Connected & Automated Driving

Chassis Systems Control

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Shaping the Future of European Automotive Industry with safe, robust, reliable and clean Technologies
Connected & Automated Driving

Future Mobility

- Automated mobility
- Connected mobility
- Electric mobility
- Data-based business models
- Integration of CE world
- Multimodal mobility
Connected & Automated Driving

... is an innovative topic of common European interest, since it

- **increases traffic safety** and significantly **contributes to decrease of road casualties** (Vision Zero 2025) in particular by
  - avoidance of human errors
  - automated protection of vulnerable road users
  - highly connected traffic with intensive data exchange

- **reduces GHG and especially CO₂ emissions** in particular by avoiding
  - traffic jams through optimal traffic guidance and vehicle routing
  - energy consuming park slot search through automated parking

- **boosts Europe’s economy** and increases/maintains its **technical advance** by
  - defining technical standards in e. g. data protection
  - realizes European technology roadmaps from R&D&I to production
  - safeguarding current jobs and increase of KET skills in education
  - forming a strong unique strategy of all key stakeholders
  - developing new business models based on KETs and combination with e.g. data services
Automated Driving – Overview

Highly automated driving is – no doubt – becoming reality

• But who has the best system concepts, encounters for more than only technical aspects and rises enough R&D&I investments to win the race?

Connected & Automated Driving

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R&D&I: Research, Development and Innovation
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Challenges of Connected & Automated Driving
- System, Component & Business Model Developments -

| Perception | New sensors, micro-controller development, Software & Data Algorithms |
| Localisation | Electronic Horizon, Camera/Sensor Technologies, Precise Digital Maps, Road Infrastructure |
| Communication | Data Security, Function Relocation from Vehicle to Server, Intelligent Transportation Systems |
| Function Validation | Test Tracks and Proving Grounds for mixed and fully Automated Traffic |
| Vehicle Motion & Safety | Enhanced Vehicle Motion and Stability Control (Parking, Highway, Urban, …) |

<table>
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<th>Standards &amp; Regulation</th>
<th>E/E Architecture</th>
<th>Connectivity</th>
<th>HAD Functions</th>
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</thead>
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<tr>
<td>Phase 1</td>
<td>2017</td>
<td>2018</td>
<td>2019</td>
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<td>Phase 2</td>
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<td>Phase 3</td>
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- Driver Assistance -
- Partial Automation 2015 -
- Conditional Automation 2019 -
- Market Entry Periods -
- High Automation 2022 -
- Full Automation 2024 -

Goal: Industrialization
Bosch has know-how and experience in all relevant domains

- The overall system (Infrastructure, Vehicles, Sub-Systems, Components, ...) can be best mastered with a collaborative approach along the vertical value chain
Connected & Automated Driving

Examples of Challenges addressed by Bosch

Safety
- Redundant steering, braking, and stabilization systems required for autonomous driving
- Modular actuation concept offers a perfect solution for automated driving

Security
- Protection of:
  - Safety & integrity of vehicle
  - Privacy of driver
  - Domains in secure E/E architectures
  - Integrity of critical in-vehicle signals
  - Integrity of ECU SW & data
- Security gateway
- Secure communication
- ECU with HSM
- Firewalls

Data Fusion
- Aggregation of:
  - Dynamic high-precision map data
  - Temporal regional information
  - Exact vehicle position
- Enabled by:
  - Cloud-based information processing
  - Advanced sensors (e.g., MEMS)

USA
- Public road performance shown in March/April 2013

DE
- Technologies & Methods for complex scenarios (high-speed, urban, ...)

MEMS: Microelectromechanical system
### Connected & Automated Driving

#### Automated and Connected – Social Benefits

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<tr>
<th>Category</th>
<th>Benefit</th>
<th>Reference</th>
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<tr>
<td><strong>Reduced congestion</strong></td>
<td>Fewer traffic jams and less waiting time at intersections and lights → 80% improvement in traffic throughput(^1)</td>
<td>(^1) Shladover, Steven, Dongyan Su and Ziao-Yun Lu (2012), Impacts of Cooperative Adaptive Cruise Control on Freeway Traffic Flow, 91st Annual Meeting of TRB, Washington.</td>
</tr>
<tr>
<td><strong>Higher fuel efficiency</strong></td>
<td>Synchronized traffic flow → 8 to 13% improvement in highway fuel economy(^2)</td>
<td>(^2) Atiyeh, Clifford (2012), Predicting Traffic Patterns, One Honda at a Time, MSN Auto, June 25.</td>
</tr>
<tr>
<td><strong>Gain in productivity</strong></td>
<td>Time in transit becomes more productive → 56 minutes per day freed up for other uses (US)(^3)</td>
<td>(^3) US Department of Transportation Highway Safety Administration (2011), Report # FHWA-PL-II-022</td>
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<td><strong>Democratization of mobility</strong></td>
<td>Over-65 segment growing 50% faster than overall population → Allow a variety of age ranges to be mobile</td>
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<td><strong>Improved safety</strong></td>
<td>90% of all accidents caused by human errors → Reduction in motor vehicle accident rates</td>
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</tr>
</tbody>
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2. Atiyeh, Clifford (2012), Predicting Traffic Patterns, One Honda at a Time, MSN Auto, June 25.
3. US Department of Transportation Highway Safety Administration (2011), Report # FHWA-PL-II-022
Chance for Europe: Future mobility will be connected and automated, thus at the same time safe and secure!

Automated driving is still a challenge requiring significant change in vehicle & infrastructure architectures.

To leverage industrial investments a multi-annual funding initiative of EU & member states is needed to push development of technologies, infrastructures, services, business models and normative measures.

Bosch is ready to further invest and to initiate an IPCEI promoting Europe’s market & technology leadership and social benefits with future mobility!
Thank you for your attention!