Progress on the move

TraXon, the new modular driveline system

Perfect customer service
How ZF keeps a legend on the road

Fascinated with high-tech
What a unique input shaft can do
ZF at the IAA
Commercial Vehicles

“The Future in Transportation.” This slogan underscores ZF’s position as a pioneer of cost-efficient and environmentally friendly technology. The company will be showcasing innovations aimed at the current and future needs of the commercial vehicle sector.

**Lightweight Construction**

- **AV 130 electric portal axle**
  - Traveling locally, emissions-free: electric drive axle for low-floor city buses
  - Electric motor performance of 2x120 kW (2x162 hp)
  - Drive concepts: series hybrid, all-electric with fuel cell or battery, tram lines

- **Independent suspension for heavy trucks**
  - Trucks with the comfort of a bus: an independent suspension from ZF promises better handling and fuel savings thanks to less weight and often manufacturers greater freedom in design
  - Weight savings over a solid axle: 40 kg (88 lb)
  - Kinematics and compact installation allow integration into the chassis

- **Cabin suspension**
  - Good working conditions: comfort in the cab with active roll stabilization from ZF
  - Less noticeable shock, pitch and roll of the vehicle from within the cab
  - New system design without the front stabilizer

**Connectivity**

- **ZF Ecolite manual 6-speed truck transmission**
  - World transmission: the 6 S 450 manual transmission built on two continents to be identical by ZF
  - 6-speed manual transmission for an input torque of up to 500 Nm (369 lb-ft)
  - Used in pickup trucks and light commercial vehicles like the VW Amarok

- **CDC 1XL**
  - Ensuring the cargo arrives safely: active rear-axle damping for trucks
  - Variable adjustment to the current driving situation
  - Very compact (CDC shock absorbers, sensors and control unit)
  - Connection to the CAN bus provides important input data

**Emissions Reduction**

- **ZF at the IAA**
  - Each new generation of commercial vehicles produce less emissions than ever before
  - How can trucks and buses get even cleaner?

**Economy**

- Cost pressures on fleet operators have not abated. What new technologies can help mitigate lifecycle costs?

**Lighting**

- **ZF Ecolite manual 6-speed truck transmission**
  - Quiet and efficient the 6-speed automatic transmission for CVs, especially buses
  - 5% less fuel consumption throughout a much longer lifecycle
  - Better cooling concept: works with up to 15% hotter oil pan temperatures
  - Greatly reduced noise during start-off

- **Lightweight rear suspension**
  - Increased torque resistance and ease of maintenance

- **ZF EcoShift manual bus transmission**
  - Equipped for the future: the newly developed ZF EcoShift manual bus transmission providing comfort across a range of variants
  - Torque range of 1,000–2,100 Nm (737–1,549 lb-ft)
  - Compatible with ServoShift and ZF Intarder for comfortable gear-shifting and low-wear braking

**Lightweight Fiberglass Studies**

- **New materials: light steering link and cab dampers made of glass-fiber-reinforced plastics (GFRP)**
  - Trains of a light steering link
  - New damper covering for cabin suspension reduces the system weight

**PRODUCTS AND THEMES**

- **AV 133 low-floor portal axle**
  - Accessible by bus: passenger comfort, safety and rapid boarding and exiting
  - Allows minimum floor heights and center aisles without steps and platforms for added comfort

- **Hybrid transmission based on EcoLife for buses**
  - Quieter and more efficient the latest automatic transmission for CVs, especially buses
  - 75% less wear compared to a manual transmission and 90% reduction in oil temperatures
  - Fully automatic transmission for city and intercity buses

- **ZF at the IAA**
  - Through its modular design, the new TraXon automatic commercial vehicle transmission offers multiple benefits for a wide range of applications
  - The same transmission can be mounted with two modules (black, left): 1. a single or double-disc clutch, 2. a dual-clutch module, 3. a hybrid module
  - The TraXon is fully automatic throughout a much longer lifetime
  - Functionality of Cr1-360 and VLS/1200 in a single transmission
  - Perfectly adapted to the needs of the fleet operator
12 TRAXON TRANSMISSION SYSTEM
Progress on the move
Traxon market launch: with this new, versatile automatic transmission for CVs, ZF will be setting the truckers’ standard for automatic gear shifting at the 2012 IAA.

20 INTERVIEW
Variety by design
Rolf Lutz, member of the Board of Management and responsible for the Commercial Vehicles Technology division, speaks about the commercial vehicle market and ZF’s opportunities within it.

22 CHINA’S BUS MARKET
Busing the Middle Kingdom
In the People’s Republic, megacities practically come to a standstill if public transport isn’t at its very best. Soon, hybrid buses with ZF technology will be doing the runs.

44 DIVERSITY
A unique selling point, even for cars

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Roads are the lifelines of countries all over the world, they enable the transport of both people and goods. However, the Leba Mountain Pass in Angola is an exceptional one. The road connects the city of Lubango, situated at 1,770 m (about 5,800 ft) above sea level, to the port city of Namibe, located 150 km (about 90 mi) away from there on the Atlantic coast. Built in the 1970s, the road is, by Angolan standards, in surprisingly good condition. The roughly 30-km-long (19 mi) stretch of road leading up to Lubango is a true spectacle. The narrow strip of road tightly hugs the edge of the precipitous cliffs, wrapping around six consecutive hairpin turns – it would make a great test track for a retarder like the ZF Intarder. Since there are only a handful of low walls and guard rails lining the road’s shoulder, drivers are recommended to not pay too much attention to the picturesque mountains and the clouds often clinging to their peaks. 
The fifth generation of the Nissan Altima is revving up, in particular in the United States. Its ease of handling and comfortable ride come thanks to ZF twin-tube dampers with new valve technology. This refinement of the standard ZF damper valve unites driving dynamics and comfort. In addition, it reduces unpleasant noise and vibrations in the car.

Also standard in vehicles with rear-wheel drive is the Servolectric power steering system from ZF Lenksysteme; combined electric-active steering is also available as an option. The four-wheel-drive version is equipped with the speed-dependent Servotronic 2 steering system.

The new Mercedes-Benz Citaro hits the road with drive and chassis technology from ZF. Among other components, the highly efficient ZF EcoLife 6-speed automatic transmission comes from the Group. It provides for a significant reduction in consumption emissions. ZF also supplies the RL 75 EC front suspension and type AV 132 and AVN 132 rear axles. Active and passive suspension damping complete the package. ZF Lenksysteme supplies the Servocom 8098 steering system, the steering column, and the steering pump.

The new Ford Transit Hi-Way is the next generation of Iveco’s heavy-duty vehicle range. It is a highlight at the IAA. The engines meet the Euro 6 emissions standard. In addition, drivetrain and suspension technology from ZF provide for ease of use, safety, and fuel economy in this new high-tech truck. Thus the AS Tronic is the first choice for customers who want an automatic transmission. Also from ZF are cab dampers and suspension components. And by the way, ZF Lenksysteme supplies the comfortable Servocom 8098 steering system, the steering column and the steering pump for the new Stralis range.

The new Ram 1500 will be getting into gear in 2013 with the 8-speed automatic transmission from ZF – and making tracks in terms of fuel efficiency. The transmission, which Chrysler will be marketing under the well-established name TorqueFlite 8, reduces fuel consumption and emissions. At the front of the Ram 1500 is the FDU FAD 215 disengageable axle drive from ZF. The rear axle is assembled by ZF in Marysville.

The new FDHF superyacht from Heesen takes advantage of innovative technologies developed by NASA. “FDHF” stands for Fast Displacement Hull Form and refers to a hull designed to be highly efficient at all speeds. The materials and workmanship of the hull yield particularly fair and smooth surfaces. ZF 23560 C transmissions were the natural choice for this high-tech vessel. They transfer the power of the type MTU 20V 4000 M93L engines so that the yacht has a top speed of 27 knots – about 30 mph.

The BMW 6 Series Coupé not only now features superior design in its third generation but also increased comfort and driving dynamics. And thanks to the 8-speed automatic transmission from ZF that comes standard, it also boasts low fuel consumption. The BMW 6 Series offers even more dynamic enjoyment with the optional Dynamic Damping Control – based on the CDC active damping system by ZF – or Adaptive Drive. The latter has integrated ARS.

New vehicles with ZF technology
Efficiency on land and at sea

Stralis Hi-Way
Accolade from Wolfsburg

ZF’s CEO, Dr. Stefan Sommer, accepted one of the most sought-after supplier awards from Dr. Martin Winterkorn, Chairman of Volkswagen AG, and Dr. Francisco Javier García Sanz, Board Member responsible for Procurement. At the event in the Danish capital of Copenhagen, the VW Group honored its best suppliers worldwide. ZF received the award for the supply of shifting systems that VW has been putting into their sharply rising numbers of car models worldwide, most recently in vehicles based on its new Modular Transverse Matrix (in German, “Modularen Querbaukastens,” or MQB) platform.

“The award is not only a testament to product quality and innovation at ZF, but also the result of constantly deepening cooperation between our companies,” said Sommer.

ZF Road Test

Audi’s baby wins big

The goal of the 2012 ZF Road Test, a major comparison test conducted by the ZF Group and the magazine Auto Test, was to determine the best subcompact car. The 10 judges were – as always in this comparison – ordinary drivers, chosen from among the readers of Auto Test, autobild.de and motortalk.de. At the final test in May, they determined the winners from among 10 vehicles, and in the end it was the Audi A1 Sportback that came in first. The city slicker from Ingolstadt outdistanced its competitors, especially in the categories of Design and On-Road.

Innovation award

ZF dressed to the 9s by Auto Test

In the magazine Auto Test’s newly created category of Innovation of the Year, the 9-speed automatic transmission from ZF was singled out as the best of 2012. The transmission for passenger cars with front-transverse engine comes on the market in 2013. Its features have already won over the magazine’s editors: modular structure, powerful software control and a significant contribution to fuel efficiency. ZF engineers estimate the fuel savings over the 6-speed automatic transmissions for front-transverse installation to be up to 16 percent.

Environment conference

A clean ride

Sustainability topped the agenda at the UN’s Rio+20 environment conference in June. During the event in Rio de Janeiro, the transportation of the delegates had to be as environmentally friendly as possible. To that end, ZF gave the organizers a bus with the Ecolife 6-speed automatic transmission. Many participants took advantage of the free shuttle in the week before the final conference, and thanks to the ZF EcoLife, they were able to get to one of the venues with less emissions and noise.

ZF Race Reporter

DTM up close

Starting with the 2012 season, ZF is supplying the DTM teams from Audi, Mercedes-Benz and BMW with clutch systems. To celebrate this development, ZF has made a special offer to all touring car fans: they can go behind the scenes of the DTM racing world by participating in the ZF Race Reporter program. The so-called “race reporters” get to observe and interview motor-sport professionals in the paddock and in the pit lanes. “They just have to be enthusiastic about motor sports and want to know more – journalism experience is not necessary,” says Catharina Felser, a race-car driver working with ZF to make the program happen.

What’s more, at the end of the season a jury will select the best ZF Race Reporter. He or she will then travel to Valencia, Spain, next year, where he or she will have the chance to drive a lap around the motor racing track in a Formula BMW car.

MORE INFORMATION

www.youtube.com/zffriedrichshafen

Spotlight on …

Dr. Christof Ehrhart, Head of Marketing Deutsche Post DHL

Since May, DHL has been running an advertising campaign featuring ZF and its CEO, Stefan Sommer. ZF appears in ads around the world and in a DHL promotional video on the Internet.

Why did your company choose the ZF Group for a testimonial campaign? As a demanding DHL customer dedicated to precision, ZF Friedrichshafen AG represented the perfect case study of our experience in the automotive sector.

What do you expect from ZF’s participation in your international campaign? With its innovative products and its success in world markets, ZF Friedrichshafen AG is a shining example of what you can do with DHL at your side. Not to mention that Dr. Sommer presents his company credibly and effectively.

Farewell gala

Adieu “HGH”

The guest list alone stood as a testament to the long-standing reputation ZF CEO Hans-Georg Härter enjoys within the automotive industry. On May 15, senior representatives of German and international corporations came to his retirement party in Friedrichshafen. Top managers of ZF clients like Audi, BMW, Daimler, Ford, GM, Jaguar, Land Rover, MAN, Porsche and Volkswagen spent the evening with Hans-Georg Härter. He stepped down on May 1. Volkswagen CEO Dr. Martin Winterkorn and Matthias Wissmann, President of the German Association of the Automotive Industry, praised Härter, the man and the business leader, in their speeches.
Progress on the move

At the IAA in Hannover, ZF is unveiling TraXon, its new automatic transmission system. Its modular system makes it both unique and future-proof. It also offers customers a functionality that is unheard of in the world of CV transmissions.

The GPS-controlled transmission software allows the Trakon transmission to anticipate the landscape and always select the right gear.
What an impressive quartet! Freshly washed and shining in yellow, red, blue, and grey, the four semis with their trailers stand side by side, coupled and ready for action. It’s a July morning, and Dr. Christoph Rüchardt is waiting for a group of journalists on ZF’s test grounds in Friedrichshafen. They have been invited to test drive TraXon, ZF’s new transmission system, for the very first time. Rüchardt may be project leader for this new transmission, but he skis away from being called “Mr. TraXon.” After all, developing this automatic CV transmission system has been a team effort.

Interdisciplinary team

Of course the team also includes development engineers from the CV Technology division and colleagues from ZF Advanced Engineering. And don’t forget the process developers and production technicians! From the very start, these specialists have ensured that it will be possible to efficiently implement the concepts the engineers develop in series production. Now TraXon has the makings of an IAA sensation. Rüchardt has been working on TraXon for six long years, and it’s not over yet. He has a team meeting today, and before that he has to welcome members of the media, teach them how to operate the test trucks, and introduce the team members that will be overseeing the test drives. Does he not sense the tension in the air, the curiosity, the hint of excitement? “No,” says Rüchardt as he smilingly glances at his watch. “I’m actually more worried about whether I’ll make it to the meeting on time.”

Quiet, strong and future-proof

The approach ZF adopted in developing TraXon is already causing a stir. The haulage world is full of diverse challenges, which means it is no longer possible to develop a transmission that is all things to all people. In line with this, ZF’s engineers in Friedrichshafen have developed a modular concept with one modern basic transmission at its core. The basic 12-speed transmission will be available from the word go, with a 16-speed version to follow later. TraXon is already setting itself apart by offering the best power-to-weight ratio and the highest gear spread on the market. The latter is of particular importance, as the gear spread determines the optimal operating point within the engine performance graph, for example on the freeway, and also reduces clutch wear during slow maneuvers. Both of these are important factors in determining how economical a CV is. Its design allows for an input torque of more than 3,200 Nm (2,360 lb-ft), and its weight and dimensions meet the current and future needs of all CV manufacturers worldwide. TraXon can

TraXon – more than just an automatic transmission

The right module for every purpose

Modular variety: 1. dry clutch, 2. dual-clutch module, 3. hybrid module, 4. engine-dependent PTO, 5. torque-converter clutch module

Modules for specialists

There are two TraXon models for use in special-purpose vehicles. The TraXon Torque is equipped with a torque-converter clutch that is installed before the transmission. This makes it possible to bring high engine torques onto the streets seamlessly. It allows drivers to maneuver heavy trucks, crane vehicles, or aircraft pusher tugs with great precision, speed and fuel efficiency. An engine-dependent PTO is another option. This is sandwiched between the transmission and vehicle engine. The PTO is particularly attractive for CVs that have ancillary equipment requiring very high engine torques regardless of vehicle speed. These include fire engines, mobile cranes, and cement pumps.
also shift CVs that are much heavier than the 40-metric-ton (44-US-short-ton) limit currently in place in Europe. The new transmission design and new wheelset means TraXon is six decibels quieter than its predecessor, the AS Tronic – that represents a halving of the noise emissions the human ear can perceive.

Unique modular system
One unique selling point for this system is the optional starting modules for the basic transmission. This approach means TraXon will be ready for use in a variety of contexts and future scenarios; there’ll always be a TraXon combination, whatever the situation. In addition to the standard dry clutch, which can be combined with a twin-plate dry clutch for smaller heavy CVs, TraXon can be combined with a hybrid module, a dual-clutch module, and a torque-converter clutch. An engine-dependent PTO is available in special purpose vehicles for power-hungry ancillary equipment such as concrete or water pumps. ZF’s high-performance retarder, Intarder, is of course also available with TraXon. As the quality of an automatic transmission system is very dependent on its control system, ZF’s engineers have developed PreVision. PreVision is a gearshift solution for TraXon that uses GPS data. PreVision shifts gears in the same way an experienced driver on a familiar route would. Could anything match the use of GPS data to determine when to shift gears in terms of innovation? Perhaps the use of a hybrid module as a basic transmission could. Wait a moment! A hybrid in a long-haul truck? Could that really work? Yes it can! Even over the short 29 km distances (12.4 mi) the journalists covered in the test drives, the PCs hooked up to the vehicles’ electronics show fuel savings of 13 percent. That’s also because the fully loaded semi-trailer is being tugged out of standstill exclusively by the 120 kW (160 bhp) electrical engine – the diesel engine doesn’t take over until later.

Managing energy intelligently
And that’s not the end of the quest to save gasoline. When the vehicle drives down a gentle slope the system’s generator produces electricity and stores it in the battery. When it’s time to start the ascent again, the electric motor supports the combustion engine, which might otherwise have initiated an energy-intensive downshift. This intelligent energy management results in considerable fuel savings, even for a fully loaded heavy truck. Based on estimates to date, fuel efficiencies of at least 5 percent can be expected with the TraXon Hybrid.

Uninterrupted traction
There is another extremely interesting module in service in one of the other vehicles in Rüchardt’s small test-vehicle fleet: TraXon Dual. In this system, a dual-clutch module directs the engine’s input horsepower so that specific gears can be shifted, even when carrying heavy loads. Depending on how the dual-clutch module is designed, this affects every second gearshift. You can see the effects when driving up the 15-percent incline on ZF’s test ground: immediately before it reaches the summit, the CV shifts down a gear. As this gearshift occurs under load, the horsepower keeps flowing, and the vehicle masters the incline effortlessly. A conventional automatic transmission that
opens the driveline while shifting gears loses traction here, resulting in decelera-
tion. For CV manufacturers, TraXon Dual is a model for the future: It allows 
them to accelerate the trend towards very long rear-axle ratios, which boosts fuel efficiencies. This technology keeps engine rpms particularly low and reduces loss. Of course, it would be possible to 
have even longer rear-axle ratios, however this would mean that a ve-

cicle would have to switch

“Depending on the module used, we expect fuel savings percent-
ages to reach double figures.”

from twelfth to eleventh gear, even when driving up very gentle inclines. This constant up- and downshifting is not just an annoyance – it results in less-than-optimal fuel consumption rates. TraXon Dual makes these gear-
shifts almost undetectable. Even for very long rear-axle ratios, of approx-
mately 2.2, if the vehicle you’re driving has TraXon Dual you’ll have to pay very close attention to notice the shift at all. But you’ll certainly notice the fuel savings at the next gas station. And while we’re on the subject of gearshifts, ZF’s gearshift system PreVi-
sion, which is also optional with TraXon, breaks new ground in intelli-
gent transmission control. This GPS-based control sys-

Intelligent shifting thanks to GPS

The fully loaded test trucks carry their 40-ton (44-US-short-ton) load down a gentle decline whose slope is so minimal it is undetectable. The system automatically activates the roll func-
tion, and the gear shifts into neutral. This is the only shift that is noticeable as the truck’s motor idles. Before it reaches the lowest point the system shifts into gear again, not a second too late, ensuring the truck continues to move forward seamlessly. A little later, the CV with its GPS-controlled PreVi-
sion transmission software begins to ascend a gentle incline that stretches out some considerable distance. The PreVision software shifts the gear back to eleventh in good time, thus ensuring that the truck can continue to move forward without unnecessarily losing speed. When the GPS system detects the approaching end of the incline, the software switches back to twelfth gear a good distance before the truck reaches summit, an impossibility for any automatic transmission without a GPS connection. A driver traveling along an unfamiliar route would also only shift to the highest gear later.

High average speed

As a result, in fleet usage of PreVision saves fuel and offers higher average speeds. Combining it with TraXon Dual increases the potential savings even more. “It is possible to further increase fuel efficiencies over and above TraX-
on’s already-efficient basic system, de-
pending on the module and control software. According to our latest field tests, the potential savings range from 5 to 14 percent,” according to Bernd Stockmann, Executive Vice President of Truck and Van Driveline Technology in the CV Technology division. It’s already clear that TraXon has something for every target group: for the manufact-
urers, vehicle fleet owners, and the truck drivers themselves. As they get out of the vehicles, the test drivers confirm this with their nods of recogni-
tion. Christoph Rüchardt isn’t there to see it. He’s already on his way to the team meeting.

FROM THE CENTER OF THE ACTION

Before the IAA, some motor journalists had the opportunity to test products like TraXon, the rear-

The rear-axle CDC is an interesting system, especially for smaller delivery vans because they often drive partially loaded through bumpy streets in the centers of cities with damping modules that are too hard.”

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Vassilis Daramouskas, “Troxoi & TIR Magazine”

Andreas Teutel, Editor in Chief, “Fernfahrer”

Hans Kuipers, freelance journalist (for “Nederlands Vervoer” among others)
ZF’s new automatic transmission system for commercial vehicles, TraXon, proved to be a product highlight and the focus of industry interest at this year’s IAA Commercial Vehicles trade show. Rolf Lutz, member of the Board of Management and responsible for the Commercial Vehicles Technology division, talks about the new flagship transmission and the challenges of the market.

Variety by design

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Mr. Lutz, ZF is presenting a completely new type of commercial vehicle transmission with TraXon. Why take this approach instead of further developing the tried and true AS Tronic?

We actually decided to start from scratch. The main question for us was not what can we further improve on with our existing products. Instead, we took the more arduous path and asked ourselves what the market will demand in the coming years. The result: further fuel and emission savings, more economical operation, increased customer value, a wide range of different uses and applications, more intelligent control software – to name just a few important points.

To meet these requirements, we saw a need for many new product features and functions ...

... that couldn’t be retrofitted in the AS Tronic?

Exactly. That’s why we needed a new transmission concept that also gave us more freedom in terms of developing the hardware and software. Two years ago our “Concept Transmission” study showed how this range of functions can be achieved – with a basic transmission and several powertrain modules. Now we are bringing the product, under the name TraXon, to the market.

What are your expectations regarding the introduction of this new generation of transmissions?

We have very ambitious goals. We plan to use TraXon not only to reinforce our success in the market for automatic transmission systems in the medium to long term but to further expand it as well. We will initially focus on Europe, but we are also keeping important overseas markets in mind.

Some truck manufacturers on the European market for truck transmissions also offer their own systems. What benefits does TraXon have compared to these manufacturers’ products?

Thanks to its modular system, TraXon offers both attractive features and a high level of customization. This is precisely where I see our major advantage compared to the transmissions offered by commercial vehicle manufacturers. But of course we do depend on collaborations with the manufacturers to network software that can be used for other innovative functions.

The platform concept and range of uses sound promising, but don’t they make manufacturing significantly more complex?

Not least for that reason we have consistently applied design-for-manufacturing approaches during the development of TraXon, involving the manufacturing and process planners early on and incorporating their feedback.

When will we see the first trucks equipped with TraXon on the roads?

We will start series production for the transmission in 2014.

On a different topic, at the IAA ZF also presented approaches for lightweight construction in commercial vehicles. What benefits are there to saving a few kilograms in a 40-tonner?

It increases the total cargo weight capacity, of course, and thus the profitability of the vehicle. Our concept of a lightweight commercial vehicle axle saves about 100 kg (220 lb), which makes a substantial contribution to compensating for the extra weight.

Are there other reasons to make trucks lighter?

Yes, we shouldn’t forget the so-called negative compensation aspect: when the Euro 6 emissions standard is introduced, many trucks will become heavier because they will need complex emission control technology. Our concept of a lightweight commercial vehicle axle saves about 100 kg (220 lb), which makes a substantial contribution to compensating for the extra weight.

The IAA 2012 showed that the pace of innovation is rising in the commercial vehicle industry. Why is that?

The reason lies in major trends, such as the need to avoid emissions and save fuel. The market puts a lot of pressure on new generations of vehicles to meet expectations in these areas. These improved market opportunities make it worthwhile to take a fundamentally new approach not only in the driveline, but also in the chassis, for example, as we are also doing with our independent wheel suspension system for heavy trucks.

Avoiding emissions and saving fuel are the major concerns of today and tomorrow.
Busing the Middle Kingdom

When it comes to public transport networks, the Chinese are a step ahead of the rest. Their trend towards mobility, coupled with urban planning expertise and state funding, also brings advantages for ZF.

China is a land of superlatives. Twelve of the top 50 most populated cities in the world can be found there. While Shanghai’s population was ranked second in 2011 with 14.9 million inhabitants, Beijing is now hot on its heels with a population approaching 12.6 million, putting it in fourth. Megacities like Shanghai and Beijing pose considerable challenges for local councils, particularly in terms of traffic and transportation. Mobility can only be guaranteed if efficient public transport systems are in place, which is where buses come into play: City buses are crucial to China’s tight-knit transport network. While cars may be more popular, they aren’t the easiest way to get around in the city: even the best multi-lane highways can’t save you from traffic jams stretching for miles. CO₂ emissions also fill the air with smog, particularly in city centers, meaning that buses are likely to play an even more important role in China’s future, at least according to Yu Zhengqing, head of the Bus Institute at the China Highway and Transportation Society.

Going by official targets and economic and social developments, China’s outlook for 2012 is looking very positive indeed: “We’re expecting a massive growth of around 8 percent across the entire bus market,” says Yu.

Energy efficiency a must
This is all good news for Chinese bus manufacturers and their suppliers, but is there a catch to Yu’s estimations? Bus makers are facing high expectations when it comes to environmental policies. At the 2011 National People’s Congress, China adopted its twelfth Five-Year Plan and high energy efficiency is priority number one for Chinese industry. “New Energy Vehicles” is the buzzword, and this includes buses. “As far as the development of electric buses is concerned, China will be leading the way over the next few years,” says Thomas Wendt, partner at Roland Berger Strategy Consultants, and co-author of a study on the global implementation of lithium-ion batteries. On the one hand, these high energy efficiency targets are only going to drive up operating costs for the mainly state-owned city bus companies. Up until a few years ago, purchase price was the main focus, but...
now companies are being forced to look at entire life-cycle costs too. On the other hand, China is heavily investing in electric and hybrid buses, meaning transport companies can take advantage of lucrative grants of between €20,000 ($25,000) and €50,000 ($62,000) per bus.

**Reliable technology, hybrid included**
Hybrid buses have very good chances in this market environment, as they offer quick returns. The drivetrain technology and driver and passenger comfort are all based on tried and tested methods – a good starting point for ZF’s new development project with two of the biggest bus manufacturers in Shanghai. The partners are fitting out a bus’ diesel powertrain with ZF hybrid technology, with the HyTronic lite hybrid transmission playing a key role. Thanks to its hybrid module delivering up to 60 kW (80 bhp) of power and 450 Nm (603 bhp) of torque, it fulfills all the functions of a hybrid, meaning that a full bus can now start off purely on electricity. The generator recovers electric energy lost when braking and stores it in the 220 kg (484 lb) lithium-ion battery.

**High fuel savings**
This hybrid bus, the first of its kind to have built-in ZF transmission technology, will soon be ready for field tests in Suzhou. HyTronic is based on the AS Tronic lite automatic transmission system. A further two Sunwin hybrid buses have also been built by development engineers at ZF Friedrichshafen. “From here onwards, we’ll be supporting our Chinese colleagues with application development, safety assessments and documentation,” says Jörg Gerspacher, who manages the HyTronic lite for buses project in the Commercial Vehicles division at ZF Friedrichshafen. “From here onwards, we’ll be supporting our Chinese colleagues with application development, safety assessments and documentation,” says Jörg Gerspacher, who manages the HyTronic lite for buses project in the Commercial Vehicles division at ZF Friedrichshafen. It’s all to do with the interplay of the components: ZF supplies the transmission, electric motor and inverter, and the battery comes from China. What’s important is the hybrid control, also programmed at the Friedrichshafen site. The software is designed to help the bus make fuel savings of up to 20 percent compared to conventional buses with manual transmission. “These buses can now run half on electricity,” beams Gerspacher. But this isn’t the first design-to-market project that ZF has undertaken to transform China’s buses into hybrids. In Beijing, fully electric buses will soon be doing their first test runs with the help of ZF’s electric portal axle AVE 130. The field tests are expected to last until mid 2013 and thereafter, it will lie with the bus manufacturers whether they decide to begin mass production on these hybrid buses with built-in ZF technology. But we already know one thing: by that point, Shanghai will have 500,000 more inhabitants, taking its total population to around 15.4 million.”
Despite being highly effective, Germany’s transport industry struggles from **image and recruitment problems**. A study conducted by ZF and the publisher EuroTransportMedia shows the need for action.

Our analysis is the first to shed light on the entire environment in which professional drivers operate in Germany,” says Professor Dirk Lohre, explaining the unique angle of the “ZF Future Study: Long-haul truckers. The human factor in the transport and logistics market.” Lohre, author of the study, is head of the Institute for Sustainability in Transport and Logistics at Heilbronn University.

The first section discusses the general environment in the area of road transport. The second part expands on this by explaining what industry experts consider the most important current and future developments. Then the truck drivers – the people directly affected – get a chance to have their say: in a representative survey, around 600 drivers answered a questionnaire about how they perceive their occupation today and what they think it will be like in a few years time. The fourth part of the study examines why aspiring truckers have chosen a career on the road. This information was based on a survey of more than 100 entry-level truckers. An analysis of expert opinions and statements made by the parties involved reveals various areas where politicians, transport companies and their customers can take action. The main challenge is to make the trucking profession more attractive to young people. Currently, about 40 percent of the 660,000 truckers in Germany are already at least 50 years old. The average retirement age is 60, which means that by 2020, Germany could be faced with a shortage of some 264,000 drivers. Ultimately, two out of three aspiring drivers said the top reason for their career choice was that they “like to drive.”

This personal motivation can only be maintained through improved working conditions, and the results of the survey represent a first step in the right direction, says ZF CEO Stefan Sommer: “The ZF Future Study on long-haul drivers aims to initiate a broad discussion on issues that affect everyone in the industry and have a direct impact on our economy in general.”

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**Construction sites and long waits**

What frustrates drivers about their job

- Narrow construction sites with passing cars
- Unforeseeable hold-ups during loading
- Constant time pressure
- Long trips under time pressure
- Average of all statements
- Critical dispatcher instructions
- Too much time sitting during long trips
- Driving in bad weather
- Having to load and unload cargo
- Driving at night
- Traffic

**Imminent driver shortage**

Of 660,000 German long-haul truckers, around 264,000 are already over 50

- 40% Older than 50
- 60% Younger than 50

**The number one motivation: a passion for driving**

What aspiring drivers find appealing

- Like to drive 67.8%
- Interesting occupation 37.9%
- I’m my own boss on the road 36.0%
- Earning potential 32.0%
- Seeing different cities/countries 30.6%
- Responsible occupation 29.0%
- Parents are also drivers 14.9%
- Lack of alternatives 13.3%
- Other 11.5%
It’s all about the big one

In the US, deep-sea fishing is considered a real man’s sport among the well-to-do. Success depends not only on the right fishing gear but on the power and agility of the big sport-fishing yachts. With its POD 4000, ZF offers the ideal propulsion system for landing a big catch.
Anderson is at the helm of a new Viking 50 Convertible. This sport-fishing yacht, operated by ZF Marine in the US, is equipped with two ZF POD 4000 drives and Caterpillar C18 engines. Each engine delivers 1,150 horsepower to the ZF POD’s counter-rotating propellers. The 50 ft (15 m) boat can reach speeds of 40 knots (74 km / 46 mi per hour) while using up to 15 percent less fuel than comparable models with conventional shaft drives. The test boat, from the venerable yacht builder Viking of New Gretna, New Jersey serves as a showcase of the latest ZF technology for both regular customers and potential buyers.

Smooth moves on the open ocean

“Swordfish swim fast, up to 50 miles an hour,” says Captain Anderson. This is a challenge for both people and technology. What is needed is an extremely fast and maneuverable boat that, like the new Viking, can withstand even the most difficult conditions at sea. First mate Townsend Keeter stands watch of all his lines. Here, too, you need top equipment with heavy-duty rods and reels. The 21-year-old fishing pro from Virginia has, despite his youth, 12 years’ experience deep-sea fishing. And so he and his captain make a perfect team. “Fish on!” Townsend calls out as a fish grabs the bait. The battle with the marlin demands not only brute strength but also finesse – something the boat can also provide with perfect maneuverability served up by its well-designed propulsion and control systems. “To keep up with the powerhouse at the end of the line, the boat has to be able to turn very quickly,” explains Gary White, Account Manager for ZF Marine Electronics in New Bern, North Carolina. The propulsion system and controls must enable the fastest of response times, otherwise you can kiss the fish goodbye.

“The two POD drive units work independent of one another which makes this 50 foot vessel very maneuverable,” says Captain Anderson. Add to this ZF Marine’s “Sportfish Mode” software which positions the POD drives perfectly, allowing for extremely precise and direct control of the boat when backing down on a fish. For Townsend Keeter on the fishing line, this handling is key to pulling the blue marlin aboard. “Todd can really make the ship dance when chasing a fish,” says Keeter. By now, it’s clear why Americans count fishing as a sport.

Drive passes trial by water

“Deep-sea fishing boats cost between $300,000 and $8 million – or more,” remarks White. But that’s not the only reason the ZF boat expert considers pro fishing a big-money sport: “It costs fishermen between $40,000 and $100,000 each just to participate in a fishing competition.” But the fisherman with the biggest catch at a fishing tournament pockets prize money that at least partially covers the costs. 

ADVENTURE MADE EASY

“The Old Man and the Sea”: With his novel, Nobel Prize winner Ernest Hemingway cast the notion of deep-sea fishing as a school of life. Following in his footsteps, deep-sea fishing guides in the Gulf of Mexico and along parts of the East and West coasts of the US take tourists and locals out on the open sea. A five-hour trip starts at about $50 per person. You can even charter a boat with crew for several days. And it’s not very hard to do. All you need is a fishing license for the state where you plan to fish from; you can get one for little money in local supermarkets or directly at the marina.
DEEP-SEA FISHING

the fishing pros from afar on TV and admire the trophies of up to 600 kg (1,323 lb). "When the boat of a prominent builder breaks a fishing record, potential buyers really pay attention," White offers with a smile.

Battle between man and marlin

Whether professionally or just for fun, a great catch is the stuff of legend. "It's a story you later tell your grandchildren," laughs Townsend Keeter. Setting out between four and five in the morning and fishing in lonely places up to 200 km (125 mi) off the coast, only to return to port in the evening, is for most people one of the last great adventures. "The adrenaline rushes through your veins when, after hours of line trawling without a bite, suddenly the tip of the rod bends and the shriek of the reel yielding line announces the first catch," Keeter says, describing the thrill of deep-sea fishing. The parade of boats back into the marina, proudly flying their catch flags (for those fish that are caught and released), and the weighing of the largest fish mesmerizes onlookers, and this in turn heightens the fishermen's sense of accomplishment.

Captain Anderson knows from long experience that sport fishermen are very picky when it comes to equipping their boats. "They are skeptical of new propulsion systems because they worry that noise and vibrations could scare away the fish." However, tests have shown that the Viking with ZF's POD 4000 can bring in a good catch, an important selling point for buyers.

Such advances ensure that the excitement for adventurers never wanes. And those Americans less willing to venture onto the open sea can watch Captain Anderson and Townsend Keeter are nearing their goal. The battle between man and marlin will take everything they've got. They have to keep the fishing line under tension so that the catch does not pull loose from the hook. The fish makes a run from the boat, darting left and right, jumping clear out of the water at times. Townsend steadily reels in line as the Captain Todd delicately uses the 2,400 horsepower in his hands to reverse the large boat in chase. Waves crash over the transom, soaking the mate. Eventually the fish tires, and is brought alongside. The line is cut and the fish set free, but only after a few pictures and cheers from the crew. The whole thing is an exciting undertaking, but it's also not without danger. "Marlin and swordfish in particular have been known to yank fishermen overboard," says Gary White. In rough seas this is an uncomfortable dive into the water. Perhaps it is risks like that these capture the imagination of fishermen - and unite them in the conviction that deep-sea fishing is one of the last great adventures.

When a fish bites, the crew has to wear it out before it can be hauled aboard.

The quality of the fishing rod is as important to success as the reliability of the ship's propulsion system.
Enthusiasm for inspired input

It is just a mechanical component, and yet it is a high-tech masterpiece: the input shaft of the 8-speed automatic transmission from ZF. Because the manufacturing process is so complex, no other supplier is able to produce it.

Production of the input shaft for the 8HP was made possible by leaps in tool technology.

It is suddenly so quiet that the production planners in Saarbrücken can hear a proverbial pin drop. The ZF engineers from Friedrichshafen have just – for the first time – presented their plans and specifications for the input shaft of the 8-speed automatic transmission known as the 8HP. That was six years ago. “At the time, we didn’t think something this complex could actually go into high-volume series production,” recalls Patrick Porten, a process development engineer with ZF’s Powertrain Technology division in Saarbrücken. But there were no real alternatives. Had the process developers objected in the initial design-for-manufacturing workshops, it would have been difficult, if not impossible, to achieve important goals in the development of the 8HP – namely, that despite its two additional gears and even higher input torque, the 8HP had to fit into the same space as its 6-speed counterpart, the 6HP. And that would have been impossible without this very complex input shaft.

Never say never

The team in Saarbrücken quickly rose to the occasion. Dr. Hermann Becker was particularly invested in industrializing this high-tech component, despite the challenges. The head of manufacturing for ZF’s Powertrain Technology division explains: “A few years ago, we would have been butting our heads against a wall, but since 2006, we have benefited from leaps in tool technology.” He knows how to motivate engineers and workers alike in Saarbrücken. But it wasn’t just a matter of the “right” process technology. With an expected production of more than 6,000 transmission input shafts per day – soon it will be 8,900 – the cost and quality targets of all the participants in the project had to be taken into account, too. The result of the effort: a manufacturing process with a total of 16 steps. There are just as many steps today from the blank – a 50-cm (20-in) long cold-forged part manufactured from ZF steel – to the finished shaft. An advantage is that all processes, even the most technically complex ones, run at the same time.
pace. This permits uniform material flow throughout production.

**Maximum precision on a micro-scale**

An example of a particularly complex manufacturing step is the deep-hole drilling. Three bores are drilled lengthwise about 40 cm (16 in), or nearly through the entire component. These precisely applied channels later ensure, among other things, the oil supply to the bearing seats and the clutch pressure in the transmission. Haluk Mehmet, who is in charge of manufacturing for the 8HP input shaft in Saarbrücken, explains: “We use special tools with extremely long and extremely hard drills. The drills are hollow, turn at 3,900 rpm and at the same time push oil into the bores with a pressure of 140 bar (2,030 psi). The oil is used for cooling and to extract the filings.” After seven further process steps, the transmission input shaft gets its characteristic appearance through impressive rotational turning. This is where the sparks fly, literally. In developing this hard turning process, ZF – together with the machine manufacturer – broke new ground. To prevent grooves from forming on the surface, the cutting board rotates in a certain pattern. To the layman, the resulting surfaces look as smooth as glass. But the manufacturing staff know that the roughness values “still” lie at 0.002 millimeters, and that this is a major challenge at the realized quantities. That’s just 2 micrometers. For comparison, a human hair is about 50 micrometers thick.

**Fighting ridges with high pressure**

After being finished, the shafts are subjected to a high-pressure washing process. There, they are washed and deburred with up to 500 bar (7,252 psi) of pressure. Anyone who paid attention in physics class knows that 500 bar is equivalent to a water column of 5,000 m (3.1 mi) in height. A tour around the input shaft production facility in Saarbrücken reveals that product quality at ZF is not just thanks to the engineering corps of the Group. Rather, it is the result of the perfect teamwork of the product developers on one side and the process engineers and process professionals on the other. Precisely because the input shaft plays such an important role, the question arises as to how the production of this high-tech compo-
Rejuvenation for a curvy classic

With a detective’s flair – and, of course, close attention to detail – specialists from ZF have refurbished the **gearbox of the pre-war BMW 328**. By doing so, they have substantially prolonged the life of this historic racing legend.

**Georg Hackl** is a notorious perfectionist. The three-time luge Olympian and 10-time world champion was known to be a bit of a geek when it came to improving his technique and his equipment on the ice chutes of the world. In May this year, “Hackl Schorsch”, as he is called, made his asphalt racing debut in the world-famous Mille Miglia, a 1,000-mile race from the northern Italian city of Brescia to Rome and back. “Not your ordinary joy ride,” remarked the former sledding dynamo before setting off in his black vintage BMW 328. BMW sent 12 of these legendary racers from the 1930s to this year’s Mille. What makes this vehicle so special? “It set the benchmark for lightweight construction and vehicle aerodynamics and laid the foundation for today’s success in this field,” says the research chief at BMW, Dr. Herbert Diess, enthusiastically. But this curvaceous automotive jewel hasn’t been at the top of its game in recent years. That’s because the original partially synchronized Hurth G 328 gearbox has fallen out of date, and there’s no replacement in sight. To make matters worse, any gear-wheel kits still around today have been modified so much over the years that they bear only a distant resemblance to the originals.

**Strict requirements for the gearbox**

Primarily to satisfy the strict requirements of the world’s vintage car watchdog, FIVA (Fédération Internationale des Véhicules Anciens), BMW commissioned the ZF Tradition department to remanufacture the gear-wheel kits of the Hurth gearbox originally used in the BMW 328 racing car. The idea was to forgo the fully synchronized special gearboxes that had until now been used for the Mille Miglia and criticized by compliance officers. And so, in
December 2010, the race to recreate the lost automobile racing technology began. Under the direction of Janine Vogler who heads up Coordination of Technical Services at ZF in Friedrrichshafen, a four-person team was formed to tackle this remanufacturing challenge. BMW sent them a properly functioning Hurth gearbox for use as a demonstration model. The ZF engineers started by disassembling the badly worn gearbox (which clearly had been modified over the past few decades), cleaning the component parts, and analyzing the design. At the same time, they looked for the design drawings and other kinds of useful original documents. But, unfortunately, the engineers found no evidence of the desired G 320 and G 328 gearbox types in the city archives of Eisenach, where BMW had built the 328 before the war. Instead, they found drawings of the G 321 model, which was built in the same way.

**Reconstruct – and improve**

Ultimately, these drawings and the components of the disassembled historical model helped the gearbox specialists come up with a parts list. “Not an easy task,” recalls Wolfgang Ammann, who was in charge of technical support for the remanufacture at ZF. “Due to the demanding requirements and special conditions, the remanufacture was basically like creating a prototype from scratch.” Another feature of the project: originally, the Hurth 328 was designed for a maximum engine output of 50–80 hp at 4,750 rpm. Too little. “Today, the BMW 328 used in vintage racing has to deliver up to 130 hp at up to 6,000 rpm,” says Janine Vogler, adding: “So we had to reinforce and optimize the gearbox.” As challenging as it was, reconstructing it was alone not enough.

“Partly because of a lack of space and partly for cost reasons, the gearbox was only partially synchronized at that time,” explains Wolfgang Ammann. What that means is that the first and second gears in the Hurth 328 were not synchronized, so that when shifting gears, the driver had to double-clutch. The third and fourth gears, however, were cone-synchronized. Only in the ‘40s, according to Ammann, did the development of synchronization come into fashion – too late for the approval of the vintage racing compliance officers for the classic car from the ‘30s. A weakness of the original gearbox has always been the helical wheel in the third gear. “We were able to optimize that as well as the bearing of the second gear wheel through a newly made gear bearing,” Ammann says, describing two improvements. The ZF team also set additional shaft sealing rings on the input shaft and the input flange, strengthened the bearings, and optimized the shifting system. They did all this in close coordination with the FIVA. To achieve a higher load capacity, the engineers replaced some of the grey-cast iron and aluminum components with modern copper-zinc alloys, as well as with modern ZF steel. In addition, heat treatment methods increased the strength and lifetime of the torque-transferring components in the gearbox replica significantly.

After 13 months of research, development, and construction, the ZF engineers were finally able to install the first gear-wheel kits in the used housings in February 2012: a major moment for project manager Vogler, but also for drivers like Georg Hackl. Since shifting with partially synchronized gearboxes requires some getting used to, two employees from ZF trained Hackl and other BMW drivers in the Mille Miglia on the BMW test track in Aschheim near Munich. Hit the clutch, shift and go – sounds easy, but it requires very instinctive hand and foot movements that are smooth and fluid.

**Successful performance**

In May 2012, the 12 BMW 328s from BMW Classic with the enhanced Hurth gearbox faced their trial by fire in the Mille Miglia. A total of 382 vintage cars took to the starting line, but about a quarter of them did not reach the endpoint. The vehicles from BMW Classic, however, did a good job, a very good job indeed: Giuliano Canè and passenger Lucia Galliani were second over the finish line. “We are delighted about taking second place,” says Karl Baumer, head of BMW Classic. “More important, however, is that all the drivers made it back safely and that the cars survived the extreme race event without any major problems.” Hackl Schorsch ranked 231st and was “completely thrilled” – by both the technology and the geeks behind it. What a compliment from the mouth of a notorious perfectionist. ■
If you’ve heard it once, you’ve probably heard this fuel-saving tip a thousand times: be gentle with the gas pedal, shift up early and run the engine at as low a speed as possible. And thanks to modern turbo and diesel engines, drivers can do just that without sacrificing the joy of the ride. That is because modern drive systems pull strongly even at low speeds. Still, there is a downside. After all, diesel engines with few cylinders aren’t exactly the epitome of refinement. When driven at low speeds, a diesel engine usually produces more rotational oscillations than a gasoline engine. It transmits these so-called torsional vibrations to the powertrain, from where they are transmitted to the whole body, and unless something is done to counter them, they create an unpleasant hum and rumble. Not only that, the vibrations manifest themselves as gear grinding when shifting and as transmission rattling when idle. To prevent this from happening, you need effective vibration damping.

Smaller through shared masses

The firing of the cylinders is what causes the rotational movement of the crankshaft, which is transmitted to the powertrain, nonuniformly – sometimes faster, sometimes slower. When driving at low engine speeds – for example, almost at idle – the vibrations from the drive are particularly intense. Although torsional dampers are installed in the dual-mass flywheel, taken to a whole new level in the search for more fuel-efficient internal combustion engines with fewer cylinders and smaller displacements. Thanks to adjustable turbine blades in the turbocharger (variable turbine geometry), modern turbo engines already generate high torque at low speeds. Furthermore, longitudinal transmissions with additional gears allow for low rpm at high speeds. And with so-called “dynamic downsizing,” individual cylinders can even be cut off completely at partial throttle. All of this saves a lot of fuel while still guaranteeing good driving dynamics. So downsizing means energy efficiency without sacrifice – a win-win situation for drivers and the environment.

All-around winner

Modest engines with smaller displacements are increasingly replacing larger variants. The dual-mass flywheel ensures that they nevertheless deliver a high level of comfort.

Even in smaller vehicles with fuel-efficient engines, the dual-mass flywheel makes for significantly quieter operation.
Diversity-driven success

Employees from numerous countries with at least as many cultural backgrounds work in multinationals all over the world. Companies that transform their employees’ unique experiences and views into know-how end up gaining a huge competitive edge.

B rigitte Kasztan, a diversity manager at Ford in Cologne, sums up the tasks of her team in just three phrases: “We contribute to the increased loyalty and productivity of our employees and we pitch our ideas to marketing and development. It’s like I always say: diversity management sells cars.”

Simply put, diversity management is the art of understanding individual differences among employees or clients and turning these differences into success factors for the company. It works, for example, by encouraging gifted employees in nontraditional ways or offering special services to target groups. At Ford, the Turkish Resource Group acts as a representative for immigrant employees; now one in every three of the company’s trainees are a part of the group. The Turkish Resource Group also helps in addressing other select ethnic minorities. Ford Transit’s sales rose by 5 percent as soon as the group was able motivate Turkish vegetable vendors at Cologne’s wholesale market to promote Ford. Cultural and other specificities are becoming more and more important at Ford. “The company’s European management board holds three meetings on the subject every year,” reports Kasztan.

Encouraging cultural diversity
What already works well at the lower levels of a company is seldom reflected in its upper echelons. More concretely, minorities are underrepresented in upper-level positions: Asians are, for instance, pretty hard to find in Western industrial companies, while Europeans or Americans are few and far between in Japanese ones. However, companies that do open up their doors to foreigners reap the benefits of the cultural diversity it generates. One study by the global management consulting firm McKinsey confirms the benefits of diversity management. According to the study, German companies with a disproportionately high amount of women and foreigners on their management board made 66 percent more in returns than companies whose top managers...
Different value systems can cause misunderstandings. Even a simple motion of one’s hand during a conversation can be if the recipient interprets the motion differently from the way the person making it intended. Seminars provide one way of helping people become more sensitized to other cultures. Take Deutsche Bank as an example: one in 10 of its 100,000 employees from more than 140 nations do not work in their native country. “We make it a point to encourage diversity because if it weren’t for the innovative strength and variety of our employees, we wouldn’t achieve our goals,” says Ulrich Schürenkrämer, Member of the Executive Board at Deutsche Bank Corporate Finance Germany. Every year roughly 2,000 executive managers learn, through classic question and answer sessions and roll-playing, about what unconscious thought patterns are and how they can be changed. “Achieving economic success,” explains Kerstin Pramberger, a project manager, “is not about influencing people in terms of a business strategy: it’s about listening to and understanding them more than anything.”

Better market access

Just sending employees abroad is not enough for a company to open its doors to other cultures. If a company wants to see growth in important markets, such as China or India, it should consider local residents for leadership positions. The rule of thumb is that companies who recruit candidates with high potential and in-depth knowledge of their culture have a big advantage. “A central element of any global company’s HR strategy should be to work with international talent pools,” recommends Till Lohmann, an HR expert at the professional services firm PricewaterhouseCoopers. That way, applicants are evaluated and selected using the same criteria in all countries. “For ZF as a globally active company, working across national borders is extremely important,” explains Jürgen Holeksa, Chief Human Resources Officer at ZF. “Knowing the ins and outs of a culture is a success factor of the utmost importance to us when selecting and developing our staff. Job rotation in foreign locations and intercultural training sessions are some other core elements of our HR strategy in terms of management development.”

As sensible and desirable as it is to have management-level employees with backgrounds that are as culturally heterogeneous as possible, this diversity can also lead to difficulties.

Women and foreigners and spur business performance

Cultural diversity pays off

Comparison: The top 25% of companies with the most women/foreigners on the executive board vs. the bottom 25% of companies with the fewest:

<table>
<thead>
<tr>
<th>Country</th>
<th>Return on equity</th>
<th>Difference</th>
</tr>
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<tbody>
<tr>
<td>Germany</td>
<td>10.3%</td>
<td>66%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>10.2%</td>
<td>66%</td>
</tr>
<tr>
<td>US</td>
<td>10.8%</td>
<td>56%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>EBIT (earnings before interest and taxes)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>22.8%</td>
<td>22%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>19.0%</td>
<td>29%</td>
</tr>
<tr>
<td>US</td>
<td>16.4%</td>
<td>36%</td>
</tr>
</tbody>
</table>

*Figures in percentages.*

The life of a turbine in time-lapse

Thanks to an elaborate research project, a team from ZF Wind Power has succeeded in analyzing the exact loads for wind turbine gearboxes. The team’s accomplishments not only benefit development engineers, but wind turbine operators, too.

There’s no doubt. They’re impressive in size. Just for comparison: the huge trucks currently on the roads in some European countries, commonly known as mega trucks, come in at just over 25 m (82 ft) in length. The test stand currently being used in the ZF Wind Power workshops in Lommel (Flanders) eclipses this by another 10 m (115 ft overall). Its performance also outshines the competition: “With an energy capacity of 13.2 megawatts, this test stand is without doubt one of the best-performing in the wind energy sector,” Sonja Goris explains with pride. This test stand is a key feature of a research project that mechanical engineer Goris has been overseeing for the past four years. “We started the project back in 2007, with the aim of significantly increasing the reliability of wind turbine gearboxes and testing their durability,” says the Belgian. A project which should be popular among owners of wind power farms, since in the past the gearbox was often a weak link in the chain for wind turbine powertrains. This has resulted in system failures and costly repairs – something Jürgen Holzmüller knows only too well. The engineer is a spokesman for 8.2 Group, whose experts and engineers have been inspecting wind turbines for nearly 10 decades. With more than 15,000 rotor assessments under their belt, the 8.2 team is one of the most experienced wind power surveyors in Germany and Europe. “The quality of wind turbine
Gearboxes have certainly improved in recent years, but I still believe there’s more research to be done,” says Holzmüller, adding: “Wind turbines are designed to last for 20 years, so we need gearboxes with similar staying power.”

**Theory meets practice**

ZF Wind Power teamed up with the University of Leuven for Kratos, a research project named after the god of strength in Greek mythology. For the past few years, a team of 15 people has been working on Kratos at ZF Wind Power. The size of the team alone testifies to the research’s importance. The project group constructed an impressive test stand, but that was far from its only exciting development. In most places, test stands and test methods where gearboxes can be started up and tested at different speeds and load levels – especially overloading – have become standard. “It was important to us to make the dynamic processes that occur in wind turbines palpable in a testing situation and to better understand the impact of these processes on the inner mechanisms of a gearbox,” emphasizes Sonja Goris, an engineer on the team. The development engineers at ZF chose a twin-track approach for the project. They used multi-body simulation models to help them understand which dynamic loads would actually impact wind turbines in real life. “To put it in layman’s terms, the models are mathematical methods used to simulate the constantly varying loads in wind turbines,” Goris explains. Finally, the team then reviewed the results of the simulation calculations on the test stand. Goris adds, “We were able to recognize within a relatively short period of time whether the simulation models would yield the same results as the test stand measurements and thus reflect the real-life situations.”

**Returning to the tried and true**

A similar procedure took shape during the second part of the Kratos project’s testing approach, called DORoTe, an abbreviation for the Design Operational Robustness Test. “This is a new test procedure that combines a shorter version of the lifetime tests usually performed in the automotive and aviation industries with a wind turbine’s typical load conditions,” says Goris. Her team primarily simulated the first years of a wind turbine’s operational life because, statistically speaking, this is the time when the most errors usually occur. On the 13.2-megawatt test stand, for example, two years of operating time could be cut down to four months thanks to the DORoTe approach. The engineers verified this using two standard gearboxes that had 2.1- and 3-megawatt power capacities, respectively. Goris adds, “Since we already know how wind turbine gearboxes look after two years of operation, we were then able to compare them to the test stand gearboxes and see whether the lifetime test was successful or not.”

**Clients win**

Sonja Goris’ boss is also pleased. “We’ve acquired a lot of valuable knowledge and new techniques with Kratos that will help put us a step ahead of the competition,” says Dr. Eckart von Westerholt, who is in charge of Research and Development at ZF Wind Power. Now ZF’s clients can use this gearbox model as a building block for their own wind turbine simulations. What kind of feedback is ZF getting? “We know that our clients appreciate the DORoTe robustness test – especially for future turbines with capacities of more than 6 megawatts,” says von Westerholt. If everything with the new gearbox models goes as planned, it will have been a Greek deity who helped the wind industry lower the cost of generating electricity and make wind energy an even more competitive option. Thank Kratos! ■
A colorful history

It’s not enough to make good products; you have to sell them as well. Here, we showcase a small selection of posters and print ads from the archives of ZF and its former subsidiaries.

It was the automotive pioneer Henry Ford who once complained: “Half the money I spend on advertising is wasted; I just don’t know which half.” At the start of the last century, advertising was still done on a trial-and-error basis. That was, to say the least, baffling to the American entrepreneur who perfected assembly-line technology in the auto industry, just as it was to many of his contemporaries. And yet advertising persisted, even in hard times. “In 1917, in the throes of World War I, we saw the first advertisement for the company, founded just two years before,” says ZF archivist Gisela Mattes. The motif: a huge factory with smoking chimneys – a proclamation that the still-small company was taking off, literally and figuratively, in the tranquil city of Friedrichshafen.

Demonstrating strength and power

“In those days, advertisements were often larger than life and painted a rosy picture of what customers could expect from the company featured. Competence and emotion came together and became the core of a brand promise, which was characterized by trust and optimism,” explains Rupert Wild, a lecturer in public relations and communications management at the private university Campus M21 in Munich.

Score with integrity

“Advertising at ZF was initially handled by top management,” says Mattes. “In the ’20s, Alfred Graf von Soden-Fraunhofen, the first director and from 1921 the chief executive of Zahnradfabrik Friedrichshafen AG, personally oversaw the company’s image vis-à-vis clients like Magirus, MAN and Benz.” As such, the posters and print ads were marked by an air of respectability and gravitas. One ad from the ’20s, for example, featured a man with a precise side parting in a white lab coat holding two gears so that they meshed. “These are gears as they should be!” he proclaims. A little research revealed that the “model” actually came from within the company. “It was Baron Hubert von...”
Thungen, who served the Zahnradfabrik AG Friedrichshafen a.B. for many years,” Mattes says, smiling. But no matter what the motif — whether it be people, driving situations or technical attributes — the ZF logo, registered as a trademark in 1917, has changed little over the years. In the beginning, the logo was sometimes displayed on a red background, sometimes on a dark background, sometimes a bit more angular, sometimes a bit rounder — all depending on the zeitgeist. For brand expert Wild, the continuity of the logo is especially important: “It’s good that the visual identity was not diluted over time. Only in this way can you achieve lasting and valuable brand essence.”

**Advertising goal: build on brand awareness**

In car magazines, ZF sought to convince customers of the quality of its products and the strength of its innovation with catchy slogans and images. But in the ’50s and early ’60s, advertising primarily served to boost brand awareness. “In view of Europe’s post-war reconstruction and increasing exports, sales promotion was not on ZF’s agenda. Annual sales growth of about 20 percent was already quite common,” says Mattes. Instead, advertising was used to fly the flag on the markets — and often tongue-in-cheek. “Comme dans du beurre” — buttery smooth gear changes, for example, was the message in the ’70s in the French-speaking market. To symbolize the smoothness of modern synchronization technology in the ad, a gearshift sticks out of a piece of golden butter. Unlike the parent company, the subsidiaries that emerged over time usually communicated directly with consumers. In the ’50s, there was a youth sitting in front of a young lady who is perched daintily on her moped in a petticoat typical of that time known as the Wirtschaftswunder, or “economic miracle” era. But the friendly look of Adonis is directed at the engine. The slogan: “Eye on the Sachs engine.” “I’m fit on all fours” is how Boge & Sohn from Bad Godesberg advertised its automotive products. And with the slogan “When you’ve got it, you’ve got it” — in this case, shock absorbers and level regulators such as the Boge Nivomat.

**Of ballerinas and control arms**

The slogan “Lemförder makes cars agile” was the promise of the Lemförder metal products company that ZF took over in 2003. Along those lines, the suspension component specialists once photographed a ballerina with control arms for the 75th anniversary ad of the Osnabrück Section of the Association of German Engineers. But did the association members get the message?

“Socio-cultural research today, on the basis of empirical data, reveals a complex picture of markets, market participants and market forces,” says marketing expert Wild. Just the answer Henry Ford would have wanted.

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**MORE INFORMATION**

www.zf.com, click on “Company,” then “Tradition”
Moving the masses

We live in the era of mobility. This doesn’t just apply to people making their usual daily commute, but also to increasing numbers of travelers. It’s a challenge for the transport and tourism industry.

More than double

The amount of money (+117 percent) is being spent on travel today compared with the beginning of the millennium. $1.03 billion was spent on travel in 2011 alone, making it one of the biggest economic sectors.

Around 7,000

Suites can be found inside the Venetian Resort Hotel in Las Vegas, making “American Venice” the biggest hotel in the world. But surprisingly, tourist hive and desert city Las Vegas has even more of these swanky retreats to offer, housing eight of the world’s ten biggest hotels.

With a 51-percent share of the transport market, flying is now the most common way to travel, followed closely by driving a car (41 percent). People travelling for leisure very rarely use railways anymore. Nowadays, only one in fifty passengers travels by rail to reach their destination.

One in two travelers went globe-trotting for personal pleasure in 2011. Those on business trips made up just 15 percent of all travelers.

9,660 kilometers

(6002 mi) is the length of the longest bus route in the world. It runs from Caracas in Venezuela to Buenos Aires in Argentina, stopping off at Columbia, Ecuador, Peru, Bolivia and Chile along the way.

250 people

Can be transported by the longest bus in the world. This 28-m (92-ft) long, double-articulated bus carries passengers from A to B along a 22.4 km (14 mi) BRT route in the Brazilian city of Curitiba.
Setra is still an important customer of the Group. It features EcoLife and AS Tronic transmissions in its city, intercity and touring buses. They make the drive train more economical, more comfortable and more efficient. Also included in many models are ZF axles and the Servocom power steering system from ZF Lenksysteme.

Kässbohrer also greatly valued modern driveline technology, which he got from ZF. The specialist for driveline and chassis technology introduced synchronized transmissions for use in buses and trucks at the beginning of the 1950s. The Setra S10 came with the Allsynchro-Getriebe S 5.33 transmission; ZF produced some 170,000 units from the AK/S 5 33 series between the years 1950 and 1970. The synchronization eased gear shifting considerably while rendering unnecessary double-clutching, a technique typically required at the time. The Setra was equipped with a Gemmer steering system from the ZF plant in Schwäbisch Gmünd.

In 1951, Otto Kässbohrer developed the first bus with a self-supporting body. That was the beginning of a great success story. While other manufacturers were still using heavy and bulky ladder frames more usually seen in trucks, Kässbohrer built light buses with passenger car-like comfort. In branding this revolutionary new design, the German designer picked the name Setra, derived from the German “selbsttragend,” meaning “self-supporting.”

A major supporting role

A bus body that supports itself – now, that was a revolutionary concept! With his Setra coaches, Otto Kässbohrer paved the way in the early 1950s for the bus to go from an uncomfortable people carrier to a comfortable and popular means of transport. The driveline technology came from ZF.

In 1953, the bus industry marveled at the lightweight Setra S10. Its self-supporting design set new standards for payload, performance and fuel economy.
I’m with ZF.
Engineer and Easy Rider.

I enjoy motorcycle riding as a hobby. My mind is free and clear. I just feel great. Especially in this famous region where I live and work. Riding on the legendary Blue Ridge Parkway with its beautiful scenic views is breathtaking. I have a great life and a great job. The doors are always open and everybody helps each other out. My name is Charles Jenkins and I’m working as a quality engineer. For more about me, what I do, and why I really enjoy working at ZF, go to www.im-with-zf.com.