Intelligent Drive next LEVEL

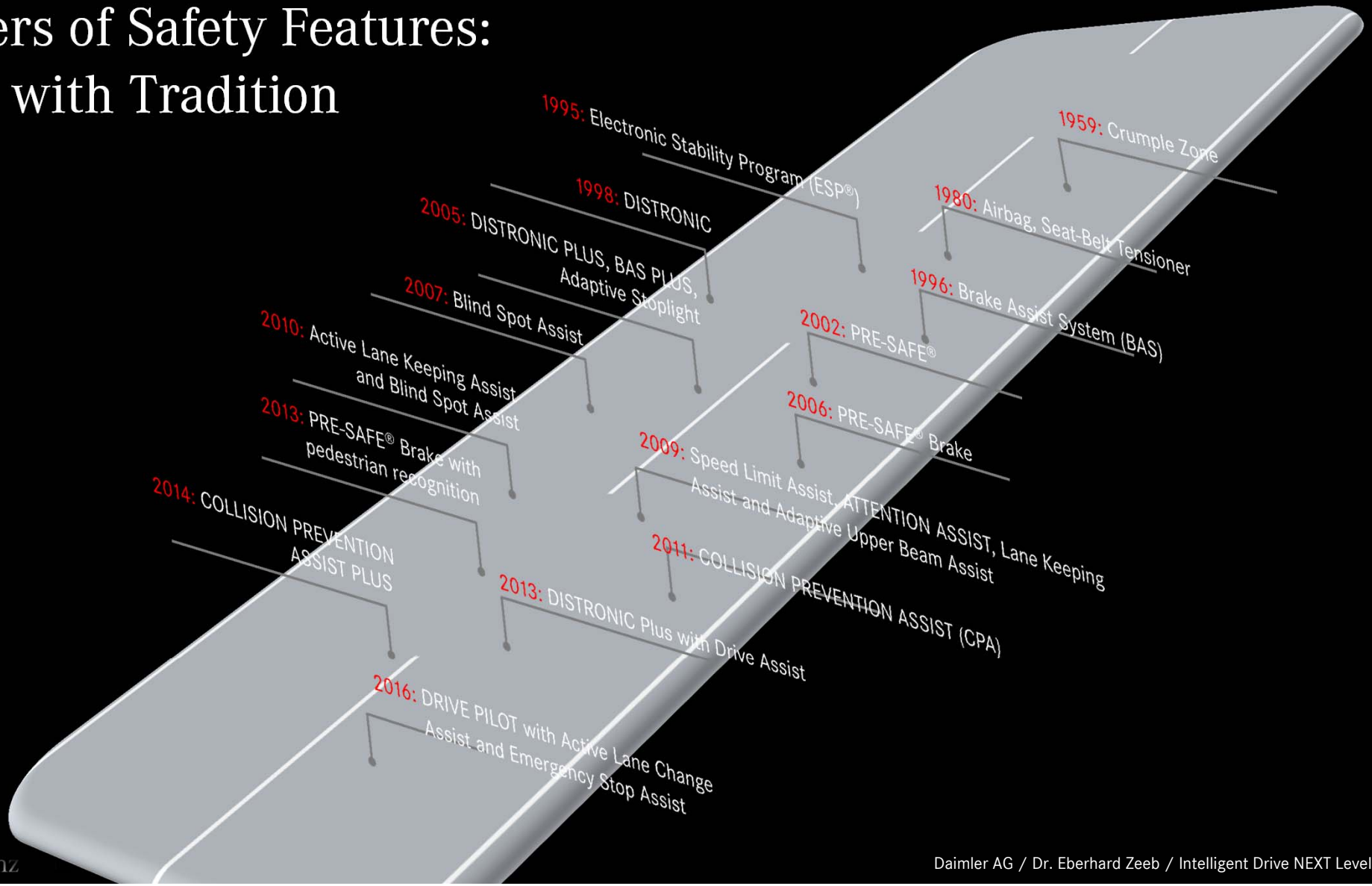
on the way towards autonomous driving

Daimler AG
Dr. Eberhard Zeeb
Senior Manager Function and Software Driver Assistance Systems

Mercedes-Benz
Das Beste oder nichts.


Pioneers of the Automobile
Bertha Benz 1888
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Pioneers of Safety Features: Safety with Tradition

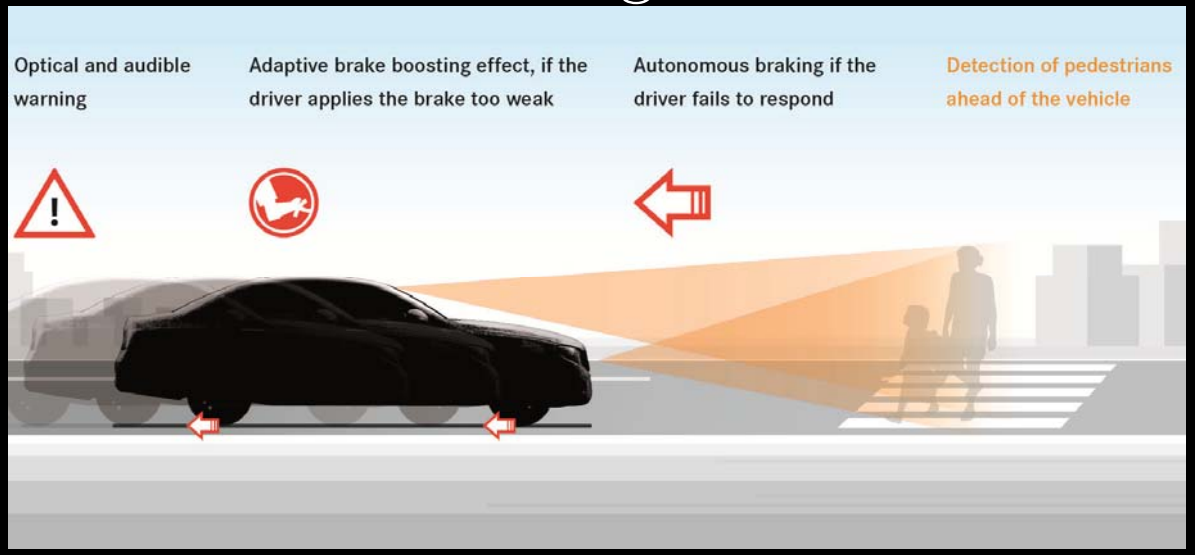


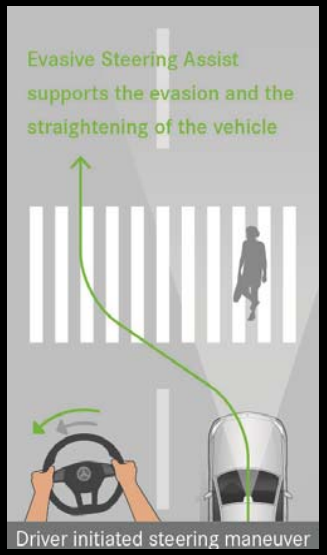
Mercedes-Benz

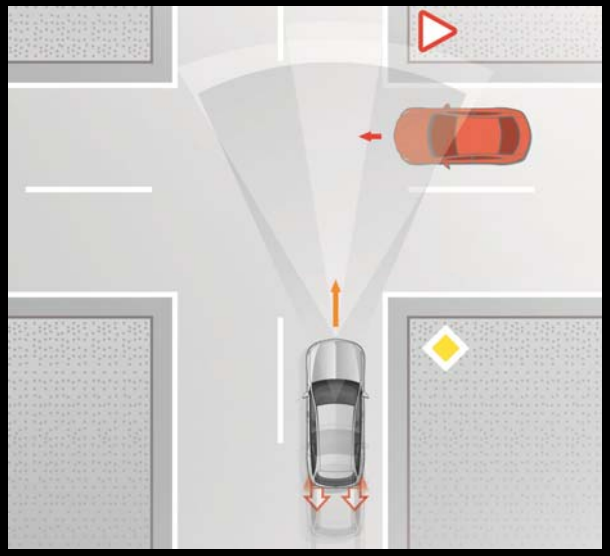
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Intelligent Drive: State-of-the-art in automated driving

Active Brake Assist with Cross-Traffic Function and Evasive Steering Assist





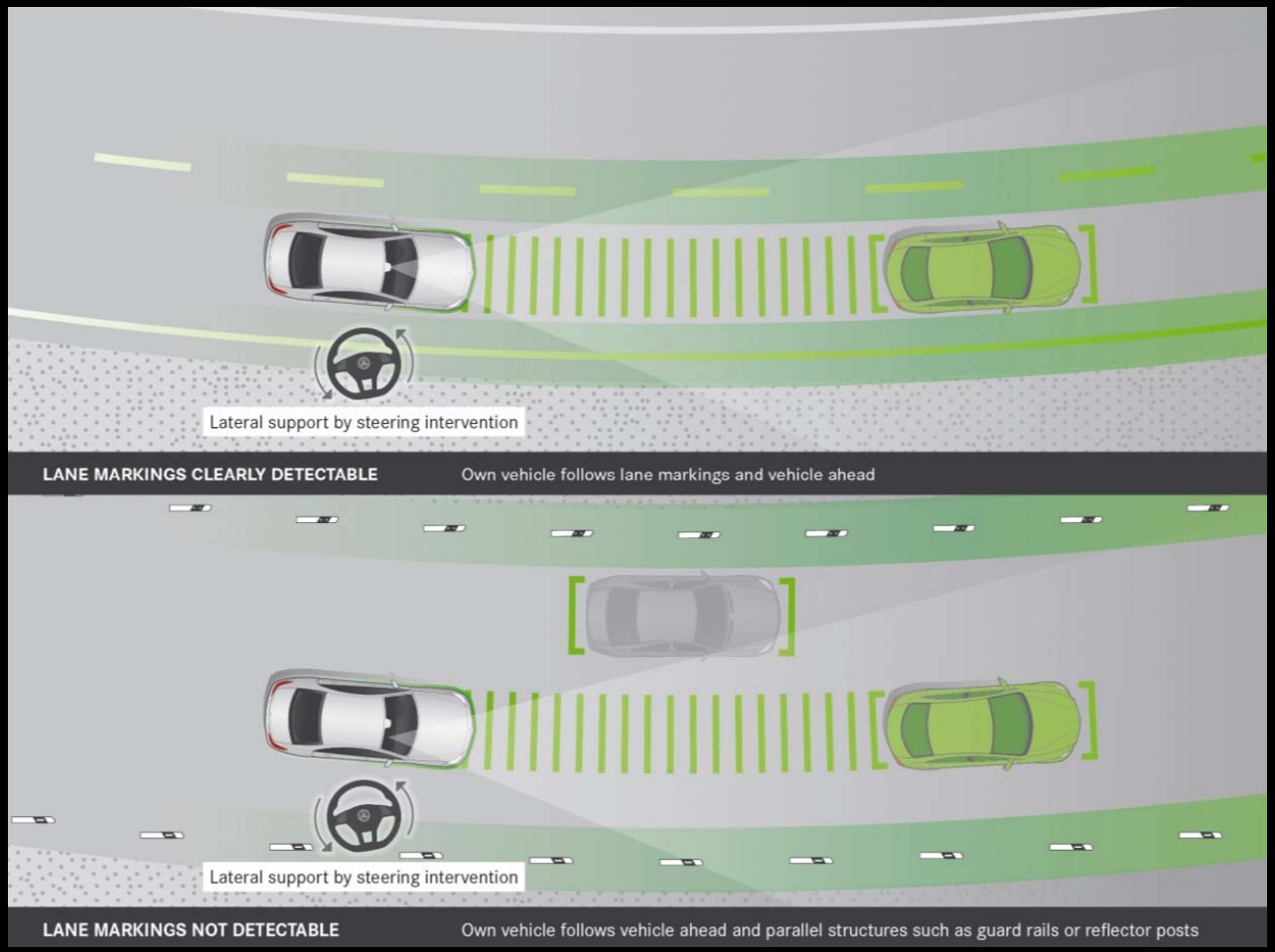


- Slower moving or stopping vehicles: 0 – 155 mph
- Standing vehicles: collision avoidance up to 43 mph, reduction of accident severity up to 62 mph
- Pedestrians: collision avoidance up to 37 mph, reduction of accident severity up to 43 mph, Evasive Steering Assist if driver initiates steering maneuver
- Detection of collision danger due to cross-traffic:
  - Situation adaptive boost of driver's braking power, if necessary up to full braking
  - Without driver reaction: autonomous emergency braking

Active Brake Assist with Evasive Steering Assist

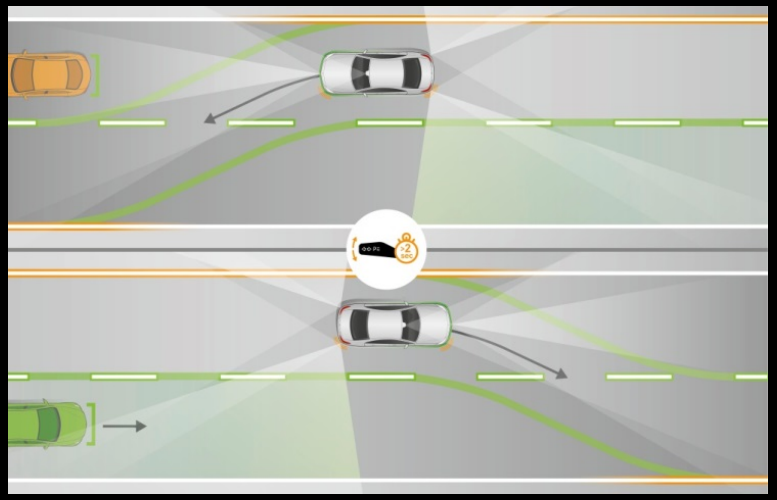
Active Brake Assist with Cross-Traffic Function

Intelligent Drive Next Level: DRIVE PILOT



- Distance Pilot DISTRONIC and Steering Pilot at speeds 0 – 130 mph
- DISTRONIC now also reacts to standing vehicles (up to 37 mph)
- Automatic re-start after DISTRONIC standstill for up to 30 s (highway only)
- Even without lane markings, steering support at speeds of up to 80 mph by orientation on surrounding vehicles and parallel structures (swarm)
- Active Lange Change Assist: Steering Pilot stays active during lane changes
- Speed Limit Pilot automatically adapts setting of DISTRONIC to detected speed limits
- More comfortable hands-on detection
- Active Emergency Stop Assist

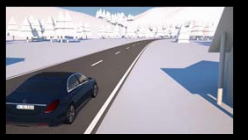
Active Lane Change Assist

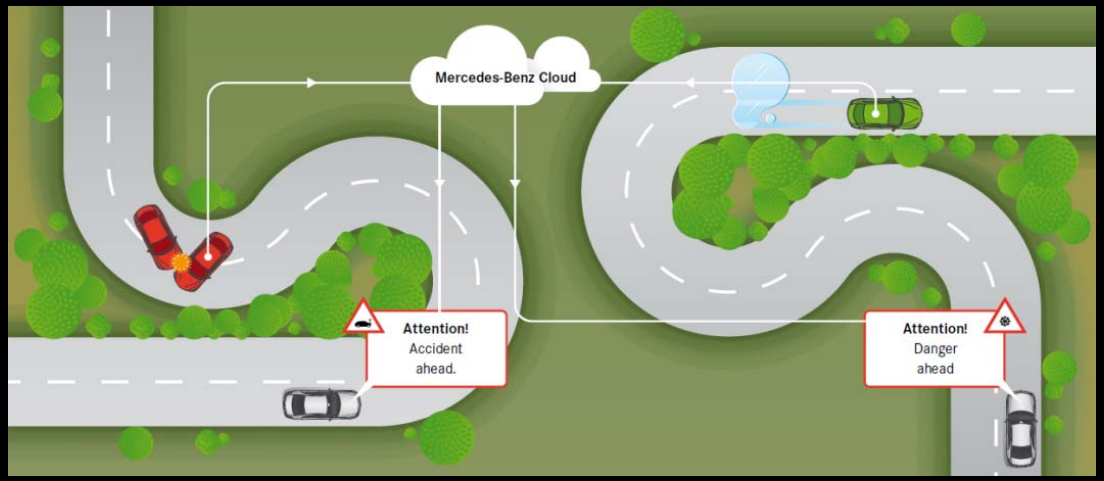


- Comfortable support of lane changes by Steering Pilot
- Initiated by driver: indicator set for more than 2 s
- Clearance of neighboring lane monitored by radar sensors and stereo camera
- Active at speed range 50 – 112 mph on multi-lane roads confirmed by navigation
- During activity the steering icon in the instrument cluster stays **green**.
  If the system is passive or not available, the icon is displayed in **gray**.
- Abortion of maneuver if
  - it is not possible within 3 s
  - obstacle is detected in neighboring lane
  - driver countersteers.

Vehicles exchange Information in Real Time

Car-to-X Communication





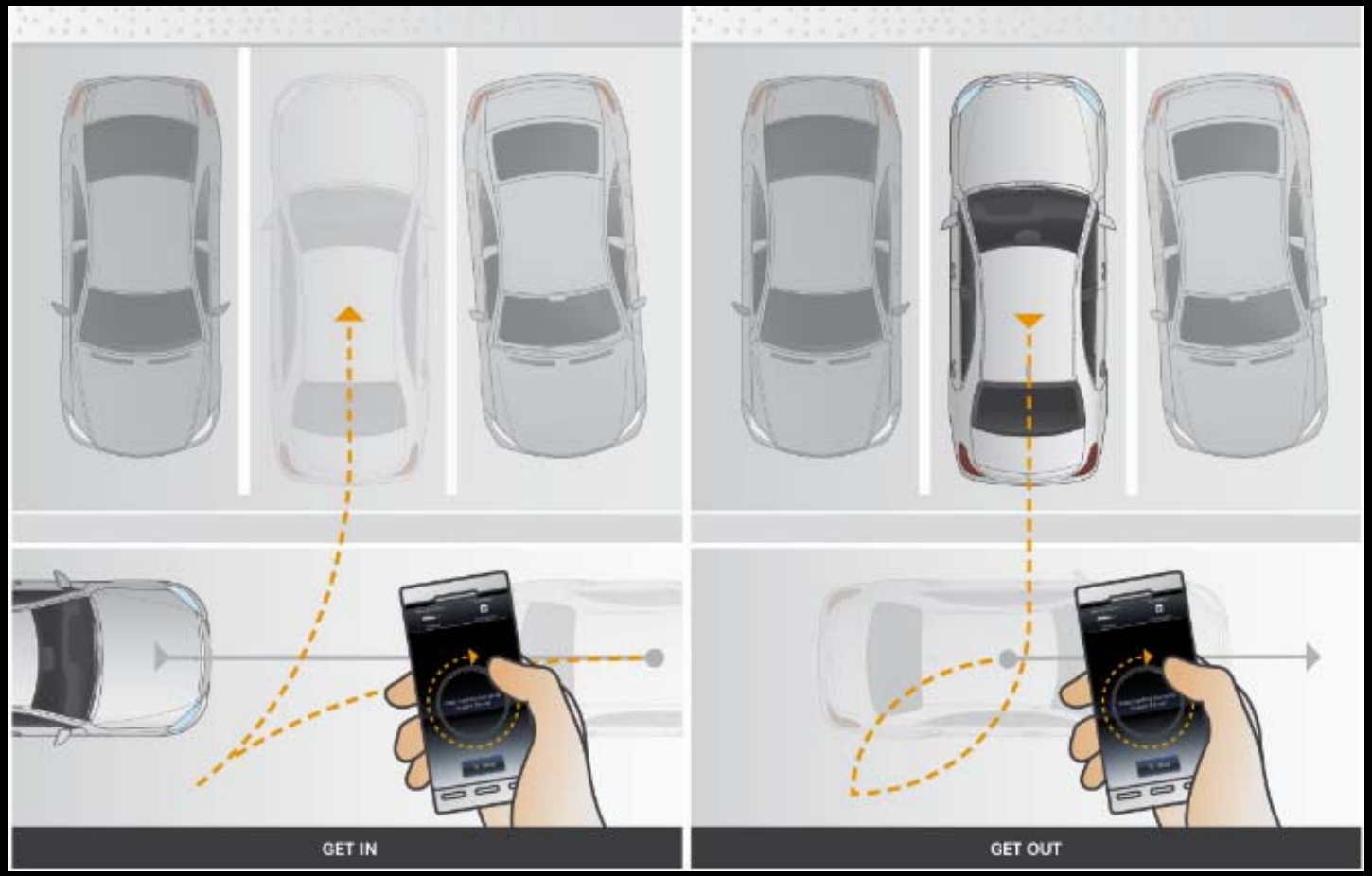
In combination with COMAND Online and Live Traffic

Event	Broken down vehicle	Accident	Hazard lights on	Slip hazard
Icon				

Examples of Warning Functions

- Expands the range of current sensors and can warn of imminent danger earlier than in-vehicle sensors
- System can automatically exchange (provide and receive) relevant information with other vehicles in the surrounding area via mobile phone technology
- Driver can also send a warning manually
- Enables the car a view around corners and bends or through obstacles
- Warning concept according to situation:
  - Icon in Navigation Display (Live Traffic)
  - Optical warning in Instrument cluster
  - Voice output ahead of source of danger

Remote Park Pilot



The New E-Class: The Most Intelligent Business Saloon

Partially automated driving, stress relief, autonomous braking

- Partially automated driving on freeways, highways and even in city traffic
  - DRIVE PILOT with Distance Pilot DISTRONIC and Steering Pilot
  - Active Emergency Stop Assist
  - Active Lane Change Assist
  - Speed Limit Pilot
- Autonomous braking in hazardous situations when necessary
- Active assistance with evasive maneuvers

These are just some of the functions of the new and extended Intelligent Drive Driving Assistance package from Mercedes-Benz. The goal is to reduce stress and enhance comfort for the driver, combined with greater safety for all road users.

Further Steps to Higher Automation Levels

Level 0	Level 1	Level 2
No Automation	Assisted (Assistiert)	Partially Automated (Teilautomatisiert)
Drivers drives by his own		Driver has to supervise the automated function continuously. **Responsibility stays at the driver** **No** side activities allowed

Fail safe

Clearly defined regulations and laws

Further Steps to Higher Automation Levels

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
No Automation	Assisted (Assistiert)	Partially Automated (Teilautomatisiert)	Conditionally Automated (Hochautomatisiert)	Highly Automated (Vollauto-matisiert)	Fully Automated (Fahrerlos)
Drivers drives by his own		Driver has to supervise the automated function continuously. **Responsibility stays at the driver** **No** side activities allowed	System **recognizes its limitations** and hands over the responsibility to the driver early enough. **Defined** side activities allowed	System is able to manage all driving sit. autonomously. Side activities are allowed and driverless driving is possible. **Driverless driving allowed**	

Fail safe | **Fail operational**

Clearly defined regulations and laws | **Regulations and laws under development**

Safety and Automation: The Major Challenge

Accidents are almost all due to human error

We have with some success automated to intervene when people do something wrong.

On the German Autobahn, every 7.5 million km we may catch an error.

Humans do much more right when driving than they do wrong

We now aim at automating those things that people do right.

We have to drive those 7.5 million km and must not fail a single time.

Further Steps:
Automated Driving on Urban and Rural Roads

Difficulty strongly depends on

- traffic situation/environment
- weather
- sensor configuration

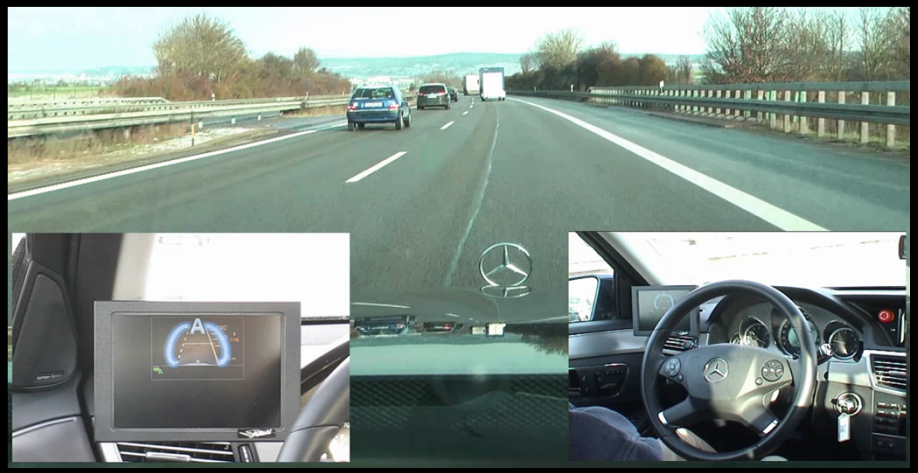
Autonomous Cars Allow Extended Individual Mobility for All

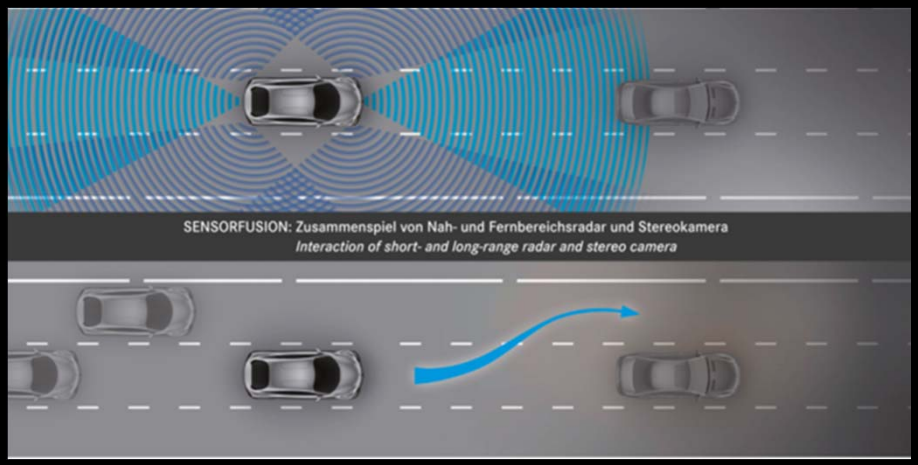
Our Main Targets for Automated/Autonomous Driving

Cars in private ownership

- Drive comfortable and safe
- Individual mobility for all
- Extended use of driving time

Next Step: Autonomous Highway-Pilot





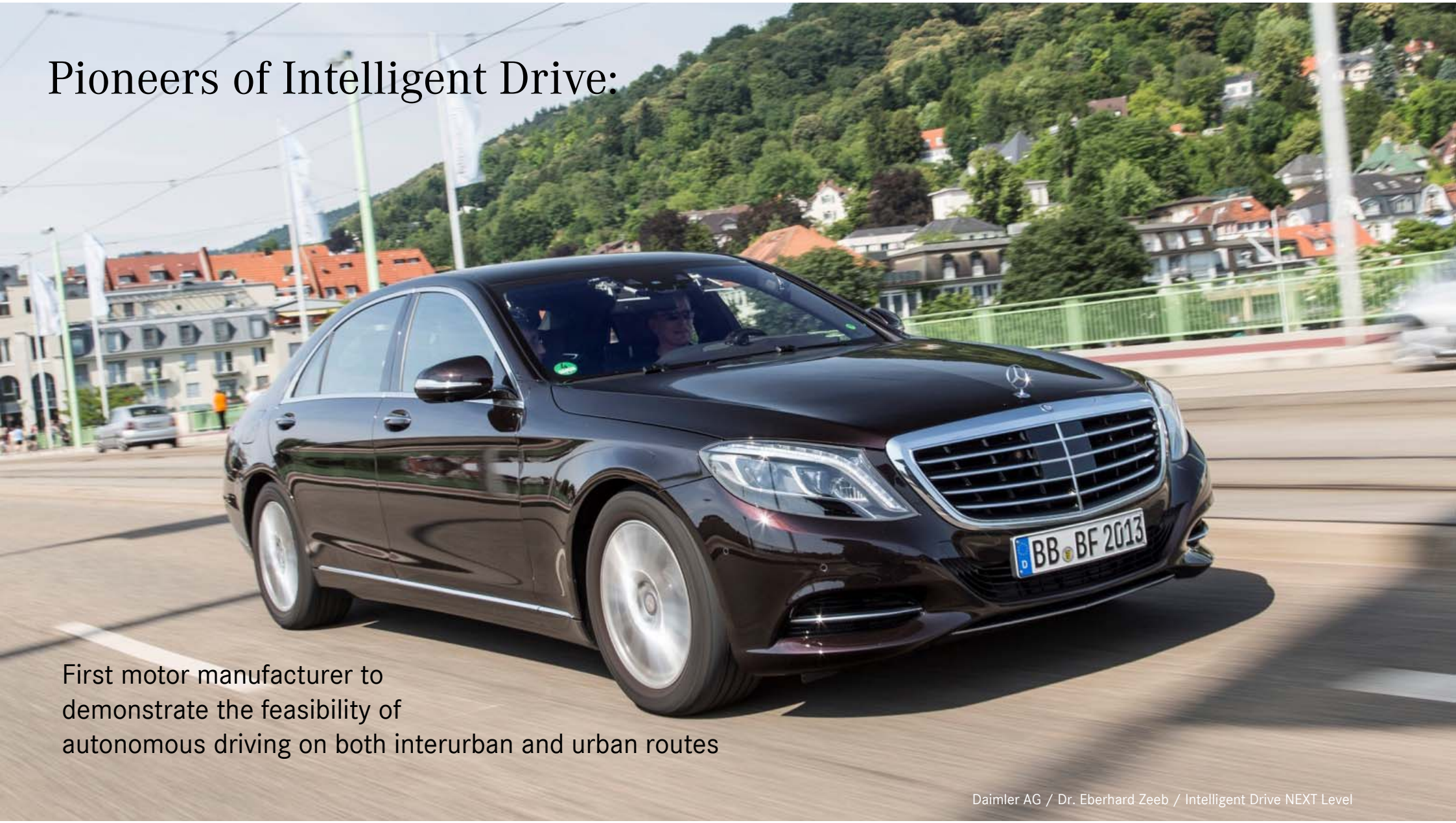
- The system takes over longitudinal and lateral control on **multi-lane** roads with parallel traffic system
- The driver may perform **certain** secondary tasks limited to the vehicle's infotainment/functions that are controlled by us
- The driver must **take over again** a certain time frame after a request by the system
- Until the driver takes over, the system remains in control
- The **system avoids collisions** at least as well as a human driver
- If the driver does not take over the system starts decelerating moderately (Active Emergency Stop Assist) until he takes over or vehicle is stopped
- **Failures by the system are handled by the system**

Nevada Test License

First motor manufacturer to receive
a test license for autonomous driving
for a series production vehicle.

Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

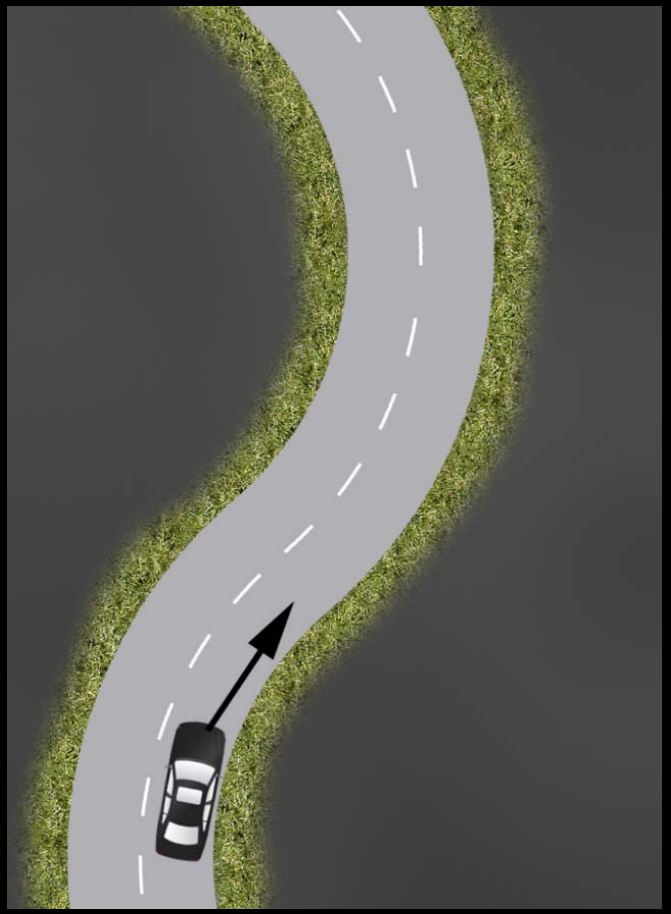
Pioneers of Intelligent Drive:



First motor manufacturer to
demonstrate the feasibility of
autonomous driving on both interurban and urban routes

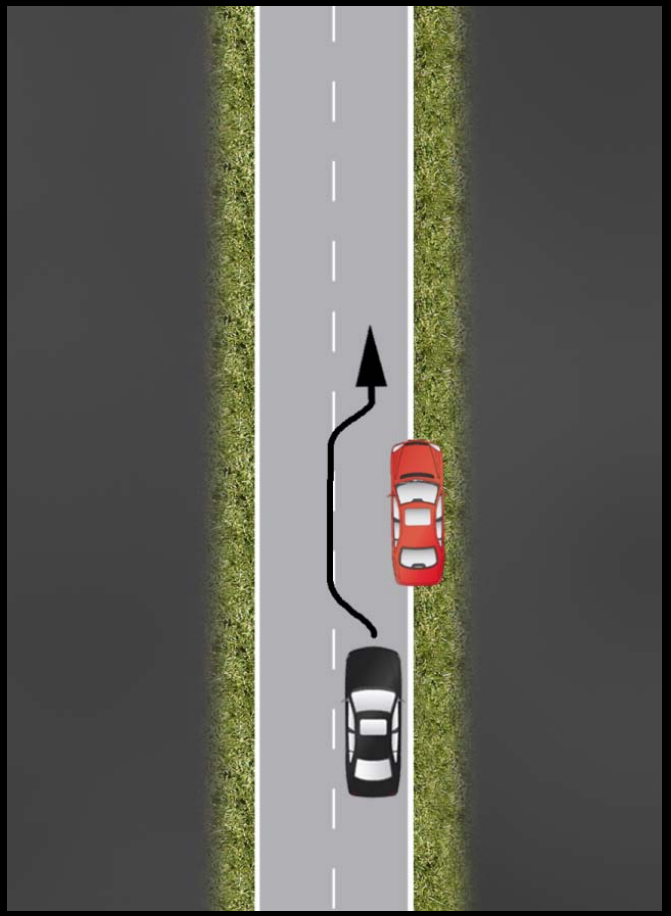
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Impression of Bertha Benz Drive: Overland



Few road users, unobstructed view, dedicated lanes

Impression of Bertha Benz Drive: Inner City



Driving around static obstacles with on-coming traffic

F 015 – Luxury in Motion

Zebra Crossing

Our Main Targets for Automated/Autonomous Driving

Cars in private ownership

- Drive comfortable and safe
- Individual mobility for all
- Extended use of driving time

Cars for rent and share

- Bring and return the car to where it is needed
- Use the best pupose car

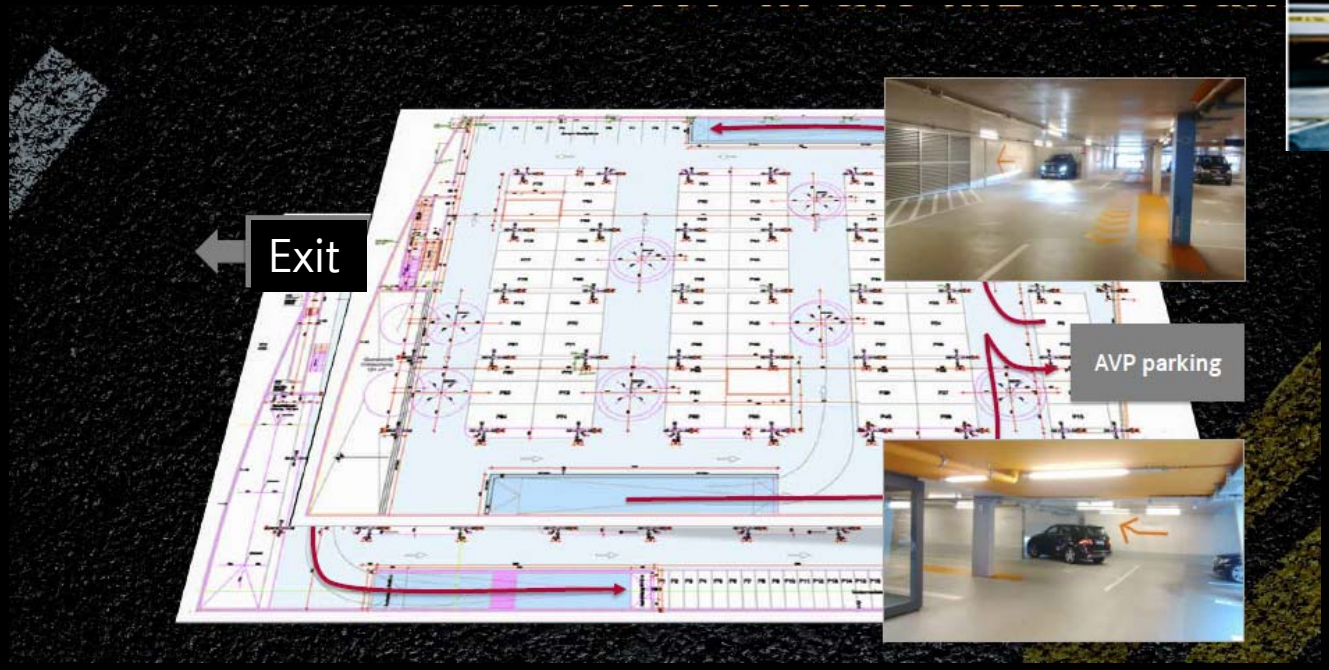
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Autonomous Cars Meet the Drivers Wherever They are Needed

Example: Long-term Vision of Car Sharing

Example: Automated Valet Parking

- Automatically driving to a chosen parking spot in a parking lot or parking garage
- Automated parking
- Driver can leave vehicle at entrance to venue



Our Main Targets for Automated/Autonomous Driving

Cars in private ownership

- Drive comfortable and safe
- Individual mobility for all
- Extended use of driving time

Trucks to deliver goods

- Extended use of driving time
- Automated loading/switching
- Drive safe and efficient

Cars for rent and share

- Bring and return the car to where it is needed
- Use the best pupose car

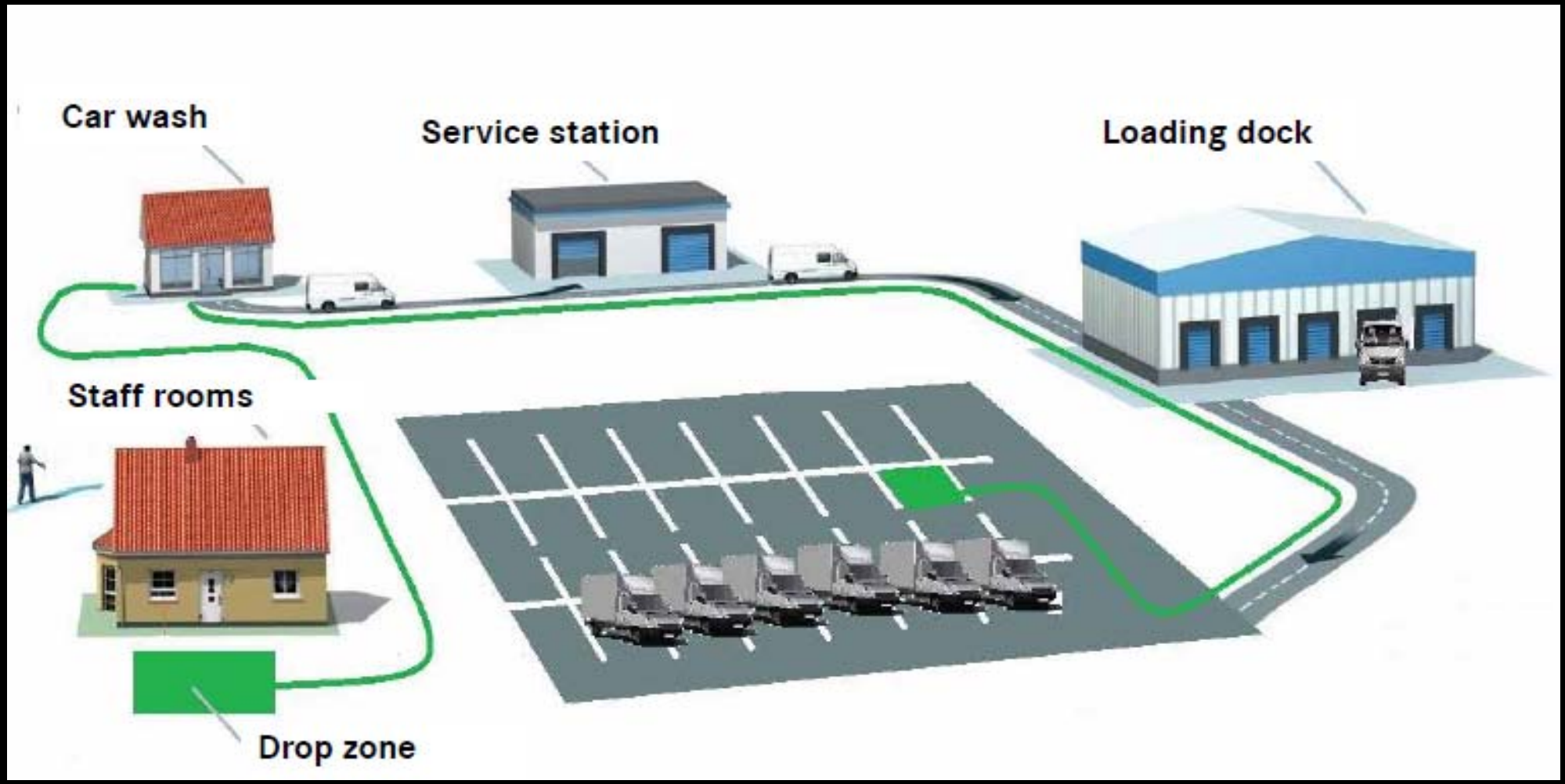
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Pioneers of Autonomous Trucks

Freightliner Inspiration Truck – the first licensed autonomous driving truck in the US

Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level

Example: Automated Depot Driving



Pioneers of Autonomous Buses

Mercedes-Benz Future Bus with City Pilot: Milestone on the way towards autonomous driving in public transport


On the road to
autonomous driving –
the best is yet to come!
Daimler AG / Dr. Eberhard Zeeb / Intelligent Drive NEXT Level