BMW GROUP TECHNOLOGY WORKSHOPS
AUTOMATED DRIVING-DIGITALIZATION
MOBILITY SERVICES
This document contains forward-looking statements that reflect BMW Group’s current views about future events. The words “anticipate,” “assume,” “believe,” “estimate,” “expect,” “intend,” “may,” ”can,” “could,” “plan,” “project,” “should” and similar expressions are used to identify forward-looking statements.

These statements are subject to many risks and uncertainties or may be affected by factors outside BMW Group’s control, including adverse developments in global economic conditions resulting in a decline in demand in BMW Group’s key markets, including China, North America and Europe; a deterioration in credit and financial markets; a shift in consumer preferences affecting demand for BMW Group’s products; changes in the prices of fuel or raw materials; disruption of production due to shortages of materials, labor strikes or supplier insolvencies; the effective implementation of BMW Group’s strategic goals and targets; changes in laws, regulations and government policies, particularly those relating to vehicle emissions, fuel economy and safety; and other risks and uncertainties, including those described under the heading “Report on Risks and Opportunities” in BMW Group’s most recent Annual Report.

If any of these risks and uncertainties materializes or if the assumptions underlying any of BMW Group’s forward-looking statements prove to be incorrect, actual results may be materially different from those BMW Group expresses or implies by such statements. BMW Group does not intend or assume any obligation to update these forward-looking statements.
AUTOMATED DRIVING. CHANGING FRAMEWORK LEADS TO NEW DEFINITION OF FUTURE MOBILITY.

BMW Group Technology Workshops – Automated Driving
DEVELOPMENT STAGES OF AUTOMATED DRIVING.

<table>
<thead>
<tr>
<th>Human</th>
<th>Transition of responsibility</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>No active assistance system</td>
<td>Early warning systems such as cruise control/ speed assistant</td>
<td>General awareness</td>
</tr>
<tr>
<td>0 – Driver Only</td>
<td>(“Feet-off”)</td>
<td>No take over request (“Mind-off”)</td>
</tr>
<tr>
<td>1 – Assistance</td>
<td>(“Hands-off”)</td>
<td>No driver</td>
</tr>
<tr>
<td>2 – Semi-Automation</td>
<td>Take over request (“Eyes-off”)</td>
<td></td>
</tr>
<tr>
<td>3 – High-Automation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 – Full-Automation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 – automated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIRST IDEAS BEING IMPLEMENTED TEN YEARS AGO.

BMW Track Trainer (2006).


Emergency stop assistant (2009).

Highly automated driving on the motorway (Gen1: 2011; Gen2: 2014)

Highly automated driving at the limits of vehicle dynamics (2014).

Fully automated remote valet parking (2015).
THE NEW BMW 5 SERIES DRIVER ASSISTANCE PROVIDES COMFORT AND SAFETY AT THE HIGHEST LEVEL.

- Crossing traffic warning rear / front
- Lane keeping assistant with active side collision protection
- Active cruise control with Stop&Go function
- Rear collision prevention
- Crossroad Assist
- 3D View
- Top View
- Night Vision
- Lateral parking aid
- Distance information
- Lane departure warning
- Wrong Way Assist
- Lane change warning
- Speed Limit Assist
- Approach control warning with braking function
- Steering and lane control assistant
- Panorama View
- BMW Selective Beam
- Active Park Distance Control
- Parking assistant
- Remote Control Parking
- Speed limit and No Pass information
- Distance information
- Speed Limit Device
- Lateral parking aid
ARCHITECTURE FOR AUTOMATED DRIVING. END-TO-END WITH ALL KEY-TECHNOLOGIES.
HD-MAP, SENSORS, AI/ENVIRONMENT MODEL AND MOTION CONTROL PLAY A KEY ROLE IN THE ARCHITECTURE OF AUTOMATED DRIVING.

HD-MAP BACKEND
- centimeter precision
- real-time capable
- highly available and reliable

SENSORS
- camera
- radar
- lidar
- ultra-sonic
- inertial sensor

AI / ENVIRONMENT MODEL
- object fusion
- free space detection
- road model
- prediction
- driving strategy / planning

VEHICLE INTEGRATION
- motion control
- safe vehicle management up to the limits
- fail operational architecture

OEM-Cooperation
Trilateral Cooperation

BMW Group Technology Workshops – Automated Driving
HAD SENSOR SETUP –
FOCUS ON LARGE-DISTANCE AREA COVERAGE.

Redundant Sensor Coverage Per View

<table>
<thead>
<tr>
<th>Lidar</th>
<th>Radar</th>
<th>Camera</th>
<th>Ultra-Sound</th>
</tr>
</thead>
</table>

Far Forward Looking

Far Rear Looking
FAD SENSOR SETUP – FOCUS ON 360° COVERAGE.

Redundant Sensor Coverage Per View

- Lidar
- Radar
- Camera
- Ultra-Sound

Far Forward Looking

Far Rear Looking

Near, Mid, Far
HIGHLY ACCURATE MAPS AND Backend CONNECTIVITY – TWO CORNERSTONES FOR HIGHLY AUTOMATED DRIVING.
BESIDES THE MERE TECHNICAL SENSING OF THE ENVIRONMENT, THE CONTEXTUAL UNDERSTANDING IS CRITICAL FOR AUTOMATED DRIVING APPLICATIONS.

ENVIRONMENT MODEL + PREDICTIVE SITUATION UNDERSTANDING

360° REPRESENTATION

- Object-based models
- Occupancy maps/free space
- Road models
“PLAYGROUND“ AUTOMATION. ROLL-OUT LIMITED BY SCENARIO COMPLEXITY AND DRIVING SPEED.
ON THE WAY TO AUTOMATED DRIVING.

- Partial automated driving incl. Steering, breaking, acceleration on all roads, worldwide, up to 210 km/h. automated lane changing on highway.
- Hands-off up to 30 sec., no Eyes-off

**PAD (L2)**

- Temporary Hands-off during Stop&Go situation on Highway

**2016**

- 2017

- 2018

- 2019

- 2020

- 2021

- 2022

**HAD (L3)**

- Hands- and Eyes-off on highway (EU, US, CN)
- Active lane changing and thread

**FAD (L4) pilot project**

- Hands- and Eyes-off on highway or highway-like (EU, US)
- Pilot project Mind-off on pre-defined routes

**Advanced ACC function**
DIGITALIZATION AT BMW GROUP.
We leverage innovative technologies, digitalization and sustainability to deliver unique customer experiences.

We embrace the opportunities that the transformation of our industry offers. We are committed to expanding our technological competence in the years to come, to enhancing the interaction of individuals, vehicles and services and to driving progress in sustainable mobility. This will secure our success and set new standards amongst our competitors.
AUTOMATED DRIVING ENABLES NEW (DIGITAL) BUSINESS OPPORTUNITIES.

Increasing penetration of option and service business

Monetization of free time

New mobility concepts

Scalable platform available for third parties.
MOBILITY SERVICES – THE URBAN REVOLUTION.
MAJOR TRENDS AND NEW TECHNOLOGICAL POSSIBILITIES ARE CHANGING THE RULES OF THE GAME.
BMW GROUP’S CORPORATE STRATEGY NUMBER ONE NEXT IS THE ANSWER TO THE CHALLENGES OF SUSTAINABLE MOBILITY AND CHANGING MARKET CONDITIONS.

“We inspire people on the move: We shape tomorrow’s individual premium mobility.”

…already TODAY!
DRIVE NOW. PREMIUM, FREE FLOATING CAR SHARING SERVICE FROM BMW GROUP & SIXT.

DriveNow Customers are BMW Group´s youngest & most modern target group

750,000 customers in 11 cities
5,000+ cars in the fleets

5,000+ cars in the fleets
DRIVE NOW OPENS THE WAY FOR E-MOBILITY AND THE BMW i3.

200,000+
first electric rides with DriveNow

6 Mio.+
emission-free kilometers with BMW i3

20% of the DriveNow fleet is electric
REACH NOW.
ON DEMAND MOBILITY SERVICES IN THE US.

Launch in April 2016 in
Seattle
Followed by
Portland and
Brooklyn (NY)

1,000,000+ kilometers
32,000+ members
32,000 members

Piloting additional features
ON DEMAND MOBILITY ON A NEW LEVEL. REACH NOW TO INTRODUCE UNIQUE FEATURES FOR THE CUSTOMERS.

New features, as piloted in US from end 2016:

Ride: Car with driver

Reserve: For long period use of vehicles and delivery of car

Share: Renting out your own car

Fleet Solutions: Individualized CarSharing offering for residential areas
CHARGE NOW.
THE SERVICE THAT MAKES CHARGING CONVENIENT AND EASY.

65,000+ charging points in 29 countries
PARK NOW.
OFFERING PREMIUM ON- AND OFF-STREET PARKING SERVICES.

On- and off-street parking
Time & cost efficient
car integration
starting with all new BMW 5 Series

Launch in 2016 in Austria, Germany & France

On- and off-street parking integration starting with all new BMW 5 Series
CENTER OF COMPETENCE URBAN MOBILITY: IMPLEMENTING SUSTAINABLE URBAN MOBILITY – TOGETHER WITH ALL STAKEHOLDERS.

Before…

…After
DIGITALIZATION AT BMW GROUP.
<table>
<thead>
<tr>
<th>Maxims for the BMW Group in the Context of Digitalization</th>
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<tbody>
<tr>
<td>Responsible data handling for Personalization &amp; convenience – Data security &amp; privacy first, business follows</td>
</tr>
<tr>
<td>Permanent updatability / disconnect between hardware and software</td>
</tr>
<tr>
<td>Constantly connected vehicle</td>
</tr>
<tr>
<td>Robust, scalable IT &amp; software architecture</td>
</tr>
<tr>
<td>Speed through software development skills and core in-house competence</td>
</tr>
<tr>
<td>Merger in the perception of product and service</td>
</tr>
<tr>
<td>X-functional collaboration</td>
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BMW WILL DRIVE DIGITALIZATION FORWARD ACROSS THE COMPANY.

We will lead the digital transformation of the automotive industry

Connected / Autonomous Vehicle & Mobility Services

Digital Customer Experiences

Business Processes