Towards Deployment of Automated Freight Transport

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ERTRAC WG Connected Automated Transport
2018 CEF-T Action
TENtec no. 2018-SE-TM-0102-S

Smart, Electronic and Autonomous Multimodal Transportation System and Port Operations

Digital Transport Days
- Session on Digitalization of TEN-T from research to deployment
Helsinki, 9 October 2019
Project Objectives

- **Development and implementation of innovative technology** by securing the necessary conditions for smart vehicles, the implementation of new safe technology can be ensured.
- **Increased interoperability** through creating smart solutions which enhance the quality of deliveries, the supply chains will become more flexible and accessible for different models.
- **Improved safety** through developing a safety network of digital solutions with a vision of zero accidents.
- **Generating resp. becoming “best practice”** by performing the pilot Action the technologies and smart solutions will be deployed and the result will contribute to the industry as well as further research.
- **Deploying smart ports**, i.e. design the port to have the ability to receive, handle, unload, charge, reload, and return of autonomous, electric vehicles with zero handling errors and emissions.
- **In principal eliminating the environmental footprint** by deploying an electrified solution which enables reduction of air pollutants, CO₂ emission and noise.
- **Increase and develop multimodality** by increasing the share of uncombined transport on terminal throughput and develop level of automation along transport chains.

Expected results

- **Piloting an autonomous and connected transportation of containers** to and within a terminal, including autonomous gate passages and communication between control towers (e.g. transport solution control tower and terminal control tower).
Pilot towards Deployment

Global project

Preparation  Stepwise ramp-up  Operation

CEF Action

Follow-up analysis  Maintenance

Co-financed by the Connecting Europe Facility of the European Union
Connected Cooperative Automated Driving
Collaboration, Network, Demonstration, Pilots
Field Operational Tests (FOT), Test verification and validation,
Platooning, V2x, Cooperative Driving, …

Advanced Driver Assistance Systems
Advanced systems for Lane Change Support, Lane Keeping
Support and Adaptive Cruise Control. Drowsiness detection.
Driver Interaction. Emergency Brake, Distance Alert, …

EU FP7/H2020 Research & Innovation project contribution examples;
CONNECTED AUTOMATED DRIVING & ADAS

Results brought into products e.g. Volvo Trucks

EUROFOT  VRA  CARTRE  ARCADE  HeadStart
SAFESPOT  CVIS  DRIVE-C2X  ENSEMBLE
SARTRE  ADAPTIVE
AIDE  PReVent  HAVEit  XCYCLE
Project’s Objectives

HEADSTART will define testing and validation procedures of CAD functions including:

- its key enabling technologies (i.e. communication, cyber-security, positioning)
- by cross-linking of all test instances such as simulation, proving ground and real world field tests
- to validate safety and security performance according to the needs of key user groups (technology developers, consumer testing and type approval)
Coordination of Automated Road Transport For Europe
Objective: Support faster deployment of connected and automated driving across Europe

European Commission funded Coordination & Support Actions

**VRA**
- July 2013 – Dec 2016

**CARTRE**
- Oct 2016 – Sep 2018
- 36 consortium partners
- 51 associated partners

**ARCADE**
- Oct 2018 – Sep 2021
- 23 partners from 11 States
- 30 associated partners
- 2000 subscribers
CAD Roadmap version 8.0 - now available!

• Increased scope to better cover Connected Automated Driving, including cooperative and connected vehicles.
• Strengthen the link to the Infrastructure, through CEDR.
• Deeper dive into three use cases including requirements on ’connected & infrastructure’:
  – Automated Passenger Cars Path
  – Automated Freight Vehicles Path
  – Urban Mobility Vehicles
• Connect to the CARTRE (CSA) results and the ARCADE (CSA) project and provide a EU wide overview (and beyond).
• Incorporate the STRIA CAD actions (2018) via Key Challenges and Objectives.
ODD / ISAD / Traffic regulations and Homologation Framework

- Explanation, common definition of Operational Design Domains (ODD)
- Vehicle and Infrastructure Interaction (e.g. ISAD)
- Regulatory and standardisation framework for Automation
- Connectivity as a requirement for vehicle-infrastructure interaction
## Automated Freight Vehicle Development Paths

| Automation Level | Established | 2018 | 2020 | 2022 | 2024 | 2026 | 2028 | 2030 | ...
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### Levels of Automation

- **Level 5:** Full Automation
- **Level 4:** High Automation
- **Level 3:** Conditional Automation
- **Level 2:** Partial Automation
- **Level 1:** Driver Assistance
- **Level 0:** No Driving Automation, support beyond human capability to act

### Technologies & Pathways

- **Highly Automated Vehicles in Confined Areas**
- **Highly Automated Vehicles on Dedicated Roads**
- **Highly Automated Vehicles on Open Roads**
- **Highway Pilot Platooning**
- **Highway Chauffeur**
- **Traffic Jam Chauffeur**
- **Automated Truck Platooning**
- **Traffic Jam Assist**
- **C-ACC Truck Platooning**
- **Adaptive Cruise Control**
- **Stop &Go**
- **Lane Keeping Assist**
- **Lane Change Assist**
- **Lane Departure Warning**
- **Blind-spot Warning**
- **Forward Collision Warning**
- **ABS, ESC**
- **Emergency Brake**

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Truck: Freight vehicle > 3.5 tonnes category N2 or N3
Key Challenge Areas

**SYSTEM & SERVICES**

- New mobility services, shared economy and business models
- Big data, artificial intelligence and their applications
- Digital and physical infrastructure, including Connectivity
- In-vehicle technology enablers
- Deployment

**VEHICLES & TECHNOLOGIES**

- Safety validation and roadworthiness testing
- Policy and regulatory needs, European harmonisation
- Socio-economic assessment and sustainability
- User awareness, users and societal acceptance and ethics, driver training

**USERS & SOCIETY**

- User awareness, users and societal acceptance and ethics, driver training
- Big data, artificial intelligence and their applications
- Digital and physical infrastructure, including Connectivity
- In-vehicle technology enablers
- Deployment

**Policy and regulatory needs, European harmonisation**

**Socio-economic assessment and sustainability**

**Safety validation and roadworthiness testing**

**User awareness, users and societal acceptance and ethics, driver training**

**Deployment**

**Human Factors**
Collaboration and Exchange of Key Importance!

Single platform for open road testing and pre-deployment of Cooperative, Connected, Automated and autonomous Mobility (CCAM)

STRIA
R&I initiatives and Action Sheets:
• In-vehicle enabler
• Vehicle validation
• Large scale demonstration pilots to enable deployment
• Shared and automated mobility services
• Human factors
• Physical and digital infrastructure
• Big data, Artificial Intelligence and their applications

ARCADE Project (CSA)
• Joint-stakeholder Workshops
• Roadmap Consolidation
• EUCAD Conferences and Seminar
Tri-lateral (Japan, USA, EU) and beyond
• Thematic Areas Clusters;
  – Society & Users
  – Systems & Services
  – Vehicle & Technology

ARCADE is funded by the European Union Horizon 2020 Work Programme
Technology Readiness towards Industry Readiness

- Pilots ongoing – but there are still research questions to be answered!

Research Challenges:
- perception, product safety, communication, vehicle motion management, L4 automation, charging, batteries, etc.

Deployment Challenges:
- System integration, business models, operational processes, user/driver acceptance, etc.

TRL 1
- Basic principles observed and reported

TRL 2
- Technology concept and/or application formulated

TRL 3
- Analytical and experimental critical function and/or characteristic proof of concept

TRL 4
- Component and/or breadboard validation in laboratory environment

TRL 5
- System/subsystem model or prototype demonstration in a relevant product/process environment
  (platform, machine, vehicle…)

TRL 6
- Component and/or breadboard validation in relevant environment

TRL 7
- System prototype demonstration in an operational product/process environment

TRL 8
- System completed and qualified through test and demonstration

TRL 9
- System proven through successful mission operations
## Conclusions: Research towards Deployment of Smart, Electric and Autonomous Multimodal Transport Systems

### Prepare for Deployment
- Harmonization, Standardization
- Regulation, Certification, Homologation, Type Approval
- Road approval, test, pilots, deployment
- Ensure appropriate funding to prepare infrastructure; i.e. traffic and transport control, charging, HD digital maps, connectivity (coverage, bandwidth, latency)

### Research & Innovation
- Develop strategic technologies; AI, Cybersecurity, Control tower, Traffic Safety, User, etc.
- Strengthen key competences in strategic areas
- Extend network with key actors in the logistics sector
- Ensure funding for Research, Innovation, Coordination and Support