Audi piloted driving

...in the fast lane to the future

Daniel Lipinski, Electronic Research Lab, Volkswagen Group of America
Audi goals for piloted driving
The potential for driver assistance and integral safety functions lies with driver support

94% of all Accidents are caused by human errors.

Source: NHTSA study 2015
Audi goals for piloted driving

1. Increased safety
2. Environmentally friendly driving
3. Enhanced convenience
4. Efficient use of transport infrastructure
Audi piloted driving history

2009
- Audi TT
- Salt Lake
- Bonneville

2010
- Audi TT
- Pikes Peak

CES 2013/14
- Park pilot & traffic jam pilot
- Permission to test piloted driving in Nevada

August 2014
- Permission to test piloted driving in Florida

September 2014
- RS7 drives piloted at the limits at Hockenheimring

January 2015
- 560 miles Test Drive from Silicon Valley to Las Vegas

2005

2007
challenges in piloted driving

Customer Acceptance

? Do I trust this technology?
Do I want it?

Technology

? Is it possible to build a safe piloted vehicle

Legal

? is it allowed to operate a piloted vehicle?

Liability

? Who is responsible in case on an accident?
User studies: Attitudes, needs and expectations around piloted driving

Setup: Online Diaries collected in North America, Germany & China

- comfort
- safety
- technological maturity
- loss of driving pleasure
- change in the everyday life

Audi piloted driving
outlines of the test drive

- Goal: Let “customers” feel how-long-distance traffic may look like in a couple of years
- 10-hour beginning-to-end road test drive will be longest on record involving media journalists at the steering wheel for most of the 550 miles+, with exception of urban traffic environments
- All drivers were previously trained at the Arizona Proving Grounds
the car

- the **Highway Pilot** is an evolutionary development continuing the Traffic Jam Pilot shown at the CES 2014
- the vehicle is equipped with a fully integrated **Piloted Human Machine Interface**
- The speed range is **0 – 70 mph**
- The system performs automatic **lane changes** (overtaking and routing).
### Levels of automation

<table>
<thead>
<tr>
<th>Assistance systems</th>
<th>Automated systems</th>
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</thead>
<tbody>
<tr>
<td><strong>Level 0</strong></td>
<td>No Automation</td>
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<tr>
<td><strong>Level 1</strong></td>
<td>Driver Assistance</td>
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<tr>
<td><strong>Level 2</strong></td>
<td>Partial Automation</td>
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<tr>
<td><strong>Level 3</strong></td>
<td>Conditional Automation</td>
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<tr>
<td><strong>Level 4</strong></td>
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<td>the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems</td>
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<tr>
<th>Level 1</th>
<th>Driver Assistance</th>
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<td>the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
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<tr>
<th>Level 2</th>
<th>Partial Automation</th>
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<td>the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment</td>
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<th>Level 3</th>
<th>Conditional Automation</th>
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<td>human driver will respond appropriately to a request to intervene</td>
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<td>even if a human driver does not respond appropriately to a request to intervene</td>
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<td>the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver</td>
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**Today’s driver assistance systems**

**Next generation**

**New area of activity**

Piloted driving and parking

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*Audi piloted driving*
meet Jack

Audi piloted driving

1. 2x Laser-scanner
2. 4x Mid-range-radar
3. 4x Top View
4. 4x Ultrasonic
5. 2x Long-range-radar
6. 1x 3D-video-camera
7. 1x Stock GPS
8. 2x Short Range Radar
...and his HMI

**Audi piloted driving**

- Transparent mode indication to enhance mode awareness
- Multimodal transitions between driver and automation

1. Central Instrument Cluster
2. Central Status Indicator
3. Enhanced Peripheral lights
4. Retractable steering wheel
5. Steering Wheel buttons
6. Speech & Sounds
challenges

Road conditions

weather

Humans :o)

Permits

Audi piloted driving
Help us create the future of piloted driving!
THANK YOU!

Audi piloted driving

A7 concept
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