

# Real Life Safety

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Autoliv Capital Markets Day 2015

**Autoliv**

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## **Towards Autonomous Driving**

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**Frank Melzer**

October 2

# Global Trends - Changing World

Biggest change in 130 years Automobile

- **Trend for Urbanization**
  - Less and less possibilities for “Fun to Drive”
- **Technology trend big data and automation**
  - IT and semiconductor industry “discovered” the car
- **Increased security needs**
  - Safety standards are driven towards “Real Life Safety”



# Impact on Driver

Increasing situations with need for Real Life Safety



## Under challenged

Boring situations – distracted driver



## Fun to drive

Enjoyable situations – focused driver



## Stressed

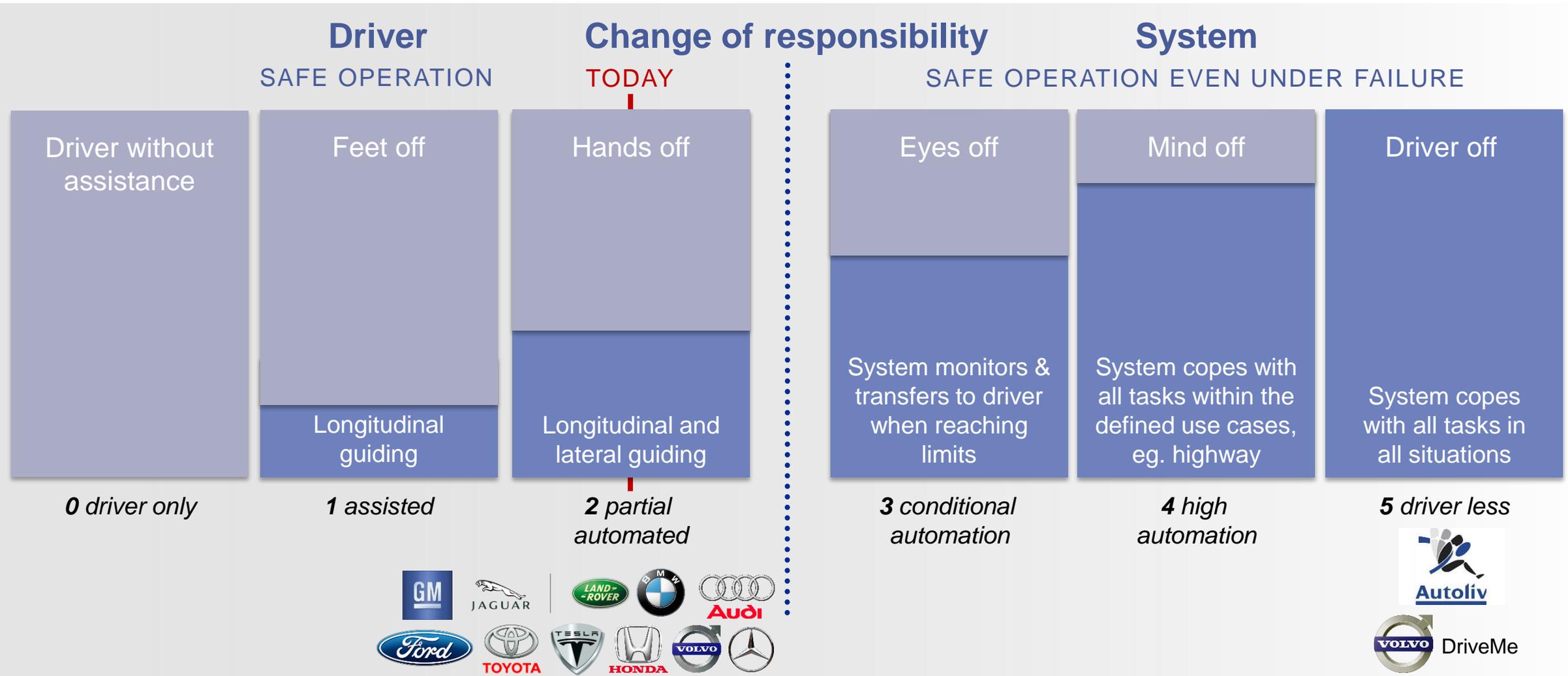
Critical situations - paralyzed driver



Need for active safety

# Industry Roadmap towards Automated Driving

From driver only to full automation

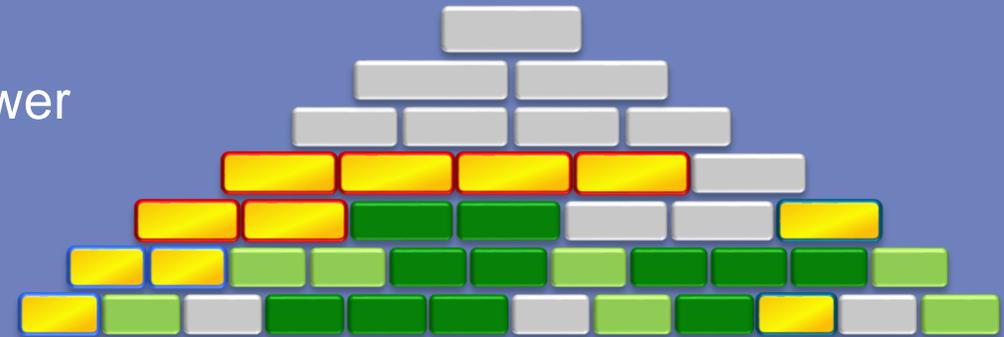


# Five Key Technologies pave the Way

Development driven by Semiconductor and Software Technology

## Autoliv Scope – Complete System Integration on Vehicle Level

- **Sensors** Range of different technologies
- **Control** Centralized high performance computing power
- **Software** Environment and decision model
- **Actuators** Highly reliable, fail-operational systems
- **Backend** Highly accurate maps and big data



# Three pillars of Autoliv Electronics

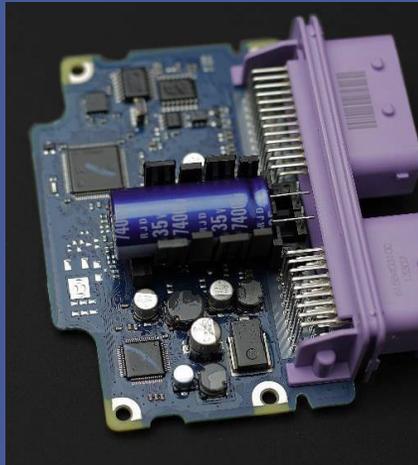
M&A is strengthening our way to \$3B

## Autoliv Electronics

### Passive Safety Electronics

#### Passive Safety Electronics

2014 approx. \$1B  
2019 > \$1B



### Active Safety

#### ADAS

2014 approx. \$500M  
2019 > \$1B



M&A MACOM

SW IP - Volvo

#### Brake Control Systems

2016 approx. \$600M\*  
2019 < \$1B



JV with  
Nissin Kogyo

(\*) closing expected early 2016

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# Customer Portfolio

Strong position with key customers

## Passive Safety Electronics

Customer base 9 out of TOP 20 OEM\*

- Autoliv has largest share at all 9 customers

## Active Safety

Customer base 6 out of TOP 20 OEM\*

- Autoliv has largest share at 4 customers

*(\*) Basis: TOP 20 Safety Electronics Customers globally*



# New Requirements drive the Market

## From standard situations to Real Life Safety

### Standardized Test Scenarios



### Real Life Situations and Benefit

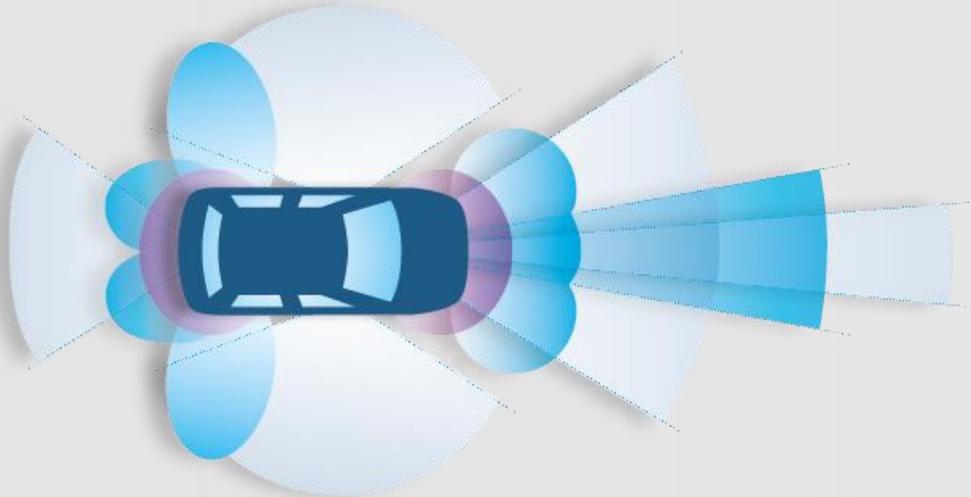


# Active Safety System 2015

## Range of Sensing Technologies and System Segmentation

### Sensing

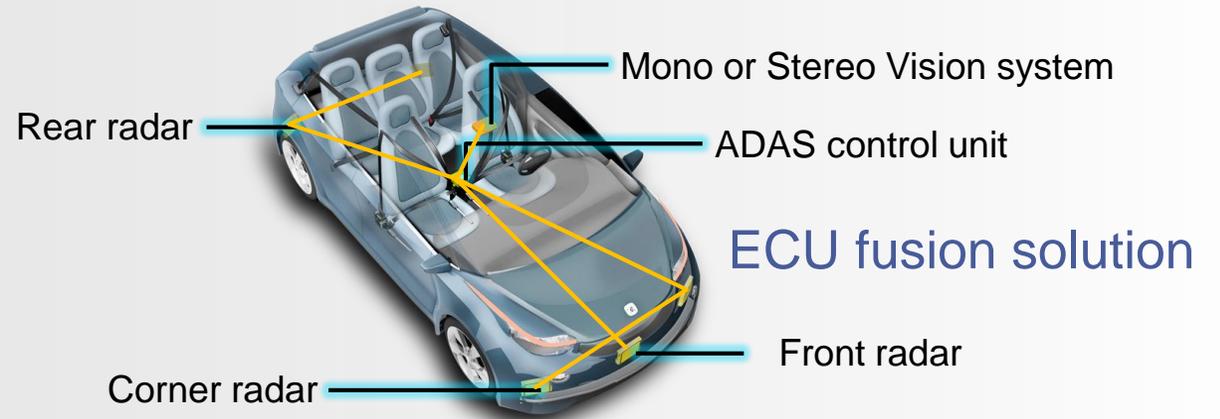
Radar Vision Infrared Lidar Ultrasonic



No single Technology able to cover all Requirements

### System Segmentation

State of the art



Base Solution



# AEB Euro NCAP 5-star Solutions 2015

## Fusion Systems dominate the market

	Lidar <sup>4.)</sup>	Mono Camera	Radar	Stereo Camera	Fusion
OEMs <sup>1.)</sup>	<b>5</b>	<b>3</b>	<b>6</b>	<b>2</b>	<b>12</b>
Exclusive solution at OEM <sup>2.)</sup>	<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>5</b>
Best Euro NCAP Rating <sup>3.)</sup>	<b>6%</b>	<b>84%</b>	<b>87%</b>	<b>91%</b>	<b>100%</b>

<sup>1.)</sup> Number of OEMs out of Top20 using the solution (multiple counts possible)

<sup>2.)</sup> Autoliv Analysis

<sup>3.)</sup> Source: [www.euroncap.com](http://www.euroncap.com), EURO-NCAP Data

<sup>4.)</sup> Used for AEB-City Testing Only, not eligible for AEB-Interurban; Potential fulfillment rate calculated for comparison

# Evolving 5-Star NCAP Requirements

Real Life Safety will rely on more complex Sensor Fusion Solutions

	2013	2014	2016	2018	2020
 Central ADAS ECU			 Market Intro Autoliv 1 <sup>st</sup>		 Preferred
 Front Corner Radar			 Market Intro Autoliv 1 <sup>st</sup>		 Preferred
 Front Sensor	 AEB Mono AEB Radar Autoliv 1 <sup>st</sup>	 1 sensor required		 Fusion preferred	 Fusion required
		 City Interurban	 Pedestrians	 Cyclists	 Intersections
	2013	2014	2016	2018	2020

# Sensors - Radar Technology

Broadest portfolio in the market

- Front and Rear Radar Systems in production on >80 different vehicles
- Market leader with Radar Only NCAP 5 star solutions
- New technology platform 77 GHz launching 2015



Portfolio of all  
Radar Sensor Technologies

# Sensors - Vision Technology

Broadest technology platform – Mono – Stereo – Night vision

- **2013**  
First to market with Vision based AEB
- **2015**  
Mono Camera with Autoliv owned algorithm  
Autoliv Stereo Camera with own AEB
- **2017**  
Mono Camera with Autoliv Vision based AEB

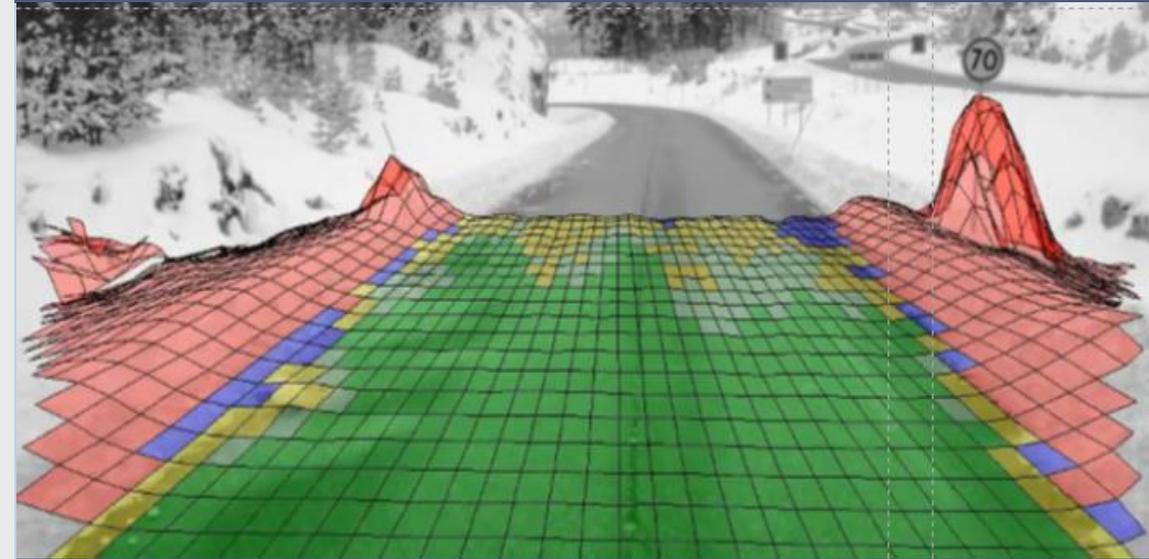


AEB  
Autonomous Emergency Braking  
Mono and Stereo

# Computer Vision Technology

Broad capabilities for growth

- Scalable Hardware Solutions for 1 to 6+ function cameras
- Stereovision with the advantage of a 3D view of the world - real-life safety solution
- In-depth knowledge of sensor algorithms enables optimized Fusion solutions

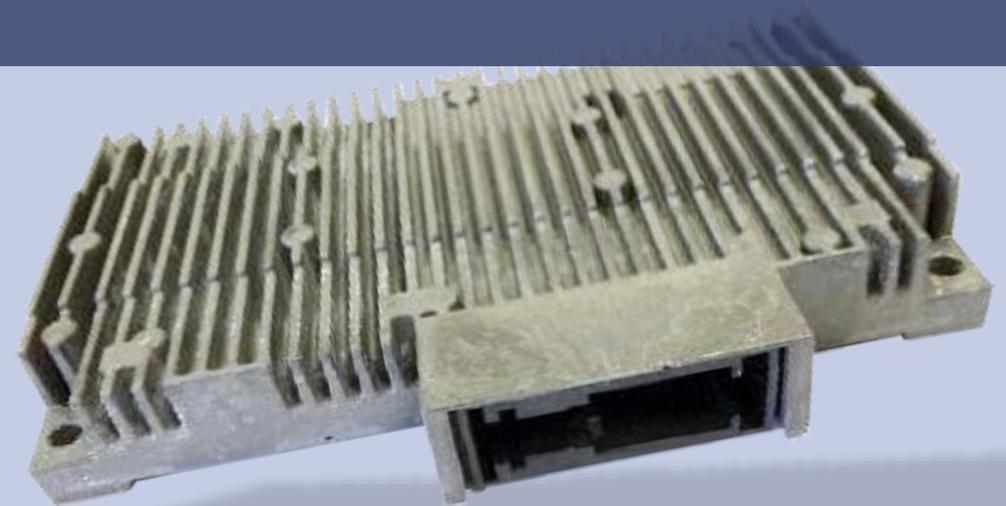


Driveable Road Surface

# Controls - ADAS ECU

The brain of an active safety system

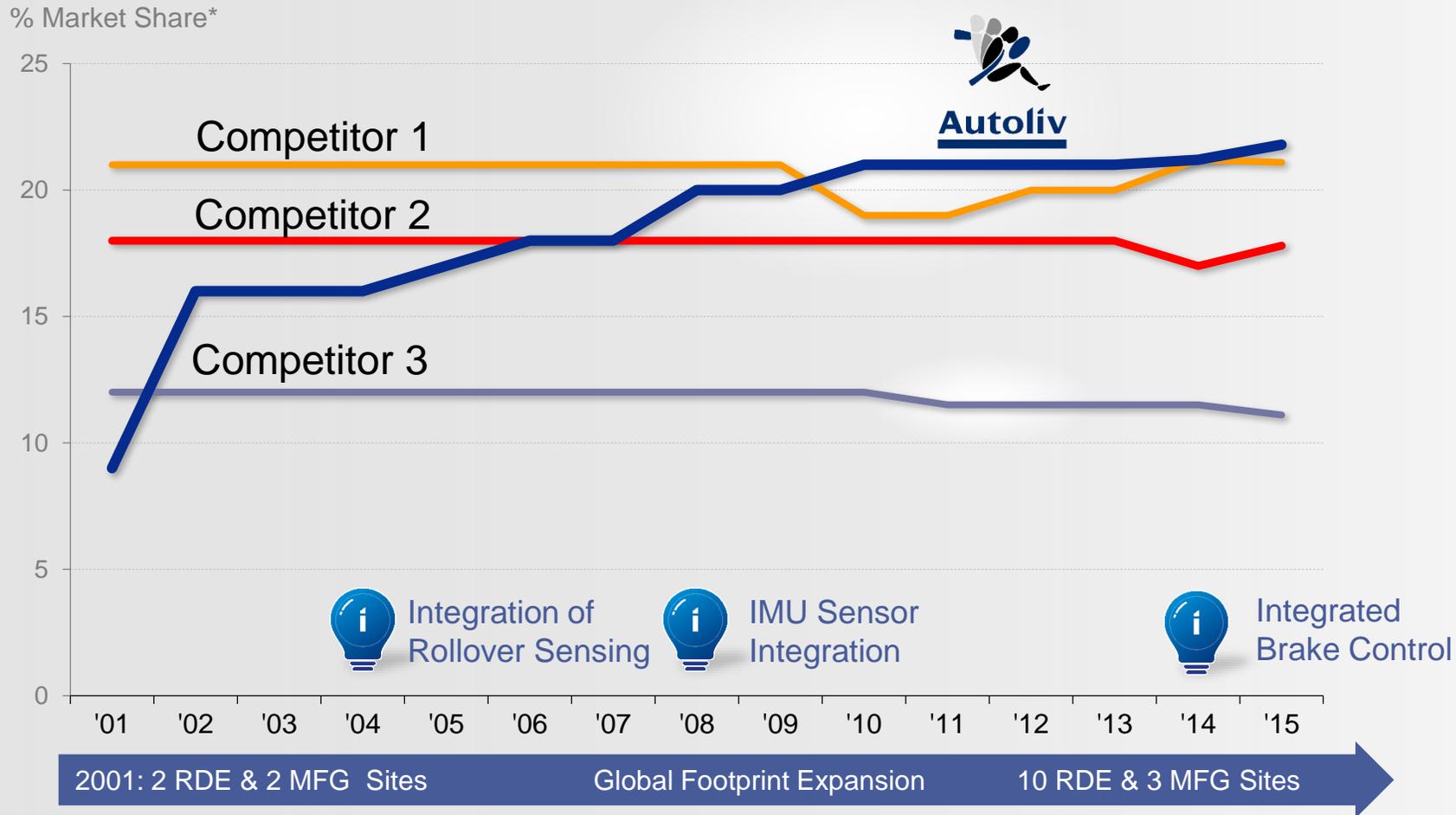
- World First Central ADAS ECU Launching 2015
- Autoliv is Industry Leader in integration of Safety Features
- Scalable Hardware Solution



World first central ADAS ECU

# Controls - Passive Safety ECU

Breakthrough Innovation paved the way to leadership



(\*) based on units IMU – Inertial Measurement Unit

# Software - Autoliv Feature and System Software

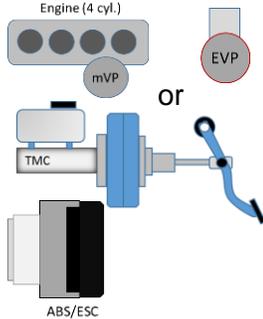
Broad capabilities for growth

- Joint development on Autonomous driving features with 2 OEMs
- Licensing Volvo ADAS software feature package and IP
- In-house development of system integration, algorithms and features



# Actuators - Brake Control Systems

Market drivers - changing towards electric actuated brake control systems

Powertrain / CO <sub>2</sub> reduction		Active Safety	Total Cost	Comfort
Hybrid / EV 	Evolution of ICE 	<p>FOR SAFER CARS</p> <p>EURO  NCAP</p> 		Brake Feel 
Regenerative braking	Low / no vacuum	High response AEB	Reduction of complexity	Variable characteristic

ICE – Internal Combustion Engine

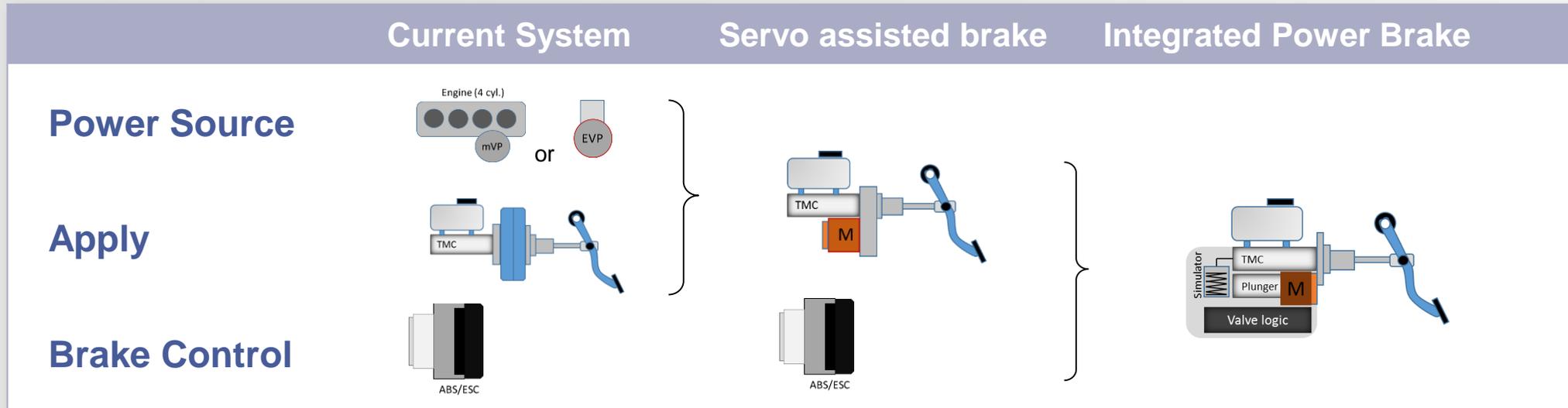
EV – Electric Vehicle

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# Actuators - New Braking Control Systems Architecture

## Hardware Integration



- More than 15 years experience with electrically actuated brake systems
- Market Leader Power Braking System 1 Million Systems 2018

# Towards Automated Driving

## Saving Lives through Real Life Safety

Our Mission guides our Growth Levers

**Customer**

**Technology**

**People**

**Autoliv**  
Safety Systems

*Active  
Safety*



**Autoliv**

Every year, Autoliv's products  
save over 30,000 lives

and prevent ten times  
as many severe injuries