

ZF

Your partner for the sustainable
mobility of tomorrow!

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Autonomous Transport Systems



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Public Transport in Change

Imagine if you never had to consult a bus or train schedule ever again. Imagine if transportation in cities, their suburbs and surrounding areas was available to you exactly when you need it. Imagine if the frequency of services was geared towards flexibility, because smaller vehicles ran “on-demand” in addition to buses or trains. And now imagine if this did not require huge investments, if available space was used optimally, and if the city and its metropolitan region became more pleasant for people to live in?

Imagine no more. Traditional public transportation is changing and expanding. Clean and modern mobility requires one thing above all: **sustainable, flexible,**

and individualized transport concepts that ease the pressure on urban districts and make public transport readily available in rural areas.

With its autonomous transport system, ZF makes such a concept reality. A network of electrically powered, driverless shuttles, with on-demand scheduling and seamless connections to other public transport systems such as buses and trains, represents a true alternative to privately owned cars. These small vehicles can even be operated economically on less busy routes – and for longer as well. With fully electric drivetrains, they are also a more environmentally friendly alternative to established vehicle types.

Our solution: autonomous transport systems



Eases pressure
on urban zones



Adds true flexibility
to public transport



Reduces CO₂
emissions,
uses recyclable
materials



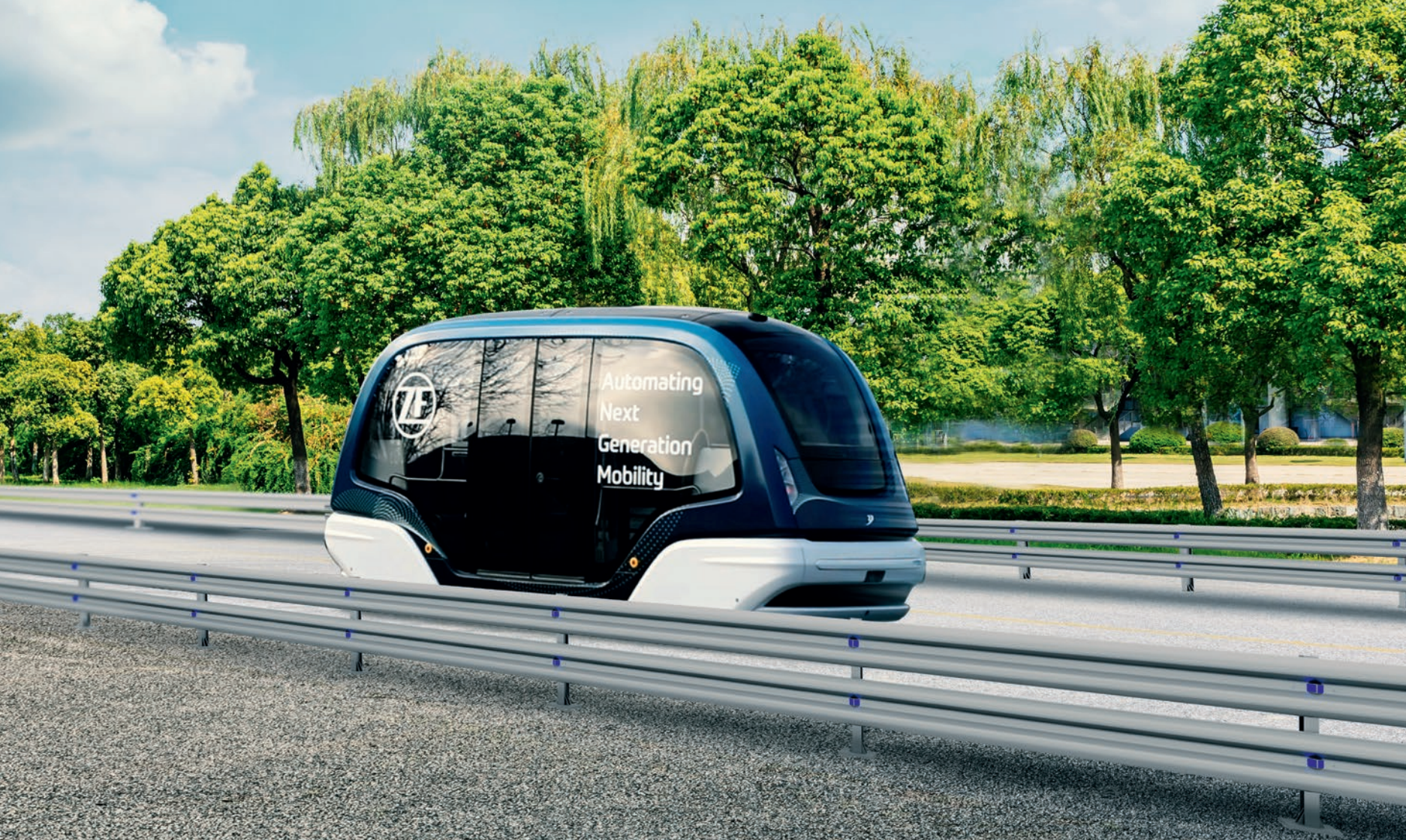
Brings more space
for city life and less
congestion



Provides better
connections for cities
and their region



Enables longer
operating hours and
on-demand frequency



Segregated Lane

Fast, sustainable, efficient –
and already available today.

Autonomous transport systems are not visions of the future. With our SL shuttles, we offer a clean, safe and tailored-to-local-markets transport solution which can already be deployed today. This system has been extensively tested: In various projects around the world, these vehicles have already covered over 100 million kilometers autonomously and entirely without the help of human operators. This reduces costs and lets the shuttles run around the clock.

The SL system brings plenty of other advantages. In their own lane separated

from flowing traffic, the vehicles steadily maintain a comfortable speed. When passenger volume is high, their service frequency can be increased on the fly. At stops, fast-charging stations ensure that the vehicles never run out of power. And because the shuttles use a magnet system built into the road surface for localization, they can travel safely in any weather without breaking down – whether on a closed-off site such as a business park or as a feeder from far-flung suburbs to the next train stop.

Autonomous Transport Systems by ZF

Facts, figures and recent projects

In operation since **1997**

More than **100** million kilometers covered by autonomous shuttles

More than **14** million passengers carried

Nearly fail-safe system availability of **99.7%**

Rivium Business Park

Since 1999, a precursor system has been transporting 3,000 passengers a day to the Rivium Business Park in Rotterdam. The service on the almost two kilometers long route is currently being converted to the GRT3 shuttle generation.

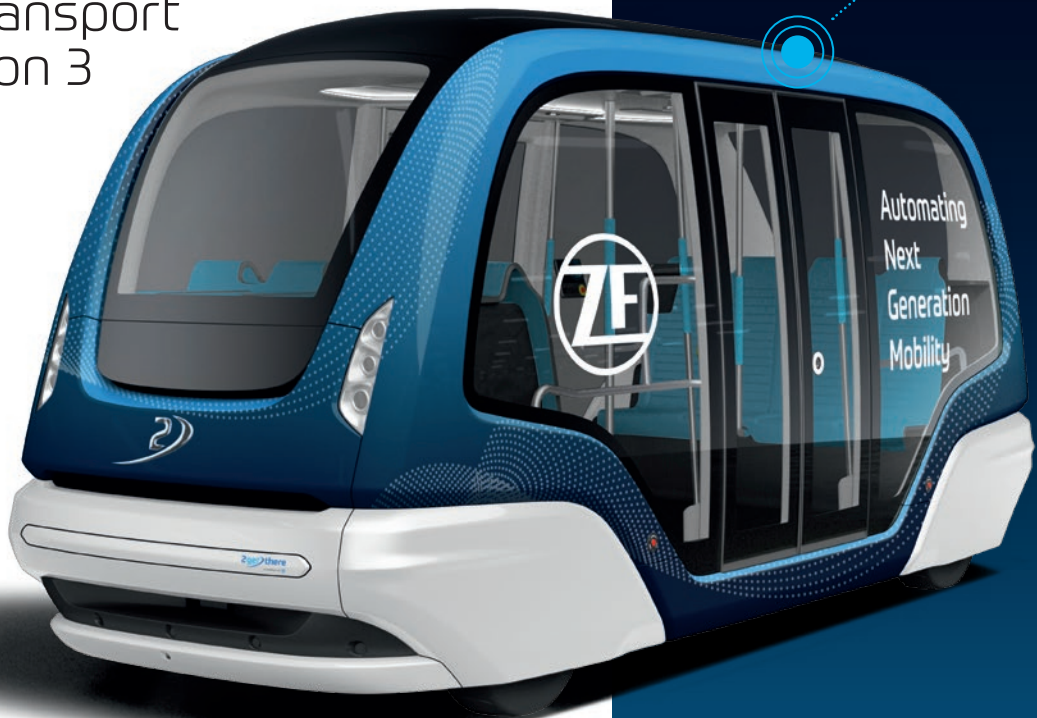


RABus

The RABus project (Real Lab for Automated Bus Services in Urban and Rural Public Transport) is currently establishing a public transport system based on electrified and automated vehicles in Mannheim and Friedrichshafen. The system will be up and running by the end of 2023 – including shuttles by ZF.

Technical Specs

Group Rapid Transport
(GRT) Generation 3



GRT3

Entry Height	370 mm
Overall Vehicle Length/Height/Width	6,044 / 2,784 / 2,100 mm
Empty Weight	4,500 kg
Total Weight	6,650 kg
Turning Diameter	15 m
Total Number of Passengers	22
Total Number of Standee Places	14
Total Number of Seats	8
Battery Capacity	36.8 kW/h
Charging Infrastructure	CCS2/Induktiv
Operational Time	24/7 with installed charging infrastructure
Vmax	40 km/h



Main advantages

- **Bi-directional driving:**
No additional turning space necessary
- **All-Wheel-Steering and „Crabbing“:**
Enables precise driving maneuvers towards platform
- **Heating and ventilation system**
with air cooling up to 40 degrees Celsius
- **Rapid charging at stops:**
Continuous operation of the shuttles prevents breaks due to long charging times; no replacement vehicles necessary

Full-Range Provider ZF

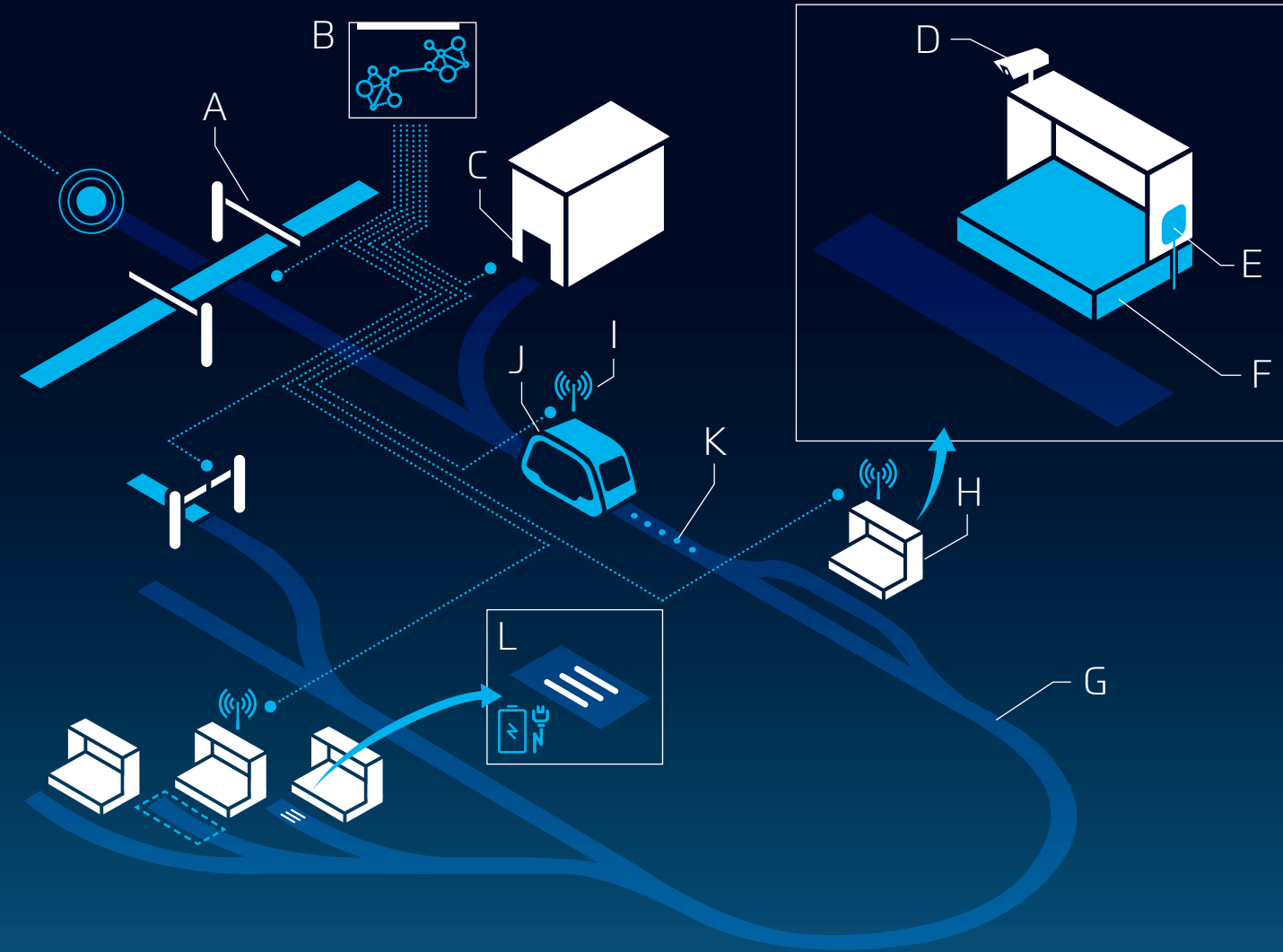
Autonomous shuttle systems can be flexibly integrated in both urban and rural areas. They complement and support existing public transport systems. **We offer a comprehensive, sustainable and modern Mobility-as-a-Service solution!**

There is a lot to consider when designing and setting up a completely new autonomous shuttle system. But don't be afraid of complexity: we are at your side as your central point of contact. With 20 years of experience and access to an established, efficient, and international network of partners, we take care of every detail. We offer an "one stop shop" solution for the urban mobility of tomorrow.

We also support you in the expansion of shuttle systems in use and find a customized solution for modernizing existing infrastructure. In doing so, we take care to make optimal and versatile use of readily available resources, such as existing tarmac.

Scope and ecosystem
of an **autonomous
transport system.**

- A** Barriers
- B** Fleet management (TOMS)
- C** Operation and maintenance facilities,
including control room and workshop
- D** Monitoring cameras (integrated in TOMS)
- E** Information terminal (at each stop)
- F** Platform
- G** Route
- H** Stop
- I** WiFi
- J** Autonomous shuttle
- K** Magnets (localization technology)
- L** Fast charging system shuttle



AD Systems by ZF

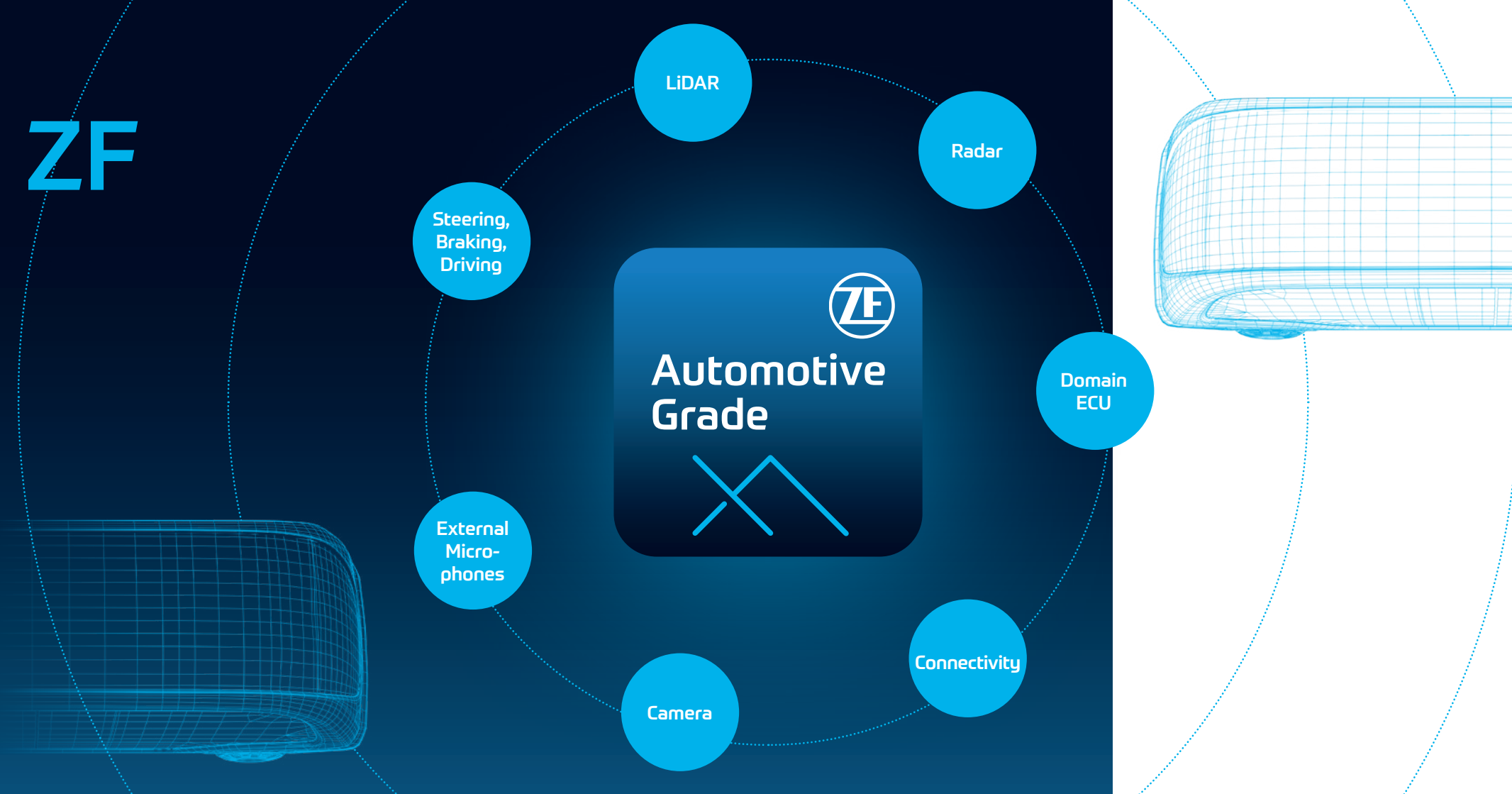
Truly “automotive grade”:
Our components are developed
and manufactured according to
the highest industry standards.

The ZF AD system is a result of fine-tuned interaction between individual components, and this is what makes our shuttle truly intelligent. It is developed according to the highest automotive standards for safety and comfort, then validated and approved in accordance with legal requirements.

Like hardly any other company in the industry, we can act as a single source for all technologies necessary to realize Level 4 autonomous driving: Sensors that digitally monitor the vehicle environment and interior; powerful, AI-based control units that fuse

incoming data into a detailed overall picture; innovative software that uses this data to calculate optimal commands for operation in real time. Precise actuators for chassis, drivetrain, brakes and steering that execute these commands precisely. And connectivity solutions that enable vehicles to communicate with each other and with the infrastructure.

Maximum comfort. Maximum safety.
All this and more can be found in ZF's Autonomous Driving portfolio.



Financing

Like any fleet, our autonomous shuttle systems need tailored financing solutions. Leasing is an option that ensures a high degree of planning security and liquidity for you as the operator. We take advantage of current leasing trends and offer attractive

leasing models for our autonomous shuttle systems via a partner, through which financing is customized to your possibilities and needs. Financial share models depending on certain project milestones are also conceivable.



Leasing as an essential part of ZF's extended range of services with partners



Customized financing depending on customer needs

Leasing process



Always on Site for You



9,000 + Employees
115 / 220 + Countries / Locations
90 Logistics centers
10,000 + Partners
90 Remanufacturing sites

Maintenance and service

For maintenance and service, ZF Aftermarket continues the OE expertise, know-how and innovation of the ZF Group. With customized solutions, high-quality parts, and first-class service offerings, ZF Aftermarket supports you in the operation of your autonomous transport system.

- Global Service Organization of ZF
- Own nationwide workshop network
- Competence center for the maintenance of autonomous transport systems
- Diagnosis and remote maintenance
- 24/7 Hotline
- Spare parts logistics
- Extensive training offer

