From ADAS to Automated Driving

Matthew Avery – Director of Research
ESC is an established life saver

- ESC equipped vehicles are 25% less likely to be involved in a serious or fatal crash in the UK

Other ADAS systems show potential...
AEB: Should It Be Mandatory...?

- Euro NCAP see a 38% overall reduction in real-world, rear-end crashes for vehicles fitted with low speed AEB compared to a sample of equivalent vehicles with no AEB.

- Thatcham Research – now a world leading reference in AEB and ADAS system functionality and effectiveness.
AEB Fitment Today

All new cars on sale in...

- 2015: 24% (Not Available), 59.3% (Standard), 16.7% (Optional)
- 2016: 27% (Not Available), 21% (Optional), 52% (Standard)

Forecast: New cars launched in...

- 2015: 27% (Not Available), 37% (Optional), 36% (Standard)
- 2016: 41% (Not Available), 10% (Optional), 49% (Standard)

Last updated: May 2016
AEB Testing & Insurer Effect

**Low Speed**
- **XC60**
  - Approaching speed (km/h): 10-80 km/h
  - Auto brake

- **Golf**
  - Auto brake

**High Speed**
- **XC60**
  - Approaching speed (km/h): 10-90 km/h
  - Auto brake
  - Forward collision warning

- **Golf**
  - Auto brake
  - Forward collision warning

**Claims Data**

- **THIRD PARTY INJURY CLAIM FREQUENCY**
  - Volvo XC60: 21%
  - SUV Control: 40%

*All Crashes*
Frontal Impacts With Pedestrians

- UK DfT reports 398 pedestrian fatalities in 2013
- 13% of all road casualties

<table>
<thead>
<tr>
<th>Test scenarios based on top 3 UK pedestrian collisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP1</td>
</tr>
<tr>
<td>CP2</td>
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<tr>
<td>CP3</td>
</tr>
</tbody>
</table>

Testing to be introduced into Euro NCAP 2016
Frontal Impacts With Cyclists

- UK DfT reports long term fall in cyclist deaths, fluctuating 100-120 in last 6 years
- 109 cyclist deaths in 2013; 11% of all road casualties
- Pedal cycle traffic increasing: 13% higher than 2005-9 average

<table>
<thead>
<tr>
<th>Crashes</th>
<th>9%</th>
<th>29%</th>
<th>22%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td>45%</td>
<td>22%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Thatcham developing testing for Euro NCAP; to be introduced into Euro NCAP 2018
Vehicle Evolution – Parking Collisions

- In the UK, 23% (725 out of 3,107 cases) of claims related to parking collisions
- 71% of parking collisions (516 out of 725 cases) occurred during reversing
Vehicle Evolution – Automated Steering

- LDW/LKA systems widespread in the market
- 20% of KSI relate to single vehicle crashes
- Sophisticated Lane Guidance Systems now available
- Run off road and across lane capabilities

Insurance claims:

- Reversing & Parking: 18%
- Car to car rear: 17%
- Single vehicle: 12%
- Junction: 4%
- Head on: 3%
- Lane change: 22%
- VRU: 23%
- Other: 12%
Defining the Technological Route to Automated Driving

Sensor Development

Current: Low & High Speed (City & Inter-Urban) AEB

2018 Sensor Capabilities (Assisted Driving)
ADAS Building Blocks

Thatcham Influence on Testing Procedures – *towards Automated Driving*

- **Automated Driving**
  - Automated Driving (Trained)
  - Automated Driving (Destination)
  - Automated Highway Driving
  - Automated City Driving
  - Automated Valet Parking
  - Autonomous Emergency Steering (AES)
  - V2X
  - AEB - City
  - AEB - Urban
  - Overtaking Assist
  - AEB – Pedestrian/Cyclist
  - Intersection Assist
  - ACC / Queue Assist
  - Lane Keeping
  - Lane Centering
  - Auto Parallel Parking
  - Navigation
  - Rear-Collision Mitigation
  - Anti-Lock Brakes
  - Stability Control
  - Electric Power Steering
  - Blind Spot Monitoring
  - Pedestrian Detection
  - Parking Aid
  - Traffic Sign Recognition
  - Lane Departure Warning
  - Forward Collision Warning
  - GPS

*Thatcham Research*
The Autonomous Car Timeline

International Categorisation of Autonomy — *open to interpretation*

0: No Automation
1: Assisted
2: Partial Automation
3: Conditional Automation
4: High Automation
5: Full Automation

0: LDW, ESC
1: ACC, LKA, BLIS, AEB
2: Queue Assist, Parking Assistance
3: (2018 on) Highway Pilot?
4: (2021 on) Automated Driving
5: (2025) Robot Taxi

Driver monitors driving environment

2016

Feet Off

Driver attention

Hands Off

Eyes Off

Brain Off?

System monitors driving environment

Driver monitored

(System functionality improvements)
Example: Drive Pilot up to 130km/h = 36m/s
Radar has 200m range, 100m used on target verification
Leaves approx. 3 seconds to bring driver back into loop; 10 seconds required
Level 3 poses increased risk of crashes?

Driver “check in” every 3 minutes?
Using Wheel or Infotainment System
AEB On Other Vehicles?

HGV

EU Regulation No. 347/2012

Currently no AEB requirement

Vans

Current 2016: Top 30 LCV AEB Functionality

Not available, 88.3%

Optional, 11.2%

Standard, 0.5%

Currently no AEB requirement
**Stage 1 (2013-15)**

**STATIC:** Requires a ≥6mph reduction of speed when driving into a stationary target at 50 mph

**MOVING:** Requires a 30mph reduction of speed when driving into a moving target moving at 20 mph

Applicable to: New HGV designs from November 2013
All HGVs in scope by November 2015

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**Stage 2 (2016-18)**

**STATIC:** Requires a 12 mph reduction of speed when driving into a stationary target at 50 mph

**MOVING:** Requires a 42.5 mph reduction of speed when driving into a target moving at 7.5 mph

Applicable to: New HGV designs from November 2016,
All HGV by November 2018

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All Tests Pass/Fail including False Positive Test; Target NOT defined
## Actual Performance of Vehicles

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Requirement (for max points or pass as applicable)</th>
<th>Achievement of best vehicle tested to-date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IGR</td>
<td>ENCAP</td>
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<tr>
<td>Stationary Target</td>
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<td>Avoid</td>
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<td>Avoid</td>
<td>Avoid</td>
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<tr>
<td>60</td>
<td>Avoid</td>
<td>Not Tested</td>
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<tr>
<td>70</td>
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<td>Avoid</td>
</tr>
<tr>
<td>80</td>
<td>-10</td>
<td>-20</td>
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<tr>
<td>90</td>
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<td>-80</td>
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<tr>
<td>Moving target</td>
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<tr>
<td>10</td>
<td>Avoid</td>
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</tr>
<tr>
<td>78</td>
<td>Avoid</td>
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</tr>
</tbody>
</table>

Volvo truck outperforms the best car....?
Truck Platooning

SARTRE project – 4m gap between vehicles

- Frees up driver time
- Safety
- Environmental impact reductions
- Fuel economy
- Improved traffic flow
Future Priorities – Turn Across Path

TAP

- Euro NCAP implementation from 2020 for cars
- Additional usage of forward looking sensors

- TAP consideration for Trucks?
- Would require additional sensors on the side

- Can Intermediate Technologies be brought forward? Economic Incentive?

- Equivalent exemptions would seriously undermine benefits
Automated Driving - Mercedes

Truck Freight set to triple by 2050

- 2025 “Freightliner Inspiration Truck”
  - Highway Pilot system
- Advantages:
  - EEG brain study revealed that driver drowsiness decreased by 25% when in automated mode
  - Drivers engaged in other tasks
  - High acceptance
- Economics:
  - Driver is significant cost in haulage; restricted by tacograph times
  - Less time responsible for driving = greater control on costs
The Autonomous Car

Levels of Autonomy – When will it happen?

0
No

1
Assisted Automation

2
Partial Automation

3
Conditional Automation

4
High Automation

5
Full Automation

New Car Sales %:
Assisted Driving

Fleet %:
Assisted Driving

Fleet %:
Partial Autonomy

New Car Sales %:
Partial Autonomy

New Car Sales %:
High Autonomy

Fleet %:
High Autonomy

New Car Sales %:
Full Autonomy

Fleet %:
Full Autonomy

0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

2005
2010
2015
2020
2025
2030
2035
2040
2045

2018
From ADAS to Automated Driving