ADAS and Automated Driving Functionality – Blessing and Curse
Alfred Eckert, Head of Advanced Technology, Systems & Technology, Continental Chassis & Safety Division
The Beginning of Automobile Locomotion
1865: Red Flag Act in the UK

Image Sources: Wikipedia, Daimler UK
Vehicle Safety in their Infancy
Crash Demonstration 1930
Road Traffic Fatalities Worldwide
Vulnerable Road Users (VRUs)

1.25 million road traffic deaths occur every year

22% pedestrians
4% cyclists
23% motorcyclists
49% of all road traffic deaths are among pedestrians, cyclists and motorcyclists

Source: World Health Organization 2015
Road Traffic Fatalities Worldwide
Regional Differences

Fatalities per 10,000 Cars

- 2
- 15
- 56

Fatalities ww share

- 59%
- 31%

Source: World Health Organization 2015
Road Traffic Fatalities
Example Germany

1973: Front Safety Seat Belts as Standard
1978: Anti-lock Brake System
1982: Airbag
1985: Front Passenger Airbag
1995/96: ESC, Brake Assist – Si Technology in Tires
1998: Adaptive Cruise Control
2001: Lane Departure Warning
2006: AEB
2014: TPMS

Fatalities per Year

0 5000 10000 15000 20000 25000

3,170* Fatal Accidents in 2017


Established in 1996
The Fundamentals of Vehicle Safety
Integration of Active and Passive Safety
Driver Assistance Systems
Increasing System Complexity and Simulation Effort

Driver Assistance Systems
› Anti-lock Brake System (ABS)*
› Electronic Stability System (ESC)*
› Brake Assist System (BAS)

Advanced Driver Assistance Systems
› Adaptive Cruise Control (ACC)
› Autonomous Emergency Braking (AEB)*
› Blind Spot Detection (BSD)
› Lateral Support System*
› Vehicle-to-X Communication (V2X)

*relevant for EURO NCAP

System of Components and Functions

Single System
Autonomous Emergency Braking AEB

Chain of Effects

**Sense**

- **Surround Sensors**
  - Radar
  - Camera
- **Autonomous Emergency Braking CPU** ¹)

**Plan**

- **Object Detection**
- **Situation Interpretation**
- **AEB Kinematic Control**

**Act**

- **Electronic Brake System**
  - Deceleration Control
  - MK C1
  - MK 100
- **Hydraulic / Mechanic Brake System, Brake Pads, Chassis and Tires**
  - Brake System
  - Brake Calipers
  - Tires
  - Tires & Vehicle

Detection & activation time ²): ~150ms - 600ms

Time to automatic full deceleration ²): ~0,3 - 1,2 sec

¹) Central processing unit hosting the AEB control function. Can be integrated into sensor,
²) Typical values
Autonomous Emergency Braking - Pedestrian
EURO NCAP 2016 relevant

› Autonomous braking on stationary or crossing pedestrians
Vehicle System Engineering @ Continental
Digitalization impact on vehicle

Digitalization opens new business opportunities.

New business opportunities require new vehicle structures & capabilities.

Vehicle systems engineering enables competitive portfolio: design & release.

1. Cross Industry System
2. Intelligent Transportation System
3. Automotive
4. In-vehicle System
5. Sub-System
6. Component

Vehicle Architecture Structures:
- Server
- xDomain
- Domain
- Distributed

Capabilities:
- Self Learning
  - Adapted functionality with upfront release
- Collaborative
  - Vehicle as active part of IoT, flexible allocation of functions
- Upgradable
  - Increase of function content, incremental release process
- Connected
  - Always On
- Updatable
  - New version of functionality, system release process
- Secure
- Fail Safe

System Abstraction Levels:
- L-E
- L-V
- L-VS
- L-SP
- L-CP

Vehicle Architecture Structures:
- HW / SW

From Product-Supplier to Vehicle System Solution-Partner

Vehicle systems engineering enables competitive portfolio: design & release.

Secure
Updatable
New version of functionality, system release process

Connected
Always On

Fail Safe

Collaborative
Vehicle as active part of IoT, flexible allocation of functions

Upgradable
Increase of function content, incremental release process

IPG OpenHouse 2018
Public

20 March 2018
A. Eckert, © Continental AG
From Advanced Driver Assistance Systems
Towards Automated Driving

Assisted ADAS Functions

- Adaptive Cruise Control
- **Autonomous Emergency Braking**
- Lane Change Assist
- Lane Keeping Assist

Automated Parking
- Emergency Steer Assist
- **Traffic Jam Assist**
- Trailer Reverse Assist

Cooperative Safety Functions
- **Cruising Chauffeur**
- Traffic Jam Chauffeur
- Valet Parking

Highly / Fully Automated

Partially Automated
Future of Mobility
Seamless Mobility

Driverless Revolution
Accessible Autonomy

Major Forces shaping future mobility

Today

Car Sharing

Evolutionary Change

Vehicle Control

Fully Autonomous

Driver Driven

Personal

Vehicle Ownership

Shared

Seamless Mobility
Individual Mobility…
That’s for What the Automobile Has Been Standing for More Than 100 Years

Benz Patent Motor Car

Ford Model T

Toyota Prius

Volkswagen Beetle

Tesla Model S

BMW i3

Mostly driver-focussed

Now let´s place the passenger center stage …
# Future Mobility
## Role of the Driver vs. Role of the System

<table>
<thead>
<tr>
<th>Privately owned</th>
<th>Public shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly Automated Car</td>
<td>Driverless Car</td>
</tr>
</tbody>
</table>

### Technical check before/while driving
- (low tire pressure, visual damages, tread depth, …)

<table>
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<th>Automated Driving →</th>
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<td>🚗 (within use cases)</td>
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### Secure control of technical operation
- (accelerating / braking / steering)

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### Evaluate weather/road condition
- (dry, wet, snow, ice, wind)

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Future Mobility
Role of the Driver vs. Role of the System

› Handover of driving task and observing task ...

... to highly automated driving
vehicle ≥ SAE Level 3

Secure a safe and reliable system operation,
within use cases, anytime, anywhere

Simulation layer

Accelerating
Braking
Steering
Control
Technical check

A. Eckert, © Continental AG
20 March 2018
Automated Driving @Continental
IAA 2017 Live Demo – Automated Valet Parking

Location:
Division Chassis & Safety Headquarters, Frankfurt Rödelheim

Automated Valet Parking
Conti’s car park demo scenario
ground floor, parking garage

Map Source: © Google 2017
C&S Headquarters, Frankfurt Rödelheim
Automated Driving
Drivers and Challenges

Drivers

More Comfort

More Safety

More Efficiency

Challenges

“Flawless” Perception

“Flawless” Decision Making

Verify & Validate

Safe Driver Interaction

Safe & Secure Operation & Degradation

Social Acceptance of Residual Risks

More Comfort

More Safety

More Efficiency

“Flawless” Perception

“Flawless” Decision Making

Verify & Validate

Safe Driver Interaction

Safe & Secure Operation & Degradation
Automated Driving
Safety Objectives

No Matter if Partially / Highly / Fully Automated Driving

Silent Testing
Simulation

1st BASIC SAFETY OBJECTIVE
No life-threatening hazards in ABSENCE of failure

2nd BASIC SAFETY OBJECTIVE
No life-threatening hazards in PRESENCE of single failure

≥ 210 million kilometers*

Social Acceptance of Residual Risks
More Safety
More Efficiency
Safe & Secure Operation & Degradation

Drivers

“Flawless” Perception
“Flawless” Decision Making
Verify & Validate
Safe Driver Interaction

Degradation tests

More Comfort

* Wachenfeld, W., Winner, H., Auswirkungen des autonomen Fahrens auf das Fahrzeugkonzept, Autonomes Fahren, Springer Verlag 2015
Safe and Dynamic Driving towards Vision Zero

Sense Plan Act