HEADSTART – Final event: **Key user groups**

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824309.

HEADSTART Key user groups

- Approval
- Consumer testing
- Technology developers

Approval

Oriol Flix, Applus IDIADA

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Approval

- Introduction to type-approval
- UN Regulation No. 157 - Automated Lane Keeping Systems (ALKS)

Type-approval

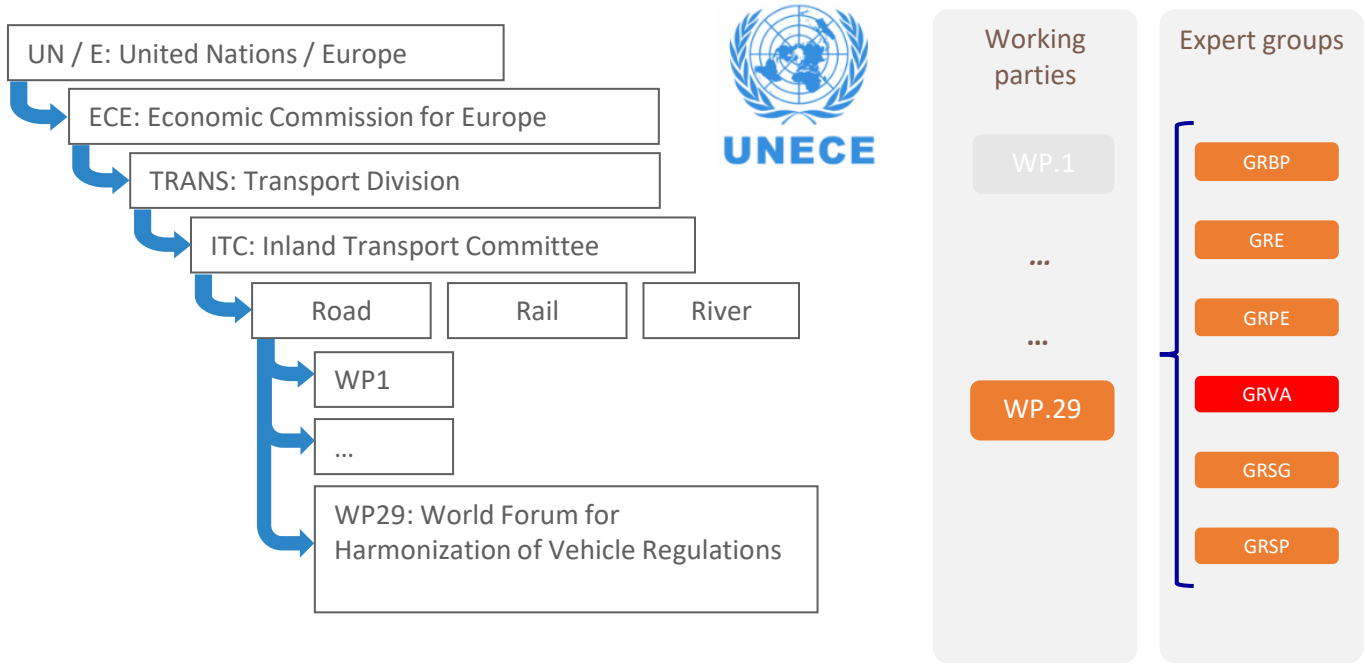
Type-approval means the procedure whereby an approval authority certifies that a type of vehicle, system, component or separate technical unit satisfies the relevant **administrative provisions** and **technical requirements**

Regulation (EU) 2018/858

UNECE WP29

WP29: World Forum for Harmonization of Vehicle Regulations

Structure:



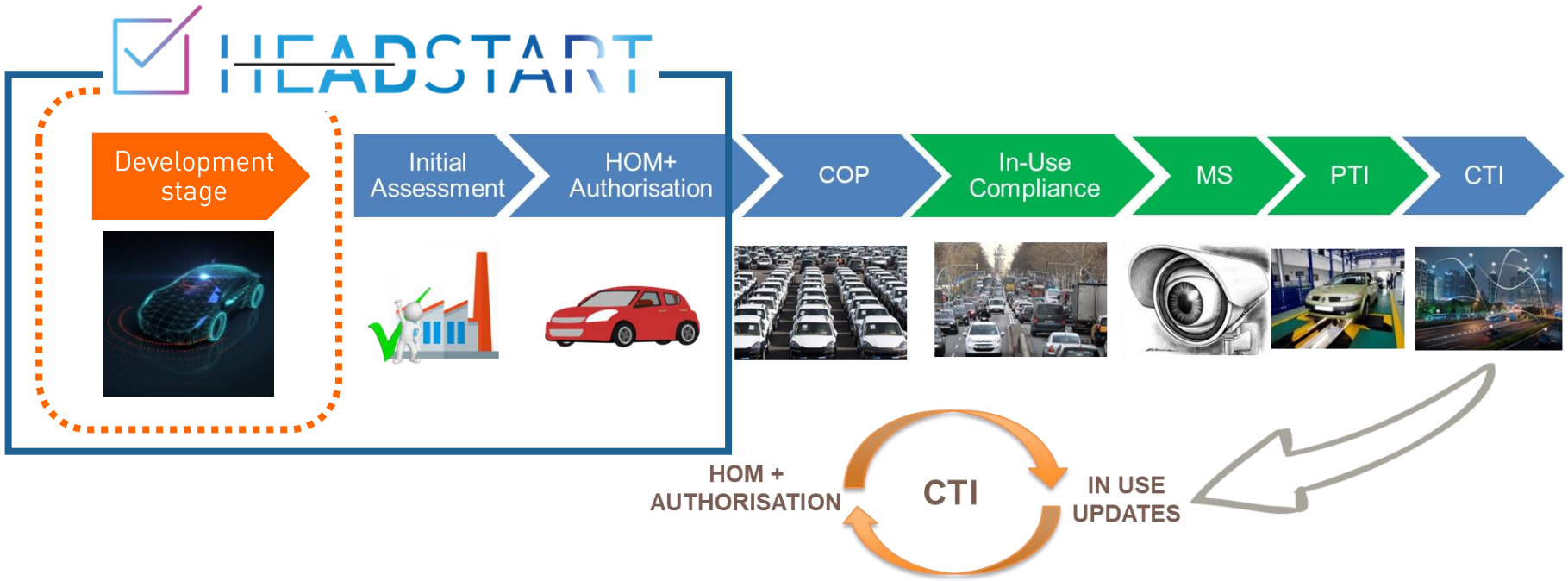
Approval contents

✓Introduction to type-approval

- UN Regulation No. 157 - Automated Lane Keeping Systems (ALKS)

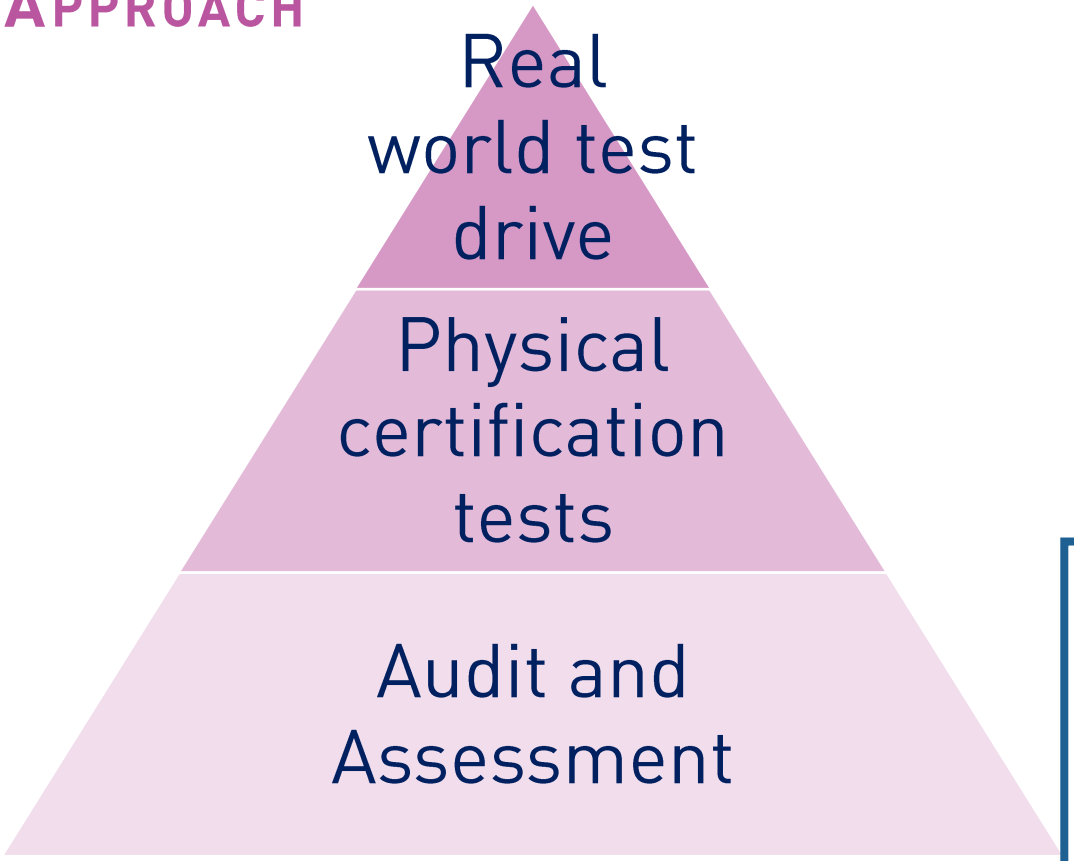
UN Regulation No. 157 – General concepts for testing ALKS

New Homologation procedure



UN Regulation No. 157 – General concepts for testing ALKS

New Homologation procedure- 3 Pillars Approach



- Overall impression of system behavior on public roads
- Assessment of system's ability to cope with real world traffic situations with a standardized checklist
- Driving license test for automated driving system
- Guidance through given set of situations which shall be passed

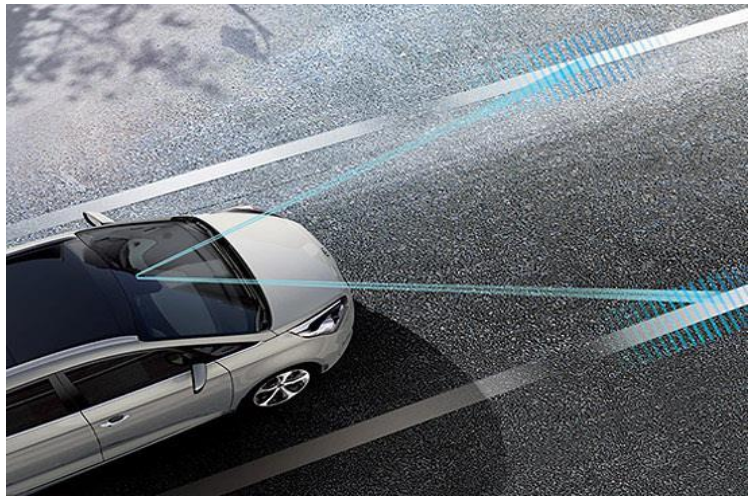
- Matching of audit/assessment results with real world behavior
- Assessment of system behavior in fixed set of challenging cases, which either aren't testable on public roads or cannot be guaranteed to occur during the real-world test drive
- Reproducibil

- Audit of development process (methods, standards)
- Assessment of safety concept (functional safety, safety of use)
- Check of integration of general safety requirements and traffic rules
- Use of simulation results (high mileage approval, capability to cope with critical situations, which aren't testable)
- Assessment of development data/field testing, OEM-self-declaration

UN Regulation No. 157 – General concepts for testing ALKS

Definition and Scope

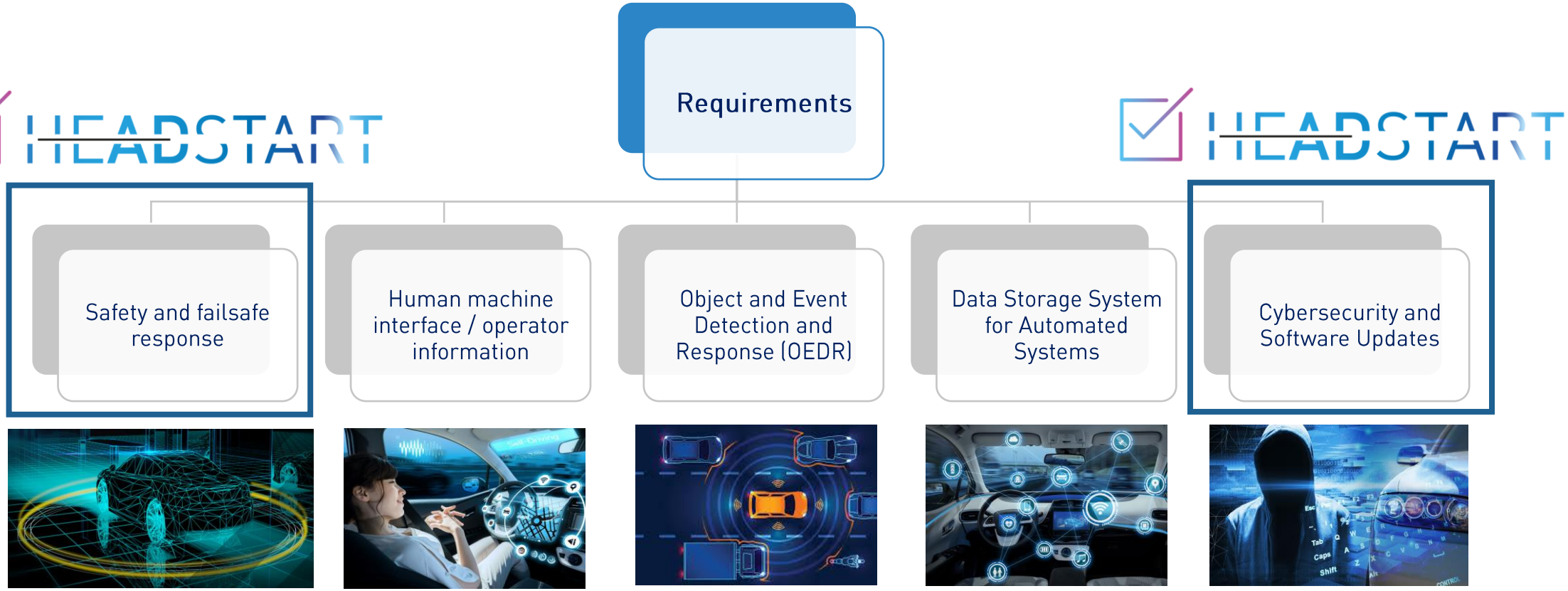
- A system which is activated by the driver and which keeps the vehicle within its lane when travelling at low speed by controlling the **lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input.**
- **M1 vehicles.**



BASIC ODD CONSTRAINS / LIMITATIONS
Roads where pedestrians and cyclists are prohibited
Physical separation that divides the traffic moving in opposite directions and prevent traffic from cutting across
Operational speed up to 60 km/h maximum

UN Regulation No. 157 – General concepts for testing ALKS

Requirements



UN Regulation No. 157 – General concepts for testing ALKS

SIMULATIONS

5.2. Dynamic Driving Task

For conditions not specified in paragraphs 5.2.4., 5.2.5. or its subparagraphs, this shall be ensured at least to the level at which a competent and careful human driver could minimize the risks. This shall be demonstrated in the assessment carried out under Annex 4 and by taking guidance from Appendix 3 to Annex 4.

Annex 4 - Appendix 3

Guidance on Traffic disturbance critical scenarios for ALKS

1. General

1. This document clarifies derivation process to define conditions under which Automated Lane Keeping Systems (ALKS) shall avoid a collision. Conditions under which ALKS shall avoid a collision are determined by a general simulation program with following attentive human driver performance model and[1] related parameters in the traffic critical disturbance scenarios.

UN Regulation No. 157 – General concepts for testing ALKS

SIMULATIONS

Cut-in scenario

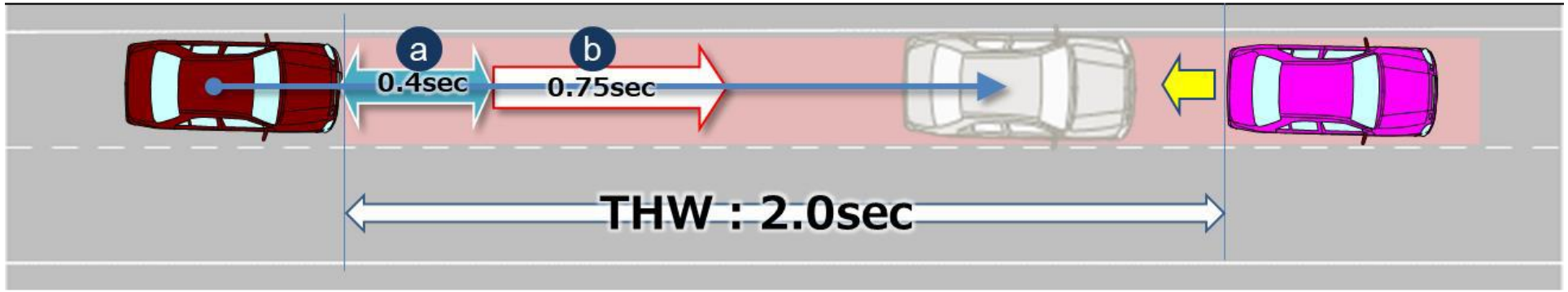
- Other Vehicle suddenly merges in front of the ego vehicle

Cut-out scenario

- Other Vehicle suddenly exits the lane of the ego Vehicle

Deceleration scenario

- Other Vehicle suddenly decelerates in front of the ego Vehicle



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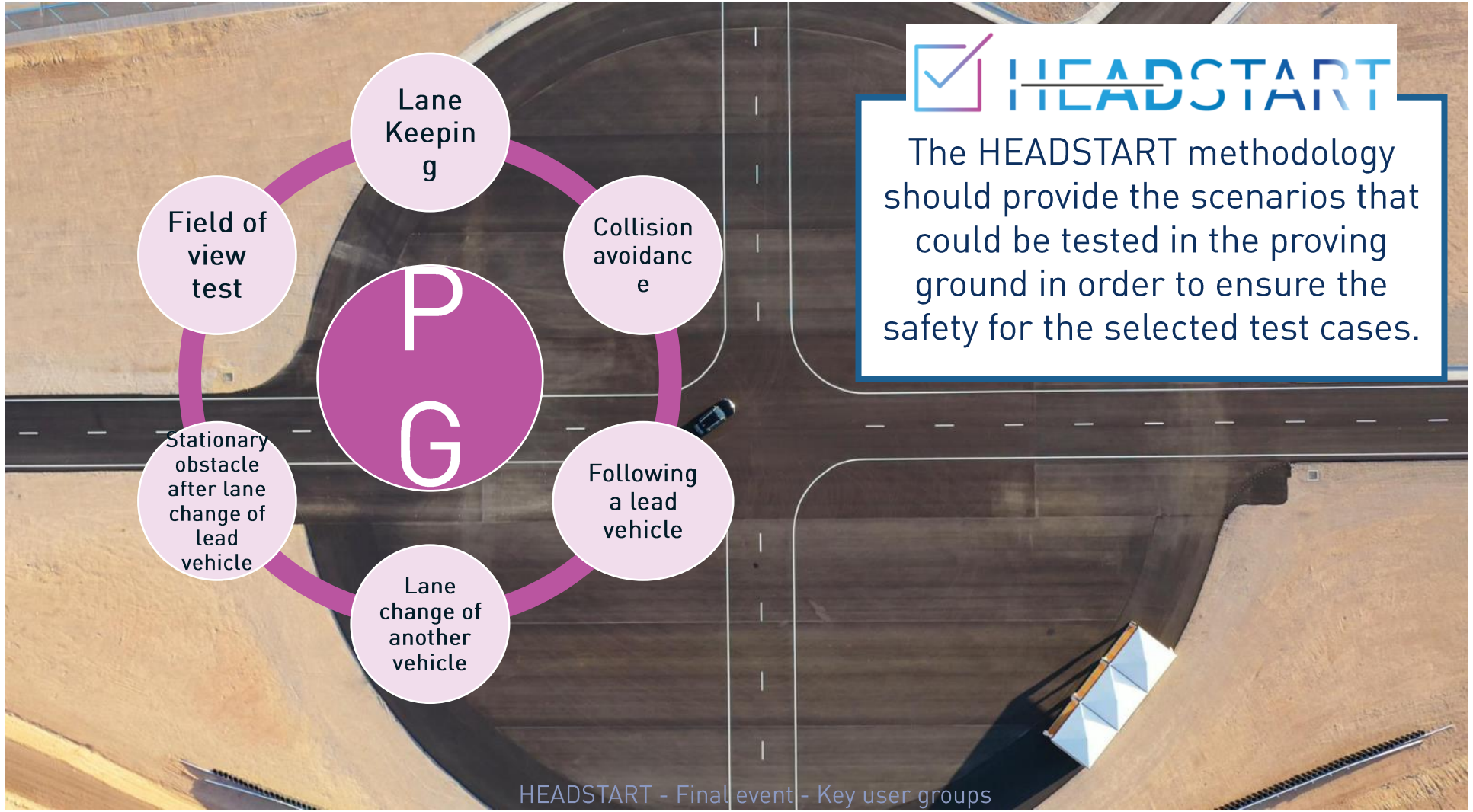
Testing – Proving Ground



Consumer testing

Sjef van Montfort, TNO

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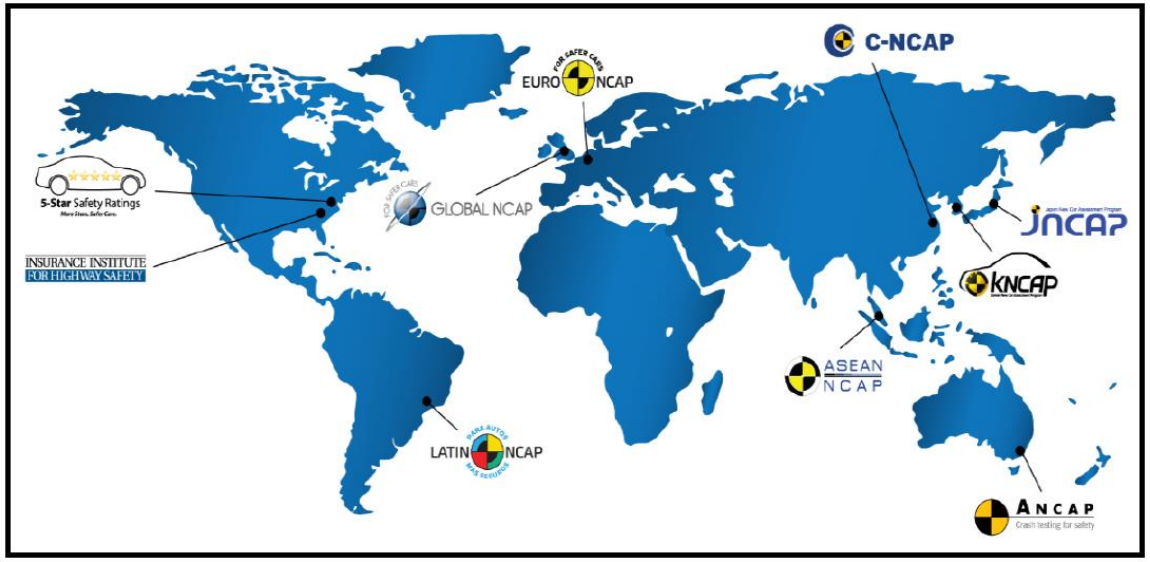
Consumer testing

Introduction

Consumer testing organization are there to provide consumers with information on the safety of the vehicle.

The tests are optional and (in general) go beyond the legal requirements wrt safety for that region.

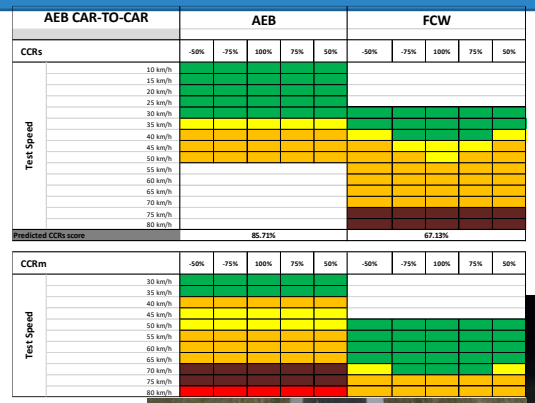
Euro NCAP exemplary for progressive Consumer testing world-wide.

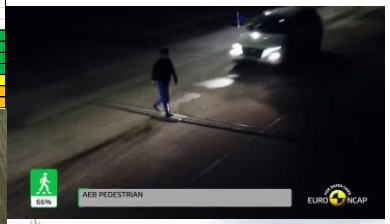


Consumer testing
Current status Euro NCAP

Current status Euro NCAP to assess safety performance of vehicle:

- Star rating: ADAS-emergency assessment
  - Largely based on physical proving ground testing combined with OEM prediction & information
- Assisted Driving (Highway Assist)
  - Assistance Competence, Vehicle Assistance & Safety Backup
  - Largely based on physical proving ground testing combined with OEM prediction & information
- Automated Driving
  - Yet to be detailed, but similar approach basis





Consumer testing

Outlook

Consumer testing wants/needs to assess larger test suite:

- Larger variation of scenarios
- More scenario parameter with wider ranges

to address:

- More (emergency) cases / more ADAS systems
- Larger ODD of Assisted Driving / Inclusion of Automated driving

→ Scenario-based approach

→ To control *Cost & Duration per series* ***inclusion of other test methods*** is required.

Consumer testing

Outlook

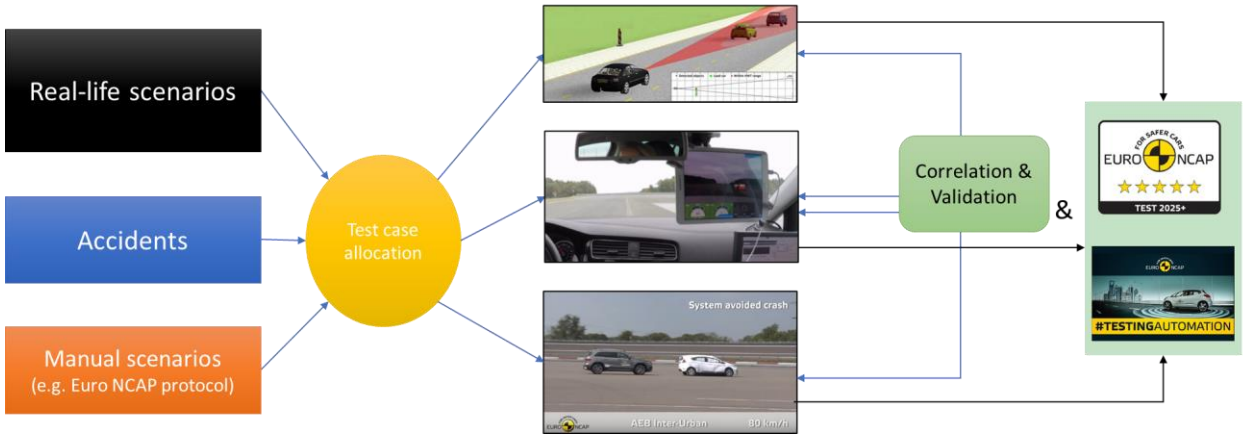
→HEADSTART methodology created to facilitate this

Euro NCAP Virtual Testing – ADAS & AD WG

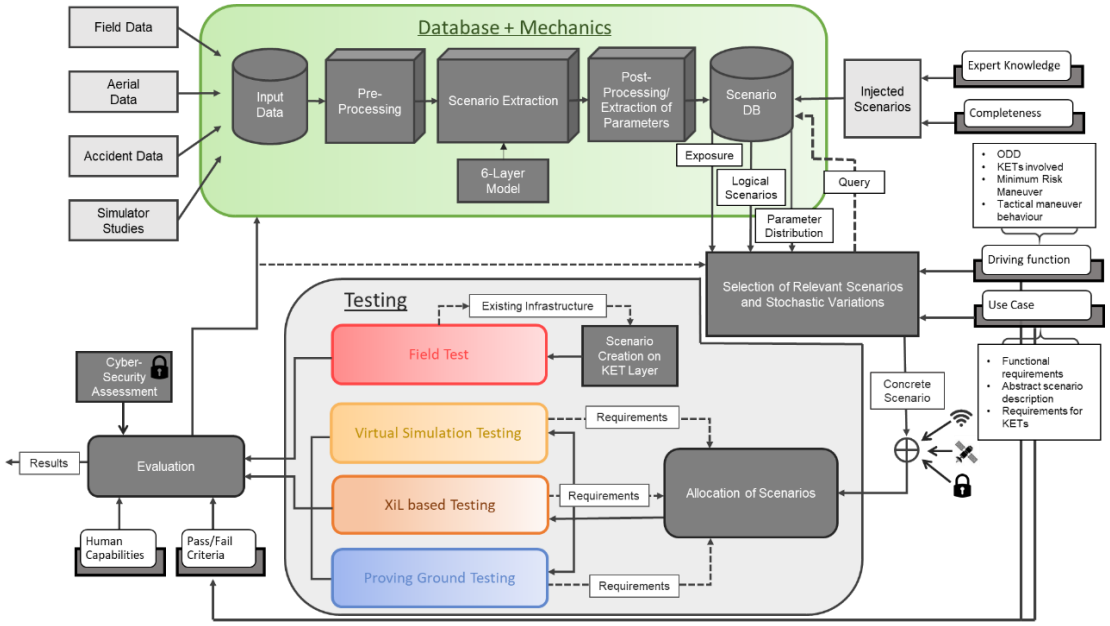
Scenario Database
- Pilot database
- Combining data
- Scenario harvesting

(Virtual) Testing
- ViLpilot case set-up
- OEM prediction
- Vehicle interface
- Methodology description

Assessment
- Correlation / Validation
- Scoring scheme



HEADSTART methodology



Technology developers

Andrea Steccanella, CRF
Presented by Sjef van Montfort, TNO

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Technology developers

Transition SAE J3016 L2 → L3/L4 ⇨ new architecture design

- Bigger responsibilities to the car-manufacturer
  - To the driver, passengers and other road-users.
- More complex architecture to replace the driver tasks
  - New sensors,
  - New homologation procedures.
- Communication with geo-localization external actors:
  - Lane-level positioning for map-matching,
  - Vehicle to Vehicle & Vehicle to Infrastructure communication.

New AD Sensors

SAE J3016 L2

- Perception sensors:
  - Radar,
  - Camera,
  - Ultrasonic.
- A-priori Perception sensors:
  - Standard GNSS receiver for geo-fencing with SD map,
  - Cellular connectivity for Emergency call.

SAE J3016 L3

- Perception sensors:
  - Radar,
  - Camera,
  - Ultrasonic,
  - Lidar (for localization purposes).
- A-priori Perception sensors:
  - HD GNSS receiver for lane-level map-matching,
  - Cellular connectivity for: GNSS corrections, HD-maps updates,
  - V2X communication: with vehicles and infrastructure beyond ranging sensors' capabilities.

New challenges for AD L3 functions:

1. STATISTICAL DEMONSTRATION OF SYSTEM SAFETY WITHOUT DRIVER INTERACTION

   Driver is not fully alert → AD must manage more situations

   - Collect data from real-world,
   - Implement scenario based testing (SiL/HiL),
   - Field monitoring after AD production.

2. SYSTEM SAFETY WITH DRIVER INTERACTION (ESPECIALLY IN TAKEOVER MANOEUVRES)

   - Clear indications on when and why the driver should take-over,
   - Safe transition between human and the AD controls.

3. CONSIDERATION OF SCENARIOS CURRENTLY NOT KNOWN IN TRAFFIC

   - Manage unforeseen scenarios,
   - Driver misuse of the AD function.

4. VALIDATION OF VARIOUS SYSTEM CONFIGURATIONS AND VARIANTS

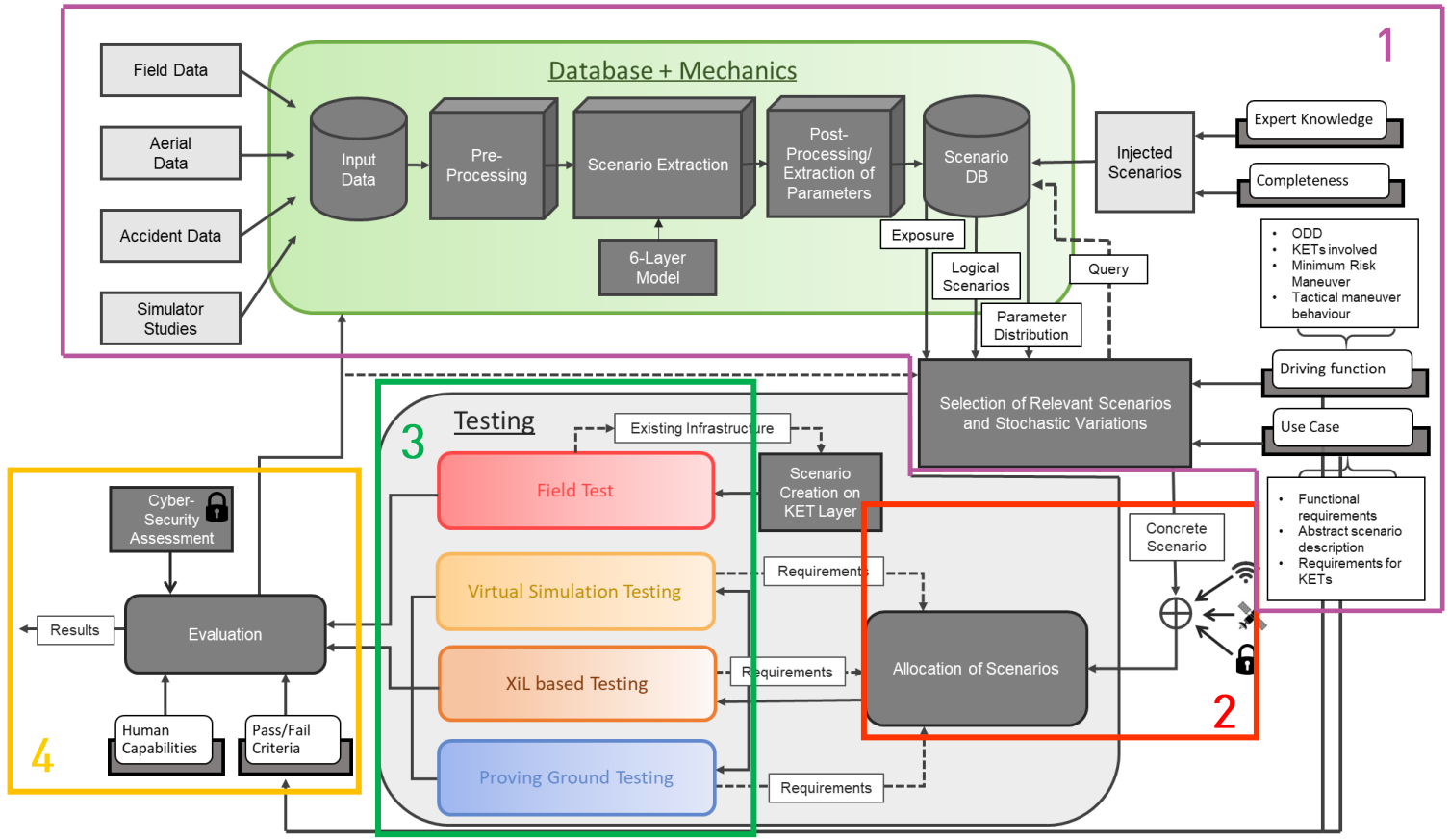
   - The AD functions should evolve over time to fix problems (SW updates),
   - HW modifications might occur (trailer/roof rack, damages).

5. VALIDATION OF SYSTEMS BASED ON MACHINE LEARNING

   - Validation of Artificial Intelligence and Machine Learning systems is more complex (it is not possible to decompose the process in independent modules).

The HEADSTART approach:

1. Creation of Scenario Database able to host:
   - Data coming from real-world,
   - Parameter distribution based on stochastic variations.
2. Injection of information coming from external agents: GNSS signals and V2X messages.
   - Including failures (interferences, RF losses).
3. Comparison of results with multiple approaches:
   - Virtual simulation,
   - Software & Hardware in the Loop,
   - Proving Ground,
   - Field Tests.
4. Pass/Fail reports to identify ODD limitations and improve the Scenario description.



HEADSTART

Thank you!

Any questions?

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