With ZF Technology to ZERO EMISSIONS

SUSTAINABILITY
How ZF lives the idea of sustainability worldwide

CHASSIS TECHNOLOGY
Networked intelligently for future mobility
see. think. act.
is our road sign that guides us towards intelligent mobility solutions that will ultimately result in

ZERO ACCIDENTS
and ZERO EMISSIONS
08 MOVING TOWARDS ZERO EMISSIONS
Massively reducing CO₂ emissions is a huge challenge. ZF technology is playing a key role in achieving the company’s self-proclaimed goal of “zero emissions”.

16 ENERGIZED GROUP
Sustainable energy means generating clean energy and conserving it. ZF pursues both approaches.

20 PREPARING FOR THE BIG TRANSFORMATION
When we hear the word “sustainability”, training is hardly the first thing that comes to mind. However, to offer customers the top quality products well into the future, highly qualified employees worldwide are indispensable for the company.

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Professor Marion Weissenberger discusses the dangerous misconception that sustainability is the primary source of additional costs.

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Since water is becoming increasingly scarce worldwide, the Group feels obliged to handle this precious substance with great care.

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To mark the 100th anniversary of ZF, employees donated millions of euros to help finance 100 schools in Africa. Editors of the “vision” magazine visited one school there, whose children can now expect a brighter future.

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ZF sensor and control technology installed in a new test vehicle now means vehicles can see and think for themselves based on the situation.

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Networked intelligence between different chassis technologies is critical for autonomous driving in the future. ZF has got this.

40 GOOD WEATHER CLOUD
ZF has introduced a cloud-based platform for mobility services that intelligently networks components and systems.

“When it comes to sustainability, why is ZF always aiming increasingly higher?”

There are not many companies where sustainability plays such a dominant role as at ZF. Our final goal is achieving “Vision Zero”. Some organizations and companies interpret this vision as a safety concept that aims to completely prevent accidents. But that is not enough for us: mobility should not cause any damage at all to humans or the environment – especially not due to traffic-related emissions. That is why ZF views “Vision Zero” to mean not only zero accidents, but also zero emissions. Using intelligent technologies, we want to help create a mobile world without accidents and emissions.

Not only do our innovative products help conserve the environment and resources. We also apply a sustainable approach to our manufacturing processes. ZF also benefits from this approach economically. When we save on energy costs, our technologies become more competitive.

We believe that sustainability goes beyond environmental protection and the economy. Social factors also play a role. As a company, we see ourselves not only as globally active, but also socially responsible. The range of projects that our charity organization “ZF hilft.” supports is correspondingly broad and ranges from providing access to education to helping the victims of natural catastrophes. I am deeply impressed by the fact that most of the donations come directly from the Group’s employees.

All this shows that ZF does more than just pay lip service to sustainability, it is a solid element of our corporate culture and firmly anchored in our core business. That is why it is only logical for us to dedicate more space to this multifaceted topic in this issue of the ZF magazine “vision”. I hope you enjoy this entertaining and informative issue.

Wolf-Henning Scheider
Chief Executive Officer of ZF Friedrichshafen AG
Perfect start to the season

Just in time for motorcyclists to kick off the most beautiful time of the year, the new BMW F 750 GS and F 850 GS models are ready to hit the road. Equipped with electronic chassis, technology from ZF, these two motorcycles guarantee top quality handling. As a market leader for semi-active motorcycle chassis, ZF focuses heavily on comfort and performance. The “Dynamic ESA” is an electronic chassis, which automatically adapts to the payload and optimizes the damping force in real time. This is achieved by the electronic control valves installed in the front and rear suspension struts. The much improved contact to the road makes motorcyclists safer and more comfortable.
Finding the perfect size

Every life form requires resources. It becomes problematic when such life forms live beyond their means. What you need to know about energy and sustainability.

One world is not enough

What exactly does “ecological footprint” mean? The term was coined in 1994 by the scientists Mathis Wackernagel and William Rees. It began with the idea that all natural raw materials consumed by humans require space to grow. Furthermore, nature needs space to break down our waste such as areas like forests where CO₂ is absorbed. The ecological footprint represents the amount of space required to permanently support the current lifestyle of a region or of a country. The result can be briefly explained as a question: how many earths would it take for the entire world population to live like the inhabitants of the country being viewed?

Hungry for power

As a result of generating the power consumed by all PCs, smartphones and IT services in Germany, experts estimate that roughly 33 million tons of CO₂ are released into the atmosphere annually. This is the equivalent of roughly the CO₂ emissions produced by German air traffic during the same period.

We are almost there

Norway wants to be the first country that covers its demand for electricity using renewable energies exclusively. And it is not far from achieving its goal. Last year, the country’s demand for electricity was already covered 98 percent by sustainable renewable energies.

Cows are the big polluters

Cars generate carbon dioxide (CO₂), cows emit methane (CH₄). Both greenhouse gases are contributing to climate change. A compact car (4.9 liters of diesel per 100 kilometers) generates 128 grams of CO₂ for every kilometer driven. At 15,000 kilometers annually, this is roughly two tons of carbon dioxide. A high-performance dairy cow emits 300 liters of methane per day on average, which is the equivalent of three tons of CO₂.

Full speed

As the second most populated country in the world after China, India is stepping up its pace in introducing electric cars. By 2030, almost 100% of the vehicles on its roads will be electric, whereas their market share was only one percent in 2016. To realize this ambitious goal, the Indian government has set up a comprehensive support program.

Recharging on the road

Low driving ranges and long recharging times are still hindering the broader spread of pure electric cars. Developers in France have been working on a possible solution to this problem since the end of 2016. For example, in Normandy, cars can be driven on a road 1,000 meters long with built-in solar panels. These panels will initially provide power for street lights, but soon will also power the electric cars that drive over them via induction. By the year 2020, the French government intends to build solar roads covering a total of 1,000 kilometers.
Moving towards zero emissions

A MAJOR CHALLENGE FOR HUMANITY IS TO ELIMINATE CO₂ EMISSIONS. ZERO-EMISSIONS MOBILITY IS ONLY ONE GOAL THAT ZF AND ITS TECHNOLOGIES ARE WORKING TOWARDS.

Text: Martin Westerhoff

The job sounds impossible: while economies and living standards are booming in heavily populated countries such as China and India, the global community is trying to put the brakes on climate change. At the same time, the global demand for energy is expected to grow by 28 percent between 2015 and 2040, with the transport industry alone likely needing 30 percent more energy. For CO₂ emissions, a rise of 0.8 percent per year is expected. At least that is the forecast from the latest report entitled “International Energy Outlook 2017” prepared by the U.S. Energy Information Administration (EIA), which is part of the U.S. Department of Energy. If this study is correct, fossil fuels will still continue to cover 77 percent of the demand up to 2040.

Renowned British economist Dieter Helm is less pessimistic about the future of fossil fuels: “What is a very real threat are the new technologies, and possibly sooner than commonly assumed.” According to the Professor of Energy Policy at the University of Oxford, technological advancements will make fossil fuels superfluous even before the reserves of oil, gas or coal dry up. Helm sees electricity as the energy source of the future, and believes that the electrification of transportation is nothing short of revolutionary.

BATTERIES AS THE MOST EFFICIENT MEANS

For ZF, electrified drives also represent a significant means of reducing CO₂ emissions out on the roads. In addition to hybrid modules and plug-in hybrid transmissions, the technology company offers drive systems for all-electric vehicles. “If the global goal is to use renewable energy from sources such as wind and the sun, the question inevitably arises as to how we can most efficiently use electricity for mobility,” says Bert Hellwig, head of the E-Mobility Systems House at ZF, outlining the initial situation. Storing electricity in batteries and then using these with an electric drive offers the highest level of efficiency. For this reason, Hellwig sees the greatest potential in battery-powered electric vehicles.

However, this technology still has quite a battle ahead of it. For example, the production of lithium-ion cells – currently state-of-the-art for vehicle batteries – is in itself energy-intensive. Furthermore, its energy density is low compared to traditional fuels. Per kilogram, modern batteries store only around five percent of the energy quantity that is contained in diesel fuel. This is why current electric vehicles have a comparatively short range. While solutions like fuel cells can increase the vehicle’s drive range, the high cost associated with this technology is currently a major obstacle that prevents greater distribution.

ZF is prepared for various scenarios and is applying its expertise particularly to system solutions. Regardless of the energy accumulator used, a system like the mSTARS axle concept and its integrated electric drive can be installed in hybrid, fuel cell and battery-powered vehicles.
ZF can leverage effects of scale through modular concepts and identical components. This helps reduce the costs for electric drives, which is an important factor when the goal is to combine ecology and economy to help electric vehicles gain larger market shares. “Natu- rality, there is great interest in using our competencies and components from the passenger car sector to make electrification commercially viable in those vehicles that are manufactured in smaller quantities, like tractors,” explains Hellwig.

Experts are still unable to agree on whether electromobility will exist in the future. “Over the past 15 years, the energy revolution has primarily focused on the electricity sector,” explains Dr. David Bothe, an industrial energy and environmental economics expert with the consulting company Frontier Economics. “However, the transport and heating sectors must also be included here,” points out Bothe. For many countries, according to his calculations, switching all existing machines and terminal units such as internal combustion engines and heaters to electricity consumers would not be the wisest option from an economic perspective. Even if a country like Germany relied on a mix of different energy sources in the future, it could become CO2-neutral by 2050 and save roughly 250 to 300 billion euros compared to extensive electrification, adds Bothe. In this scenario, electricity generated from renewable sources would also be used, but indirectly. Hydrogen would be produced from some of it and then converted, together with CO2, into synthetic fuels. This approach has advantages and disadvantages. For example, the process of producing hydrogen means an energy loss of approximately 25 percent. Every additional process step further reduces the amount of energy from the electricity used that ultimately remains stored in the fuel. However, there are major benefits, including the fact that synthetic fuels can be used in existing and technologically advanced combustion engines. They can be blended into conventional gasoline or diesel, in some cases even without any technical modification. In addition, there is already a well-established global fuel station network.

All of the scenarios outlined here create challenges and offer opportunities. That is why ZF is pursuing an open technological approach to achieve the goal of zero emissions. It is also clear that whatever technological solution prevails in the end, the energy efficiency of all drive systems will have to be considerably improved. Dr. Bernd Vahlensieck, head of Advanced Drive Engineering at ZF, sees, above all, huge potential with plug-in hybrids. These vehicles are equipped with a combustion engine, an electric motor and a battery that is normally designed for distances of around 50 kilometres. “Plug-in hybrids represent an outstanding option that allows vehicles to be electrically powered for a maximum number of kilometers using a comparatively small battery at a correspondingly low cost,” adds Vahlensieck. “They also fare very well in CO2 considerations, ‘euros per gram of reduction’. Moreover, end customers can drive a fully-featured car for many of their daily trips that is ideally driven all electrically using renewable power from the grid.” The plug-in transmission from ZF, which is based on the proven 8HP, is already on the market. It combines the transmission and the electric motor. The latter produces a maximum of 90 kilowatts (122 horsepower) that make purely electric maximum speeds of up to 120 kilometers per hour possible, depending on the vehicle, of course. The hybrid module in the 8-speed dual clutch transmission features up to 100 kilowatts, making it even more powerful. Already 60 percent of all new Panamera models that Porsche delivers in Europe are equipped with this ZF hybrid transmission.
equipping their volume-produced trucks with the highly efficient TraXon transmission or are opting for a hybrid option with a 100-kilowatt (136-horsepower) electric motor, which is also achieving respectable results. “Fuel savings of up to five percent can be achieved in a normal long-haul transportation cycle,” says Dr. Ingolf Müller, summarizing the results of a study.

But it is not only alternative drives that can reduce CO₂ emissions. “The use of lightweight components in commercial vehicles,” says Dr. Ingolf Müller, “can yield better results than they already do in passenger cars.” As an expert in lightweight construction in the Department for Advanced Engineering for Chassis and Overall Vehicle at ZF, Müller describes a classic rear axle design as an example. As a first step, integrating the functions reduces the weight from around 120 kilograms to 60 to 70 kilograms for the affected components. Requiring lightweight designs and materials can additionally bring this value down to roughly 35 kilograms. “Given the typically long service lives of trucks, these actions will pay for themselves quickly,” Müller asserts. The saved weight also benefits a higher payload. It means each truck can transport more goods, which ultimately could reduce the number of trucks on the road, thereby also reducing emissions.

The most sensible way to reduce CO₂ emissions is to make the routes as short and efficient as possible. Openmatics, the Open Telematics Platform, is contributing to this. The most varied of apps can be installed on this platform. Openmatics can be used to monitor an entire fleet live, which means routes can be adjusted centrally. Not only that, truck manufacturers are able to use the precise consumption and load analyses from their customer vehicles in real time to optimize the control of the powertrain relative to vehicle weight. At the same time, the four percent of fuel and CO₂ alone because his drivers know that their vehicle data is being transmitted. This means that behind the wheel they drive with greater discipline and in a more forward-thinking manner,” which makes it clear that for tasks performed by humans to be environmentally sustainable, everyone must monitor their own behavior so that as few greenhouse gas emissions as possible are produced. In the meantime, ZF will continue working on the technologies required to achieve these goals.

The smelting processes in ironworks require particularly large amounts of energy. Instead of losing unused waste heat in the cooling water, which flows into a fjord, the ironworks facility of Norwegian company Finnfjord AS in the Norwegian town of Finnsnes uses a 40-megawatt steam turbine with a generator. It produces so much power that the amount of electricity that has to be sourced from the grid has dropped 40 percent. Compared to electricity generated from coal, this recovered electricity is the equivalent of preventing approximately 240,000 tons of CO₂ emissions per year. With investments such as these and the intensive use of hydroelectric power plants, the country aims to generate all of its required energy in the future without CO₂ emissions.

With an output of more than one billion tons of CO₂ per year, shipping traffic is responsible for more than three percent of global CO₂ emissions. Towing kites with spans of up to 32 meters aim to help replace part of this required drive energy with wind power. According to the manufacturer, SkySails, ships can – depending on the wind conditions – save on average between 10 and 35 percent on fuel and thus emissions over a year. Reaching an altitude of approximately 400 meters, kites use intensive winds. In combination with an automatically controlled flight path in the form of a horizontal figure of eight, they generate 5 to 25 times the drive force compared to an ordinary sail with mast.
Efficiency down to the last detail

Efficiency down to the last detail

SOPHISTICATED INDIVIDUAL SOLUTIONS ARE THE BUILDING BLOCKS FOR SUSTAINED MOBILITY. COMPONENTS THAT ARE WELL-OILED, INTELLIGENTLY STREAMLINED, OFFER COOLING AND BRAKING FUNCTIONS ALL HELP REDUCE EMISSIONS.

WELL-OILED
The needs-based and streamlined oiling system ensures greater efficiency in the ZF 8DT 8-speed dual clutch transmission. It is designed with two pumps connected to one another by the hydraulic unit. Smart software regulates the necessary oil flows and determines the cooling needs in the gearing. The necessary oil flow is constantly available to each sub-transmission that is currently in the power flow. A special ECO mode for the transmission lowers the pressure level when driving in suitable conditions without impairing performance.

LESS ABRASION

Less brake dust – less particulates. Regenerative braking systems in the electric or hybrid vehicles make this possible. Electric motors do not only power the vehicle, they can also delay it. Because the conventional brakes are freed up, there is less brake dust. Regenerative braking systems are equipped with both the conventional ESC as well as the integrated IBC braking system. The regenerative braking systems can currently recuperate up to 90 percent of the electrical energy. ZF is currently working on a 100 percent solution. This also reduces brake dust by roughly 50 percent, depending on the engine and battery.

PATENTED COOLING

The AVE 130 electric portal axle for e-city buses is the logical solution on the road towards emissions-free public transport. To ensure a healthy thermal balance in the overall system, ZF engineers have developed a new kind of patented cooling system. It cools not only both close-to-wheel electric motors, but also distributes the temperature more evenly. In doing so, the water jacket reduces the temperatures of both the pressed-in stator as well as the cooling heat exchanger radiator grills for the air circulating in the engine.

LIGHT PRETENSIONER

The Jeep Wrangler is currently equipped with ZF’s lightest pretensioner. The new Snake Pretensioner Retractor (SPR8) saves 20 percent in weight by using plastic components instead of metal screws to transfer the pretensioning torque to the belt reel via a torque rod. This allows a simpler design and a more compact package for the reel tensioner. The SPR8 has a pyrotechnical generator that is triggered by the vehicle sensors in the case of a crash. It only takes ten milliseconds from the trigger point to the end of pre-tensioning.
His statistic is alarming but, according to an estimate from the Intergovernmental Panel on Climate Change (IPCC) from 2010, heat and power generation for all types of buildings is responsible for around one third of greenhouse gas emissions. In view of the growing world population and the dynamism of the economy, the experts predict an even faster rise in emissions. Since then, legislators throughout the world have taken countermeasures and created incentives to deal with energy more efficiently.

ZF too has been paying attention to its ecological footprint for years and has also taken steps in production and administration in terms of both energy demand and energy consumption. “In view of the sustainable development policy for our products, it is a matter of credibility that we also focus on sustainability within the company. The same attention is also paid to our suppliers,” says Jürgen Holeksa, board member for Human Resources at ZF, where he is also responsible for sustainability. Back in 2012, ZF set itself the target of reducing its specific CO₂ emissions (i.e. in relation to sales) by 20 percent by 2020 – and it has attained this target already.

Combined heat and power is an interesting supply model for ZF’s large German production locations. Here special gas engines produce both heat and electrical energy in combined heat and power (CHP) plants. These low-emission systems achieve an energy conversion efficiency of up to 90 percent. Using CHPs is far more efficient and cheaper than sourcing electricity and heat from different power stations.

Since 2013, ZF has relied on combined heat and power plants. The first plant was commissioned back then at the headquarters in Friedrichshafen with another going into operation at the same location a year later. The two power stations deliver a joint power output of almost four megawatts. Additional, smaller CHPs are located at the German locations in Koblenz, Aschau and Laage as well as in Padua, Italy. The latest CHP with an electrical output of 1.2 megawatts has been supplying the Passau factory halls and offices with energy since 2017. The cost of this energy generated in-house is also lower than the market price charged by external electricity providers.

Compared with conventional energy supply, all the CHPs in the ZF Group contribute to reducing the annual emissions of the greenhouse gas carbon dioxide by an estimated 42,000 tons. Together they generate 42 gigawatt hours of electricity. That is almost equivalent to the annual consumption of 10,000 four-person households. A welcome side effect: “ZF does not have to purchase these 42 gigawatt hours from electricity suppliers, and that saves cash,” says Christoph Weippert, who is responsible for energy management at ZF Real Estate Management.
The investments in combined heat and power plants pay off for the locations. In Friedrichshafen, for example, the investment paid for itself in just a little over two years. The savings created. The managers of the CHP in Passau also calculate that the investment there will have been paid back in the same timeframe.

**TAPPING INDIA’S SUN**

The use of combined heat and power plants does not make sense everywhere, as the defining criterion for their efficient operation is the demand for heating energy. Other sources of power are therefore of interest at many internal sites, such as Pune, India. Recently, large solar panels with a power output of 200 kilowatts were installed on a factory roof there. The data collected can be used to make processes more robust and power plants pay off for the location.

ZF Energy Manager Somasundaram Balasubramaniam identifies machines with unnecessarily high power consumption:

> ZF in Pune, India, generates 290 megawatt hours of solar power annually.

**STABILIZING PROCESSES AND SAVING ELECTRICITY**

When Balasubramaniam glances at the monitors in the “DO MORE” control room at the ZF location in Coimbatore, India, he sees how much electricity the machinery on site is using in real time. The acronym DO MORE stands for Digital Online Machine and Operations Research. The project was launched in early 2016 with the aim of making digital operating data from machines and systems centrally available and evaluable. The data collected can be used to make processes more robust while at the same time indicating, which machines require preventive maintenance. “DO MORE can also be used for energy management to increase energy efficiency on-site,” says Balasubramaniam. “We can conduct targeted searches for indications of excessive power consumption,” he adds. This makes it possible to identify inefficient motors that should be replaced, for example. The difference between the power consumption in production and power consumption elsewhere at the location in Coimbatore also offers a great deal of savings potential. While DO MORE was started as a pilot project in India, it can be transferred to other Group locations.

**IT’S LIGHTS OFF FOR POWER GUZZLERS**

Combating energy wasters is well worth while – ecologically as well as economically – as evidenced by quite a number of other projects at ZF. One worth mentioning here is the replacement of traditional lighting products with LED lights. The widespread use of LEDs in production and administration can save a great deal of energy. Compared to traditional lighting products, they can reduce power consumption by up to 75 percent. Additionally, LED lamps have a significantly longer service life. Sometimes even fewer lamps are necessary, because LEDs generate much brighter light that is also far easier on the human eye. “We are saving three gigawatt hours of electricity annually simply by having replaced 1,600 factory downlights at the Friedrichshafen location with LEDs,” explains Martin Rück, who is responsible for environmental protection at the Friedrichshafen location.

**HEAT TREATMENT: MODERN AND EFFICIENT**

Improved manufacturing processes also help reduce energy consumption, which in turn cuts emissions and costs. Heat treatment with Assembly of Warm Parts (AWP) tempering, as practiced in the Car Chassis Technology Division, is one example. This AWP tempering is a new procedure based on induction. The technique means that a workpiece is no longer heat-treated as a whole in an oven, but selectively via induction. This reduces energy consumption considerably compared to the conventional oven method. But that’s not all, not by a long shot: the new procedure also requires less investment and is much easier to integrate into the production process. “Now, we have more available manufacturing space because we no longer need the huge ovens. We also save on storage space for the parts to be processed,” says Hans-Hermann Borggreve. In the Car Chassis Technology Division, he is responsible for safety and the environment. The procedure has already been introduced at eight locations worldwide with others planned.

The combined heat and power plants at ZF generate around 42 GWh of electricity annually.
Preparing for the big transformation

WHEN WE HEAR THE WORD “SUSTAINABILITY”, TRAINING IS HARDLY THE FIRST THING THAT COMES TO MIND. HOWEVER, TO OFFER CUSTOMERS THE HIGHEST QUALITY PRODUCTS WELL INTO THE FUTURE, HIGHLY QUALIFIED EMPLOYEES WORLDWIDE ARE INDISPENSABLE FOR THE COMPANY.

Text: Lars Weitbrecht

The race to shape the mobility of the future has been underway for a long time, with digitalization, automated driving and electromobility totally shaking up the automobile industry. Only the companies that train their employees to meet their precise needs – on a global level – will be able to keep up. That’s why ZF is already laying the foundation for its global quality promise in the area of education and training. In the end, after completing their training, young people just starting their careers will most likely stay with the company for several years as skilled workers. For ZF, this means setting new job requirements for employees, coordinating the training materials accordingly and defining standards. Equally important are the promotion of new methods of learning and the creation of cooperative relationships with educational institutions in the relevant country.

GERMANY: UPDATING A CLASSIC

The German dual education system enjoys an outstanding reputation around the world. For it to stay that way, politicians and business leaders here in Germany are preoccupied with the question of how the rise in digitalization and international production connectedness are going to impact today’s existing professions. Just two years ago, Jürgen Holeksa, ZF board member for Human Resources, launched "Training 4.0". "This project involves identifying the highly skilled jobs of the future and defining what new content has to be integrated into existing training programs," explains Holeksa, adding "since the differences in training, especially on the shop floor level, are huge worldwide, we are working with the highest possible standards."

Instructors and trainers are playing a decisive role in this regard. For example, this new globally connected world means skilled workers and specialists must communicate with one another more frequently. As such, in addition to language skills, they also have to be familiar with the new digital media and demonstrate intercultural awareness. “We invest strongly in the qualifications of our employees at international level, because we know that they are an extremely important success factor in mastering the change in our industry”, says Stefan Haas, project manager of "Training 4.0". In addition to new and updated training concepts, ZF is also investing in modern equipment for its training centers.

SLOVAKIA: ZF SETS UP TRAINING CENTERS

Slovakia first adopted a dual education and training system in 2015. Prior to that, the automotive sector was growing at such a fast pace that the vocational schools simply could not cover the demand for skilled labor. With four locations in Slovakia, ZF was one of the first companies to support the new education and training system. In 2016, as part of its commitment, the company set up two new training centers in Trnava and Levice. These centers provide training for future cutting machine operators, toolmakers, machine operators and electronic technicians and engineers.

ZF trains young people not only in the metalworking professions, but also as electronic and mechatronic technicians and engineers.

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“At the ZF training center in Saarbrücken, experienced master craftsmen and foremen train young apprentices.”
Apprentices obtain the theoretical economy of industrial giant Detroit exodus. ZF also noticed this exodus at its Northville, Marysville and skilled workers. At that time, the apprentices were leaving the city in droves. ZF also noticed this exodus at its centers train on state-of-art machines and equipment,” adds Marek Benedik, who oversees training at ZF in Slovakia. Depending on the area of study, the apprenticeship lasts three to four years. Apprentices alternate between the desk and the work bench on a weekly basis. In 2016, 51 apprentices began a dual education and training program at ZF Slovakia, just a year later, the number rose to 67.

USA: MICHIGAN LAUNCHES FLAGSHIP PROJECT

Rick Snyder, governor of Michigan since 2011, had also been losing sleep over the shortage of skilled workers. At that time, the economy of industrial giant Detroit had tanked. Highly skilled technicians were leaving the city in droves. ZF also noticed this exodus at its Northville, Marysville and Lapeer, Michigan locations. Snyder was familiar with the dual education and training system from Germany and wanted to launch a similar concept in Michigan. So ZF, the State of Michigan and other partners joined forces to establish the “Michigan Advanced Technician Training Program” (MAT²). MAT² sets standards for skilled worker training programs that last three years – almost a year longer than comparable U.S. training programs.

In the meantime, the program is now seen as flagship project in Michigan and beyond. It sets mandatory standards for qualifications. Participants in the MAT² program receive a wage right from the start. Graduates must commit to staying at ZF for at least two years after completing the program. In the meantime, the number of young skilled workers who have graduated from the MAT² program is rising every year at the three ZF locations in Michigan (Northville, Lapeer and Fenton). This chosen path is a win-win situation for companies and for employees, thus representing a sustainable investment in the future.

“To master the change, we invest strongly in the qualification of our employees at international level.”

STEFAN HAAS

Project manager of "Training 4.0"

Advantage through sustainability

WHEN IT COMES TO SUSTAINABILITY, MANY COMPANIES FIRST TURN THEIR ATTENTION TO ADDITIONAL EXPENDITURE AND EXTRA COSTS, BUT HARDLY TO STRATEGIC COMPETITIVE ADVANTAGES. THIS IS RISKY AND SHORTSIGHTED.

Many companies only look at sustainability from the ecological perspective. This is important without a doubt, because the economy plays a key role in meeting national and international climate targets.

However, the social and also economic component of sustainability is often forgotten. How closely these three dimensions interlink is well illustrated with the example of energy and resource efficiency: if companies consume raw materials and energy sparingly, this not only benefits the environment, but it relieves the financial burden and creates scope for investment and has major social impacts.

Research results from Fraunhofer ISI confirm that companies that know a lot about their energy and raw material consumption far more often deploy technologies for energy recovery or for recycling and thus save costs. Every third large company in the manufacturing industry and almost every fourth small and medium-sized enterprise (SME) now integrates energy efficiency in decision-making on future investment – such as the purchase of new machines and plants. And not least, smart energy management systems enjoy growing popularity as a means of accurately depicting material and energy consumption and thus optimizing entire production chains by utilizing knowledge of the material and energy flows involved. If companies deal with sustainability in a purposeful way, this also leads to advantages from a strategic viewpoint. For example, many manufacturing companies today are already dependent on some extent on the developments on the international raw material markets.

This dependency could grow in the future and force companies to handle energy and raw materials far more sparingly than before, to seek alternative suppliers or to consider substitution potential and recycling through- out the company. So if they are already doing this today by using resources sustainably, they can gain knowl- edge and competitive advantages, establish structures for reliable raw material supply, and they can help to make sure that technology-driven demand stimuli have less impact on raw material prices.

The responsible use of raw materials, in turn, has a positive impact on social structures. So the sooner companies tackle the field of sustainability and also take into consideration the social dimension of sustainability, the better they are prepared for the transformation to green economy in terms of society, economy and ecology.
Liquid gold

WATER IS A RESOURCE THAT PLAYS A MAJOR ROLE IN ZF’S SUSTAINABILITY STRATEGY. SINCE WATER IS BECOMING INCREASINGLY SCARCE WORLDWIDE, THE GROUP FEELS OBLIGED TO HANDLE THE PRECIOUS SUBSTANCE WITH GREAT CARE.

Text: Kathrin Wildemann

Water, or more precisely its scarcity, is already one of the major global social issues of our time. Without clean water, there is no life. In many regions of the world, the water supply situation is already fraught. The growing global population requires that we use this valuable resource more economically and efficiently. This of course also applies to industry. Even though the share of global fresh water consumption attributable to manufacturing is, according to the United Nations’ 2016 World Water Development Report, currently still quite low at only around four percent, the authors of the report are forecasting a four-fold increase in this figure by the year 2050.

ZF is meeting this challenge head-on. In countries like India, Brazil and Mexico, where the company has several production locations, water is already a rare commodity. This often results in restrictions on water extraction, higher water prices and therefore also increasing production costs. “For us, using water sustainably is not just a question of good economic sense, however, it is also a question of corporate social responsibility, and it is part of our company values,” says Jürgen Holeksa, board member for Human Resources at ZF, who is responsible for sustainability. “This is why we are constantly searching for ways to use less fresh water and to reduce our wastewater emissions.”

RINSING, CLEANING, COOLING

It goes without saying that a company like ZF requires vast quantities of water. In addition to production facilities, canteens and sanitary facilities for 137,000 employees worldwide, the green areas on our plants’ premises also require water. However, it is the production process that accounts for the lion’s share of consumption. For example, water is an important component in galvanic and chemical treatment processes, where it is used to protect metal surfaces against corrosion or mechanical abrasion. It is used for washing, rinsing and cleaning components and also for cooling in many processing operations. In addition, water is required as a basis for solvents and emulsions, such as for preparing coolants. ZF has long been using all technical procedures available to save water in the production process.

ONE CHALLENGE, MANY SOLUTIONS

Some examples worth mentioning here are the cascade cleaning system for washing processes, a type of multilevel waterfall, which significantly reduces the quantity of fresh water used and has been standard practice for years, and the reuse of treated process water.

Text: Kathrin Wildemann
ZF is constantly working on reducing its water consumption via completely different approaches.

**GUADALAJARA, MEXICO**

At the wastewater treatment plant in Guadalajara, a final enrichment with ozone ensures that the water fulfills all local wastewater quality standards. “In Mexico, water is a valuable resource. We use the treated water to maintain the green areas here at the plant,” says Francisco Rosas, who is responsible here for maintenance, the environment, health and safety. With that, the ZF plant not only reduced its fresh water consumption, but also saved the equivalent of around 17,000 euros in only nine months. However, watering the green areas is only the start. In the future, the treated wastewater will also be used to rinse various parts in the chromate conversion coating systems in production. Initial tests are already underway.

**SOROCABA, BRAZIL**

At the Sorocaba location, some 100 kilometers from São Paulo, a reverse osmosis process has been complementing the location’s own wastewater treatment plant since 2013. In this process, a membrane only lets through water molecules and holds back dissolved substances. Thus, no deposits are formed when the water is reused in production to quench heated metal components. Afterwards, the water returns to the wastewater treatment plant and the cycle starts over. In this manner, production at the Sorocaba location saves over 17,000 cubic meters of water per year. “In the past, we had to purchase fresh water for this. Now, the quenching equipment is supplied entirely with our treated wastewater,” reports João Gambarra, who is responsible for environmental matters at the Sorocaba plant.

**SCHWEINFURT, GERMANY**

Since 2016, the Schweinfurt site has been utilizing a new ion exchanger system. It transforms contaminated groundwater into ultrapure water for rinsing processes in production. The recovered ultrapure water is used in systems for surface treatment. The new ion exchanger system replaces four old ion exchangers. In addition to large quantities of process chemicals, it saves 11,000 cubic meters of fresh water per year and 66,000 kilowatt hours of electricity. Project Manager Felix Röttinger comments: “As part of our restructuring concept we collect the groundwater in a well. To date we had to dispose of it at our own expense, but we now have found a way to make use of it in production.” In addition, the new technical solution makes an important contribution to soil remediation.

**HANDLING WATER ECONOMICALLY**

According to the latest figures from the German Federal Environmental Agency, the automotive industry in Germany is mere small fry in terms of water consumption: in the manufacturing sector, it was the chemicals industry that accounted for a share of 56 percent of total water consumption in 2013. The share attributable to automobile production and mechanical engineering of 2.5 percent appears rather modest by comparison. However, this 2.5 percent represents around 110 million cubic meters of water.

To date, German vehicle manufacturing has reduced its water consumption by around 40 percent compared to the year 2000. This was made possible by making the move to modern processes and using treated water. This is not an isolated case. According to the European Automobile Manufacturers’ Association (ACEA), Europe’s automobile manufacturers reduced their water consumption by just under 31 percent in the period from 2007 to 2016.
Combating poverty with knowledge

TO MARK THE 100TH BIRTHDAY OF ZF, EMPLOYEES AND THE COMPANY DONATED A SUM RUNNING INTO MILLIONS. WE VISITED A SCHOOL IN AFRICA WHOSE CHILDREN, THANKS TO THIS MONEY, NOW HAVE THE PROSPECT OF A BETTER FUTURE.

Text: Michael Scheibe

On the dusty dashboard of the SUV the thermometer is already showing 35 degrees Celsius on this December morning. Whenever the vehicle stops in the traffic of Freetown, shimmering heat streams through the wound-down windows into the inside of the car. Freetown is the capital of the West African country of Sierra Leone. Now the paved road has long since come to an end, fruit and vegetable gardens roll by. Embedded in the hilly countryside beneath white clouds like cotton wool lies the town of Grafton, around 14 kilometers from Freetown. Here the journey ends in a cloud of dust on the dirt track in front of high walls and a large purple-colored gate. Welcome to the “Rising Academy Grafton”.

The walls serve to protect the 200 or so children that go to school here. The operator of the school is the private education organization “Rising Academy Network”. It runs ten private schools in and around Freetown. ZF has financially assisted all ten institutions through its charitable association “ZF hilft!”. The mediator was the “YOU foundation – Education for Children in Need”, formerly the “UNESCO Foundation – Education for Children in Need”. In 2015, when the company celebrated its 100th birthday, ZF appealed to its employees to donate to the project “100 Years – 100 Schools”. At the end of the anniversary year, the sum donated was 4.2 million euros! The money mainly came from ZF employees, from the Group itself and from the UBS Optimus Foundation. The money was firstly put to use to buy 4,300 bicycles, so children in Africa could get to a school in the first place. Secondly, 100 school projects worldwide – in India, Bangladesh, China, Mexico, Nepal, Peru, in the Philippines and in Sierra Leone – received financial assistance.

The school buildings in Grafton stand on a free area inside extensive grounds. There are eleven metal containers, painted blue and white, arranged in a square like a fortress. On the open side of the container complex, the students have formed a large WELCOME on the ground with white stones. Somewhat offset in a corner of the courtyard, a majestic tree with outstretched branches provides almost the only shade.

ESCAPING POVERTY THROUGH EDUCATION

The fact that outside aid is so badly needed in this West African country deeply marked by poverty, civil war, Ebola epidemic and natural disasters is underlined by the annual World Education Report from the United Nations Educational, Scientific and Cultural Organization (UNESCO). According to this report, Sierra Leone is one of the countries with the greatest educational deficits worldwide.

The 200 students of the Rising Academy Grafton have the opportunity to escape poverty through education. Just how disciplined they work towards this goal is demonstrated at “Assembly” at the start of the week. This gathering on every Monday morning is an integral part of the school’s daily life. Monday morning of every week starts with an address from the director, prayers and singing.
ZF assumes corporate social responsibility. For this reason, ZF has been supporting international projects in the areas of education, social affairs and culture by way of its "ZF hilft." charitable association established in 2005. So far, "ZF hilft." has raised over 10.5 million euros that have gone to 77 projects around the world.

ZF set up a new platform in the fall of 2016 called "we›care" to also allow employees outside of Germany to be active on behalf of social causes. The platform unites all local and regional aid initiatives by ZF colleagues around the world. The German charitable association "ZF hilft." also works within this parent organization.

LEARNING IN HARMONIOUS DISCIPLINE

Kpakima’s team comprises 15 educators who teach reading, writing, arithmetic and natural sciences. The Rising Academy develops the school curricula and makes them available to the teachers on their smartphones. In class, the director places great importance on “harmonious discipline”. What is that? Should a teacher, for example, notice that the class is becoming unruly during a lesson, he or she will strike up the attention song: “All eyes on me, all eyes on me”. The children in their purple-white school uniforms repeat this sentence in the same sing-song voice until the attention is back on the teacher. There is also a special reward ritual with clapping for correct answers. The clapping can be heard all day from far beyond the schoolyard.

The principal Florence Kpakima leans against the trunk of the mighty tree. She does not consider it merely as protection against the burning tropical sun, she also sees parallels to her charges: something which continuously grows and is cared for, will be strong and steadfast in the future – this is her conviction. She also knows that to care for her human saplings, she needs help from the outside. “Without the donations from ‘ZF hilft.’, this school would not exist. The donors are the true heroes, because they enable important changes in the lives of young people,” Florence Kpakima expresses her thanks on behalf of all teachers and students.

ZF hilft.

ZF set up a new platform in the fall of 2016 called "we›care" to also allow employees outside of Germany to be active on behalf of social causes. The platform unites all local and regional aid initiatives by ZF colleagues around the world. The German charitable association "ZF hilft." also works within this parent organization.

The school curricula for its ten schools in the region are drawn up autonomously by the Rising Academy Network.
All drivers read up on right-of-way rules and traffic signs at some point when learning how to drive. Over numerous hours of driving practice, they learn not only how to actuate the clutch, change gears and steer, they also learn – and this is most important – how to correctly read traffic situations. It is precisely this knowledge that the automated and autonomous vehicles of the future will have to acquire. All vehicle developers agree that the road to this future passes via artificial intelligence (AI). “For vehicles to be able to analyze the complexity of traffic, deterministic software codes in the style of ‘if – then’ will not suffice,” says Arnold Schlegel. “However, in order to make possible the use of artificial intelligence and deep learning in the automotive environment and on this basis develop autonomous driving functions, we need new approaches to hardware and software and to the entire development architecture,” continues the development engineer from Advanced Engineering at ZF.

CHANNELING THE FLOOD OF DATA

It is precisely in this area that ZF has done pioneering work. At this year’s Consumer Electronics Show (CES), held in Las Vegas in January, the Group presented a highly automated test vehicle, which is already equipped for Level-3 automation (of the 5-level automation system defined by the German Association of the Automotive Industry, VDA). The test vehicle is a project by ZF Advanced Engineering. Project Manager Schlegel and his team built the test vehicle within nine months. The heart of the machine is the AI control box, ZF ProAI. Over the past number of months, ZF has, together with its development partner Nvidia, brought it to a stage where it is practically ready to go into production. In real time, this supercomputer processes the signals from the integrated sensor set, comprising numerous front, side and rear cameras as well as Lidar and radar sensors. In addition to this data recorded by the vehicle itself, it also receives GPS map data and position determinations.

In order to use the system under realistic conditions, the ZF development team focused on an urban environment: on road junctions, cycle paths, bus stops, roundabouts, traffic lights, crosswalks – and of course on road users including pedestrians, cyclists, motorcyclists and other drivers. Autonomous driving on a wide, straight U.S. highway is no great technical challenge. In busy European city traffic, however, automated driving is quite a different story. After all, in the complex environment of a city, the vehicle sensors deliver a flood of signals to the central computer, which its software must interpret quickly and correctly. “From this multitude of data, our algorithms create a realistic picture of the traffic situation. This is the basis for the decisions that precede the actions of every autonomous vehicle,” says Oliver Briemle. At ZF Advanced Engineering, he heads the areas of Driving Function Development and Central Control Units.

HIGH COMPUTING POWER GUARANTEED

The extremely high computing power of the ZF ProAI is critical for autonomous driving. One camera alone generates a gigabit of digital data per second. A regular PC processor would have no chance of processing in real time all the sensor data required for the 360-degree view of a Level-3 vehicle. The ZF ProAI, on the other hand, is a supercomputer. With its Xavier chip and the latter’s 8-core CPU architecture as well as seven billion transistors, its performance is appropriately impressive. The chip creates up to 30 trillion arithmetic operations per second (termed TOPS – trillion operations per second) with a current consumption of around 40 watts – depending on...
the customer requirements. Thanks to ZF, it complies with the strictest standards for automotive applications – just like the ZF ProAI itself.

However, ZF’s particular achievement is not only adapting the hardware, but also developing the right software. Schlegel and his team have devised a versatile development architecture that enables especially efficient application of deep-learning algorithms and AI for the development of autonomous driving functions plus their effective linking to the sensor hardware. This architecture can be adapted to each desired use case.

SCALABLE SOLUTIONS FOR EVERY REQUIREMENT

Incidentally, there is no absolute concept of automated or autonomous driving. Experts differentiate between five levels, from Level 1 (full control by the driver, supported by individual assistance systems if need be) to Level 5 (driverless, full control by the system).

For engineers in the automotive industry, there is no blueprint they can use to realize developments for the relevant automation level. “The broad field of automated or autonomous driving is the sum of many individual driving functions, which a car must be able to control without human intervention. All driving functions must be fail-safe and must work under the most varied of conditions, whether they be weather-, traffic- or visibility-related,” Schlegel explains. With their software architecture, he and his team have found an answer to the question as to which sensor set and software modules are needed for automated cars at Levels 3 and 4.

In this way, ZF can offer scalable solutions. Manufacturers that want to offer a highly automated Level-3 solution (i.e., where the driver takes control again within a defined time period) get precisely the sensor set, processing power and software modules they need. Moving up the scale, a Level-4 vehicle, where the software controls the car permanently and in a fully automated way, gets a more powerful and more extensive configuration. The team from ZF Advanced Engineering has worked intensively on the interface between sensors and software, i.e., the intersection between “see” and “think” in ZF’s strategic three-step process. The last stage in this process, “act”, encompasses the implementation of propulsion commands by the mechatronic systems in the drive, brakes and steering system. The development team has made great progress, particularly with data interpretation using AI. This relates especially to data fusion, for instance when it is only possible to reliably recognize objects by comparing radar and camera data.

NEXT STOP: VOLUME PRODUCTION APPLICATION

With this development, ZF has created a solid basis for the volume production application of ZF ProAI. Chinese automotive manufacturer Chery has already expressed an interest. ZF’s computing power and AI are to be used to bring highly automated driving functions to the volume production vehicle. This will not only benefit drivers, who will be relieved of many tasks, but all road users because the comprehensive assistance systems will help increase road safety overall.

The ZF ProAI supercomputer developed jointly by ZF and Nvidia is the control center of the test vehicle. This is how the sensor set, comprising camera, radar and Lidar sensors, sees the environment.
A complex road for the chassis

NETWORKED INTELLIGENCE BETWEEN DIFFERENT CHASSIS SYSTEMS IS CRITICAL FOR AUTONOMOUS DRIVING IN THE FUTURE. AND ZF HAS GOT THIS.

Text: Stefan Schrata
longitudinal dynamics. The electronic braking system of the users in function and safety is indispensable. For the acceptance of autonomous vehicles the confidence ride experience. to ensure a comfortable passenger grates numerous chassis systems from ZF comes into play. It inte-
ability. This is where new software mine our confidence in that driver's another driver, all of which under-
steering, braking or acceleration by as conventional passengers, we are
coordinated. From our experience vehicle must first be optimally
and transverse dynamics of the
experience in autonomous vehicles
important the integration of ver-
tical dynamics will become. "If
you're not actually sitting behind
the wheel, it is easier to blame the
autopilot for every noticeable pot-
hole or unexpected bump in the
road," Lovell explains. "To prevent
these negative experiences from
occurring at all, we have integrated
innovative chassis systems into
the new software."

For autonomous vehicles to gain acceptance, Lovell believes that
well-coordinated longitudinal and transverse dynamics are critical
factors. The more dynamic the vehicles are on the road, the more
important the integration of ver-
tical dynamics will become. "If
we move closer and closer to fully
automated driving."

new mobility concepts that will first
be used in inner-city traffic at low
speeds. "Someday we may find our-
selves facing a driverless robot taxi
or people mover and we will have to
decide: will I get in or not?

NETWORKED FUNCTIONS FOR AUTONOMOUS DRIVING

In order to make the driving experience in autonomous vehicles
a pleasant one, the longitudinal and transverse dynamics of the
vehicle must first be optimally coor-
dinated. From our experience as conventional passengers, we are
familiar with jolting, unexpected
steering, braking or acceleration by
another driver, all of which under-
mine our confidence in that driver's
ability. This is where new software from ZF comes into play. It inte-
grates numerous chassis systems to
ensure a comfortable passenger
ride experience.

According to Lovell: "Our goal
is to centrally control all of the
vehicle's active and semi-active
actors that influence the driving
experience and the safety of a pas-
senger, including steering systems,
shock absorbers, brakes and the
driveline." At the moment, vehicles
are equipped with a large number
of sensors and control units for the
individual actuators in the chassis.
These form an extremely complex
information network and they must
communicate with one another indi-
vividually. The new software connects
all of this to create a modular and
scalable control mechanism for the
vehicle’s longitudinal, transverse
and vertical dynamics, with the ulti-
mate goal of making a passenger’s
ride experience as comfortable as
possible. At the same time, the
engineers benefit from the fact that
ZF technologies are developed for
autonomous driving and its compo-
nents cover all aspects of dynamic
driving. As the central communica-
tions interface, the software coor-
dinates the advanced driver assis-
tance functions (ADAS) and the
actuators. That way it can control
all components that are relevant for
longitudinal and transverse dynam-
ics. These include electric power
steering (EPS), the electronic brak-
ing system (EBS), rear wheel steer-
ing (Active Kinematics Control) and
the electric drive system integrated
in the rear axle (mSTARS). If elec-
tronically controlled shock absor-
bers are installed, it is even possible
to control the vertical dynamics.

SYSTEM INTEGRATION REDUCES COMPONENTS

System integration offers yet
another advantage: it can meet
the demand for redundancy within
safety-relevant systems more easily
thanks to intelligent task distrib-
ution. For example, if the brakes fail,
the mSTARS axle is able to safely
decelerate the vehicle using its
generator function. If the EPS were
to fail, this could be compensated
for in a targeted fashion with the
assistance of the Active Kinematics
Control, an SBB (Steer by Brake) or
torque vectoring, in order to safely
steer the vehicle to the side of the
road in an emergency situation.

HIGH-TECH SOLUTION AGAINST POTHOLES

For autonomous vehicles to gain
acceptance, Lovell believes that
well-coordinated longitudinal and
transverse dynamics are critical
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Networking active dynamic driving systems can further
exhaust the physical limits of sports cars. Examples of this
include functions like Torque Vectoring, Active Roll Stabilization,
Electromechanical Roll Control (ERC). The ERC eliminates
unwelcoming chassis movements that would otherwise affect
the car body when driving dynamically through bends and on
uneven road surfaces. The 48-volt electric motor installed on
the axle equalizes vehicle roll motion in under 300 milliseconds
torques of up to 1,400 newton meters. The result is greater
stability in the curves. Combined with the active rear axle
kinematics (Active Kinematics Control), further applications
are possible, which can bring the safety, performance
and comfort of conventional vehicles to a whole new level.
IT HAS BECOME IMPERATIVE TO NETWORK COMPONENTS OR SYSTEMS. PUTTING THE CHERRY ON TOP, ZF PRESENTS AN INTELLIGENT PLATFORM FOR MOBILITY SERVICES.

Text: Christine Kordt

OVER-THE-AIR UPDATES AND URBAN RIDESHARING

ZF has elaborated initial application examples with start-ups and innovative mobility providers of its ecosystem. This includes a ridesharing app for persons and goods jointly developed by ZF and the mobility start-up door2door. The app allows autonomous fleets to be used in urban areas for the first time ever. End customers can get vehicles to autonomously drive them to their destination and receive suggestions by speech recognition on restaurants or other places of interest. Face recognition for identification is carried out via selfies.

ZF has also integrated the software from networking specialist Excelfore in the IoT platform. This way, software updates are transmitted over-the-air directly from the cloud into the vehicle. Additionally, the system protects against intruders from the outside and closes any security vulnerabilities.

What role does Microsoft play in mobility?

Microsoft sees itself as a global provider of cloud services. With this technology, we make digital mobility offerings possible for the first time. The technical basis for this is our cloud platform Azure. Furthermore, we offer our customers a platform and support in the analysis of the massive and continuously growing quantity of data in the mobile domain, for instance through the use of deep learning or artificial intelligence.

What form does the partnership of ZF and Microsoft take?

We are impressed with ZF’s Vision Zero, a world of mobility without accidents and emissions and we are pleased to support this vision. Specifically, with Microsoft Azure we provide the fundament for the cloud platform with which ZF can offer sustainable and secure mobility services. This positions ZF as a pioneer for today’s and tomorrow’s connected society in the mobility space.

Many people are concerned about the security of clouds. As Microsoft we take this concern very seriously and invest a great deal of money in the development and implementation of security concepts. This related to the general infrastructure, but also the security of individual customer data, such as IP, e-mails and all data saved in the cloud. We have the industry’s largest portfolio of certificates and will continue prioritizing security as the fundamental element for the enablement of mobility and connected services.

A UNIFIED PLATFORM FOR B2B AND B2C CUSTOMERS

Fleet Management
Predictive Maintenance
Predictive Health

Fleet Manager

OTA Updates
OTA Security
Connected Vehicles
Multimodal Transport Services
Smart Payment
Sharing Services
Package Delivery

INQUIRING WITH STEFAN ANDRE RASCHKE, SENIOR DIRECTOR AUTOMOTIVE MICROSOFT GERMANY

Video: Experts explain the ZF cloud platform.
Sales recorded by ZF for the 2017 fiscal year. Compared to the prior year, this represents an increase of 3.6 percent. The adjusted EBIT improved to 2.3 billion euros (+4.5 percent), the adjusted EBIT margin was 6.4 percent. ZF invested 2.2 billion euros in research and development, which makes up 6.1 percent of sales. At the end of 2017, roughly 146,000 employees worked for ZF worldwide.

Lamborghini’s newest sports car, the Urus, introduced at the Geneva Motor Show is the fastest SUV in the world. Featuring 650 horsepower and 850 newton meters of torque, it reaches a maximum speed of 305 km/h. To bring this much power onto the road, the Italian sports car manufacturer uses numerous ZF products. One highlight is the operating system designed especially for the Urus, which combines function and design at the highest level. It is located in the vehicle’s central console and looks like a thrust lever in an airplane cockpit. The driver can actuate the automatic transmission’s shift-by-wire system with the lever of the central module. Other functions can be actuated using the operating elements and the levers of both lateral modules, including selecting the driving mode or activating all-wheel drive. And, like in a traditional sports car, the start button for the SUV power unit is located under a red cover to protect it from unintentional actuation.

In an era of online orders and just-in-time production, logistics departments are faced with major challenges. It all starts right at the beginning of the supply chain. From the production hall and warehouse to the logistics center, all workflows must be perfectly aligned with one another and function smoothly. And this is where the forklift truck can play a decisive role. In the future, they do not only have to transport goods more energy-efficiently, but also detect obstacles or people.

The Innovation Fork Lift from ZF, which the Group will be unveiling at this year’s Hanover trade show, demonstrates just how this might work. Following ZF’s vision “see. think. act.” the Innovation Forklift Truck independently monitors the area behind it (“See”); it detects potential hazards (“Think”) and, if applicable, uses visual and acoustic signals to warn of potential collisions (“Act”). This is all made possible by the ZF ProAI supercomputer, which interconnects the electric drive components with radar and camera system sensors. ZF’s electromechanical steering system ZF eSTEER EPS3 also facilitates automated driving functions. It replaces conventional hydrostatic steering and reduces the vehicle’s energy demand by more than ten percent.

Camera systems
Radar systems
ZF ProAI processor
eTrAC

The Innovation Fork Lift shows initiative: it monitors its rear space, recognizes obstacles and alerts the operator.
With its new steering wheel concept, ZF is improving communication between driver and vehicle, thus taking yet another step towards highly automated driving. Through gesture control, the system makes it possible to activate various vehicle functions. At the same time, the steering wheel detects the intuitive movements that everyone is familiar with from the smartphone. So, for example, a one-time tap on the steering wheel could activate the windshield wipers, while swipe gestures could trigger other functions. A 7-inch LC display in the middle of the steering wheel and an LED light band integrated around the wheel’s outer rim issue information and warnings to the driver. In autonomous driving mode, the band lights up blue, in manual control white and in case of warnings red.

Better informed

The central display screen and a light band on the edge of the steering wheel instruct the driver.

“In the automotive industry, ZF is viewed as an important driving force in the automation of vehicles.”

FRANKFURTER ALLGEMEINE ZEITUNG, Germany

Together with numerous partners, ZF is propelling the development of autonomous driving in China. After just four months of collaborating with the computer and AI specialist Nvidia as well as the Chinese technology group Baidu, the Group presented its first application at the Consumer Electronics Show (CES). This application relies on the supercomputer ZF ProAI. The system enables vehicles to independently locate a parking space, park, then later pull out of the space and return to where its owner is waiting. The passenger car can be summoned or sent away via a smartphone app.

ZF is also working on autonomous driving together with Chinese automotive manufacturers such as Chery. As part of this cooperation, the supercomputer ZF ProAI is, for the first time, being installed in volume-production vehicles that are sold on the world’s largest automobile market. It enables driving functions at Level 3 (highly automated driving), thus making deep-learning algorithms possible in affordable vehicles.

The valet parking function celebrates its premiere in a test fleet from Pand Auto, one of the largest Chinese carsharing providers.

SUV with outstanding comfort is what the Range Rover has stood for going on almost 50 years. The British automobile manufacturer has demonstrated that the luxury SUV is not so yesterday after all, now that its newest Range Rover model is available as a plug-in hybrid for the first time. ZF’s 8-speed plug-in hybrid transmission plays an important role because it allows all the functionalities of a standard transmission to be combined with the benefits of an electric drive. This ZF transmission makes boosting, recuperating and purely electric driving possible, thanks to the hybrid module integrated directly into the transmission housing. The Range Rover PHEV achieves a range of up to 51 kilometers in full-electric mode, operating silently with zero local emissions.

On the road together in China

Tradition meets the modern era

The valet parking function celebrates its premiere in a test fleet from Pand Auto, one of the largest Chinese carsharing providers.

The central display screen and a light band on the edge of the steering wheel instruct the driver.

After its successful application in trucks, the TraXon transmission system now conquers territory in buses – such as the Irizar i8, which has been awarded “Coach of the Year 2018”, during the Busworld exhibition. Featuring the highest transmission efficiency in its class, the ZF product makes a key contribution to more efficient and quieter drivelines.

ZF HIGHLIGHT

Developed by ZF, eLSD delivers dynamism and traction especially on race courses or heavy terrain. Unlike purely mechanical differential locks, it intelligently adapts to the current driving situation. The solution does not just react when specific drive torques or wheel differential speeds occur – it analyzes all sensor data relating to driving dynamics for active, predictive and highly sensitive vehicle control.

A key component is an electric-motor-driven actuator that controls a multi-disc package. That makes it possible to vary the differential locking force on the drive axle seamlessly between 0 and 2,500 newton meters. If a wheel loses grip, the eLSD transfers the force with exacting precision to another wheel that still has grip. Normal differential systems leave wheels spinning in thin air in extreme situations like this.

Even during everyday driving, the locking differential can offer enhanced safety. For example, it gets swerving vehicles back on track faster.

Currently, the eLSD is making its mark at Porsche as an option in specific Cayenne, Macan and Panamera models. The Jeep Grand Cherokee from Fiat Chrysler Automobiles (in the image above) also excels with this function.

The eLSD can generate a seamless variable locking torque.