29 partners
Examples of driver assistance systems

Longitudinal control
- City Break Assist
- ACC & Front Assist

Lateral control
- Side Assist
- Lane Assist

Park assist systems
- Park Assist
- Park Pilot
- Rear Assist

Light
- Light Assist

Recommendation
- Pause
- Recommendation

Driver information
- Sign Assist
Examples for automated driving - industrial projects

**Bertha Benz drive**
- 2013
- Mercedes
- © Daimler

**Traffic jam pilot**
- 2012
- Audi
- © Audi

**Motorway pilot**
- 2011
- BMW
- © BMW

**Google car**
- 2011
- Google
- © Google

**Pikes Peak**
- 2010
- Audi
- © Audi

**Junior**
- 2007
- VW
- © VW
Examples for automated driving - funded projects

- **eT!: Follow me!**
  - 2011 eT! (BMU)
  - © VW

- **AutoNOMOUS**
  - 2011 FU Berlin (BMBF)
  - © FU Berlin

- **Emergency stop assistance**
  - 2011 SmartSenior (BMBF)
  - © BMW

- **Temporary auto pilot**
  - 2011 HAVEit (EU)
  - © VW

- **Platooning**
  - 2012 Sartre (EU)
  - © Volvo

- **Parking and charging**
  - 2011-2015 V-Charge (EU)
  - © VW
## Motivation for automated driving functions

| **Zero emission** | **Reduction of fuel consumption & CO₂ emission**  
Optimization of traffic flow |
|-------------------|------------------------------------------------|
| **Demographic change** | **Support unconfident drivers**  
Enhance mobility for elderly people |
| **Vision zero** | **Potential for more driver support by avoiding human driving errors** |
Terms related to automated driving

Driverless
Piloted
Self driving
Partial autonomy
Semi automated
Fully autonomous
Conditional automation
Partial automation
High automation
Full automation
### Levels of driving automation acc. to SAE and VDA

<table>
<thead>
<tr>
<th>series</th>
<th>development</th>
<th>research</th>
<th>n.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDW FCW</td>
<td>LKA ACC</td>
<td>Parking Assistance</td>
<td>Traffic Jam Chauffeur</td>
</tr>
<tr>
<td>level 0</td>
<td>level 1</td>
<td>level 2</td>
<td>level 3</td>
</tr>
<tr>
<td>No automation</td>
<td>Assisted</td>
<td>Partial automation</td>
<td>Conditional automation</td>
</tr>
</tbody>
</table>

| driver “in the loop” | yes | | no (optional) |
| secondary tasks | none | specific | all (incl. sleeping) |
| min. risk condition | none | some | always (must!) |
| final fallback level | driver | | automation |
| from origin to dest. | no (specific use cases) | | yes |

Source: SAE document J3016, “Taxonomy and Definitions for Terms Related to On-Road Automated Motor Vehicles”, issued 2014-01-16, see also http://standards.sae.org/j3016_201401/
## Introduction scenario

| 2 | Partial automation |  | Parking assistant  
|   |                     |  | Traffic jam assist. |
| 1 | Assisted | ACC  
|   |         | LKA  
| 0 | No automation | LDW  
|   |           | FCW  

**ACC:** Adaptive Cruise Control  
**LKA:** Lane Keep Assist  
**LDW:** Lane Departure Warning  
**FCW:** Forward Collision Warning

---

**ADAS today**  
**ADAS tomorrow**
## Introduction scenario

<table>
<thead>
<tr>
<th>Level</th>
<th>Automation Type</th>
<th>ADAS today</th>
<th>ADAS tomorrow</th>
<th>Automation Gen. 1</th>
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<tbody>
<tr>
<td>3</td>
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<td></td>
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<tr>
<td>1</td>
<td>Assisted</td>
<td>ACC</td>
<td>City Cruise</td>
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<td></td>
<td>LKA</td>
<td>Constr. ass.</td>
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</tr>
<tr>
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<td>LDW</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>FCW</td>
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### Introduction scenario

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<th>Automation Gen. 2</th>
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<tr>
<td>4</td>
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<td></td>
<td>Parking garage</td>
<td>pilot</td>
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<tr>
<td>3</td>
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<td></td>
<td>Traffic jam chauffeur</td>
<td></td>
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<tr>
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<td>City Cruise</td>
<td>Parking ass.</td>
<td>Traff. jam a.</td>
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<td>City Cruise</td>
<td></td>
<td>Constr. ass.</td>
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<tr>
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<td>No automation</td>
<td>LDW, FCW</td>
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</tbody>
</table>

**Adaptive Cruise**

**City Cruise**

**Parking garage pilot**

**Traffic jam chauffeur**

**Highway chauffeur**
## Introduction scenario

<table>
<thead>
<tr>
<th>5</th>
<th>Full automation</th>
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<td>Parking garage Pilot</td>
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<td>Traf. J. Cha. City Chauff.</td>
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<tr>
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<td>LDW FCW</td>
<td>ADAS today ADAS tomorrow</td>
<td>Automation Gen. 1 Automation Gen. 2</td>
<td>n.a.</td>
</tr>
</tbody>
</table>
// Challenges and objectives

Widespread application of automated driving to improve traffic safety, efficiency and comfort

- Legal issues, terminology
- Strategies for human-vehicle integration
- New evaluation methods, impact assessment
// Possible side effects

Altered driver state
- Drowsiness
- Reduced situation awareness

System understanding
- Mode confusion
- Mental model

Long term effects
- Loss of skills
- Behavioural adaptation

Inappropriate trust in automation
- Overreliance
- Misuse
Demonstrators

Parking assistance, garage, special areas, multi-level garage, Stop & go

City cruise, City chauffeur, Supervised city control

Enter & exit highway, following lane, lane-change, filter-in, overtaking, danger spot intervention, Stop & go

Safe stop
Thank you.

Aria Etemad
Volkswagen Group Research

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