented mobility solution. Powered by data, shaped by design and brought alive by business, the SNAP family of vehicles define the future of mobility.

THE POWER OF AN INDEPENDENT PLATFORM

In the connected future, users, vehicles and the infrastructure will generate vast quantities of valuable data. Monetization of this information through new business models will unlock significant revenue streams for all participants of the interconnected mobility network.

A mobility data platform manages and orchestrates data from consumers, auto manufacturers and service providers. A mobility business network enables parties to seamlessly interact and transact on a trusted marketplace made possible by SAP's technical and business expertise.

SMART CITIES AND INTELLIGENT MOBILITY

A smart city, in combination with smart mobility, offers residents, visitors and stakeholders a quality of life and an ease of experience that pre-emptively addresses their needs, desires and transport requirements. If a smart city can so be equated with a human, smart mobility is a city's circulatory system.

The smart city leverages data and connectivity to enrich the lives of its residents. The residents no longer own vehicles in the smart city – especially when parking space is increasingly becoming scarce in urban settings. Intelligent mobility solutions offer flexibility and sustainability by compiling different mobility services, including flexible car- and ride-sharing and other on-demand services. End-to-end mobility solutions will cover every customer desire from planning to booking and payment.

The SNAP was designed to be a vital component of such smart cities. Given its modular design and high degree of connectivity and integration into an urban space's data lattice, a fleet of SNAPS can provide everything from mobility services to new approaches in medical services, energy management, entertainment and many more.

INTELLIGENT LAST MILE DELIVERY

As consumers increasingly turn to e-commerce for all their shopping needs, speedy fulfillment isn't just a "nice to have" – it's the expectation of every online shopping experience. As a re-



sult, businesses are developing new technologies and intelligent supply chain models to increase parcel volume, expedite deliveries, and delight customers – all while creating sustainable and convenient delivery models. Taking advantage of our intelligent supply chain solutions we revolutionize last mile delivery in urban areas: Creating delivery and distribution hubs in strategic locations across the city and connecting these via automated routes in underground tunnels. Packages will arrive via the underground tunnels to dedicated distribution hubs and will be delivered to their final destination via microSNAPS, drones or bicycle couriers.

SNAP AND BEYOND

The SNAP concept illustrates the art of the possible for the mobility of tomorrow. But the revolution will extend far beyond the vehicle. New means of mobility will inspire new ways of consuming transport. New kinds of connectivity will drive simpler logistics, cleaner energy, smarter cities, higher quality of life: a mobility ecosystem of connectedness and capability.

With SAP's end-to-end portfolio of products and technology innovations, we can deliver on this vision through a new generation of intelligent business processes and business models.



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schoeller
the spinning group

ALPAKA AUTOMOTIVE - NEW LEVEL OF SUSTAINABILITY

Sustainability and nature are becoming increasingly relevant market factors in the automotive sector. Schoeller is further expanding the range of materials available to the car seat sector with the introduction of its fibre mix of alpaca and jet dyed polyester - the first of its kind in the world. The alpaca fibres are not dyed. Instead, the untreated fibres are sorted based on their colour for use in the manufacturing process. These allows melange colours to be created that require no dyes or water for dying. Nature dyes the material for us! This is a huge advantage for sustainability, or as many people say "a new level of sustainability (NLS)". Due to the high level of interest the market has shown, the Alpaca NLS is already available for automotive uses in three different natural melanges of white, beige and anthracite. Available for evaluating as article 54709 Nm 36/2. This genuinely natural car-friendly alpaca NLS thread, used on the seat shown using flat knit technology, is a further step towards fully implementing sustainability in the automotive sector.

The Schoeller Spinning Group from Hard in Austria is one of the world's leading worsted yarn producers. Some 500 employees produce approx. 3,500 tons of yarn per year in different locations in Europe. Schoeller is a company of Indorama Ventures Company (www.indoramaventures.com). One-and-a half century of experience and an innovative research and development department assure that the technological lead is not only maintained but continuously enhanced. The course of development is marked by the principle of sustainability firmly enshrined in the corporate philosophy. And that's why Schoeller was the first worsted yarn spinning mill to have been awarded the comprehensive "bluesign" label, an environmental and ecological certificate. Moreover, Schoeller has been distinguished by the much coveted "bluesign Award", is actively involved in the International Association of Natural Textile Industry (IVN) and produces according to the Global Organic Textile Standards (GOTS) and the EU-Flower.

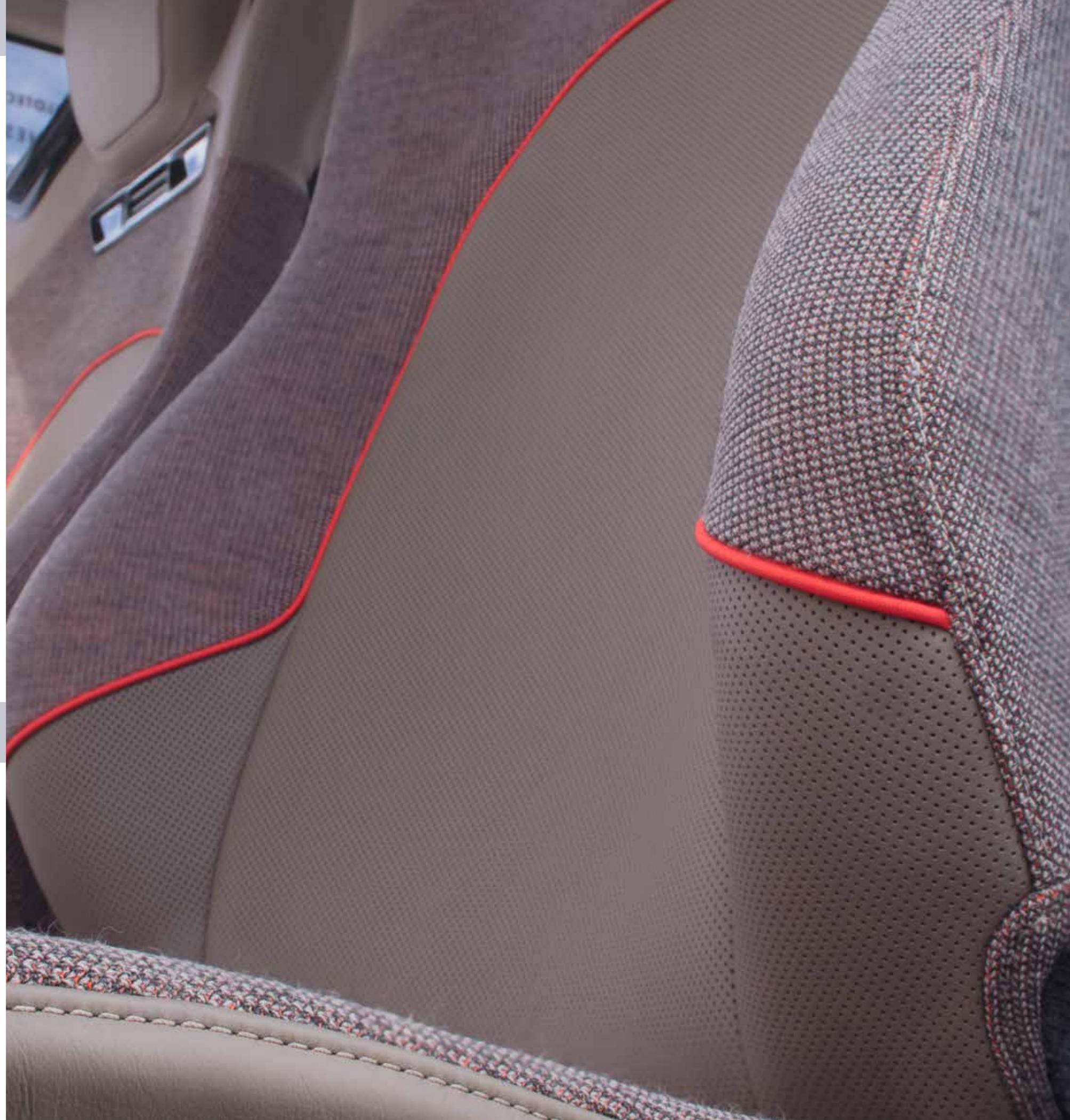
In a nutshell: sustainability + innovation = sustainnovation.



www.schoeller-wool.com



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Austria





CREATING THE CAR INTERIOR OF THE FUTURE

Great innovations and lowering the environmental impact go hand in hand

As the surface expert for car interior trim materials like leather, synthetics and rubbers, Stahl cooperates for the fourth time with Rinspeed in creating the car of the future. As the market leader in their niche, Stahl believes that investing in strong partnerships is the key to changing the automotive industry in the long run. By pushing boundaries, innovation and by shaping the future of urban mobility together.

The concept car of Rinspeed is the perfect example of the inspiration that arises from working together with the leading brands from various fields to move boundaries and to succeed in creating the best solutions. Every year we challenge ourselves again in how to contribute to the optimal mobility ecosystem of the future.

LOW IMPACT CHEMISTRY

Stahl believes in the value of trusted partnerships. In the automotive leather category, Stahl has partnered up with BADER Leather, co-developing next-generation environmentally friendly natural automotive leather. After carefully selected raw materials, Stahl used advanced chemistry based on natural, renewable resources made from plant ingredients with a low impact on the environment. Together Stahl and Bader challenged the norms and pushed boundaries in each stage of the manufacturing process. The

end result is a natural leather of the highest quality produced in a more responsible way, meeting the demands of the automotive sector of tomorrow.

HIGH PERFORMANCE AND AESTHETIC VALUE

With this year's microSNAP concept car, Stahl recognizes the long-term trend for personal-hygiene solutions in car interiors. The use of pale colors in the car interior is increasing and are used more intensively as a shared living space. This makes it even more important to keep the car interior clean and enticing. Stahl is proud to present our latest generation of surface coatings for leather and synthetics as well as the innovative aftercare range using Stahl's Stay Clean® technology. The Stay Clean® products protect pale-colored surfaces against common stains such as dye from jeans, spilled coffee and dirt. It avoids any permanent damage to used materials. The surface coatings and aftercare portfolio ensure a premium look and feel that not only is high in performance, but also pleases the eye.

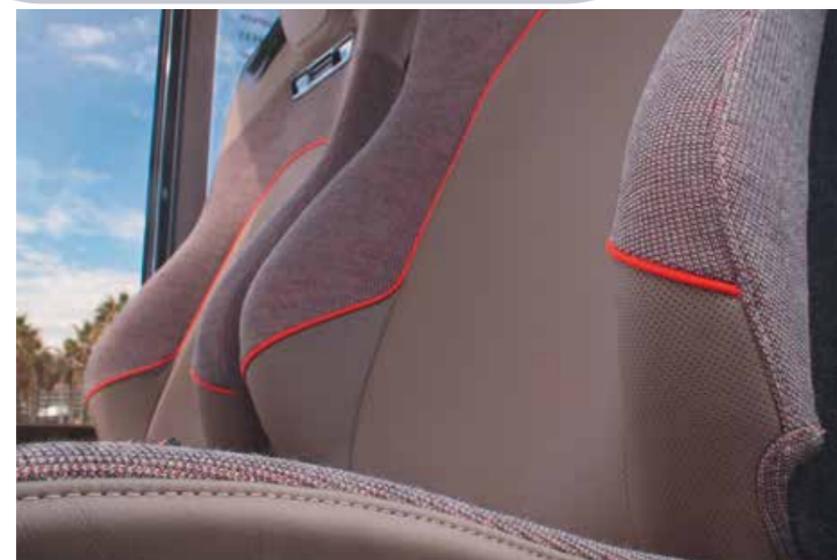
CONTINUOUSLY EXPERIMENTING FOR A BETTER FUTURE

In creating the car interior of the future, great innovations and lowering the environmental impact go hand in hand. At our headquar-

ters in Waalwijk in the Netherlands and at our manufacturing site in Suzhou, China, we invite OEMs, peers and partners to our 'Automotive Centers of Excellence' to share knowledge, passion and enthusiasm for opening up endless possibilities. At Stahl, we strive to minimize the presence of volatile substances from concept to launch. We recently invested in first-class VOC-analysis systems to further optimize the composition of coatings and to advise clients about the presence of VOCs in used materials. All the solutions that have been incorporated in the Rinspeed microSNAP concept car are VOC-free and part of a higher mission: developing premium and more sustainable car interior materials that are in sync with the environment and the mobility needs of the future.

ABOUT STAHL

Stahl is the world market leader in surface treatment and coating solutions for flexible materials. We are active in differentiated value-add niches, providing technology driven solutions and a unique service model for premium applications. Our innovative products give the ultimate level of appeal, functionality, durability and comfort, while reducing environmental impact. Although they do not realize it, hundreds of millions of people around the world touch and use Stahl products every day.



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STRÄHLE+HESS

WE LIVE AND BREATHE TEXTILES. AND HAVE DONE FOR MORE THAN 90 YEARS.

It is our vision to create evocative interiors. Around 300 employees knit and warp knit with passion and expertise in Althengstett, Bisingen, Topol'čany (Slovakia) and Auburn (USA) for the unique character of your car. Our designers translate trends into textiles and develop harmonious colour and material concepts. With our expertise and skill, we enrich the products of all well-known car manufacturers worldwide.

And this is how STRÄHLE+HESS turns your vehicle into something very special.

CONCENTRATED

One of the outstanding features of SNAP was the uncompromising separation of transient IT and durable mechanics. microSNAP is the sum of the very best of its predecessor SNAP, taken to a logical extreme. The small city mobile is extremely compact. The convertible vehicle will quickly take you through the city jungle at any time.

FULL OF CHARACTER

STRÄHLE+HESS has immersed the interior of the microSNAP into an aura of calm. Earthy, muted colours welcome you. Everyone should be able to feel at home here.

A fine piqué covers everything from the pillars to the headliner. Geonic printing takes textiles to a third dimension. Comfortable seats, in textile and leather, invite you to take a seat. The natural alpaca mixed yarn from Schoeller lends the flat knit pattern a woolly character. A cheeky flash of red shines through the generous loop structure.

The luminescent red is taken up by the piping and underscores the lines of the seat and dashboard. As a special highlight, STRÄHLE+HESS is presenting the innovative luminous piping.

Take the opportunity to relax in this harmonious atmosphere, while the microSNAP quickly takes you to your destination.

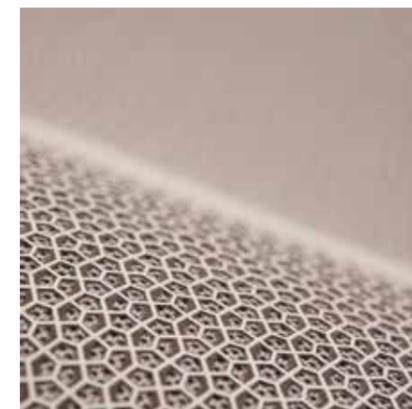
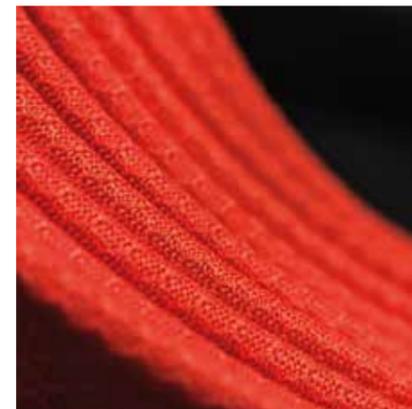
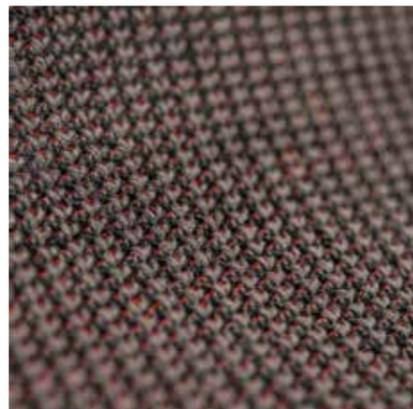
TEXTILE

You can achieve whatever aim you are pursuing with textile products from STRÄHLE+HESS.

Be inspired by our creativity and the virtually never-ending diversity of design and structure options in the knitting sector.

Join us and rely on the unbeatably positive characteristics of textiles.

We are your experts whatever the knitting technology and will put all our efforts into finding the solution to your challenges.



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STRÄHLE+HESS

microSnap