PEGASUS MOTIVATION

Why the promoted PEGASUS joint project for the safeguarding of highly automated functions hence SAE Level 3 is needed?

The Driver is responsible
- Critical scenarios are solved by the driver
- The assistance systems support the driver

The automation is responsible
- Critical scenarios are solved by the automation
- The quality of the automation is compared to human driving abilities
- High complexity and various possible scenarios for the validation process
- The validation by established methods is economically infeasible

PEGASUS delivers the standards for the automation of the future
With the PEGASUS joint project, promoted by the Federal Ministry for Economic Affairs and Energy (BMWi), major key gaps in the field of testing for the release of highly-automated driving functions will be concluded by the middle of 2019.

Standards for the safeguarding of highly-automated vehicles
- Definition of a standardized procedure for the testing and experimenting of automated vehicle systems in simulation, on test stands and in real environments.
- Development of a continuous and flexible tool chain to safeguard the automated driving.
- Integration of the tests in the development processes at an early stage.
- Creation of a cross-manufacturer method for the safeguarding of highly automated driving functions.

Figure Source: Bartels, Arne & Eberle, Ulrich & Knapp, Andreas & , AdaptIVe. (2015). Automated Driving Applications and Technologies: System Classification and Glossary.
Safeguarding automated driving functions

How is a generally accepted and uniform approach for testing highly automated driving functions achieved?

The aim of PEGASUS is the development of a method for the safeguarding of highly automated driving functions, which is intended as a blueprint for later series development of such systems. Due to the high degree of networking between the various subprojects and their work packages within the PEGASUS project, the following overall method is developed:

- On the basis of knowledge (laws, standards, etc.) requirements are defined
- Scenarios are systematically derived from data and knowledge
- In the common database data is processed and prepared for the test instances
- The HAF safety statement is based on the test results and the safety argument

**PEGASUS Method for Assessment of Highly Automated Driving Function (HAD-F)**

**Assessment of Highly Automated Driving Function (incl. Human)**

- **Release**
  - Risk Assessment
  - Scenarios
  - Data Preparation
- **Test Evaluation**
  - Evaluation and Classification
  - Test Data
- **Test Execution**
  - Test HAD-F: Simulation Proving Ground Real World Drive
- **Test Case Derivation**
  - Application of Test Concept incl. Variation Method

**Requirements Definition & Conversion for Database**

- Requirements Definition
- Systematic Identification of Scenarios
- Preprocessing / Reconstruction

**Database Processing**

- Source of Information
  - Knowledge: Law, Standards, Guidelines, ...
  - Data: Test Drive, Simulation, FOT, NDS, Accident
- Data in PEGASUS Format

**Evaluation & Conversion for Database**

- Data Processing
- Scenario Compilation

**Evidence**

- Application of Metrics + Mapping to Logical Scenarios
- Logical Scenarios + Parameter Space
- Integration + Pass Criteria
- Determination of Exposure

**Assessment of Highly Automated Driving Function (incl. Human)**

- Test Drive
- Scenario Preparation
- Test Evaluation
- Test Execution
- Test Case Derivation

**Data in PEGASUS Format**

- Application of Metrics + Mapping to Logical Scenarios
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**Requirements Definition & Conversion for Database**

- Requirements Definition
- Systematic Identification of Scenarios
- Preprocessing / Reconstruction
Start – Stand 1
APPRAOCH & CONSISTENCY

The structure of the exhibition follows the PEGASUS method. Selected topics are presented in detail.

The following diagram gives an overview of all booths and how these are based on the PEGASUS method.

Start
1 Approach & Consistency

Requirements & Context
2 V-Model and Process Analysis
3 The Highway-Chauffeur
4 Scenario Description
5 Critical Scenarios for Human Drivers
6 Critical Scenarios for and by the HAD (L3)
7 Social Acceptance for HAD (L3)
8 Challenges of a scenario-based approach
9 Functional Decomposition

Basics for Testing
10 Test Concept and Test Case Allocation
11 Scenario Formats
12 Test Specification Database
13 Test Case Generation, Test Space Coverage and Test Effort Reduction
14 Interdisciplinary Test Infrastructures / Maps

Testing & Safeguarding
15 Sensor Simulation Models
16 Software-in-the-Loop
17 Hardware-in-the-Loop
18 Proving Ground - Generic Approach and Control Center
19 Tools for Proving Ground and Field Tests
20 Wizard-of-Oz-Vehicle
21 Field Test Concept

Finish
22. Outlook to Evaluation of PEGASUS Method

PEGASUS Method for Assessment of Highly Automated Driving Function (HAD-F)

Assessment of Highly Automated Driving Function (incl. Human)
Release Test Evaluation Test Execution Test Case Derivation

Test Data:
10 Application of
11 Integration
12 Logical
13 Determination
14 Parameter Space
15 Risk
16 Procedure
17 Evidence
18 Statement
19 Systematic
20 Accident
21 Test
22 Start

Requirements definition & Conversion for Database
Source of Information

Evaluation & Conversion for Database

Data Processing

Scenario Compilation

Data in PEGASUS Format

Prep & Recom.

1. Source: Guidelines
2. Use Case & Existing Data/ Knowledge
3. Data: Test Drive Simulation -in-the-Loop
4. Identify Scenarios
5. Prepre & Recom.
6. Test Data:
7. Require Definition
8. Tech. Requirements
9. Technical Evaluation
10. Application of Test Cases
11. Logical Scenarios
12. Parameter Space
13. Integration
14. Determination
15. Risk
16. Procedure
17. Evidence
18. Statement
19. Systematic
20. Accident
21. Test
22. Start

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Finish
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