

CAPS - Combined Active & Passive Safety

Right on track to enhanced driving safety

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Robert Bosch GmbH
CC/PJ-CAPS: Jochen Pfäffle



Outline

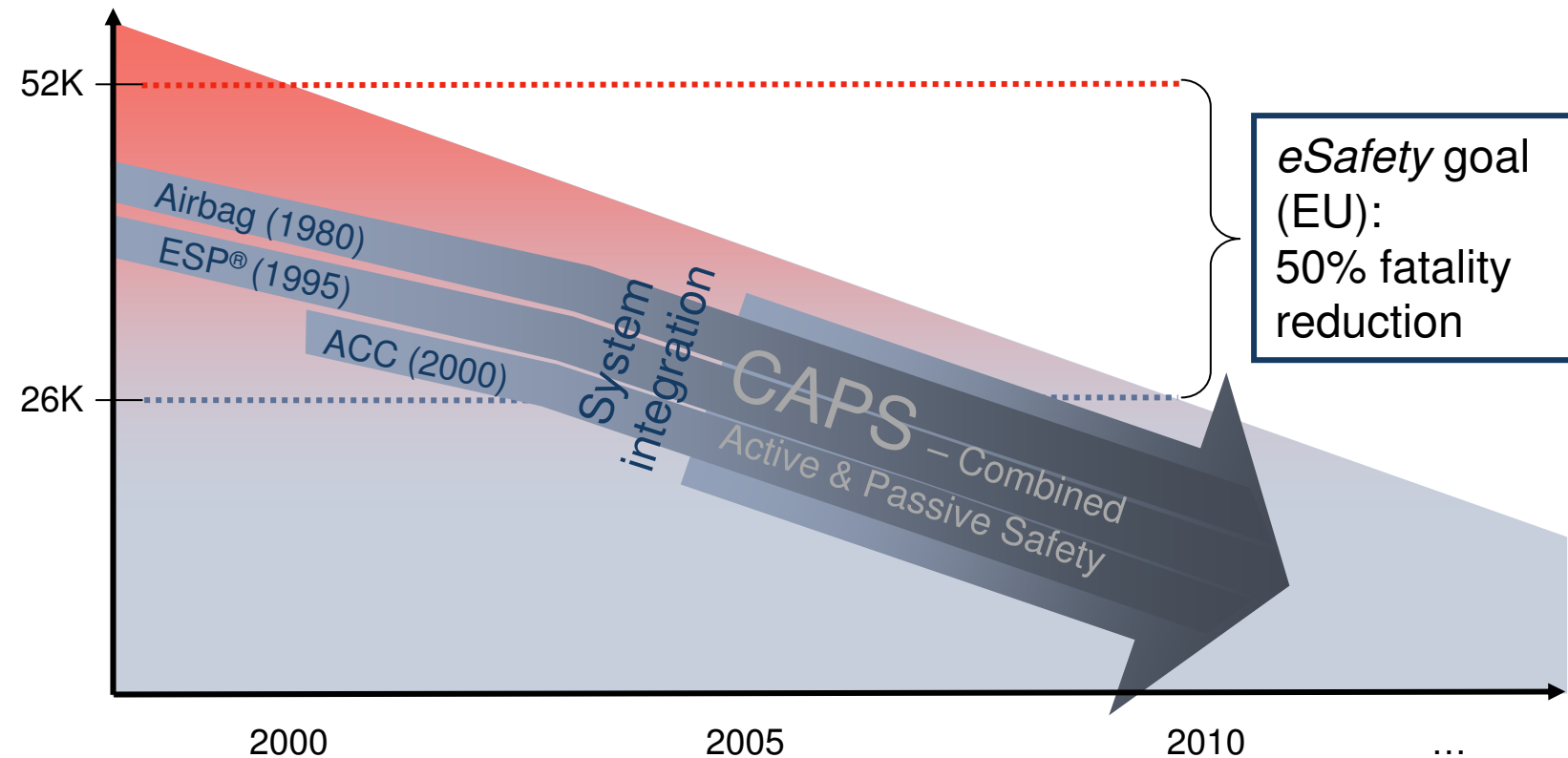
- CAPS motivation & content of activity
- Accident analysis & development methodology
- Market, drivers, trends & challenges



CAPS - Combined Active & Passive Safety

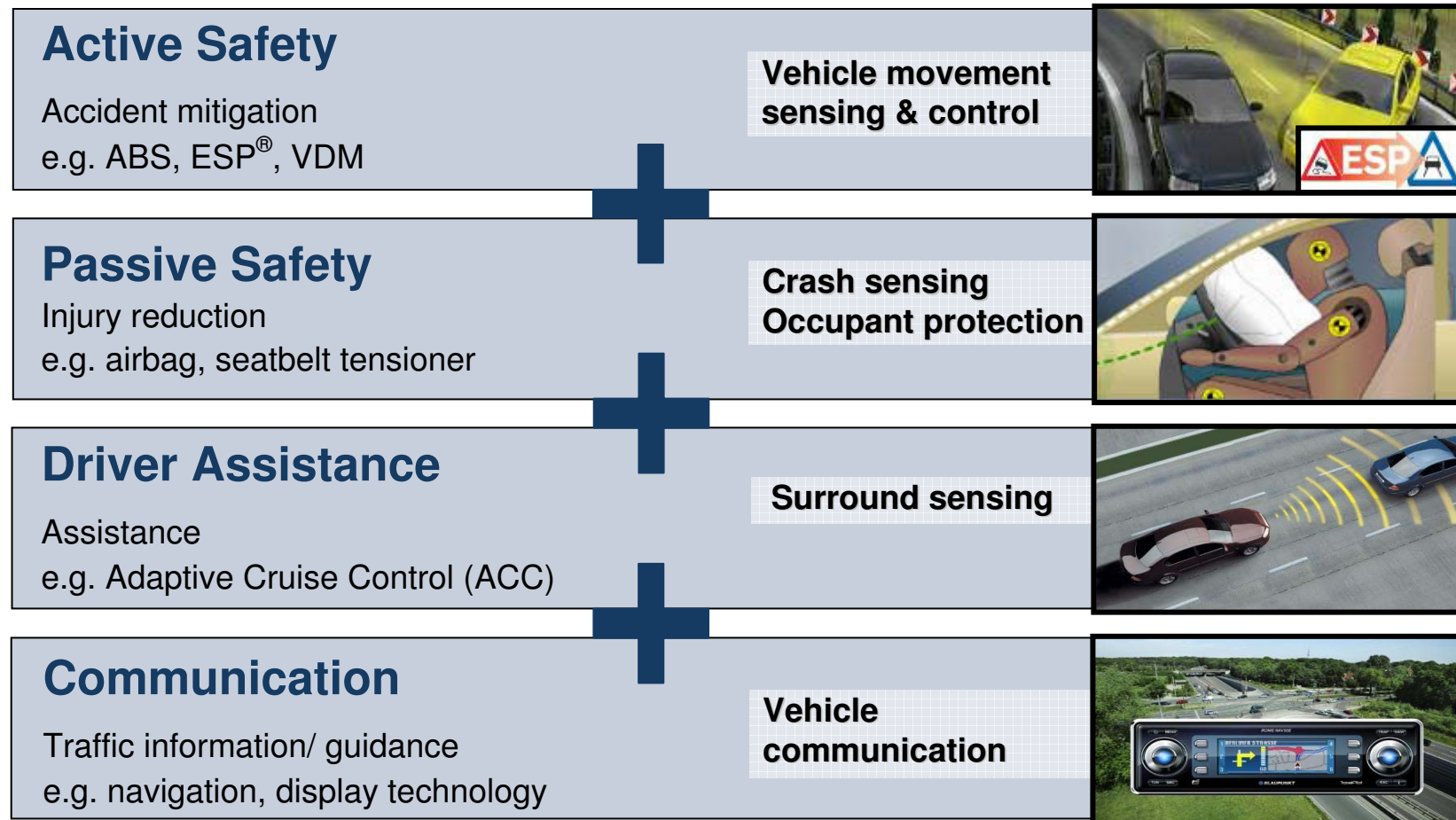
Reduction of crash fatalities

Fatalities EU 25



CAPS - Combined Active & Passive Safety

CAPS is ...



CAPS - Combined Active & Passive Safety

CAPS – the route to enhanced driving safety

Driver Assistance



Vehicle stabilizing



Brake functions



Vehicle dynamics

Active Safety

Radar based systems



Ultrasonic based systems



Video based systems



CAPS

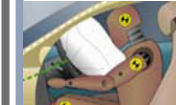
- Preventive information
- Coordinated interaction
- Added value functions

Targets:

Accident mitigation and reduced accident severity



Detection and sensing



Occupant protection



Pedestrian protection

Passive Safety

Communication

Navigation systems



Display technology



Car-to-x



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Selection of safety functions – Predictive Safety Systems

Active Safety

Driver Assistance



Radar based systems



Ultrasonic based systems



Video based systems

PBA (Predictive Brake Assist)

- Adaptive Brake Assist (ABA)
- Automatic Brake Pre-fill (ABP)
- Reduced braking distance

PCW (Predictive Collision Warning)

- PBA + driver warning (e.g. short brake pulse)

PEB (Predictive Emergency Brake)

- PCW + automatic emergency braking before an inevitable collision



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Selection of safety functions – occupant protection

Active Safety



Vehicle stabilizing



Brake functions



Vehicle dynamics

Passive Safety

RoSe II (Roll-over Sensing)

- Earlier deployment of curtain airbags based on ESP® sensor signals in roll-over situations

EPCD (Early Pole Crash Detection)

- Earlier deployment of restraint devices in case of a door intrusion after a lateral trip of the vehicle

PREFIRE^{ESP}

- Activation of reversible belt tensioners in critical driving situations



Detection and sensing



Occupant protection






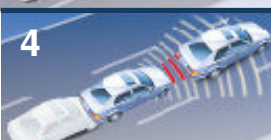


Pedestrian protection



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CAPS multiphase safety concept

Risk phases

	1 Risk avoidance: Traffic guidance Warn driver in advance in case of e.g. traffic jam or improper speed
	2 Increased risk: Brake preparation Raise brake efficiency
	3 High risk: Driver warning / Accident mitigation Guide the drivers attention towards crash avoidance
	4 Crash inevitable: Accident preparation Prepare occupant protection, slow down vehicle
	5 In-crash: Occupant protection Optimize occupant protection
	6 After crash: Information Inform rescue services, warn following traffic



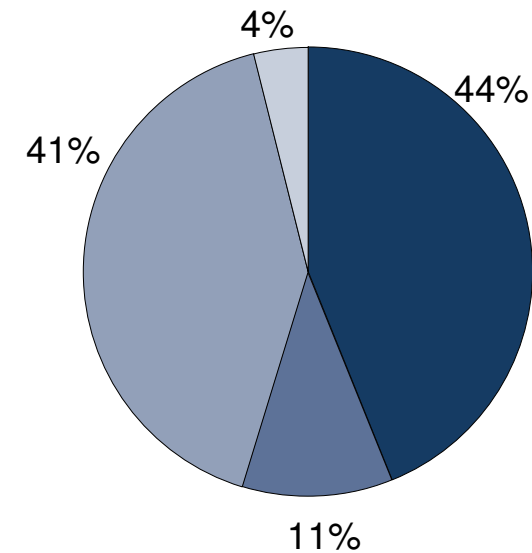
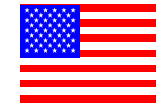
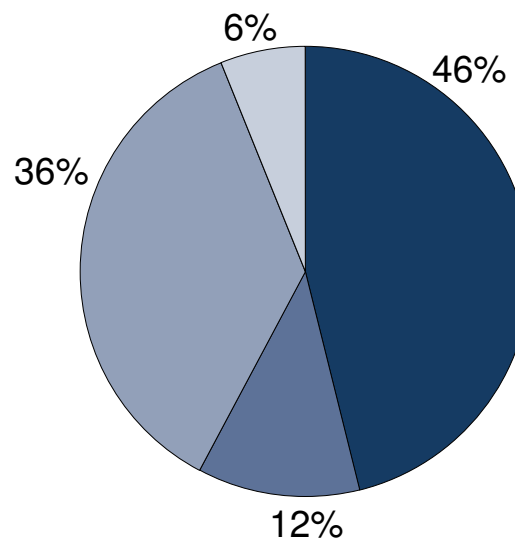
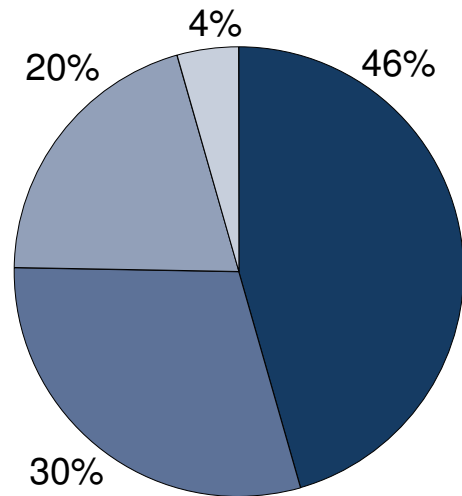
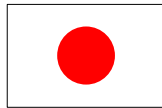
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Main fatalities categories



- Vehicle-to-vehicle
- Single vehicle
- Vehicle-to-pedestrian
- Others

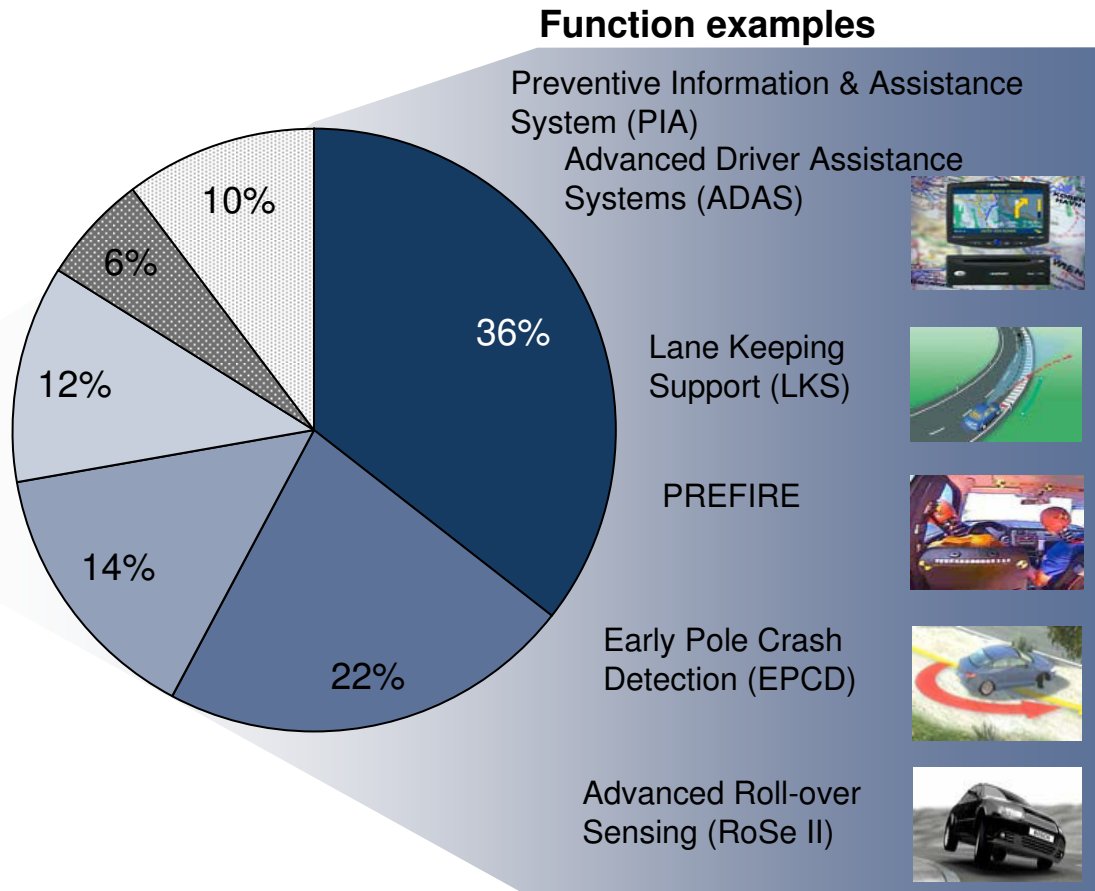
Source: Traffic Bureau, National Policy Agency, 2004; GIDAS, 2004, BaSt 2004; FARS 2004



Fatalities versus kinds of accidents



- Leaving the carriageway to the right or left
- Collision with another oncoming vehicle
- Collision with another vehicle which turns into or crosses a road
- Collision between vehicle and pedestrian
- Collision with another vehicle which is moving ahead or waiting
- Others



Source: GIDAS, 2004, BaSt 2004



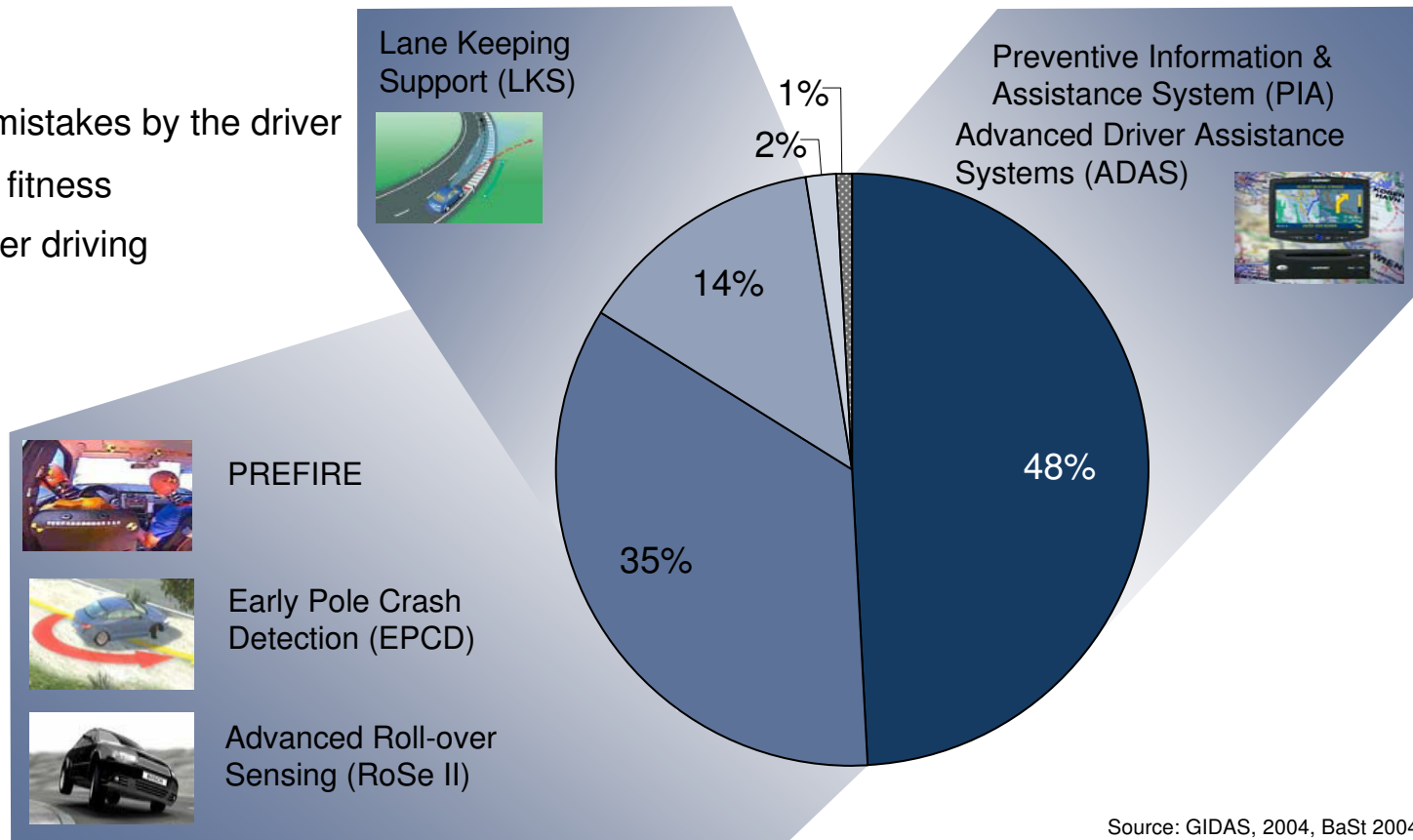
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Fatalities causes



Cause: collision while leaving the carriageway to the right or left

- Speed
- Other mistakes by the driver
- Driving fitness
- Improper driving
- Others



Source: GIDAS, 2004, BaSt 2004



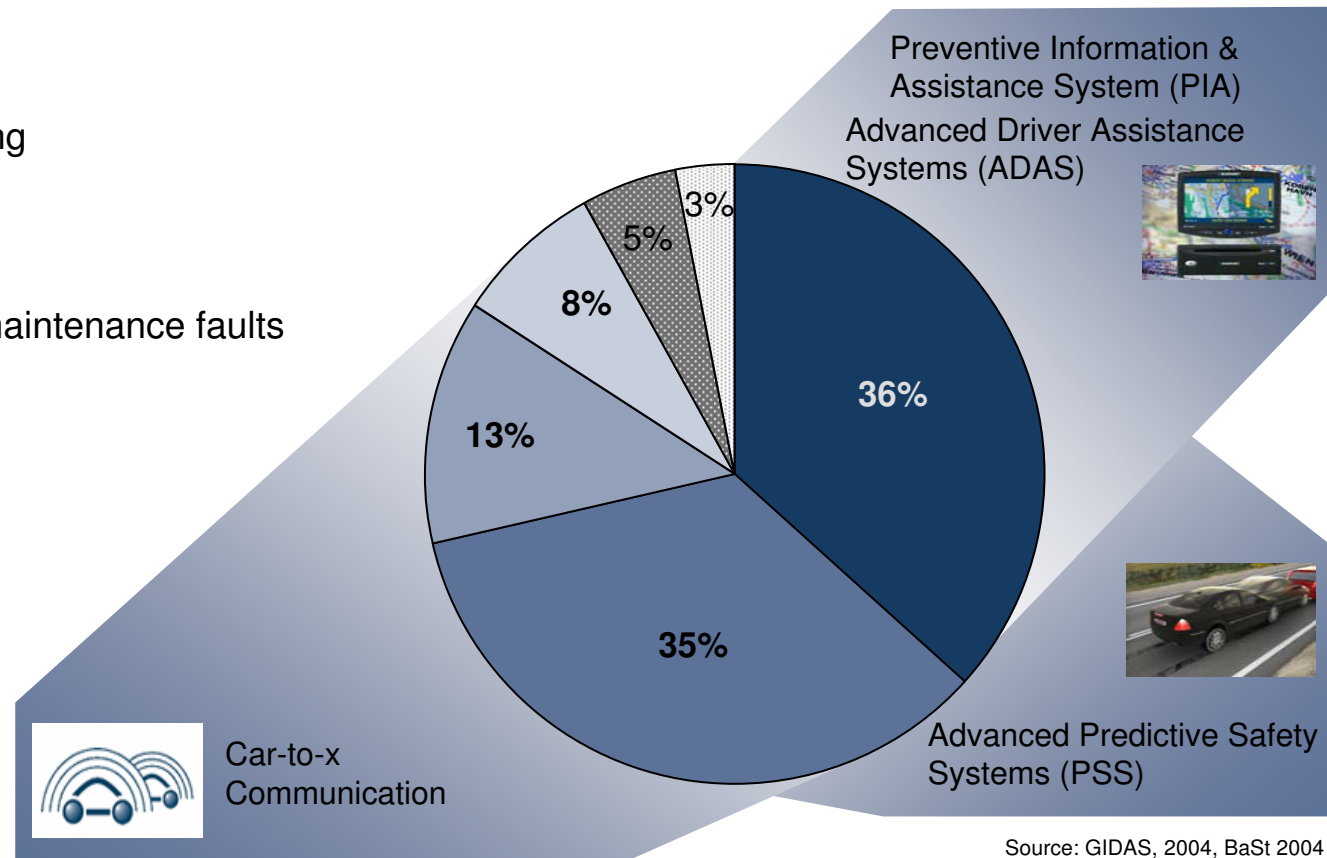
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Fatalities causes



Cause: collision with another oncoming vehicle

- Speed
- Improper driving
- Overtaking
- Driving fitness
- Technical or maintenance faults
- Others



Source: GIDAS, 2004, BaSt 2004

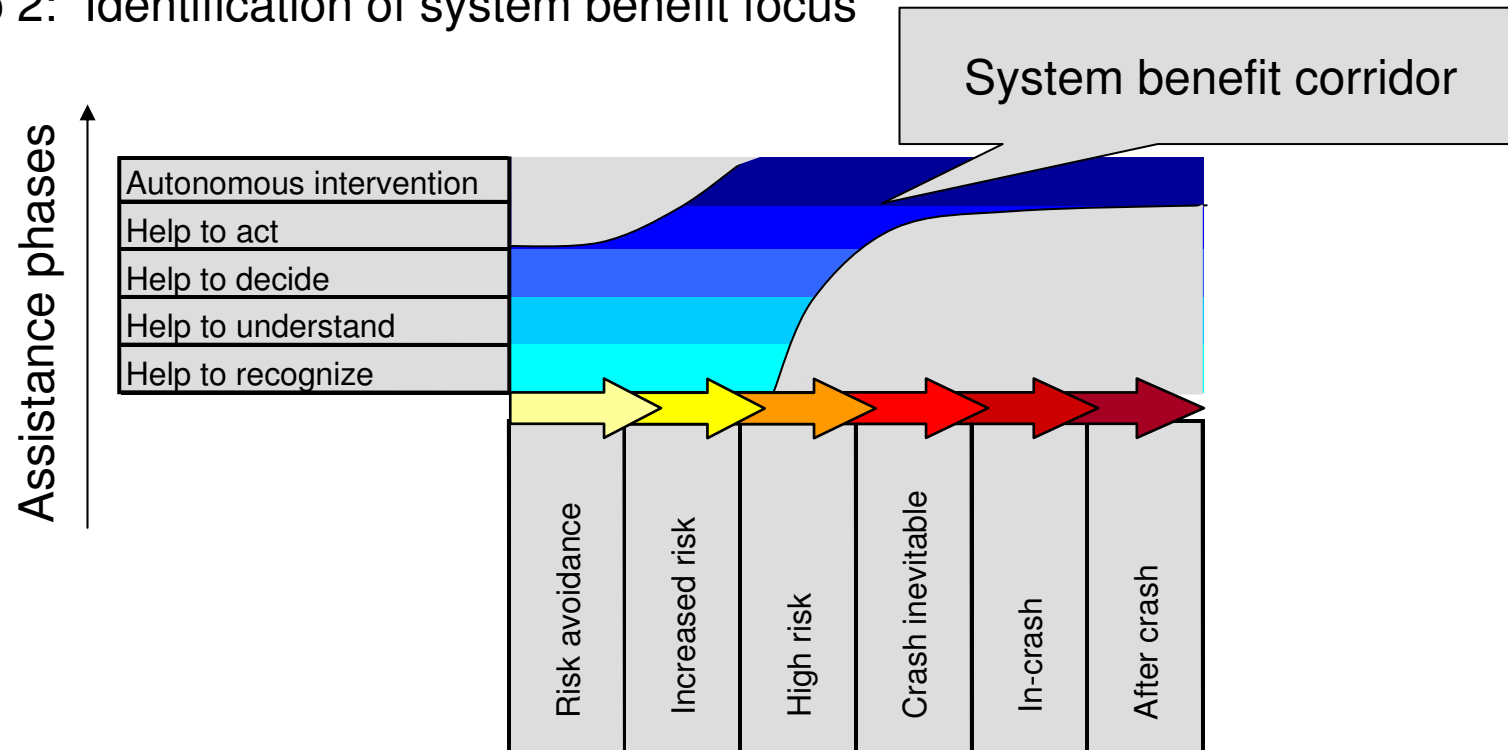


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Methodology – Top-down process, steps

Step 1: Identification of main area of function focus (cause, kind related)

Step 2: Identification of system benefit focus



⇒ Benefit for driver / passenger is mostly given within the corridor

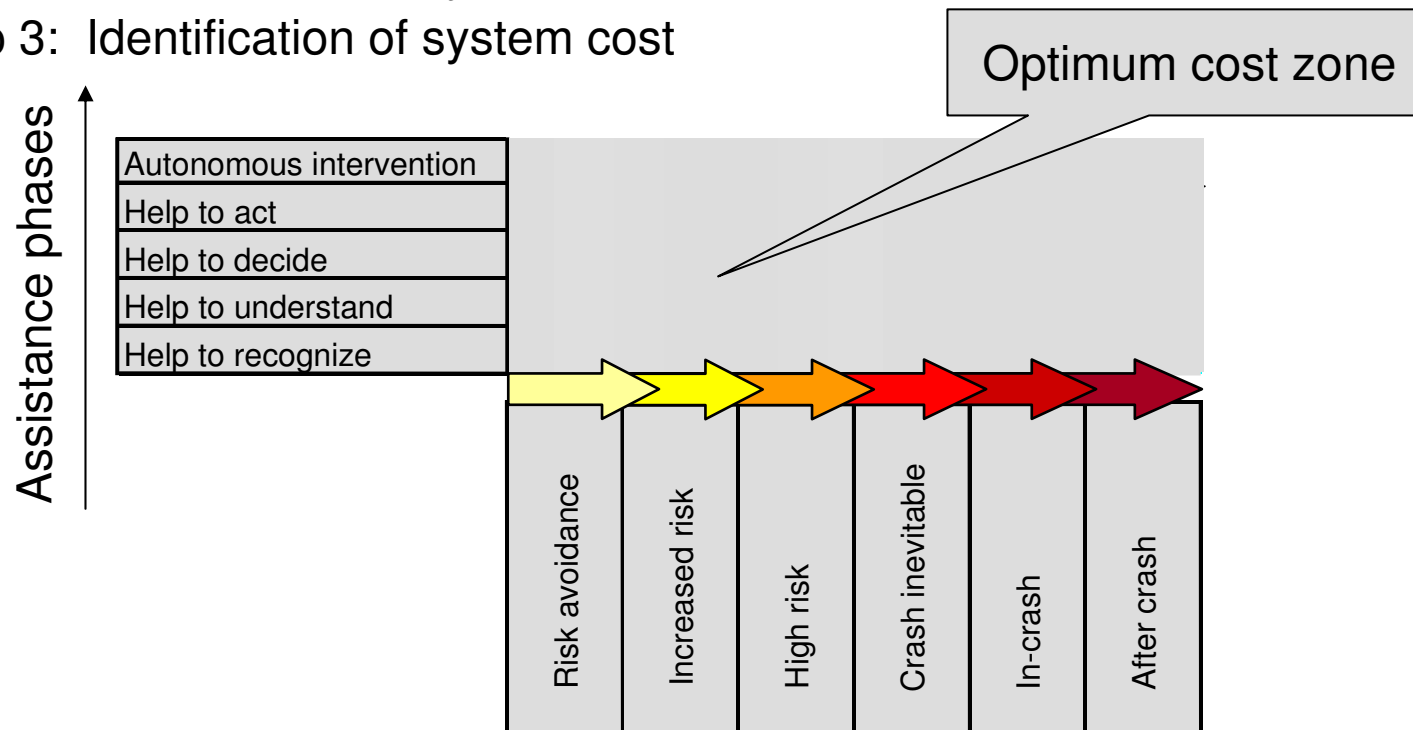
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Methodology – Top-down process, steps

Step 1: Identification of main area of function focus (cause, kind related)

Step 2: Identification of system benefit focus

Step 3: Identification of system cost



⇒ System cost and complexity is lowest in the optimum cost zone

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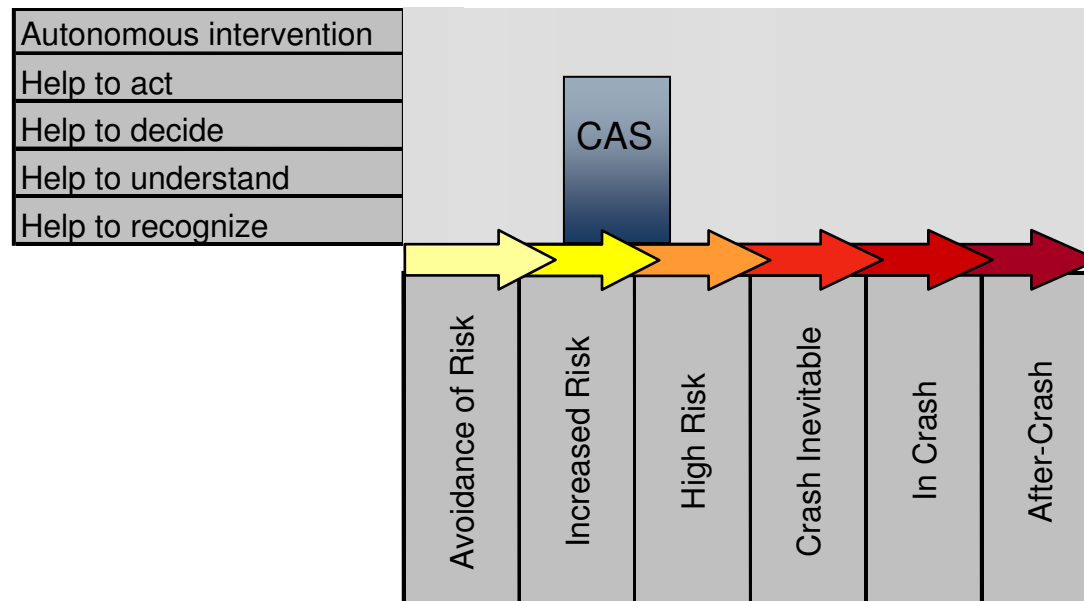
Methodology – Top-down process, steps

Step 4: Identification of function idea

Step 5: Functional assessment

Step 6: Function specification

Step 7: Function development, validation



→ **E.g.**

- Assistant for crossings & intersections

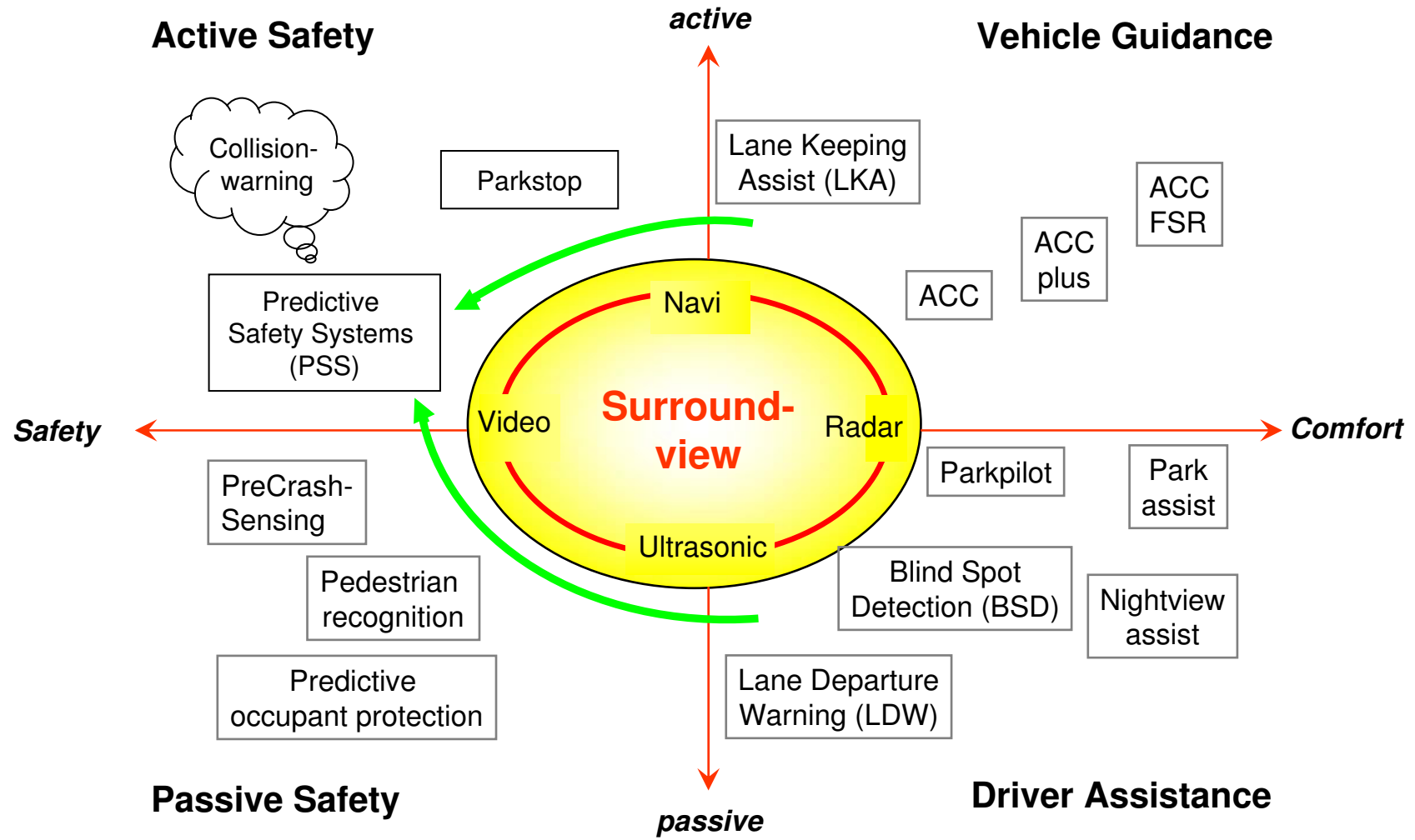


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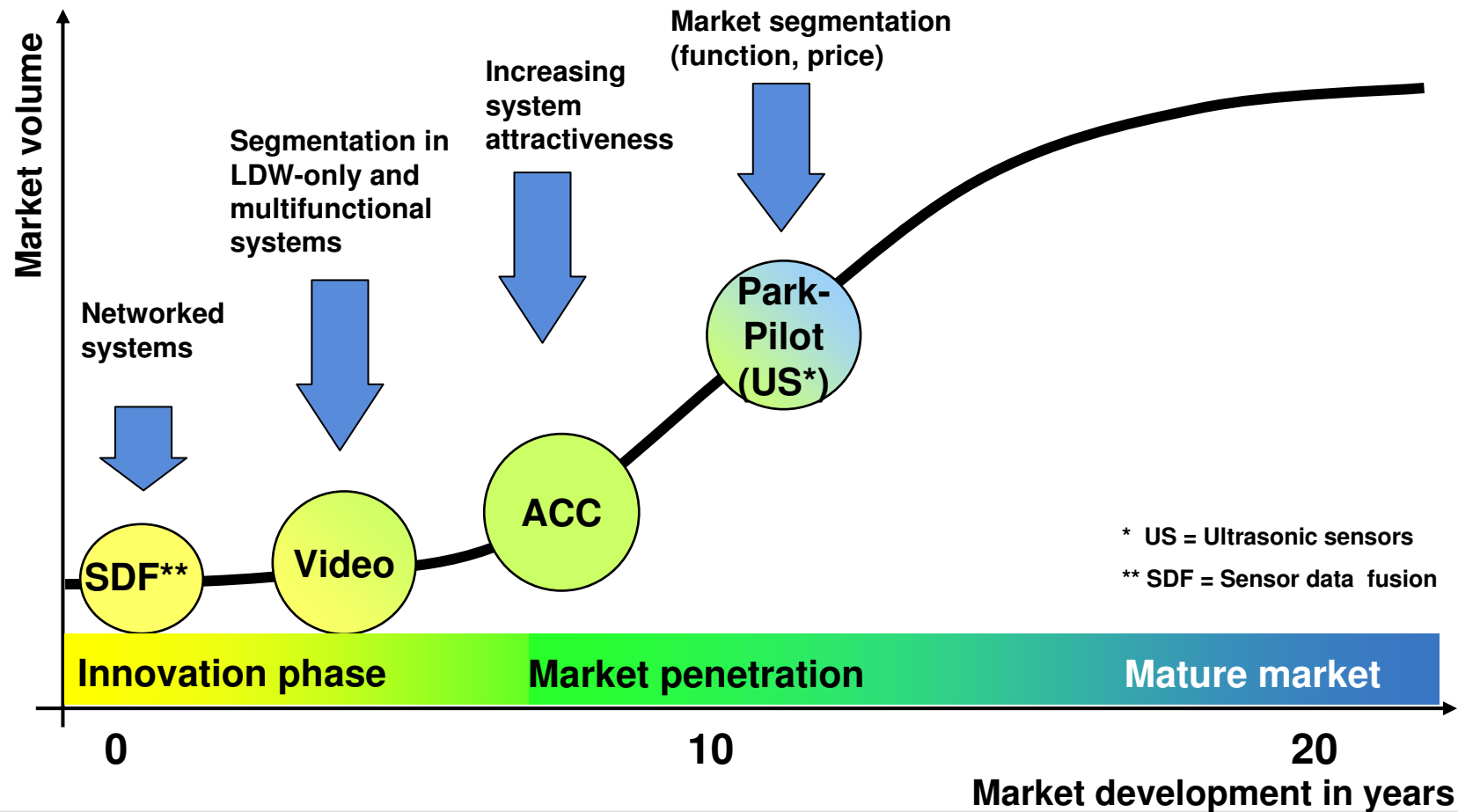


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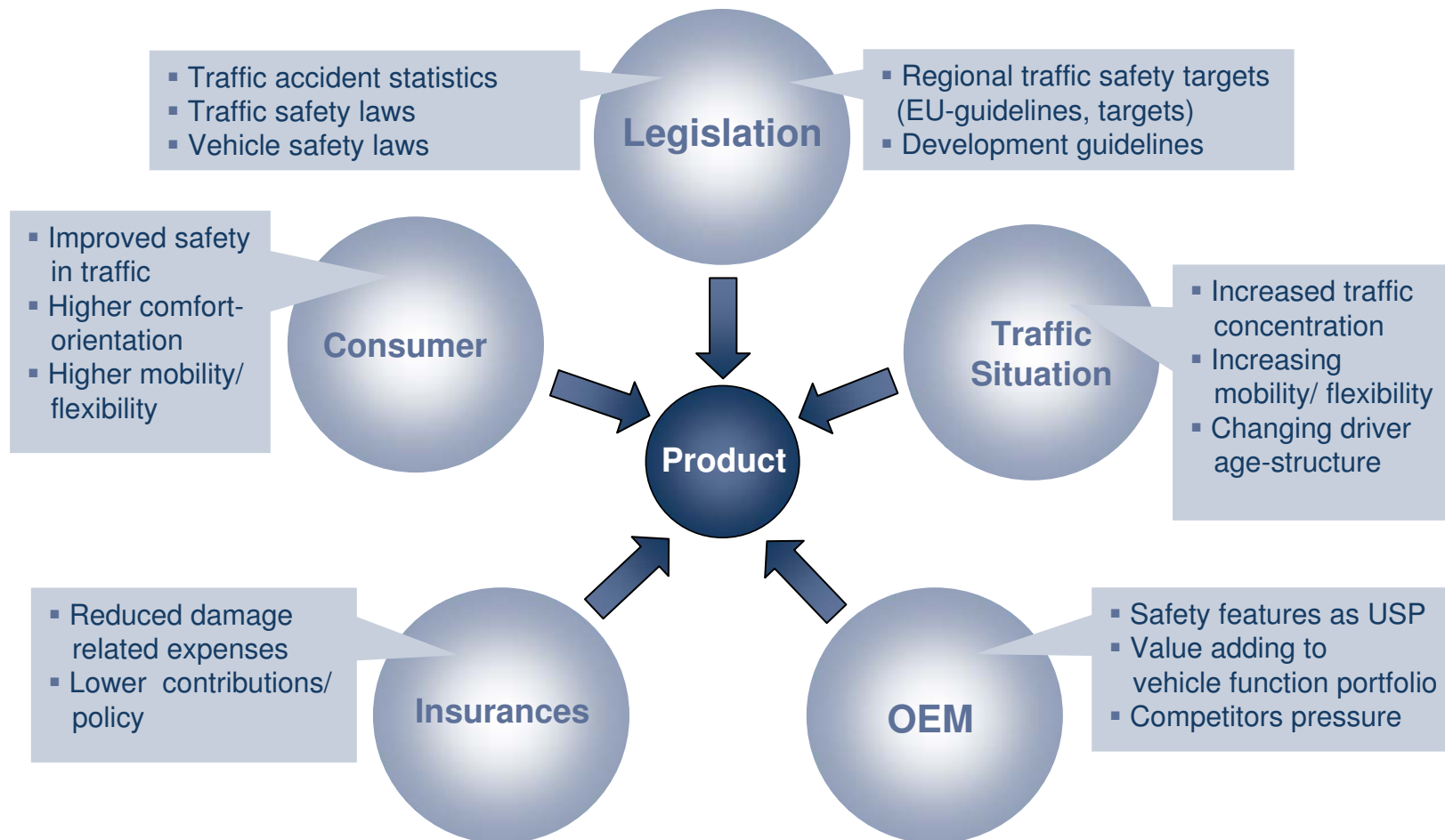
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Maturity of the Driver Assistance markets



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Market environment – Trends and drivers



Trends & challenges 1/2

Mainstream (“state of the art”)

- Stand alone systems in „peaceful coexistence“
- Dedicated sensors for dedicated systems
- Side effects might still be covered with manageable testing effort
- Mainly iterative development process

Front end

- Sensor data fusion for function prototypes
- First usages of sensor cluster for comfort- and safety functions
- Safety related requirements increase testing effort excessively
- Enormous cost increase for iterative development process



Trends & challenges 2/2

Future

- Driver Assistance Systems:
Step by step evolution from comfort systems to safety systems
- Safety applications become a dominant driver for surround sensing systems
- Increasing requirements regarding safety systems (ASIL D) → vehicle architecture
- Covering of side effects in high complex systems will not allow anymore iterative development process
- Core competences such as vehicle dynamics, trajectory control, identification of traffic situation and safety systems will be combined increasingly → „CAPS“
- **High potential to improve driving safety especially for the domain „Active Safety“**



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Halving the number of road accident victims in the EU by 2010



A shared responsibility

