Connected & Autonomous Car
A MAJOR CHALLENGE FOR AUTOMOTIVE INDUSTRY

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Groupe RENAULT Overview
5 brands: 3.76 million vehicles sold in 2017
GROUPE RENAULT: THE ALLIANCE

1st LARGEST AUTOMOTIVE MANUFACTURER

10.6 MILLION OF VEHICLES SOLD IN 2017

€5.7 BILLION IN SYNERGIES IN 2017

WORLD LEADER IN ELECTRIC VEHICLE WITH MORE THAN 630 000 UNITS SOLD BY THE ALLIANCE
Autonomous Driving: more and more on stage
FOUR HIGH STAKES FOR MOBILITY

- 90% accidents due to human errors
- 78 minutes each day in car, in Ile de France
- 55% of French population without access to public transport
- 30% to 60% of delivery time for driving in urban city
TRUE AUTOMATION STARTS FROM LEVEL 3 (SAE)

Authorised by Vienna convention

Not yet authorised by Vienna convention
RENAULT VISION FOR AUTONOMOUS DRIVING (Passenger Car)

AUTONOMOUS DRIVE

SAFETY BENEFIT

STRESS-FREE BENEFIT

FREE TIME BENEFIT

MANUAL DRIVE

DRIVING PLEASURE
RENAULT SYMBIOZ DEMO CAR: TOMORROW'S CAR IN ACTION
AUTONOMOUS, ELECTRIC AND CONNECTED

https://youtu.be/caMvuQRXggc
THE NECESSARY TECHNOLOGY FOR AD

Core technologies

SENSING

COGNITION

ACTUATION

DECISION

Redundancy

Sensing

Steering

Navigation

Brake

EE Architecture, ECU

Power Supply

Lidar, Camera, Radar, Sonar

SBW, Redundant EPS

HD Map, Safe positioning

e-Booster, ESC, e-PKB

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SUCCESS CONDITIONS : SOCIAL ACCEPTANCE

- Regulations
- Product Liability
- Infrastructure
- Insurance
- Consumer awareness
- Driver Education

Experimentation

- Proof by FOT on certified roads

Social acceptance

- Sweden
  - On-road test permission was issued
  - Term: 2013-2018

- France
  - Term: 2015-2020

- Germany
  - Term: 2015-2018

- Japan
  - Term: 2017-2020

- Korea
  - Term: 2015-2021

- USA
  - US Automation Program
  - Term: TBD
THE MAJOR STAKE IS SAFETY
SYSTEM OF SYSTEM & LOCALIZATION

Connectivity: V2V, V2I, HDmap...
AD IS A MAJOR DISRUPTION

ADAS (L1, L2, L3)

Driver is the last resort

Driver reliability proof

Driver training + experience

AD (L3+(1), L4, L5)

System is the last resort

System reliability proof

Massive mile accumulation + simulation

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(1) Emerging German L3 "standard"
(2) Tentative consensus among European OEM

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Driver reliability proof

System reliability proof

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AD objective: $10^{-8}$

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OECt average fatalities per hour

All roads: $10^{-6}$

Highways: $10^{-7}$
AD SIMULATION IS KEY
AD / ADAS SIMULATION CHAIN

1 Scenario catalog

Use cases
• Expert Knowledge (sensor/interpretation)
• Accident database (relevance due to outcome)
• Field test (critical traffic scenario)

2 Simulation

Scenario Factory

Digital vehicle
Vehicle model
Sensor model
Driving Simulator

Massive Simulation Platform

3 Post-Processing

Capitalization

Not good
AD / ADAS SIMULATION CHAIN

PARTNERSHIPS

1. Scenario catalog
   - Use cases:
     - Expert Knowledge (sensor/interpretation)
     - Accident database (relevance due to outcome)
     - Field test (critical traffic scenario)

2. Simulation
   - Scenario Factory
   - Digital vehicle
     - Vehicle model
     - Sensor model
   - Massive Simulation Platform
   - Driving Simulator

3. Post-Processing

Capitalization

Not good

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SEPTEMBER 2018

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DRIVING SIMULATOR: DRIVER IN THE LOOP

1. Scenario catalog
   - Use cases
     - Expert Knowledge (sensor/interpretation)
     - Accident database (relevance due to outcome)
     - Field test (critical traffic scenario)

2. Simulation
   - Scenario Factory
   - Digital vehicle
     - Vehicle model
     - Sensor model
   - Massive Simulation Platform

3. Post-Processing
   - Not good

Capitalization

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PDS INTERFACED TO DRIVING SIMULATOR

Autonomous vehicle application: Cut In use case example

PDS: Digital Vehicle

Driving Simulator: ULTIMATE
ROADS: NEW DRIVING SIMULATOR

• 9 DOF Driving Simulator
• Up-to 1g accelerations on all axis
• Dome with 360° 3D Ultra High definition projection
• Full instrumented cabin with 360°
• Turn-table inside the dome
• 30m x 30m evolution area
  (15 m x 15 m useable stroke)
• 10,5 MWatts (8MW from supercapacitors)

Localisation
Renault Technocentre
Guyancourt - France
CONCLUSION
Simulation and Driving simulator are key to develop and validate new connected and autonomous vehicles.
https://youtu.be/-8wWwYhBGhE
Thank You for your attention

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