European Activities on Connected and Automated Driving; The Present and Beyond - The ADAPTIVE and AUTONET2030 Use Cases

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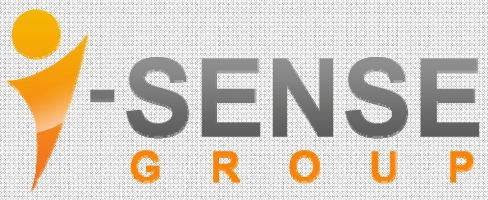
OUTLINE

- ADAPTIVE developments and status

- AUTONET2030 final results



TOWARDS HIGHER LEVELS OF AUTOMATED DRIVING: THE EUROPEAN PROJECT ADAPTIVE

https://www.adaptive-ip.eu/

PROJECT FACTS

Budget:	**EUR 25 Million**
European Commission:	**EUR 14,3 Million**
Duration:	**42 months (January 2014 – June 2017)**
Coordinator:	**Aria Etemad, Volkswagen Group**
8 Countries:	**France, Germany, Greece, Italy, Spain, Sweden, The Netherlands, United Kingdom**

EUCAR
EUROPEAN COUNCIL FOR AUTOMOTIVE R&D

AdaptIVe
Automated Driving

28 partners

i-SENSE GROUP
Opel
DAIMLER
UNIVERSITY OF TRENTO - Italy
UNIVERSITY OF LEEDS
WIVW
Julius-Maximilian UNIVERSITÄT WÜRZBURG
RENAULT
VOLKSWAGEN
ika RWTH AACHEN UNIVERSITY
CHALMERS
Ford
TNO
BMW Group Research and Technology
PSA PEUGEOT CITROËN
eict
alcor
BOSCH Invented for life
CTAG Centro Tecnológico de Automoción de Galicia
LUND UNIVERSITY
CRF
bast
DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

MOTIVATION
(TOWARDS AUTOMATED DRIVING)

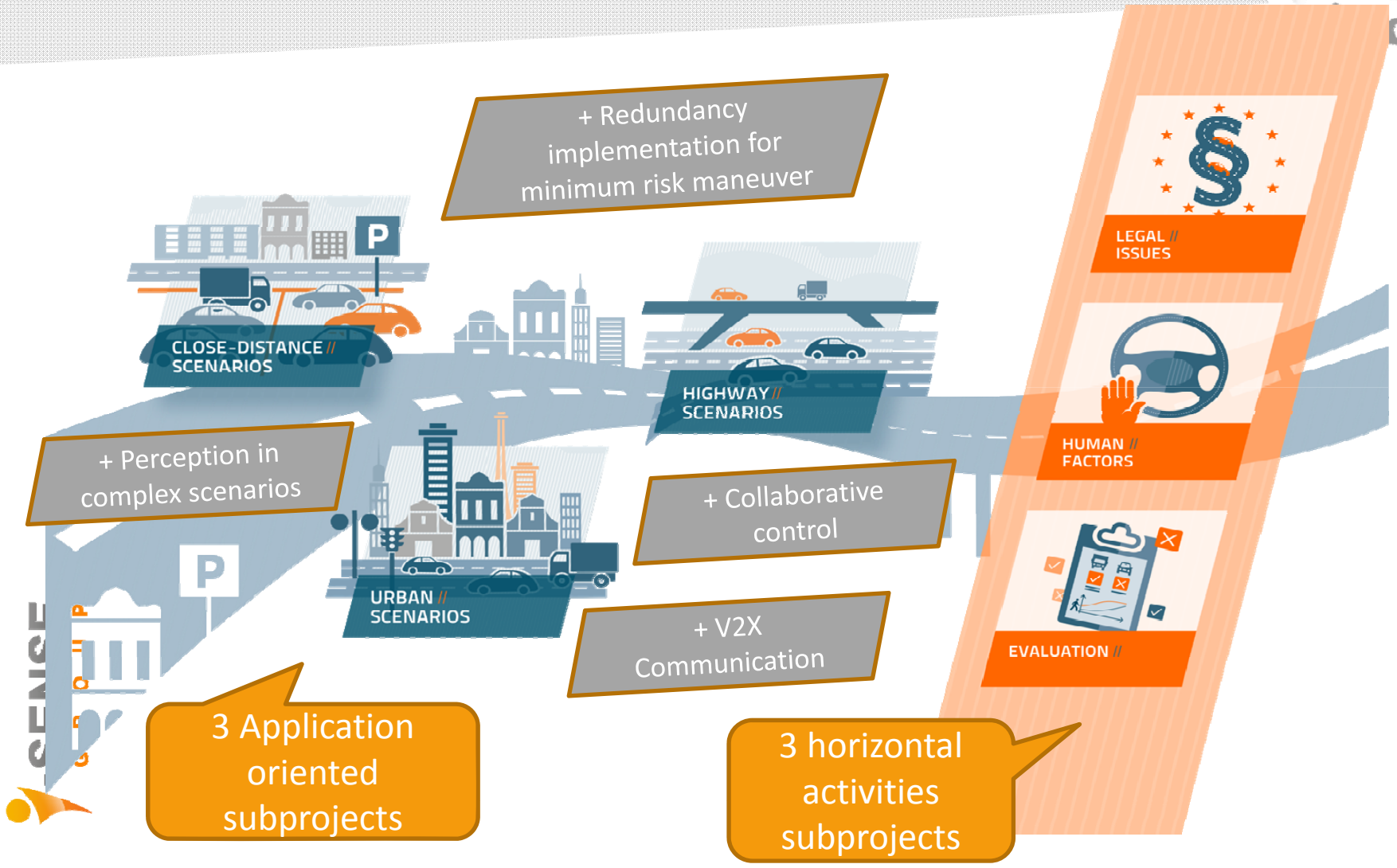
Drivers are supported in demanding or repetitive tasks. Travel comfort increases.

Vehicles dynamically adapt the level of automation according to the current situation.

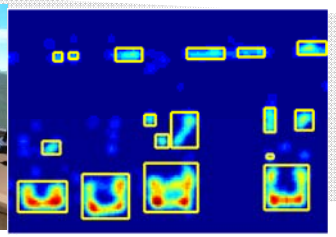
Vehicles react more effectively to external threats.

Vehicles are resilient to different types of system and human failure.

ADAPTIVE IN A NUTSELL

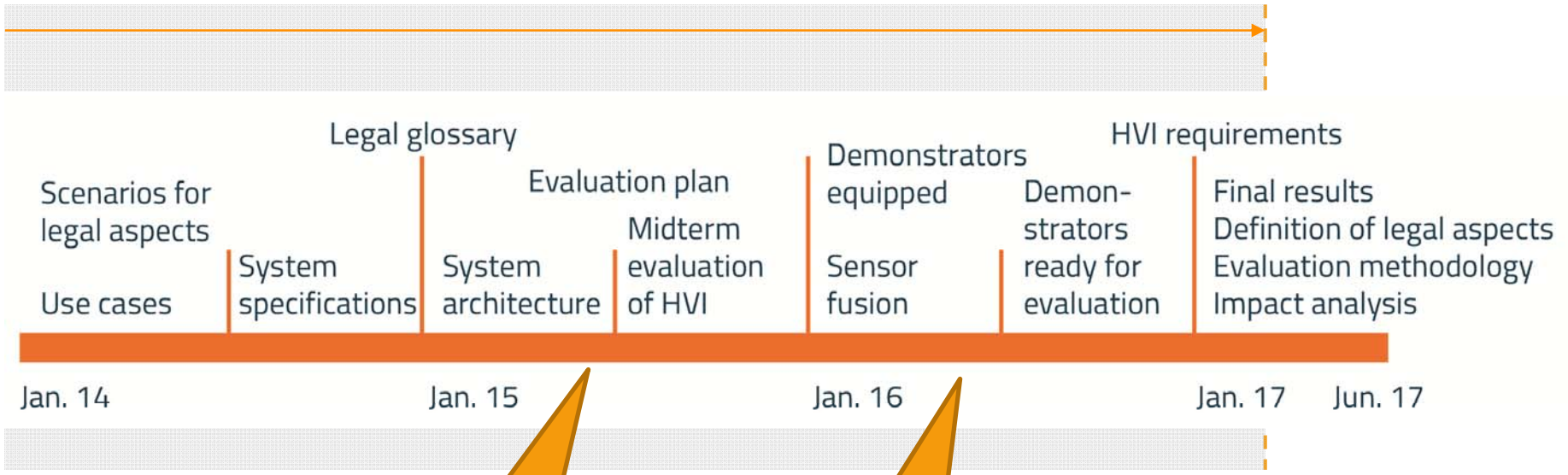


TARGETS FOR R&D



- **Demonstrate automated driving in complex traffic environments**. Test integrated applications in all possible scenarios taking into account the full range of automation levels.
  - **Enhance the perception performance** in complex scenarios by using advanced sensors supported by cooperative and communication technologies.
  - Provide **guidelines** for the implementation of cooperative controls involving both drivers and automation.
  - Define and validate specific **evaluation methodologies**.
- **Assess the impact** of automated driving on European road transport.
- Evaluate the **legal framework** with regards to existing implementation barriers.

TIMELINE

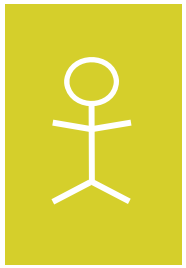


Legal issues open workshop **Paris** September 2015

Technical workshop on automation issues **Athens** April 2016

Presentation available on the AdaptIVe webpage

LEVELS OF DRIVING AUTOMATION ACC. TO SAE AND VDA



	LDW FCW	LKA ACC	Parking Assistance	Traffic Jam Chauffeur	Parking Garage Pilot	Robot Taxi
	level 0	level 1	level 2	level 3	level 4	level 5
	No auto-mation	Assisted	Partial auto-mation	Condi-tional auto-mation	High auto-mation	Full auto-mation

Driver in the loop

- No significant change with respect to existing driver assistance systems

Driver out of the loop

- Not in accordance with regulatory law (Vienna Convention of 1968, national road law)
- Shared responsibility for control between driver and system

➔ need for action

Source: SAE document J3016, "Taxonomy and Definitions for Terms Related to On-Road Automated Motor Vehicles", issued 2014-01-16, see also http://standards.sae.org/j3016_201401/

RESEARCH ACTIVITIES

Legal Aspects

[redacted]

Human Factors

[redacted]

Evaluation

[redacted]

RESEARCH ACTIVITIES

Close-distance

[redacted]

Urban

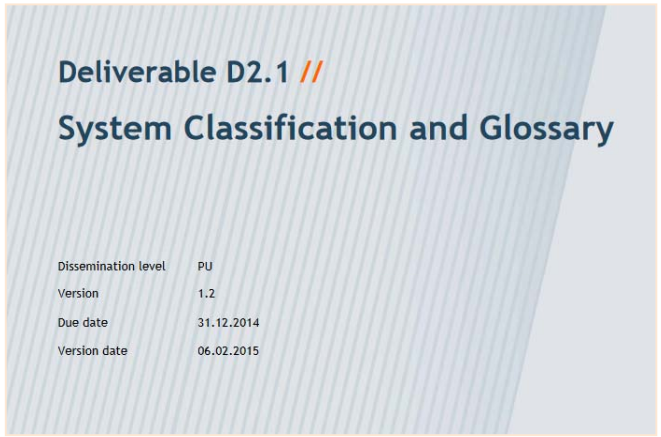
[redacted]

Highway

[redacted]

ACHIEVEMENTS

- **System Classification and Glossary**
- Systematic derivation of relevant system parameters for:
  - Vehicle
  - Driver
  - Environment
- Public Deliverable D2.1 is available on the AdaptIVe website.



ACHIEVEMENTS

- Defining Legal Aspects:
  - Report on technical system limits
  - Internal report on safety validation
  - Internal report on legal aspects

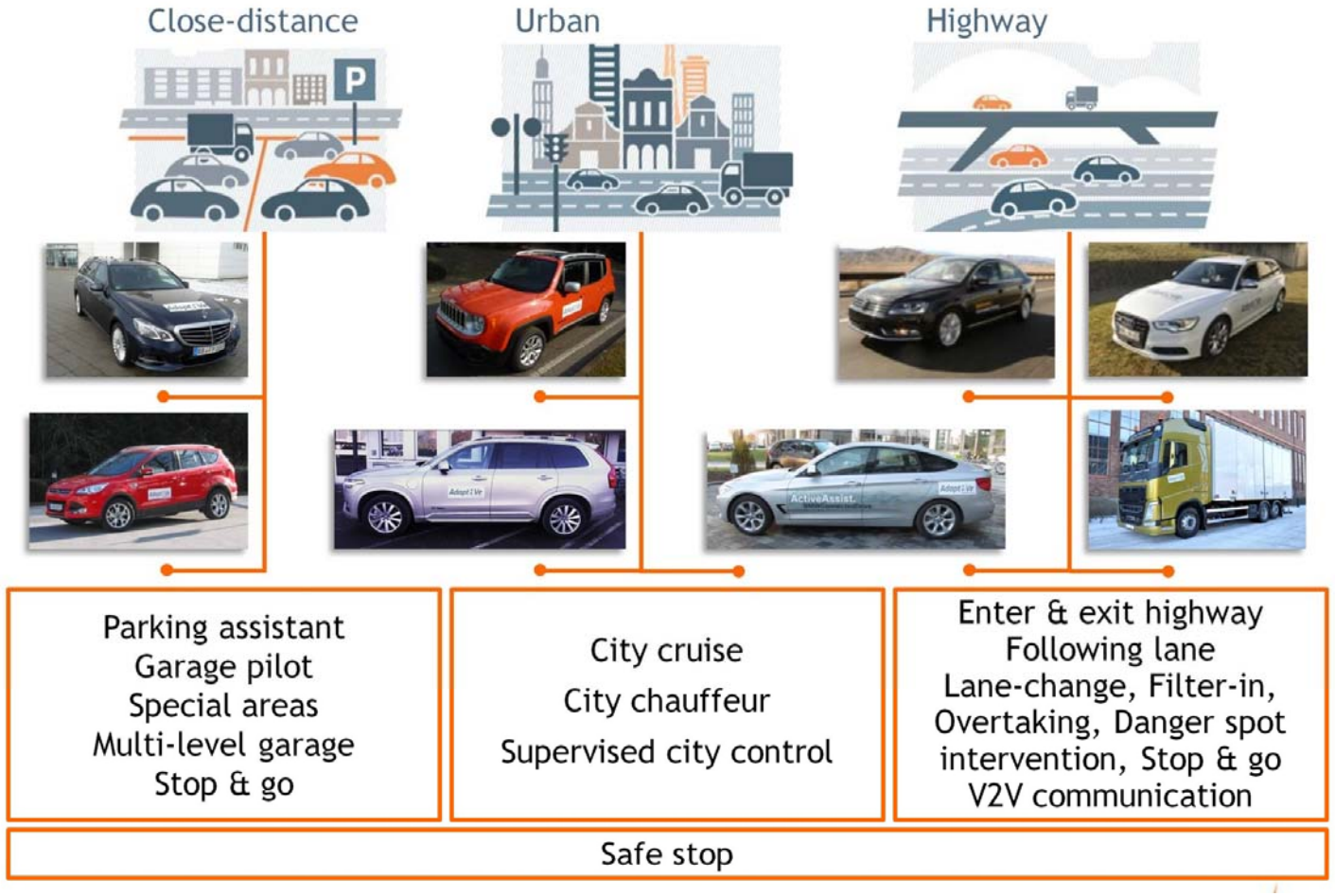
- Open Legal Aspects Workshop in Paris on Sep 17, 2015:
  - Discussing legal topics with external stakeholders and expert community
  - 11 international speakers, 80 experts
  - Presentations and report available on www.adaptive-ip.eu



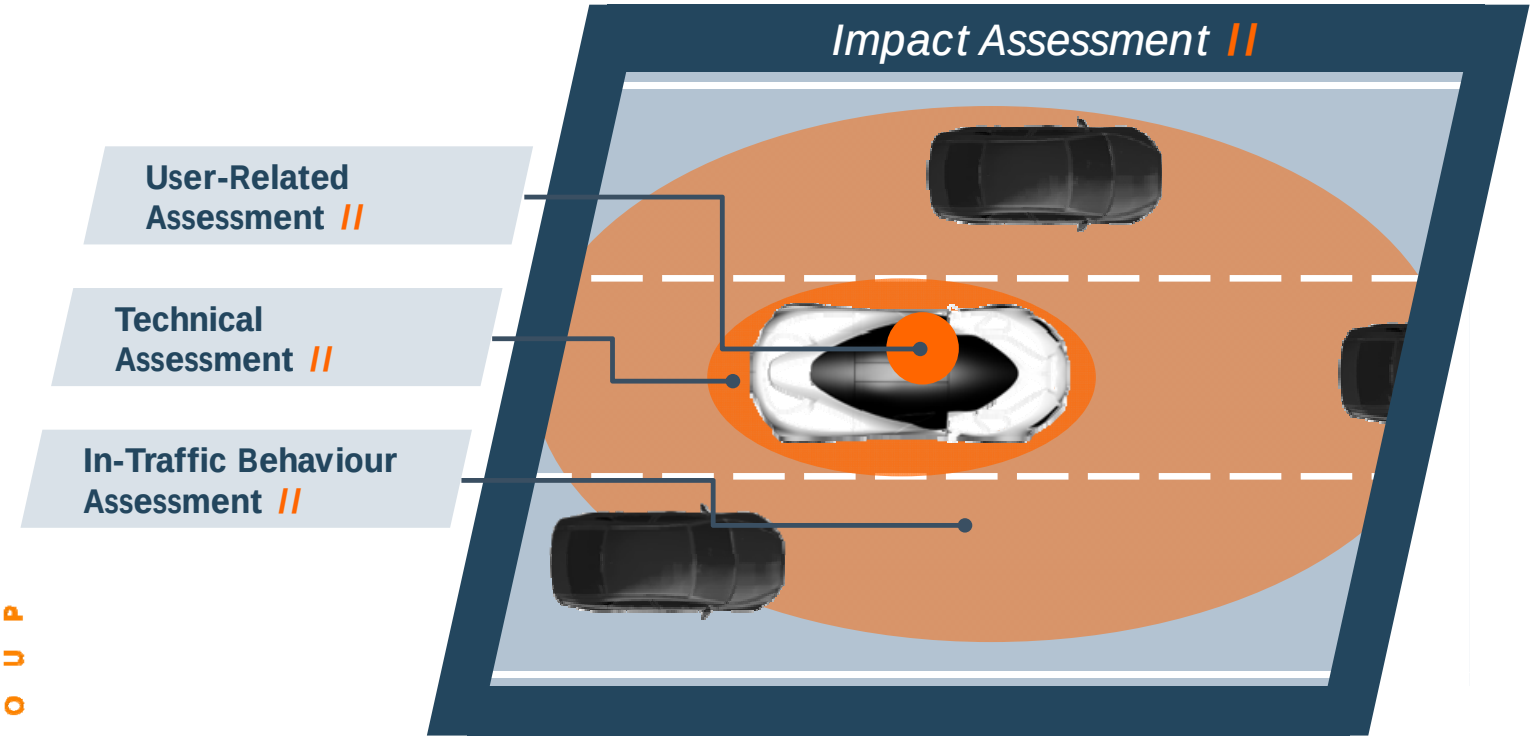
ACHIEVEMENTS

- A total of 17 experiments were conducted
  - Surveys
  - Simulator studies
  - Field studies
- More than 300 participants and one survey with 2700 respondents
- Basis for the human factors recommendations

DEMONSTRATORS READY



NEXT STEP - EVALUATION



SAVE THE DATE: ADAPTIVE FINAL EVENT

- Project results will be showcased through driving demonstrations, presentations and exhibition.
- For more information see: https://adaptive-ip.eu/index.php/final-event.html

AUTONET2030 PROJECT – FINAL RESULTS

http://www.autonet2030.eu/

THE GENERAL OVERVIEW OF THE PROJECT

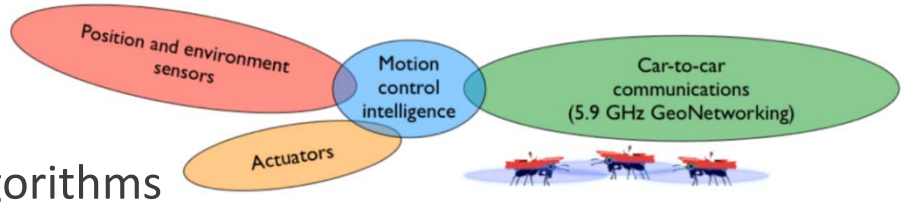
EC Call	Type of Action	Project Budget	EU funding	Start	End
FP7-ICT-2013-10	S/M Collaborative Project	€ 4.59 M	€ 3.35 M	1st Nov. 2013	31st Oct. 2016

- Consortium of 9 partners

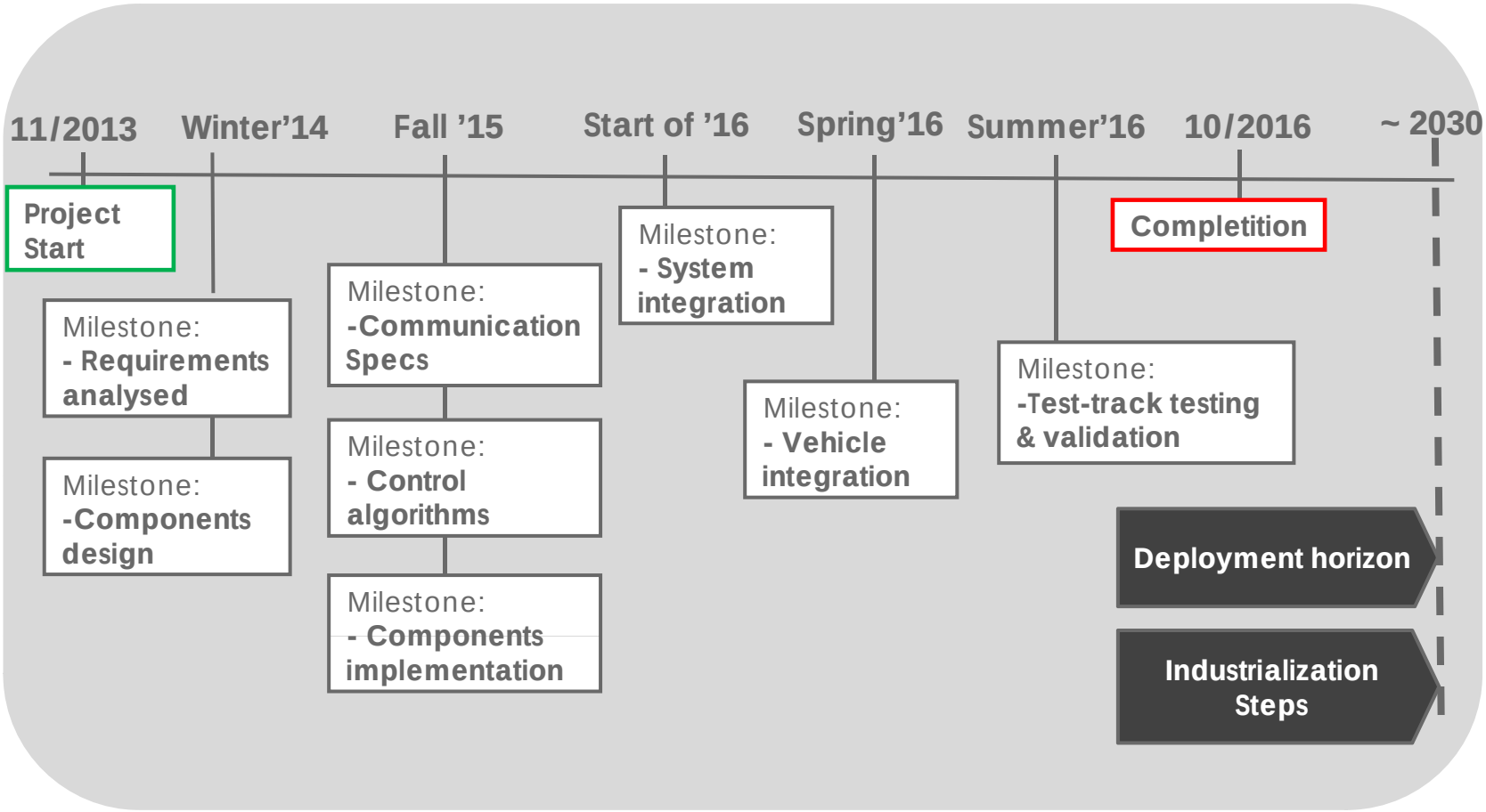
SCANIA · CRF CENTRO RICERCHE FIAT · Hitachi Europe · BASELABS · broadbit · ARMINES · EPFL · TECHNISCHE UNIVERSITÄT DRESDEN




- **Approach** To enable the convergence of pure sensor-based automation with cooperative V2X communications and decentralised maneuvering control algorithms

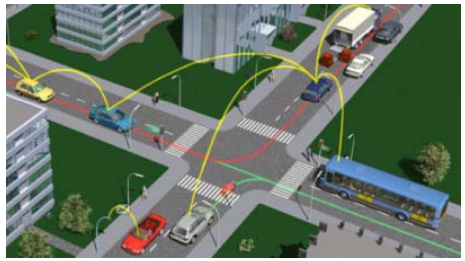


AUTONET2030 WORK IN THE COURSE OF TIME

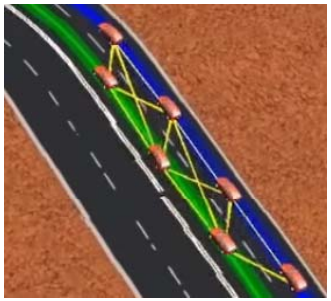


WHAT THE PROJECT HAS ACHIEVED

- Enhance V2X communication for Cooperative Automated Driving
  - *Extensions* of V2X message set and *optimization* of protocol stack
  - Contribution to V2X standardization



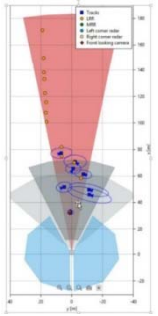
- Distributed graph-based convoy control
  - Innovative algorithm design to address the *dynamic number* of *heterogeneous* vehicles



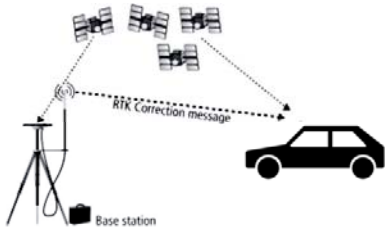
- Hierarchical control architecture for Cooperative Automated Driving
  - *Robust* and *cooperative-aware* motion planning algorithm
  - Intersection management algorithm for automated vehicles at no-traffic light intersections

WHAT THE PROJECT HAS ACHIEVED

- 360° perception layer
  - High-confidence data through sensor-fusion
  - Combination of on-board and communication sensors



- High positioning accuracy (<0.5m) during high speed driving
  - Advanced differential positioning approach
  - Cooperative 5.9GHz broadcasting of RTK support data



- Dual-display HMI for vehicles of various automation level
  - Customized Android apps to provide directives/informative messages

THE PROJECT'S FINAL EVENT

- **Really successful live demonstration of the AutoNet2030 system in highway use-cases, complemented by video demonstration of urban use cases!**
  - Convoy-based maneuvers with 2 automated & 1 manual vehicle at ~75km/h
- **Highly-visible workshop discussing the AutoNet2030 results & latest ITS advances**
  - around 80 participants (more than 55 externals)
  - people coming from USA & Japan especially for this event!!

WHAT THE PROJECT HAS SHOWCASED

THE EXPECTED IMPACT

Without AutoNet2030

With AutoNet2030

The AutoNet2030 work has clearly illustrated the benefits of (networked) cooperation in automated driving

PLACES TO LOOK FOR AUTONET2030 FOOTPRINTS

- The experimental evidence of the effective collaboration between automated and manually-driven vehicles
  - shows how vehicle-automation leads to safer & cost-effective mobility

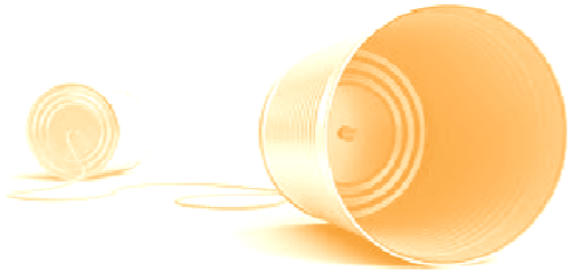
    Innovative convoy-control algorithms
  - provides higher confidence for (potential) users of vehicle automation technology

    Cooperative sensing capabilities realized!
  - significantly contributes to the increase of user acceptance for emerging C-ITS technologies
- Impact on ITS research (as best-paper awards suggest)

CONCLUSIONS – KEY FINDINGS

- Connected automation is evolving rapidly
- EU is continues to invest a lot on automation in road transport in H2020 framework

- The experimental evidence of the effective collaboration between automated and manually-driven vehicles
  - shows how vehicle-automation leads to safer & cost-effective mobility
  - provides higher confidence for (potential) users of vehicle automation technology
  - significantly contributes to the increase of user acceptance for emerging C-ITS technologies



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