Code of Practice for development, validation and market introduction of ADAS

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Overview

- Safety Benefit and Product Safety of Driver Assistance Systems
- Challenges and Consequences for OEM and suppliers developing ADAS
- Rationale of the Project RESPONSE 3
- Legal aspects of a Code of Practice (CoP)
- Scope and content of the CoP
- Timeline RESPONSE 3, what’s your job
Safety Benefit of Driver Assistance Systems

- Vehicle Safety in good shape
- Driver‘s Performance can and should be assisted

Driving Accidents: After series introduction of ESP, a significant decrease of accident numbers within MB-cars

AARU / VW / Gidas data base
Product Safety of Driver Assistance Systems

Main focus of IVIS
Task 1: Navigation
Determination of Destination and Travel Time

Main focus of ADAS
Task 2: Manoeuvring
Mental determination of a collision-free Corridor

ABS, ESP/DSC,..
Task 3: Stabilisation
Operation of throttle, brakes, steering wheel, gear change, ...

Distraction ESoP

Risk Issues?

Safety approved

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RESPONSE 3, München, 04.04. 2006
Safety Topics of Driver Assistance Systems

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Human Machine Interface, Nomadic Device

Human Machine Interaction

Technical Safety Concept
Driver Assistance Systems

Navigation
Knowledge based
Information systems (IVIS)
e.g. Navigation System

Stabilisation
Skill based
Systems of active safety
e.g. ABS, ESP

Manoeuvring
Rule based
Assistance of normal driving
e.g. Lane Change Assist

Assistance in emergency situations e.g.
Automatic Emergency Brake

Advanced Driver Assistance Systems
Development and introduction of Advanced Driver Assistance Systems means:

- **Supporting and/or substituting the driver** in his driving task
- Therefore: *complex interaction* of system and driver in multiple traffic situations
- Therefore new challenges for system safety due to
  - functional complexity (software; human errors in development)
  - more complex driver system interaction,
  - lack of experience and unknown user reactions (human errors in usage)
Consequences for OEMs and Suppliers by market introduction of ADAS

• possible business case but there are also financial risks based on:
  – possible damage of brand image, if ADAS doesn’t meet consumer expectations
  – possible recall campaigns, if ADAS doesn’t meet consumer expectations or shows malfunctions
  – product liability, if ADAS doesn’t meet requirements of a safe product
ADAS risks - Driver Acceptance

ACC: Developed as comfort - functions: focus on high availability

Satisfaction index (ACC) over time of usage

It is really working!
Fascinating!

Does it work at all?

Unfortunately it is not working all the time

Explain your customer:
It’s not a bug, it’s a feature!

* from H. Winner, TU Darmstadt
ADAS Risks - Sensor Limits

Radar

Lidar

How to explain these limits to a customer?
How will the customer create a mental model?
Rationale for RESPONSE 3

• What can be done about legal risks linked to ADAS?
  – How to prove, that the product is reasonably safe?
  – How to prove, that the manufacturer has fulfilled his duty of care?
  – What is the state of the art for development and validation of ADAS?

Code of Practice as a solution?
• A product is defective, if
  – it does not provide the **safety that can reasonably be expected** taking into account all circumstances,
    • in particular the presentation of the product,
    • the use of the product that can be expected in faith

• Codes of practice already play a role on a European level in product safety law.

• Can therefore contribute to the assessment of “safe product“/”non-defective product“ on the same level as other voluntary rules/ guidelines / recommendations.

• Code of Practice should integrate existing elements of state of art/state of science and art such as standards, recommendations etc, and fill the gaps not yet covered.
Importance of Validation Effort
Legal Consideration of a CoP

- Safety Levels:
- Product Liability Law: State of science and art
- Product Safety Law: State of art and technology
  - (1) Community provisions (European legislation)
  - (2) Rules of national law
  - (3) National standards giving effect to a European standard
  - (4) Community technical specifications
  - (5) National standards
  - (6) **Code of good practice**
  - (7) State of art and technology
  - (8) Safety which consumers reasonably expect

A Code of Practice will be legally relevant
Scope of the Draft CoP

• This COP specifies a procedure for assisting the assessment of safety issues of ADAS, focussing Human-Machine-Interaction. It addresses

- Risk identification within specification work of ADAS
- Performing hazard and risk analyses
- Assessment methodology for ADAS
Scope of the Draft CoP (2)

RESPONSE 1

Level of Support
Safety
Reliability & Robustness
Performance

System Aspects

Drivers Aspects
Human-Machine-Integration
Cognition Emotion/Motivation
Psychomotoric Performance
Product Use & Responsibility

Legal Aspects

Traffic Law / Type Approval
Product Liability Law / Tort Law
Insurance Law
Criminal Law

Controllability Concept

ISO TC22/SC3/WG16

The Integrated Approach

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Definition of Controllability

Controllability:

Likelihood that the driver can cope with driving situations including ADAS assisted driving, system limits and system failures.
Controllability Concept

Controllability is related to

…the possibility and capability to **perceive** the **criticality** of the situation

…the capability to **decide** on an **appropriate countermeasure** (e.g. override capabilities, complexity of the system switch-off procedure)

…the driver’s ability to **perform** the chosen **countermeasure** (e.g. reaction time, sensory-motor speed, accuracy)
Elements of a safety process and controllability aspects

Concept Phase
- Definition phase
  - Hazard analysis and risk assessment
  - Controllability Safety Concept
    - Draft HMI concept
  - Controllability Assessment
    - Definition and Comparison of HMI concepts
  - HMI concept freeze

Series Development
- Series Development
  - Concept competition
  - Proof of Concept
    - Safety Requirements
    - Controllability Assessment
      - HMI concept freeze
  - Detailed Design
    - Detailed HMI Specification
    - Prelim. Sign off
  - Testing
    - Controll. Prelim. Sign off
    - HMI Realisation
    - HMI Verification
  - Validation & Sign off
    - Controllability Confirmation final proof
    - Sign off & SoP

Activities regarding Controllability
- Elements of a General Safety Process
- Activities regarding Human machine interaction
Content - Overview

Evaluation of controllability

Estimation of controllability problems

Identification of possible risky situations

Specification Framework

Perceptibility (message transfer to driver) | Yes | No | Not suitable | Comments
--- | --- | --- | --- | ---
1. Is it possible that the driver may fail to perceive a system message? | ☺ | ☺ |
2. Is it necessary to support system feedback using additional information channels? (e.g. acoustic in addition to optical display) | ☺ | ☺ |
3. Does the system provide timely feedback about system reaction in a given traffic situation? (e.g. take over request from adaptive cruise control) | ☺ | ☺ |
4. Can system output and information be perceived by the driver quickly enough to enable him to react appropriately? (e.g. take over request from adaptive cruise control) | ☺ | ☺ |
5. Is a misinterpretation of a system message possible? | ☺ | ☺ |
Timeline of RESPONSE 3 – What’s your job?

**Preparation Phase**
- Preparation of Draft CoP by RESPONSE 3 partners

**Validation Phase and Update**
- Wider Application of Draft CoP by partners and also members of Consensus team
- Collecting feedback about use of the Draft CoP
  - Useability
  - Missing content
  - Objections to the content

Start in 10/2004
WS on Draft CoP 11/2005
WS on Final CoP 09/2006
Summary of RESPONSE 3: Code of Practice for ADAS

- Translating the key issues of “reasonable safety” and “duty of care” into engineering practice

- Basis for a definition of "safe" ADAS development and testing also from a legal point of view

- Agreement on these development guidelines between all stakeholders as basis for company internal translation and/or optimisation of system design specifications and complementary verification methods.