1. Approach and Consistency

REQUIREMENTS AND CONDITIONS
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 AND 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
   a) Localization and Collision Avoidance
   b) Mobile Traffic Acquisition
20. Wizard-of-Oz-Vehicle
21. Field Test Concept

   Outdoor Area: SoftCrashTarget, Traffic-Simulation-Vehicle, mobile settings

TARGET
22. Outlook to Evaluation of PEGASUS Method
In this exhibition we show selected (intermediate) results of the PEGASUS project tries to provide a method to prove that a Level 3 HAD system can fulfill its requirements for safe operation in traffic.

In addition, simulation requires standardized integration and access to geometry and infrastructure elements of real roads and test tracks on proving grounds as well as tools to customize them for virtual testing (14).

By using a test specification database relevant basic test scenarios are provided for safeguarding HAD-functions. For this purpose, data from different types of sources is harmonized and further processed using a uniform process chain. In this way, parameter spaces and test specifications based on them can be derived (12).

Key challenge of using a scenario-based approach is generating a sufficient small number of test cases. This task is assigned to the test automation (13). For a basic test scenario, test automation varies parameters for the tests carried out. The used values depend on observed distributions and extreme values. At the same time, it is validated whether the tests that had been carried out already cover sufficiently the underlying parameter space. If the test depth is not sufficient new runs are generated recursively.

The test concept (10) assigns the test cases to the test instances with a corresponding test target, including assessment metrics and pass criteria. Thereby, the strengths of the test instances and also methods for reducing the test effort are taken into account.

Simulation, in particular, offers a wide range of possibilities for time- and cost-efficient implementation. „What is the intelligent realization of the process by which we provide evidence?“ A high degree of virtualization and parallel further development and intelligent integration of traditional test tools such as simulation, proving ground and field tests offer ideal prerequisites for covering the test space. In doing so, the topic area „Requirements & Conditions“ provides release criteria and „Basics for Testing“ provides the basics and prerequisites for the development of the test tools as described here.

Improvements in the field of phenomenological sensor simulation models (15) are associated with extensions to the presentation of the environment. For this purpose, material properties, object geometries and structural details have to be integrated intelligently. The first tests of the HAD function start in „software-in-the-loop“ (16) or „hardware-in-the-loop“ (17) frameworks. Key elements are the coupling with the test specification database, the integration of test automation and effort reduction plus an automatic verification of pass criteria.

The systematic transfer from simulation to real traffic events requires an extension of the test methodology on proving grounds (18). A high precision, exactly reproducible execution of script-based maneuvers becomes important. A coupled interaction with the simulation enables parallel, continuous validation. On the test site, novel support tools (19) such as independent collision avoidance (19a) or infrastructure-based monitoring for testing (19b) are added to the repertoire. The „Wizard-of-Oz-Vehicle“ (20) is an innovative test instance enabling an examination of human interaction with the HAD system at a very early stage. The example „Influence of Traffic Intensity“ shows an integration in real life traffic tests. The final step in the overall verification process is the validation of test results by means of real life field tests (21). Here, concepts for an investigation of vehicle fleets equipped with HAD-functions are presented.