

Automated vehicles

Horizontal regulation

Preliminary considerations

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Outline

- **Context and grounds to act**
- **Importance of definitions**
- **Regulation “philosophy”**
- **Considerations on validation**
- **References**



Context and grounds to act

- Need for a systemic approach
 - # vehicle components / functions
 - Interactions vehicle / driver / driving environment
 - Connectivity
 - Learning systems
- Need for a comprehensive approach
 - Increasing variety of use cases
 - # automated functions
 - # driving conditions or design domains
 - # triggering + transition conditions

Importance of definitions

- Vehicle's subsystems
 - Driver
 - Automation systems
 - HMI's
 - Vehicle's ECU + components

- Use cases =
 - Operational design domain (= driving environment)
 - Automation functionalities (= automated manoeuvres)
 - Triggering (= activation / desactivation) conditions
 - Driving task-sharing

Horizontal regulation “philosophy” (1)

- **Regulation domains**
 - ***Non use-case specific :***
 - Data recording and sharing, Privacy, Cyber security
 - System safety
 - Perception functions
 - ***Use-case specific :***
 - ***Operation domain***
 - definition
 - recognition
 - ***Driver’s attitude***
 - expectations
 - monitoring
 - ***Automation functions***
 - Elementary functions
 - Triggering (activation / deactivation) conditions
 - Transition procedures
 - Emergency and minimal risk manoeuvres
 - Logigram of manoeuvres

Horizontal regulation “philosophy” (2)

- Use case description
- Use case criticality analysis → critical situations and events
- Use case requirements =
 - Horizontal
 - Events and situations criticality-independent
 - Perception functions
 - Operation domain recognition
 - HMIs (incl drivers monitoring)
 - Events and situations criticality-dependent
 - Situations and events responses (incl minimal risk manouevres)
 - Vertical
 - Non automatic functions
 - ADAS
- *NB : articulation horizontal / vertical to be clarified*

Validation approaches and tools (1)

- **Validation approaches' simplistic taxonomy**
 - ***Types (levels) of requirements***
 - Situation and event acknowledgment
 - Response
 - Availability
 - Functional description
 - Required functionalities
 - Required performance
 - ***Types (levels) of verification***
 - Self declared
 - Evidence-based declared
 - Third party certified
 - Authority tested
 - ***Validation tools***
 - Documentation screening or analysis
 - Simulations
 - Tests (one driver or multi-drivers)

Validation approaches and tools (2)

- A possible proportionate framework

<i>Level of verification</i> <i>Level of criticality</i>	Self-declaration	Evidence based	Certified	Tested
Criticality level 1				
Criticality level 2				
Criticality level 3				
Criticality level 4				
Criticality level 5				

Some references

- 1. ACSF-11-09 - (EC) Commission study on vehicle certification
- 2. AdaptIVe-SP2-v12-DL-D2.1 System Classification
- 3. Villa_Ladenburg_Use_Cases_English_Release
- 4. Pegasus_Validation of assisted and automated driving systems
- 5. Pegasus_Safety assurance based on an objective identification of scenarios
- 6. From development to type approval
- 7. AdapIVve evaluation methodology for automated vehicles
- 8. Requirements on tools for assessment and validation of assisted and automated driving systems
- 9. Safety Assurance for Highly Automated Driving - The PEGASUS Approach
- 10. AUTONET Prototype validation report and performance analysis
- 11. Assessment of the ISO 26262 Standard, “Road Vehicles – Functional Safety”
- 12. Best Practices for Embedded Software Testing of Safety Compliant Systems – National Instruments
- 13. Certification for Autonomous Driving
- 14. Challenges in applying the ISO 26262 for driver assistance systems
- 15. ISO 26262 in Practice – Resolving Myths with
- 16. Challenges in Autonomous Vehicle Testing and Validation
- 17. Interactive Safety Analysis Framework of Autonomous Intelligent
- 18. Driving to Safety
- 19. A Philosophy for Developing Trust in Self - Driving Cars
- 20. NHTSA guidance + various research reports: