LAAS Research & Technology

Conferences

Automatized vehicle @ Toulouse from “PROMETHEUS to EasyMile”

A storytelling by Jean- Luc MATE

LAAS 23 march 2017

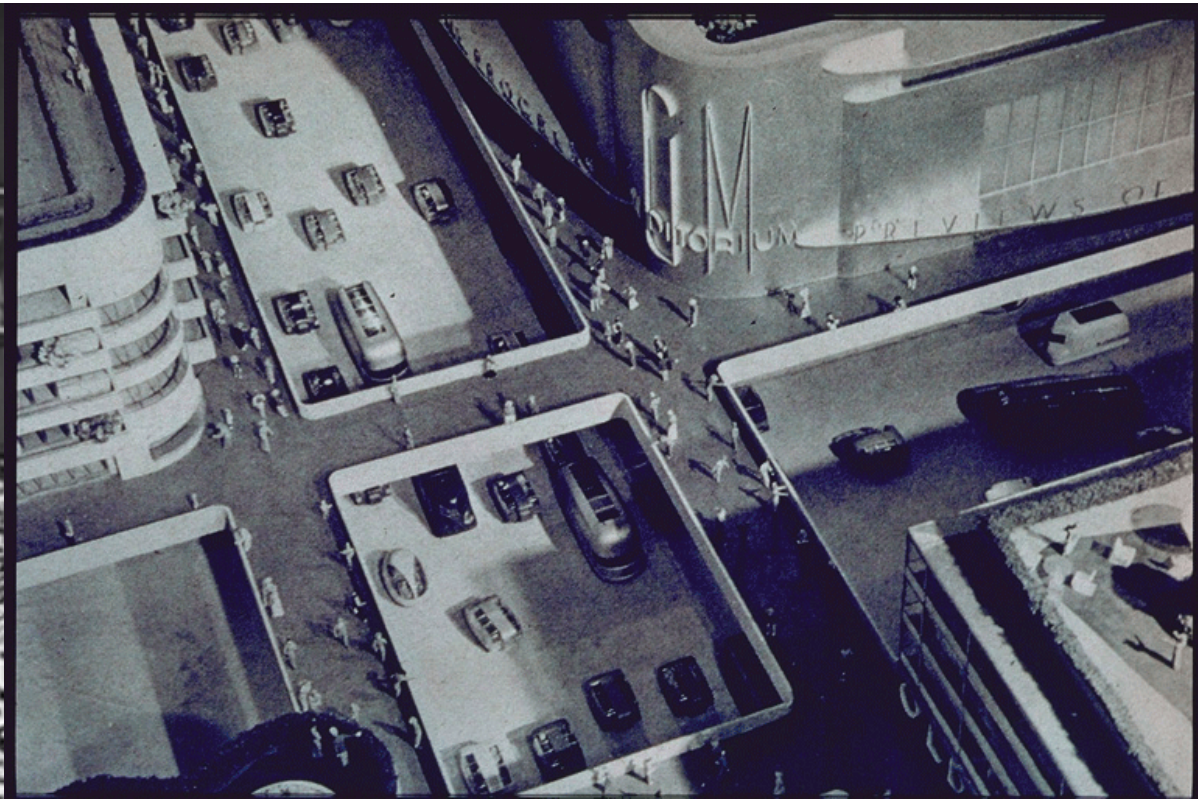
Chapter 1
Genesis
The world before LAAS

1925 Houdina remote Radio controlled car

1939 New York FUTURAMA Exhibition

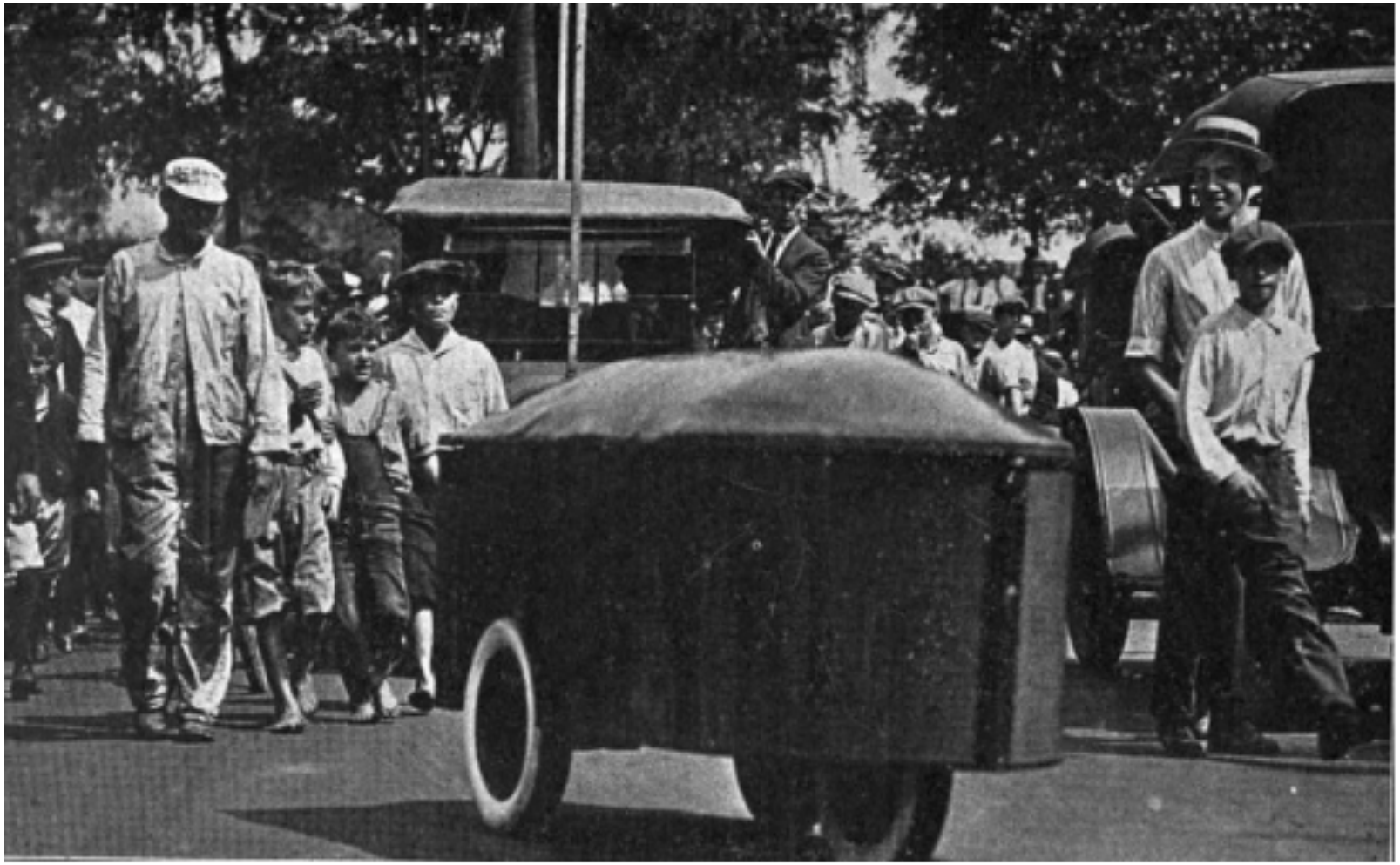
- An early representation of the autonomous car was Norman Bel Geddes ‘s Futurama exhibit sponsored by **General Motors** at the **1939** World’s fair, which depicted :
- **electric cars powered by circuits embedded in the roadway and controlled by radio**.

1939 New York FUTURAMA Exhibition



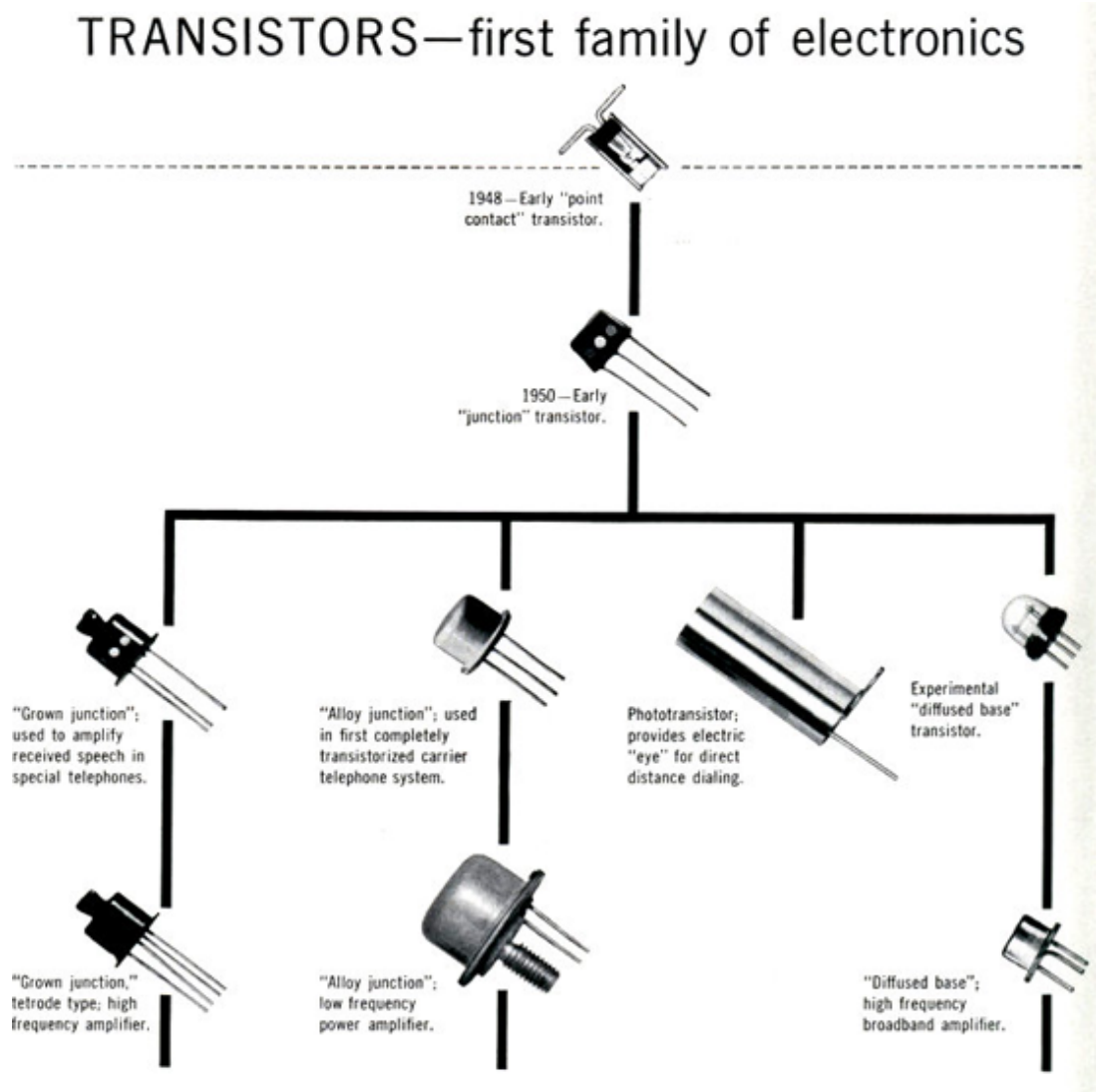

AUDITOR

1950 RCA LAB'S Radio controlled car



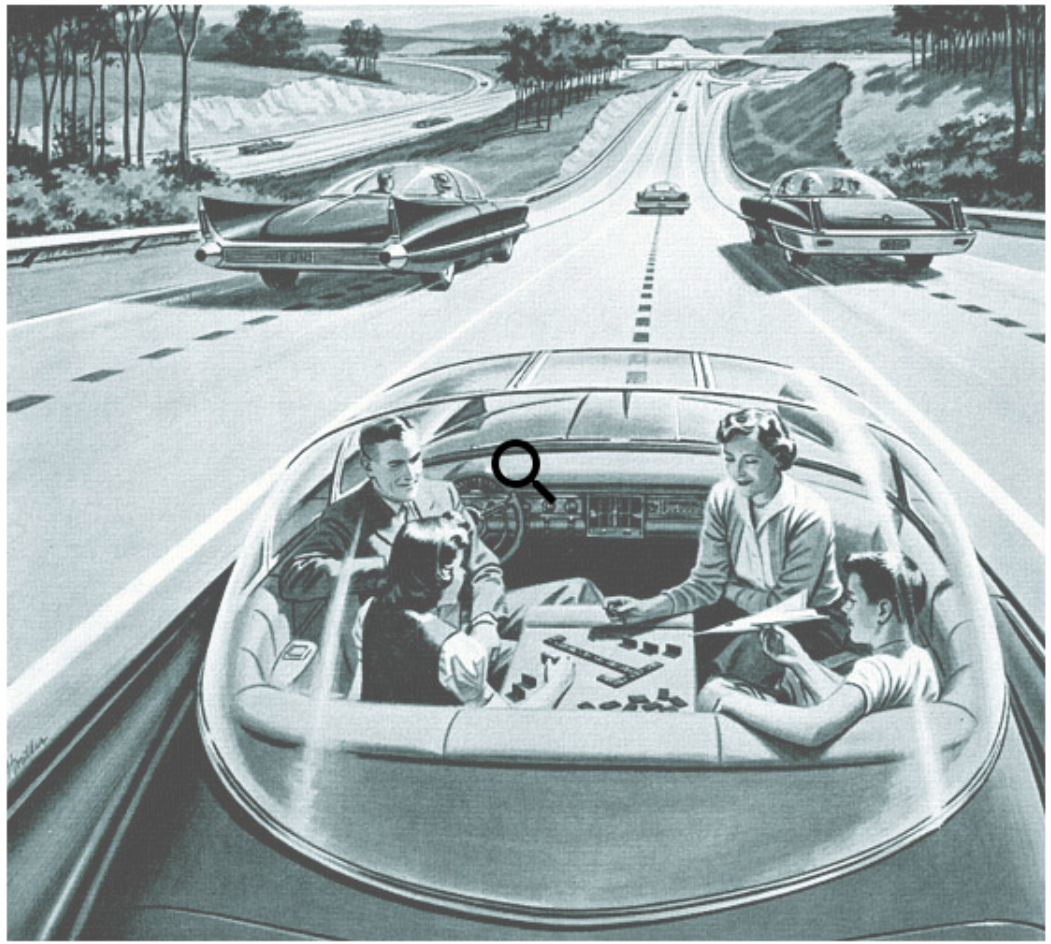
The RCA radio-controlled car. *(Credit: Wikimedia Commons)*

1950 First Radio Transistor

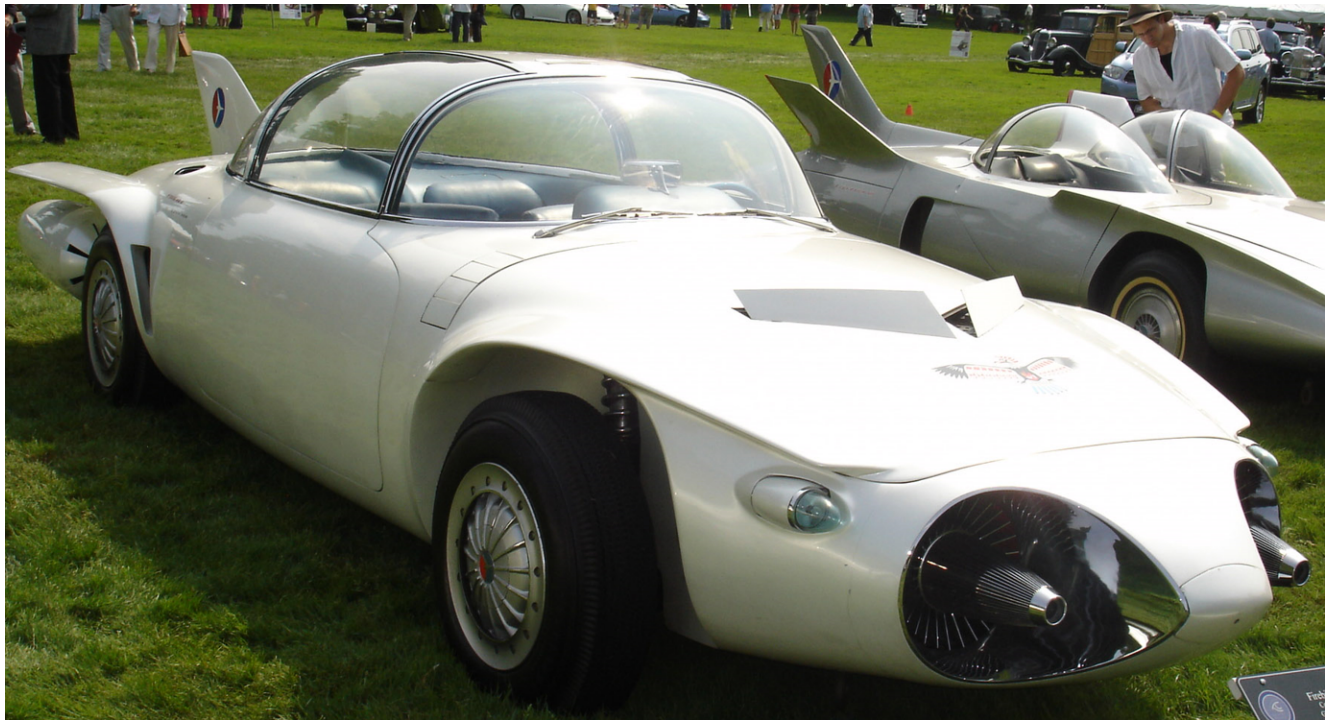


1956 the American autonomous car dream
1958 GM firebird II

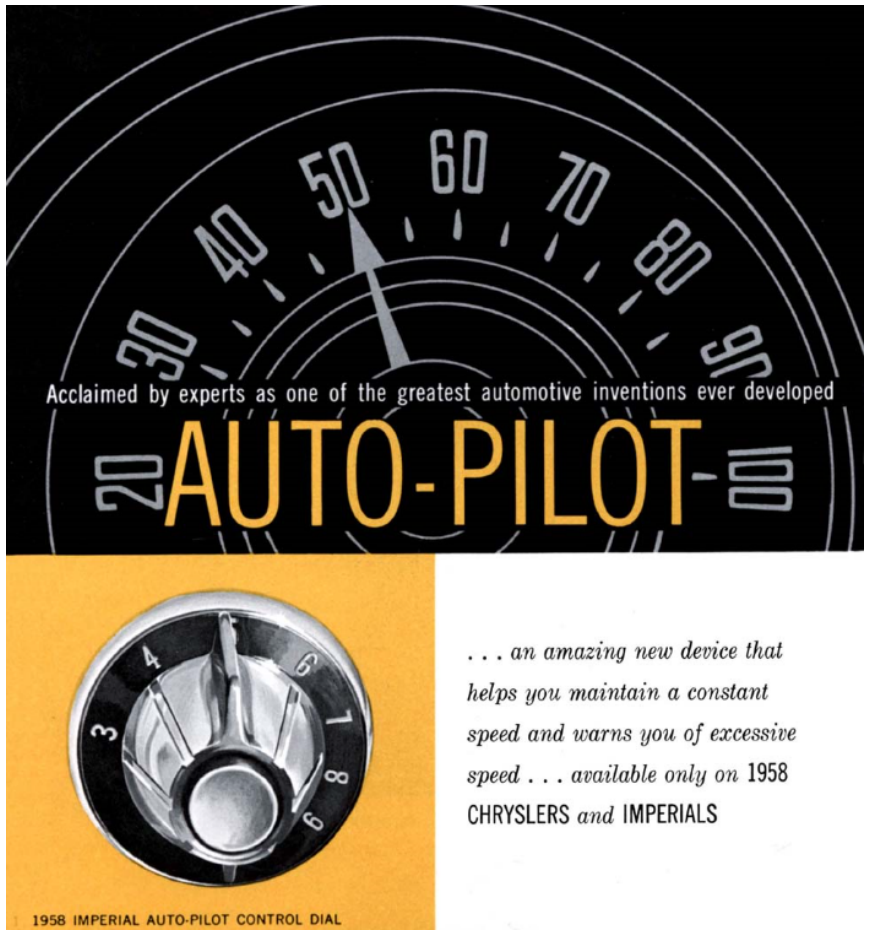
A sophisticated guidance system intended for use with "the highway of the future," where an electrical wire embedded in the roadway would send signals that would help guide future cars and avoid accidents.

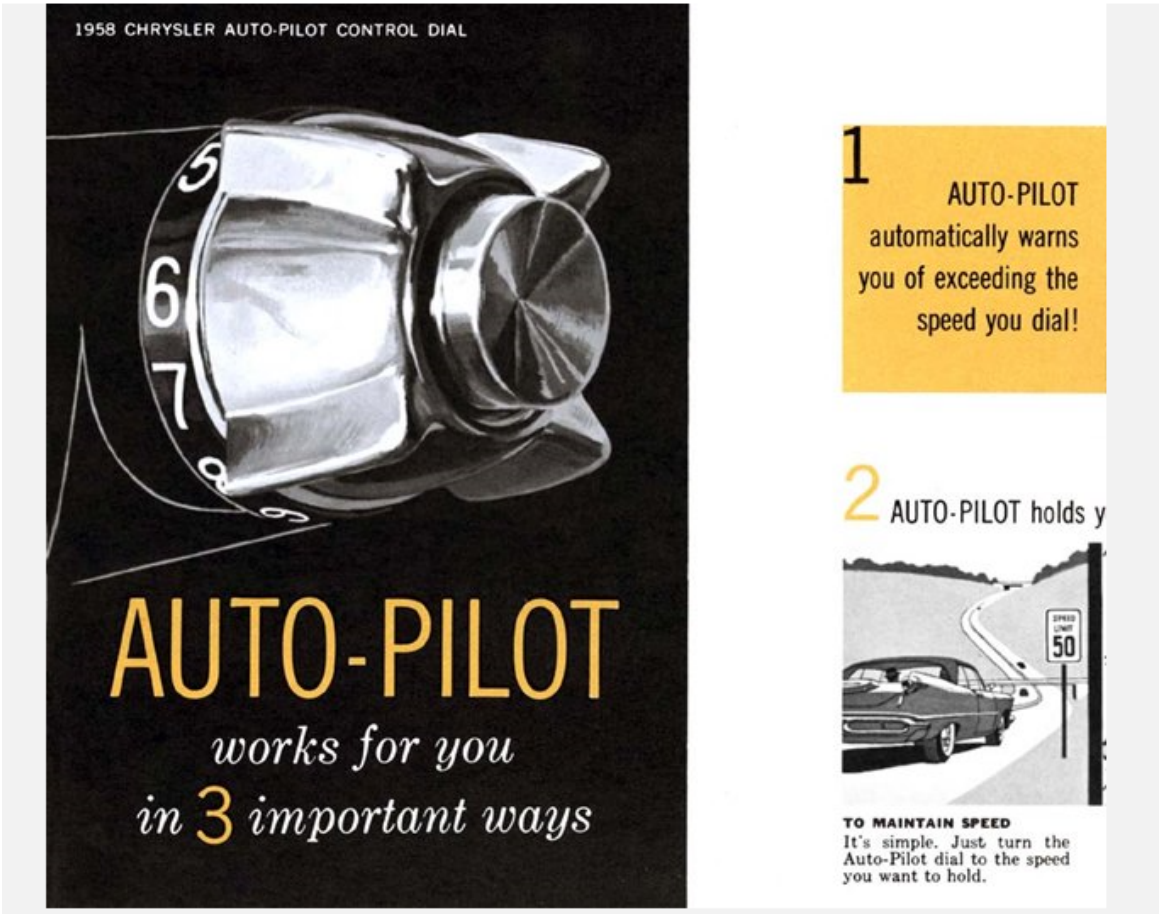


America's Power Companies' advertisement from 1956 depicting a future with autonomous cars.

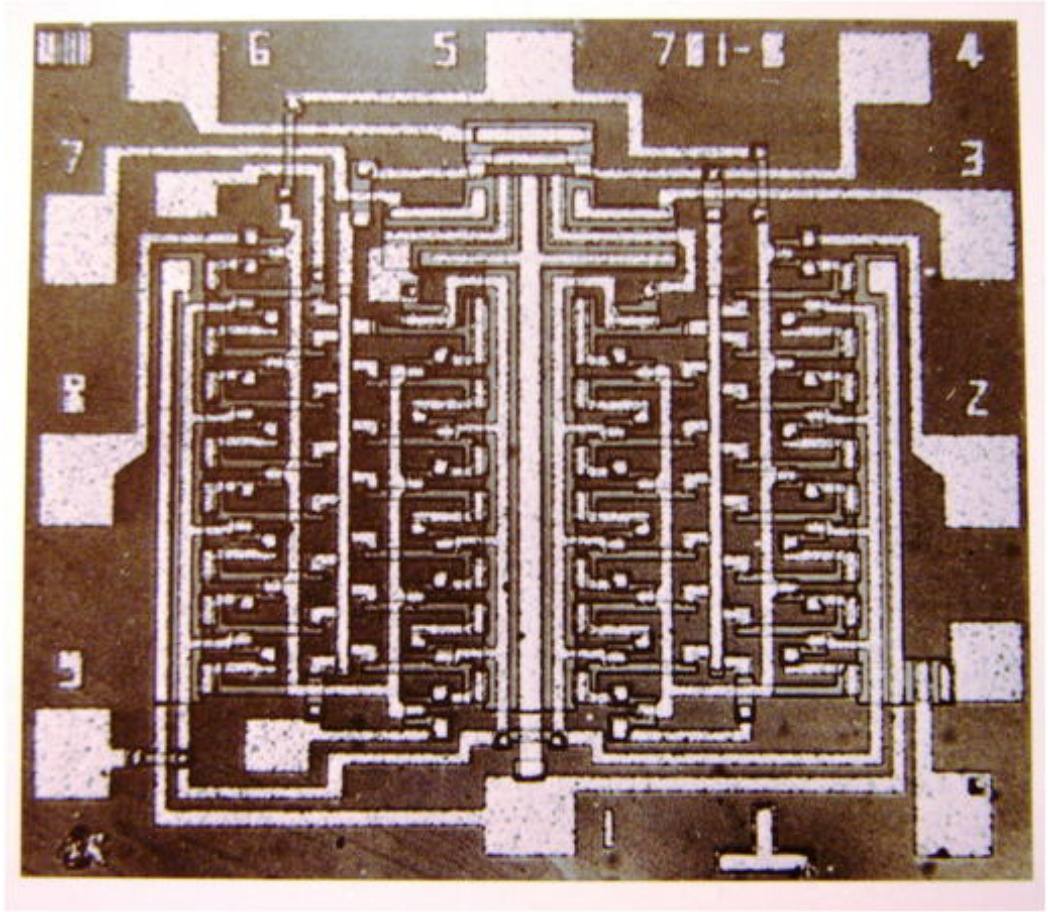


1958 the first cruise control on Chrysler Imperial





1960 first integrated circuit



Chapter 2 :
The world with LAAS in Toulouse

Charismatic electronic engineer with teaching talent and strong entrepreneur profile

1963	Création de l'INSA de Toulouse
1963	Construction du bâtiment de Génie Electrique
1963	Jean Lagasse 1er directeur du DGE
1965	Réception du bâtiment de Génie Electrique
1968	Création du laboratoire LAAS/CNRS
1968	Jean Lagasse 1er directeur du LAAS/CNRS

1967 Jean Lagasse contribute to attract Motorola

C'était, raconte Jean-Etienne Cassignol en 1966 à Toulouse. Motorola, le leader mondial dans les semi-conducteurs, cherchait à s'implanter en Europe. Une délégation conduite par le grand patron avait entrepris un tour de France pour choisir le site du nouveau centre de fabrication destiné aux besoins européens.

Nous étions avec Jean à Toulouse, très intéressés par cette implantation. C'était mon premier contact avec Lester Hogan, le grand patron des semi-conducteurs chez Motorola, qui allait faire basculer toute ma carrière.

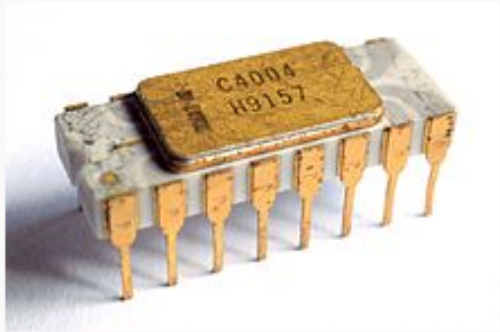
1968 :The LAAS Founder …. again a builder

MAY 1968 Another aniversary in PARIS

1968 :The LAAS Founder …… select his deputy

1971 we can start on computing miniaturization

Intel 4004



La version céramique C4004 avec traces grises

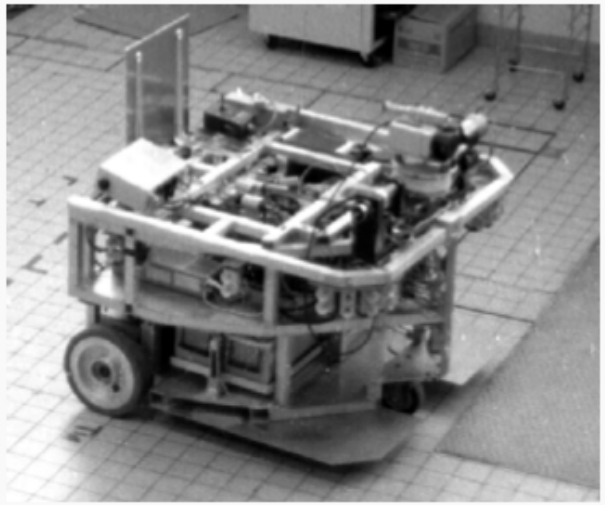
Caractéristiques

Production	De 15 novembre 1971 à 1981
Fabricant	Intel
Fréquence	740 kHz
Finesse de gravure	10 µm
Architecture	4 bits

Georges Giralt French pionner in Mobile Robotics

1977-1992 **The Hilare Family**
LAAS - France

1977 - Hilare I

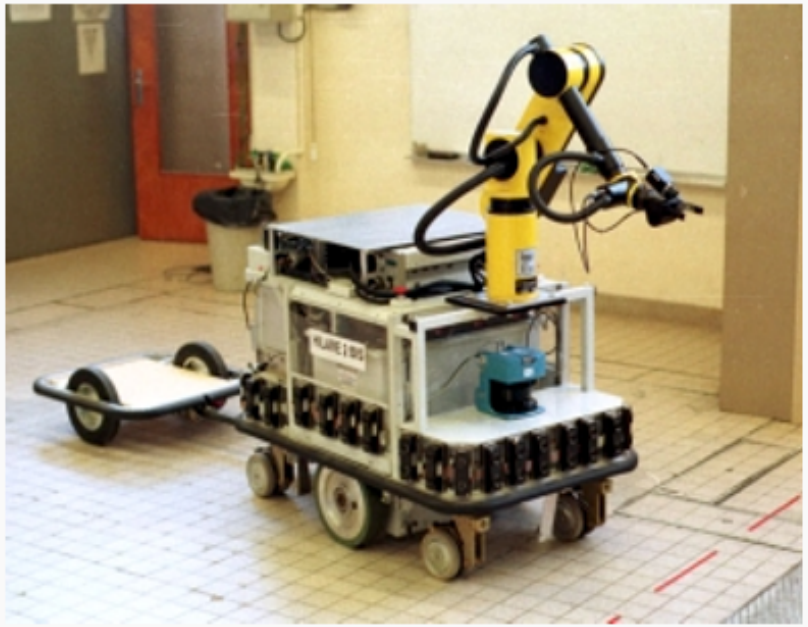


Wheels:
2 driving wheels and a free wheel
Batteries:
24V
Bus:
Multibus
Processors:
4 x Intel 80286
Operating system:
none
Communication:
serial radio modem (9600 bauds)
Sensors:
Odometer,
16 US sensors,
a Laser Range Finder
Dimensions (LxWxH):
80cm x 80cm x 60 cm
Weight:
400kg

Robotics and Artificial intelligence RIA french foundation

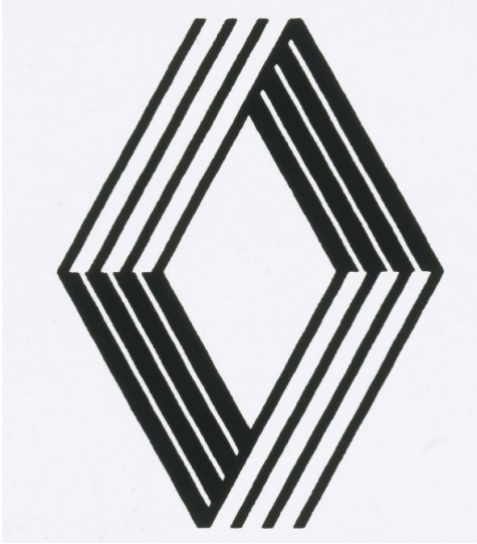
1990 - Hilare II

1992 - Hilare IIbis



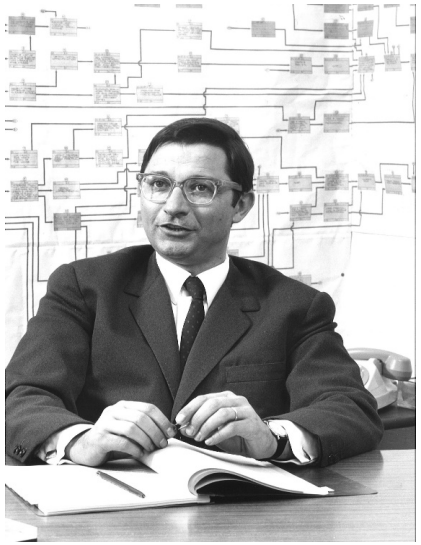
Wheels:
2 driving wheels + 4 free wheels
Batteries:
48V
Bus:
1 VME Rack
Processors:
4 x Motorola 68040 + 1 Motorola PPC 604
Operating system:
VxWorks 5.3.1
Communication:
Ethernet radio modem (3 Mbit/s)
Sensors:
odometry,
32 Sonar range sensors,
2D Laser Range Finder,
1B&W camera
Dimensions (LxWxH):
130cm x 80cm x 80cm
Weight:
400kg

1977 - 87 Jean Lagasse enter the industry !



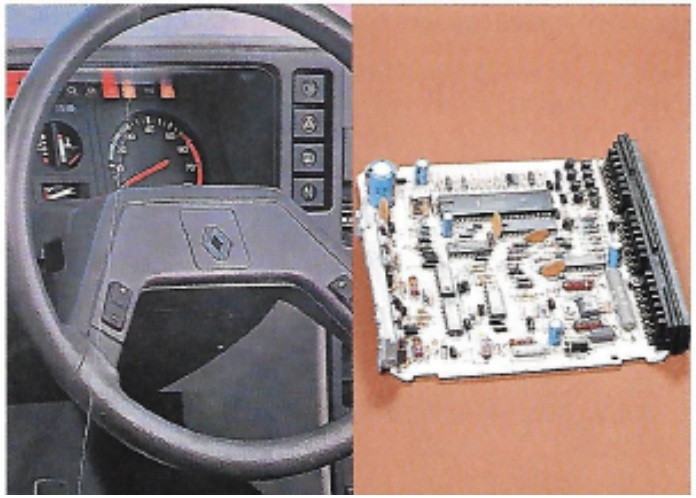
After having been director of scientific and technical affairs (DRAST) at Renault, he was promoted director of research and president of REGIENOV (Renault innovation)

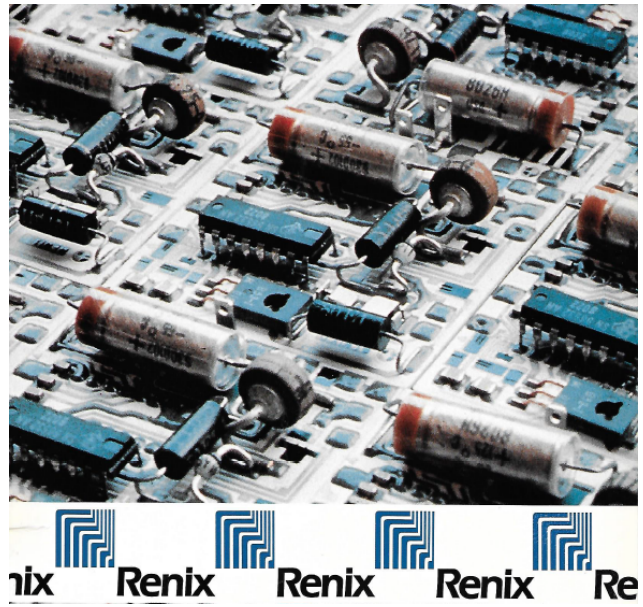
1978 : Jean Lagasse brings to Toulouse the French Automotive Electronics foundation



• et en MAI pour le RÉGULATEUR DE VITESSE ''NORMALUR'', qui équipe en série la Renault 30 TX, et équipera prochainement, en option, certains autres modèles de RENAULT.

Régulateur de vitesse "Normalur".





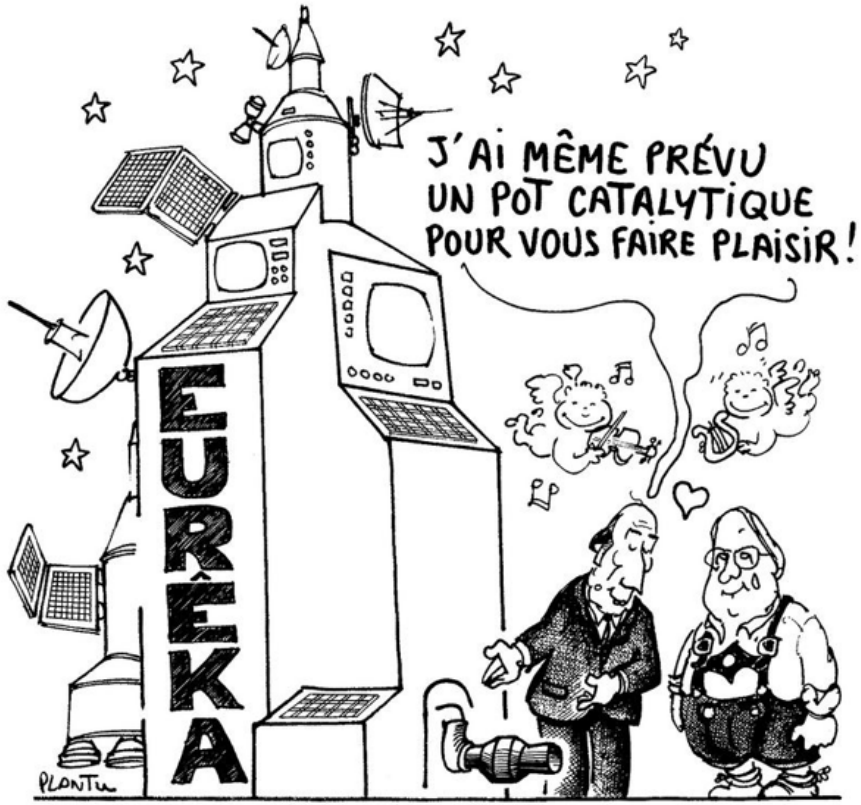
80’s German car makers are leading Automated Driving

https://www.youtube.com/watch?v=I39sxwYKlEE

Chapter 3 :

French German EUREKA Initiative

Prometheus : the largest R&D program for the vehicle of the future

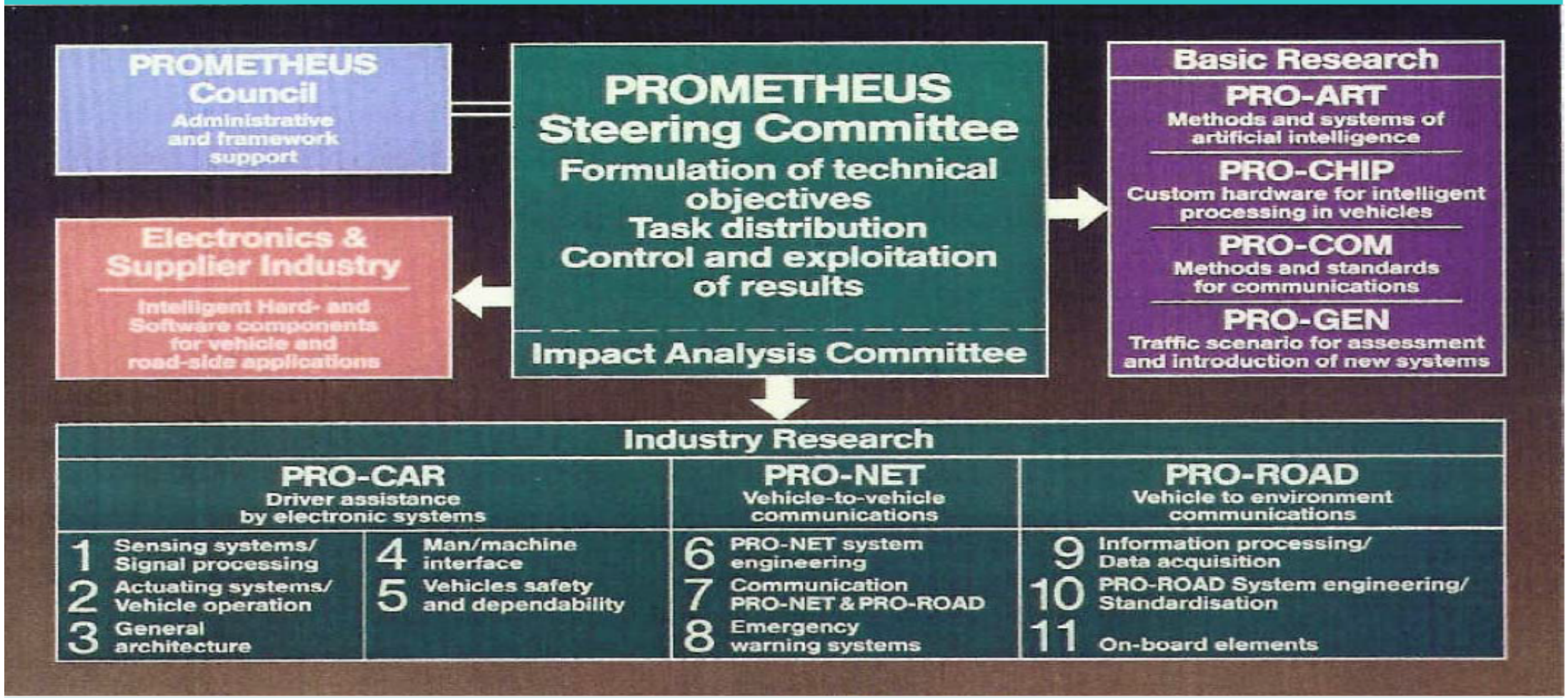


***PRO**gra**M**me for a **E**uropean **T**raffic of **H**ighest **E**fficiency and **U**nprecedented **S**afety*, 1987-1995 - 749M€

Defined the state of the art of "autonomous" vehicles.

CED 1 : Vision Enhancement
CED 2-1 : Friction Monitoring and Vehicle Dynamics
CED 2-2 : Lane Keeping Support
CED 2-3 : Visibility Range Monitoring
CED 2-4 : Driver Status Monitoring
CED 3 : Collision Avoidance
CED 4 : Cooperative Driving
CED 5 : Autonomous Intelligent Cruise Control
CED 6 : Automatic Emergency Call
CED 7 : Fleet Management
CED 9 : Dual Mode Route Guidance
CED 10: Travel and Traffic Information Systems

Prometheus – Structure and Research Tasks



Strategic Approach: From the product “Vehicle” to the product “traffic”.
Considering the high complexity of the program, it had been started and planned carefully and installed a new form of cooperation between industry, basic research entities and governments in order to integrate all relevant partner just from the beginning.

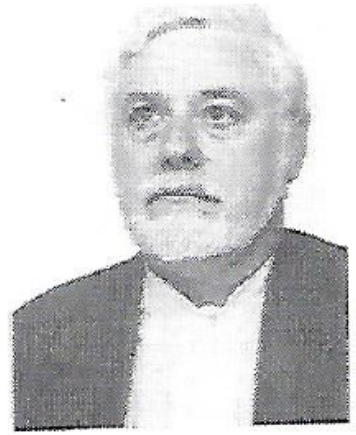
The Key people @ Renault - PSA & LAAS

D. Augello

• Directeur de la Recherche RENAULT S.A. • Chef de Projet PROMETHEUS,
• Représentant RENAULT au Steering Committee du Programme.
(Avant propos).
(R.N.U.R.
9/11, Avenue du 18 Juin 1940
92500 Rueil Malmaison)

A. Rault

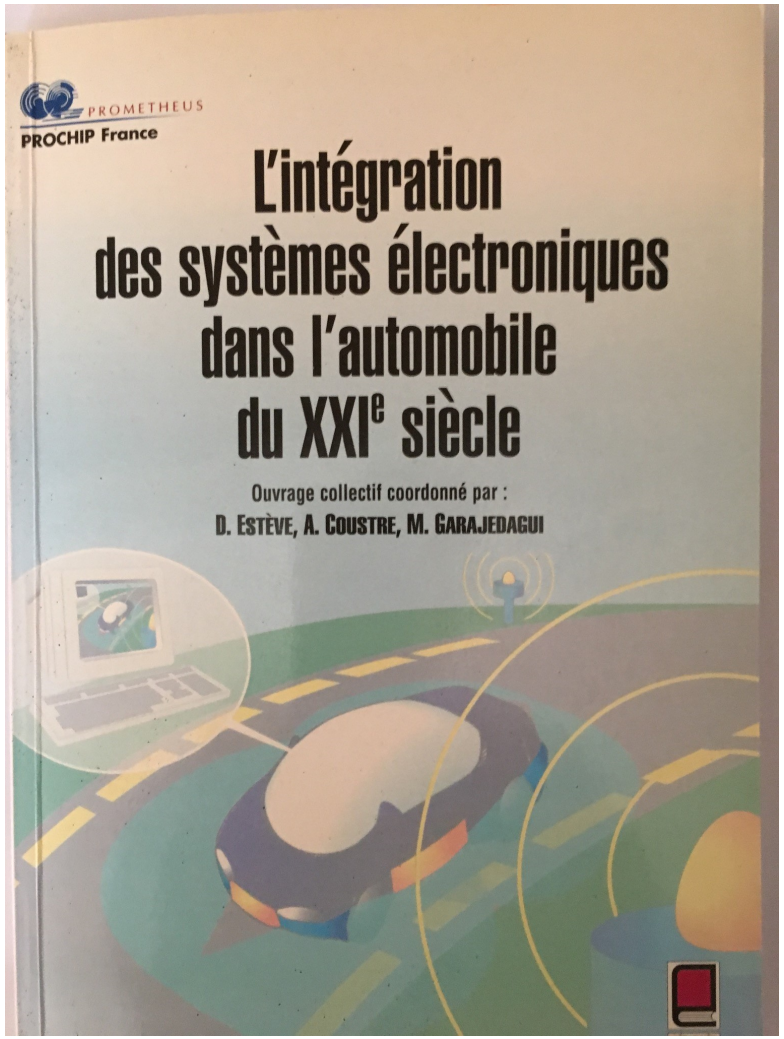
• Direction des Recherches et Affaires Scientifiques.
• Représentant PSA à PROMETHEUS.
(Avant-Propos).
(Peugeot S.A. - Centre Technique Citroën - D.R..A.S. - Route de GISY
78140 Velizy-Villacoublay)

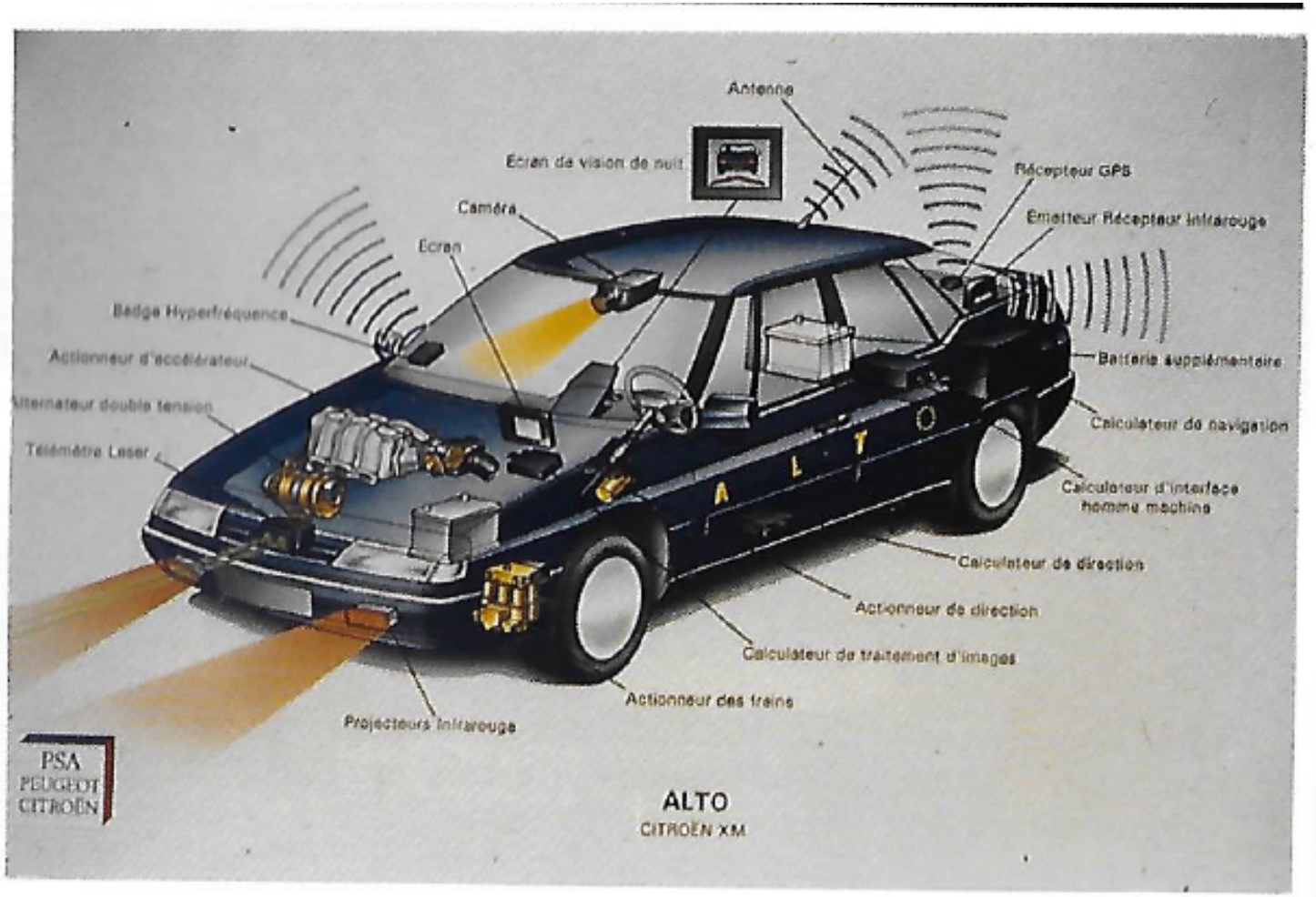


D. Estève

• Directeur de Recherche au LAAS/CNRS.
• Responsable Scientifique du Programme PROCHIPFRANCE
Spécialiste des questions d'intégration de systèmes et microsystèmes (Introduction générale Chap. 1. Parag. 1 et 2).
(LAAS-CNRS
7, avenue du Colonel Roche
31077 Toulouse cedex)

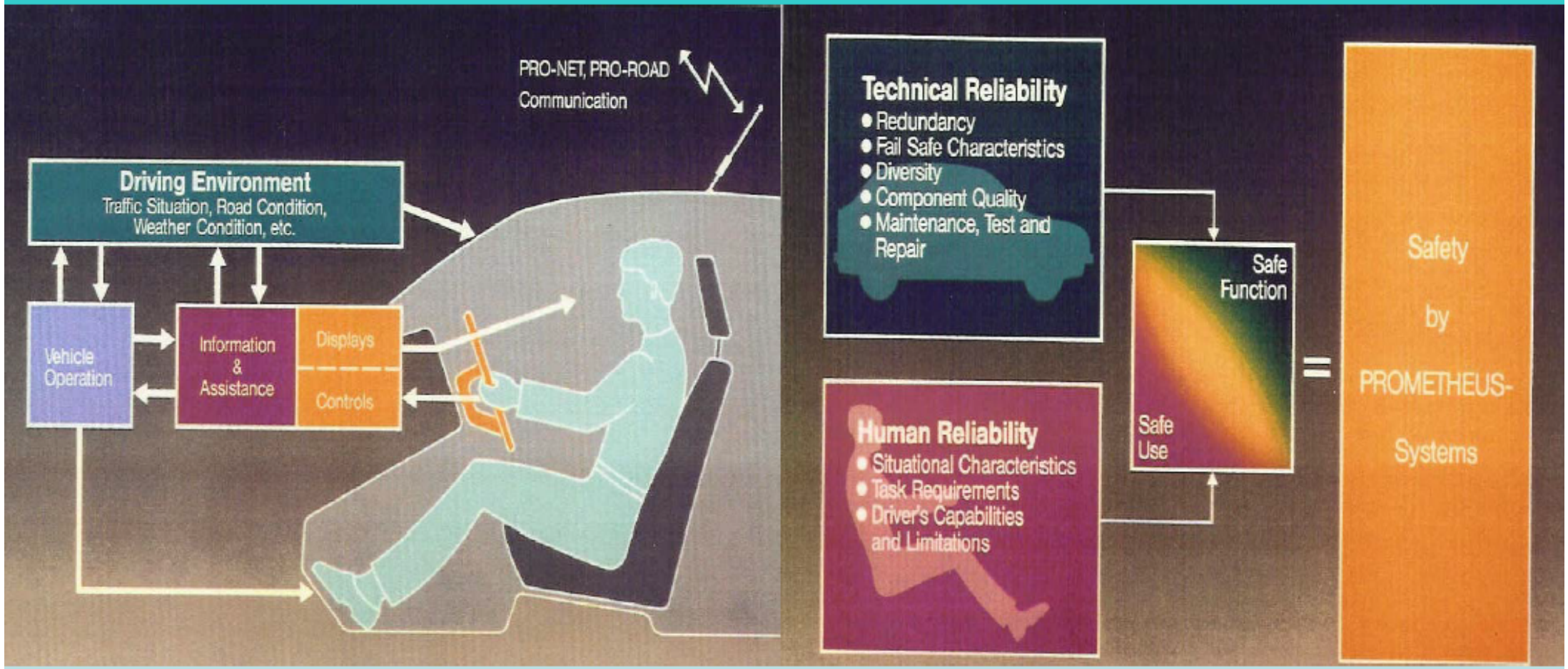
Pro-Chip: Development of the integrated microelectronics required for a Prometheus vehicle with advanced on-board automotive electronics
Pro- Art: Methodological investigations of applications of Artificial Intelligence for signal processing and decision making processes.





XM Alto : véhicule de synthèse de PSA Peugeot Citroën

Prometheus – MMI and Safety concepts in Pro-Car



Pro- Car: Development of

- Computer-assisted systems in vehicles to assist and relieve the driver
- MMI- concepts to support safe interactions between driver and computer-assisted systems.
- Reliable, safe and high quality Hard- and Software and concepts for diagnosis, service and maintenance.

1990 - 1994 First French common research – Industry Laboratory

MIRGAS

LABORATOIRE DE RECHERCHE SUR LES SYSTEMES AUTOMOBILES
COMMUN A
SIEMENS, CNRS, INPT, REGION MIDI - PYRENEES.

Automotive systems focused
Siemens Automotive
4 laboratories CNRS/INPT :
LAAS, LEEI, LEN7, IMFT
Midi-Pyrénées region funding

10 industry/research projects

Fuzzy and neuro control for semi–active and active suspension

André TITLI[(1)], Serge BOVERIE[(2)]

(1) INSA / LAAS–CNRS, 7 avenue du colonel Roche, 31077 Toulouse, France
(2) SIEMENS AUTOMOTIVE SA, Avenue du Mirail, BP 1149, 31036 Toulouse Cedex, France

Abstract– After a short introduction about suspension systems, the first part of this paper presents the design of a fuzzy controller for active and semi–active suspension. The second part is dedicated to the optimization of this fuzzy controller, based on conventional methods like gradient descent methods. To complete this study, this fuzzy controller is copied by a neuro–controller, whose adaptiveness and robustness are studied.
This studies are illustrated by simulations and experiments on a test bench.

Keywords: Fuzzy control, neuro control, active suspension, optimization techniques

RENAULT
PUBLIÉ LE 15/01/1998 À 00H00

AUTOMOBILE

L'automatisme s'adapte au style de conduite

La nouvelle boîte de vitesses automatique DPO développée en commun par Renault et PSA fait appel à la logique floue pour calquer son comportement sur celui d'une transmission mécanique classique.

réagit comme une boîte mécanique. Cela grâce à son système de gestion électronique par logique floue, développé avec Siemens. Ainsi, la DPO intègre neuf lois de passage auto-adaptatives, alors que la plupart de ses concurrentes n'en possèdent que deux. Le calculateur 8

1996 - 2005 Institute for Embedded Systems for transportation

I E R S E T

Institut Européen de Recherche
sur les Systèmes Embarqués
et leurs Technologies

Strong focus in Automotive driven by visionary managers and Toulouse city

25 funded projects with active participation of Renault and PSA (PREDIT)

IERSET in the top of ADAS R&D projects

DRIVER VIGILANCE MONITORING - NEW DEVELOPMENTS

S. Boverie[a], D. Daurenjou[a], D. Estève[b], H. Poulard[c], J Thomas[c]

[a] *Siemens VDO Automotive SAS - B.P.1149 av. Paul Ourliac 31036 TOULOUSE Cedex France.*
[b] *Laboratoire L.A.A.S./C.N.R.S. - 7, av. du Colonel Roche 31077 TOULOUSE France.*
[c] *ACTIA – 25, Chemin de Pouvourville 31400 TOULOUSE France*

Abstract: Driver drowsiness is a major cause of traffic crashes all over the world. The real time detection and assessment of driver impairment through non-intrusive driver drowsiness detection system is a real challenge. Within this paper a quick overview of former development related with driver monitoring system is given. Then latest developments and results concerning sensing capabilities and diagnostic are presented. Finally some promising results are presented.

Keywords: ADAS, Driver vigilance, diagnostic, image processing

PREDIT Research in Terrestrial transportation

New Active safety functions : ADAS

Drowsiness driver Monitoring

French Research ministry award

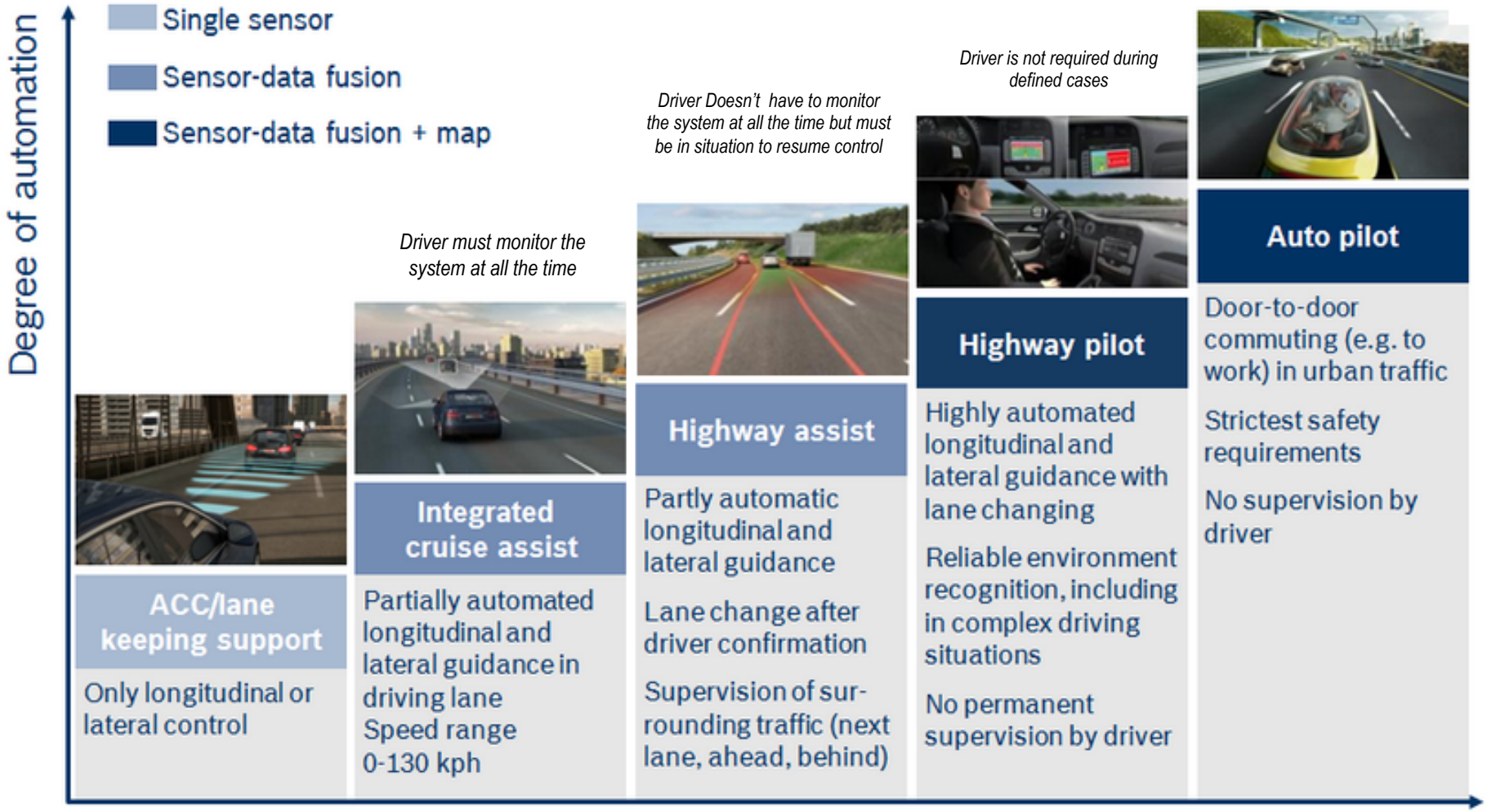
Chapter 4

2010 ’s The IT world is changing the Automobile to more Connected & Automatized

The Internet Industry is Interested in the Connected Car

Internet consumer hours double with the car.

From manual driving to full automation

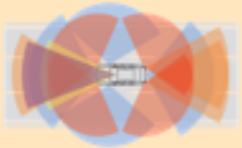


Highly Automated Driving
Functional Architecture

Continental Engineering Services

Driver Monitoring

Environment & Vehicle Sensing



Connectivity & Backend

Modeling

Driver Model

Vehicle Model

Environment Model

HAD Functions

Traffic Jam

Parking

City

Highway

HMI

Action (Motion Control)

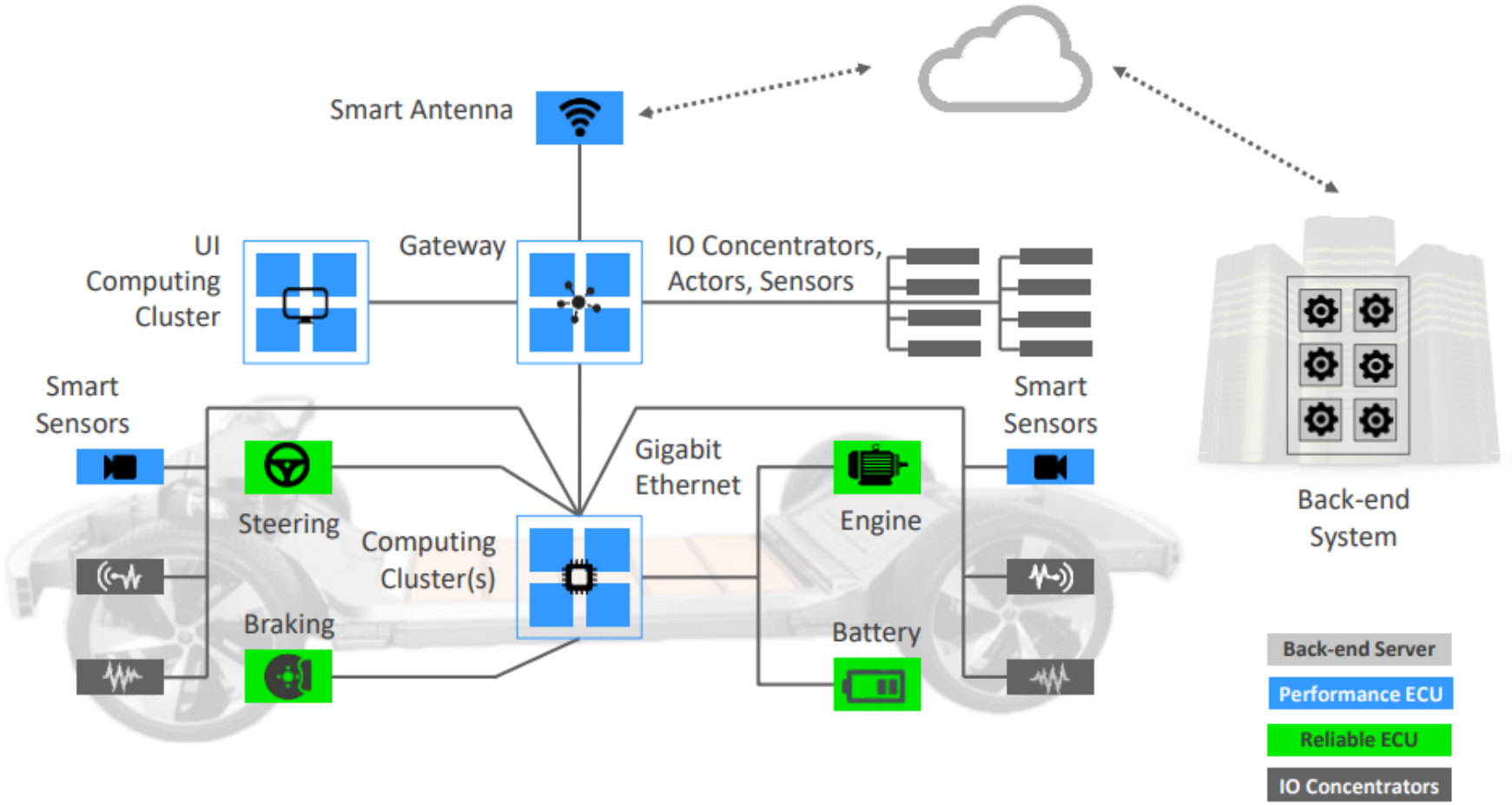
Steering

Brakes

Engine

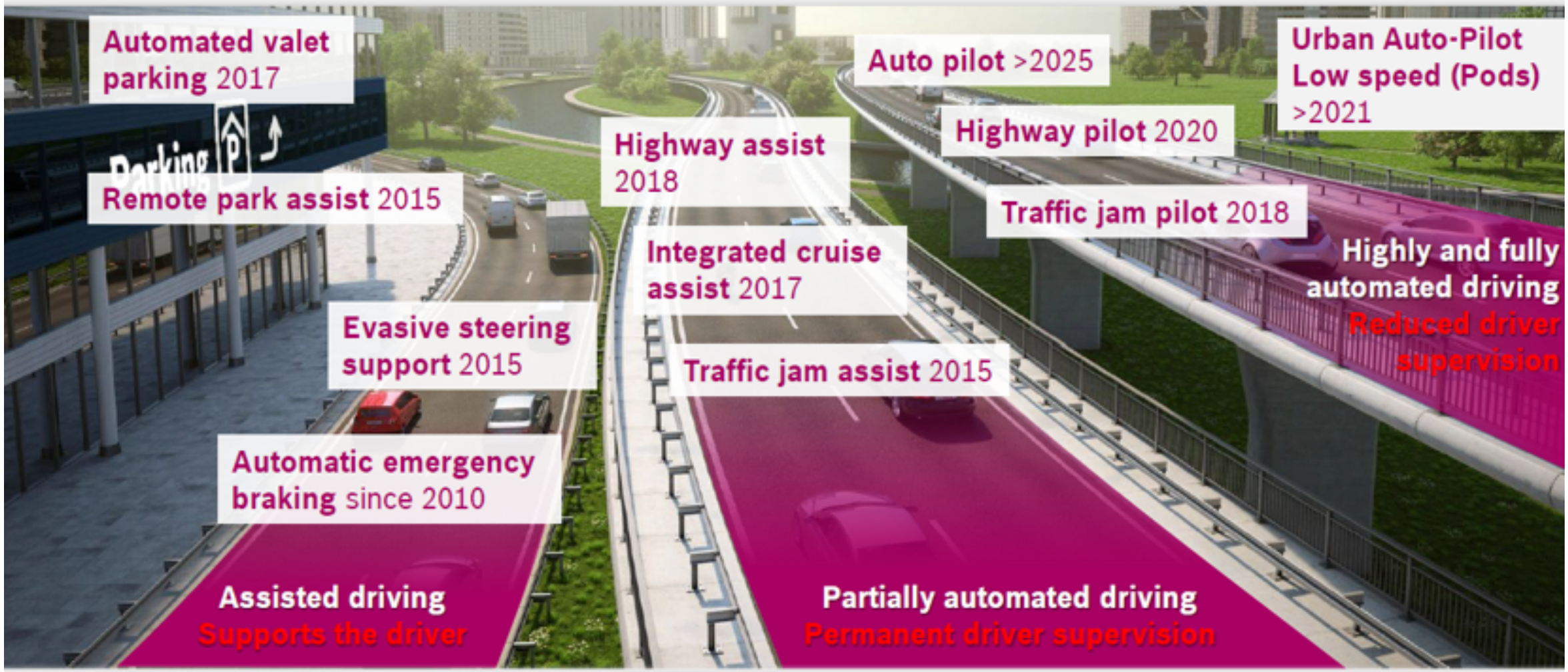
Gearbox

Consolidated vehicle infrastructure architecture



Back to USA Open road in Nevada

Self-Driving Vehicles, from Science-fiction to Reality
Automated Driving Roadmap



RBFB/KMS - Franck Cacenave | 22/11/2017

BOSCH

Challenges to Highly Automated Driving - Level 3 to 4

- Environment models world wide !
- Vehicle E/E Architecture with robust OTA reprogramming & cybersecurity
- Functional Safety
- AI & Deep learning smart integration
- Driver monitoring : valid for all types of drivers world wide !
- Integration of third party information: connected & cooperative driving
- Legal aspects
- Add on cost in a given platform
- **Safety , Security** and Intuitive use for customer acceptance.

Chapter 5
2017 The Toulouse Automotive EcoSystem is booming

GUIDE

SCIC SA – Innovation in GNSS metrology

Stakeholders

m3 SYSTEMS GROUPEMISTRAL

Silicom

OKTAL-SE Synthetic Environment

GEOSAT

TERIA

CGX

Business Geolocation testing laboratory

Mission Assess and validate the performances of geolocation critical functions, especially dedicated to **autonomous vehicles** and trains.

President Marc POLLINA : CEO M3 Systems

Workforce Full time engineers supported by the founding members and CNES (French Space Agency).

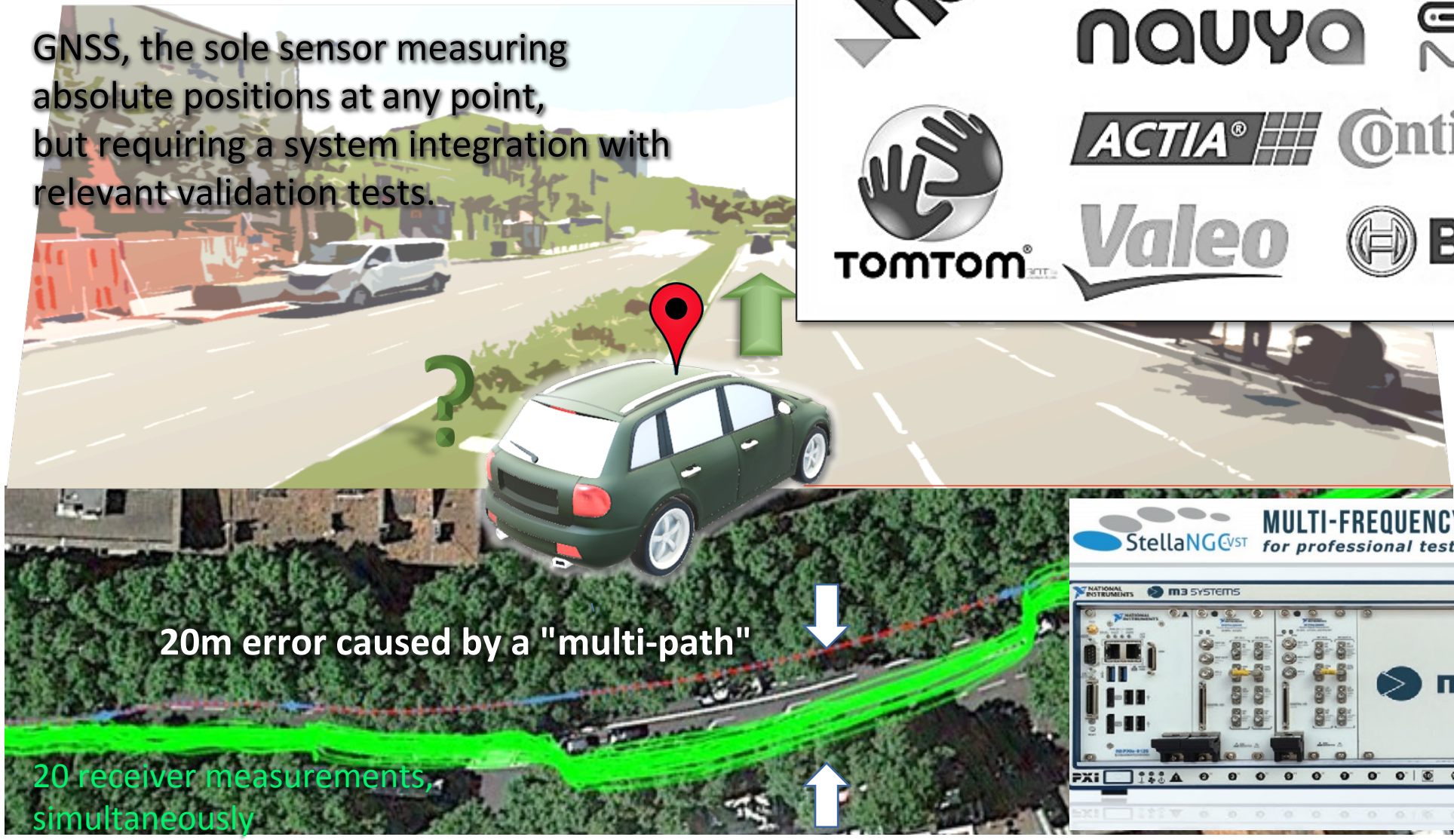
Key-Projects ECOTAXE, PPP, JUPITER, GUEST, GPSTART, GEOFER, HISTB2,

Know how **Simulation tests based on GNSS signals and sensor measurements, previously collected in the field.**

Geolocation performances

Accuracy – Integrity – Availability

GNSS, the sole sensor measuring absolute positions at any point, but requiring a system integration with relevant validation tests.



here · RENAULT La vie, avec passion · PSA · navya · easyMile · TOMTOM · ACTIA · Continental · Valeo · BOSCH

Visionary manager with strong link with top company challenges can change the world

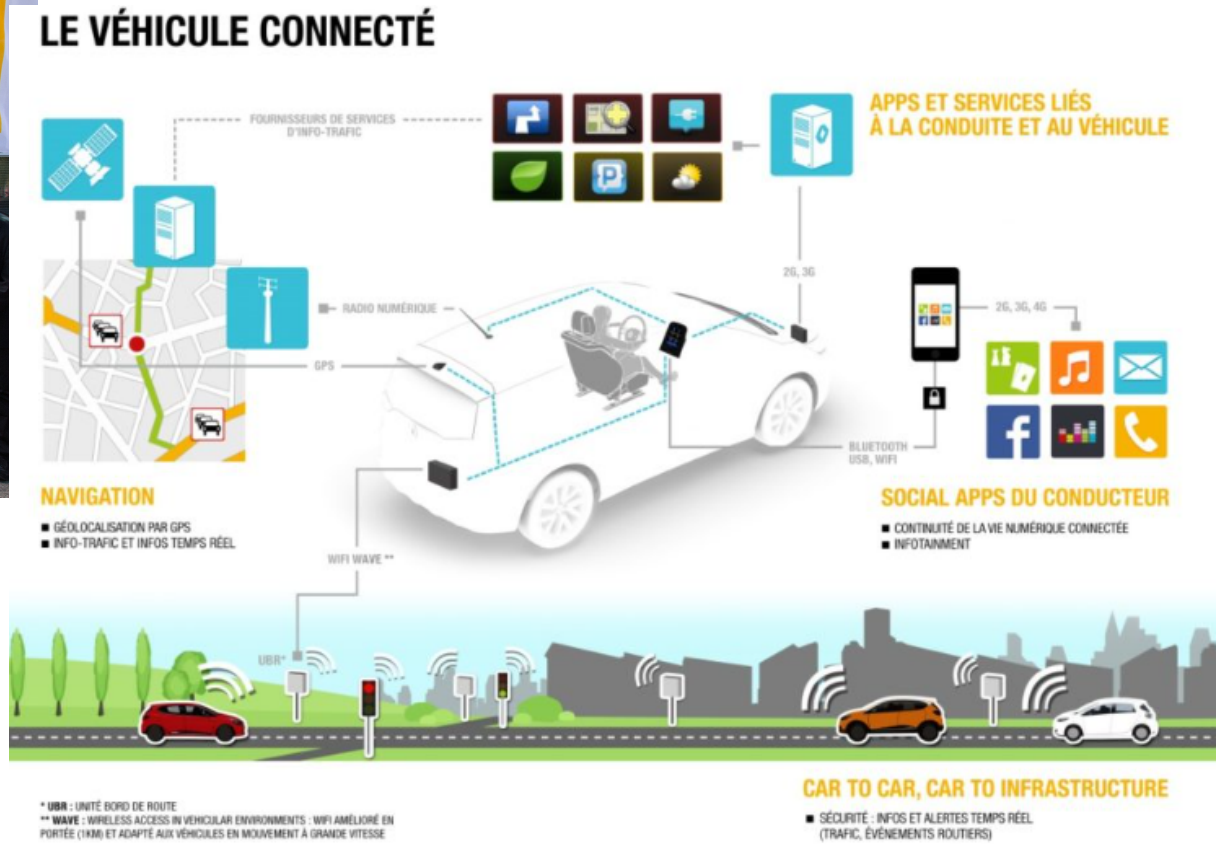
ALEXANDRE CORJON
ALLIANCE GLOBAL VICE PRESIDENT
RENAULT-NISSAN, FRANCE

Renault reinforces its development in connected vehicles, with the acquisition of Intel's French embedded software R&D activity : Renault Software Labs

"This acquisition is right in line with Groupe Renault's strategy of offering new connected services and improving the experience of its customers. The Intel employees joining Renault hold highly relevant skills in what is a strong competitive technical field, where the Alliance is one of the world leaders. Groupe Renault thereby continues to support French innovation and economic development in France," said Carlos Ghosn, Chairman and Chief Executive Officer of Renault.

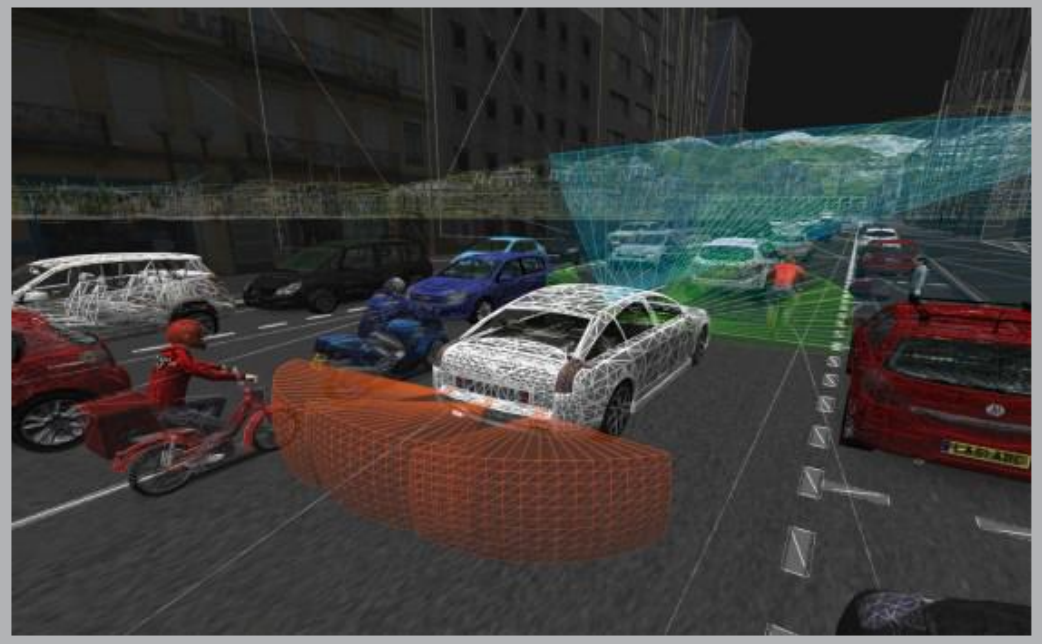
RENAULT NISSAN

260 pasionated SW designers ready to build in house innovations for RENAULT NISSAN Connected cars in Toulouse



Joint venture **AVS** SAS on driving simulators

Visit OKTAL at Booth 7000 at Autonomous Vehicle Technology World Expo Stuttgart 2017, 21th – 22th June at Stuttgart



Les simulateurs jouent un rôle déterminant dans le développement de nouveaux véhicules.

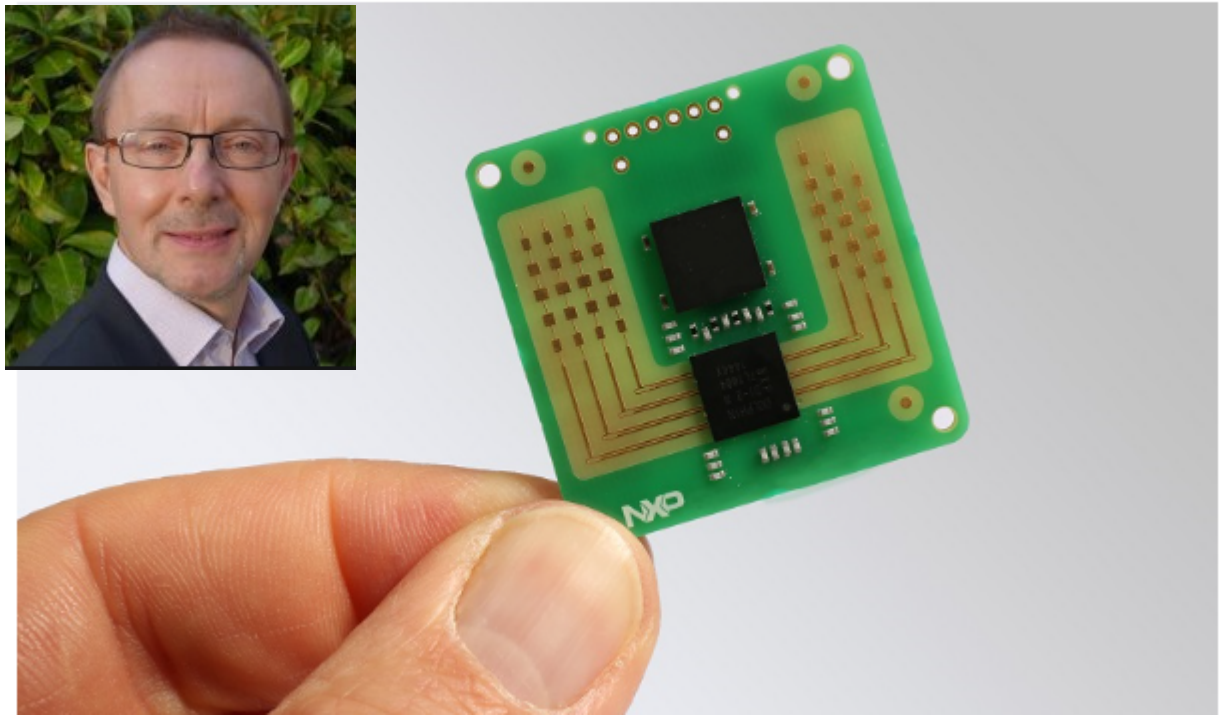
MOTOROLA

freescale™ semiconductor

NXP

TEF810X Fully-Integrated 77 GHz Radar Transceiver

TEF8102



Toulouse AUTOMOTIVE IC design and application center support ADAS & automatized Driving

- Microwave radar Chip set
  11 years experience
  3rd Monolithic generation ready for market

- ADAS Application center
- V TO X Connectivity
- Ethernet in Automotive
- Vehicle control computing platform:
- MEMS Smart sensor

Continental engineering services provide an open door to the group

Continental Engineering Services

Highlight Topics

AUTOMATED DRIVING

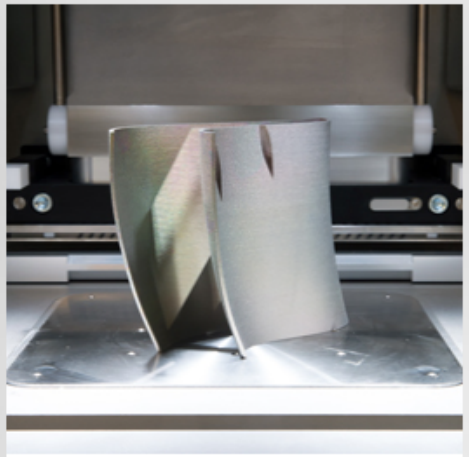
Our strong system competence allows us to develop comprehensive technical concepts, which have our single systems ideally interact and accompany you on the way to automated driving...

Read More

ELECTRIC DRIVING

We realize effective solutions and high-performance powertrain systems...

Read More



TECHNOLOGY TRANSFER

With our automotive experience we offer you technological solutions in any of your industries...

Read More

BIG DATA

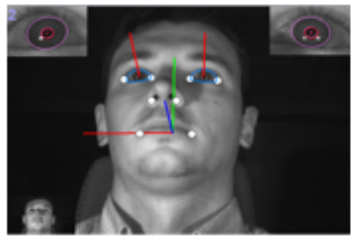
Due to increasingly networked vehicles, more and more data is generated. When appropriately used, a variety of new functions and applications follow.

Read More

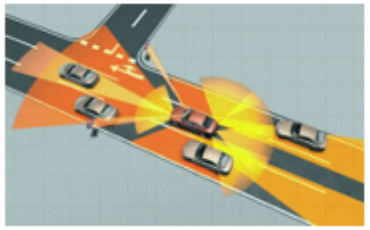
Dr Boverie : ADAS engineering competence center in Toulouse

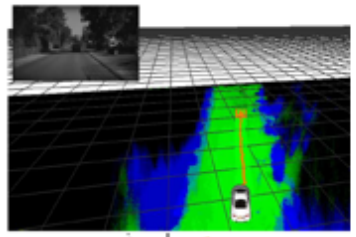
Continental Engineering Services

Driver Monitoring
- Image Processing
- Driver Modelling
- Human Machine Cooperation



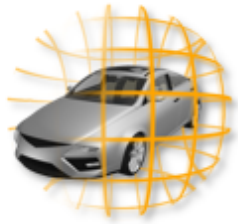
Environment Modelling
- Radar, Lidar, Camera
- eHorizon
- Sensor fusion





Vehicle Control
- Vehicle Modelling
- ADAS Functions
- Brake & Steering Control

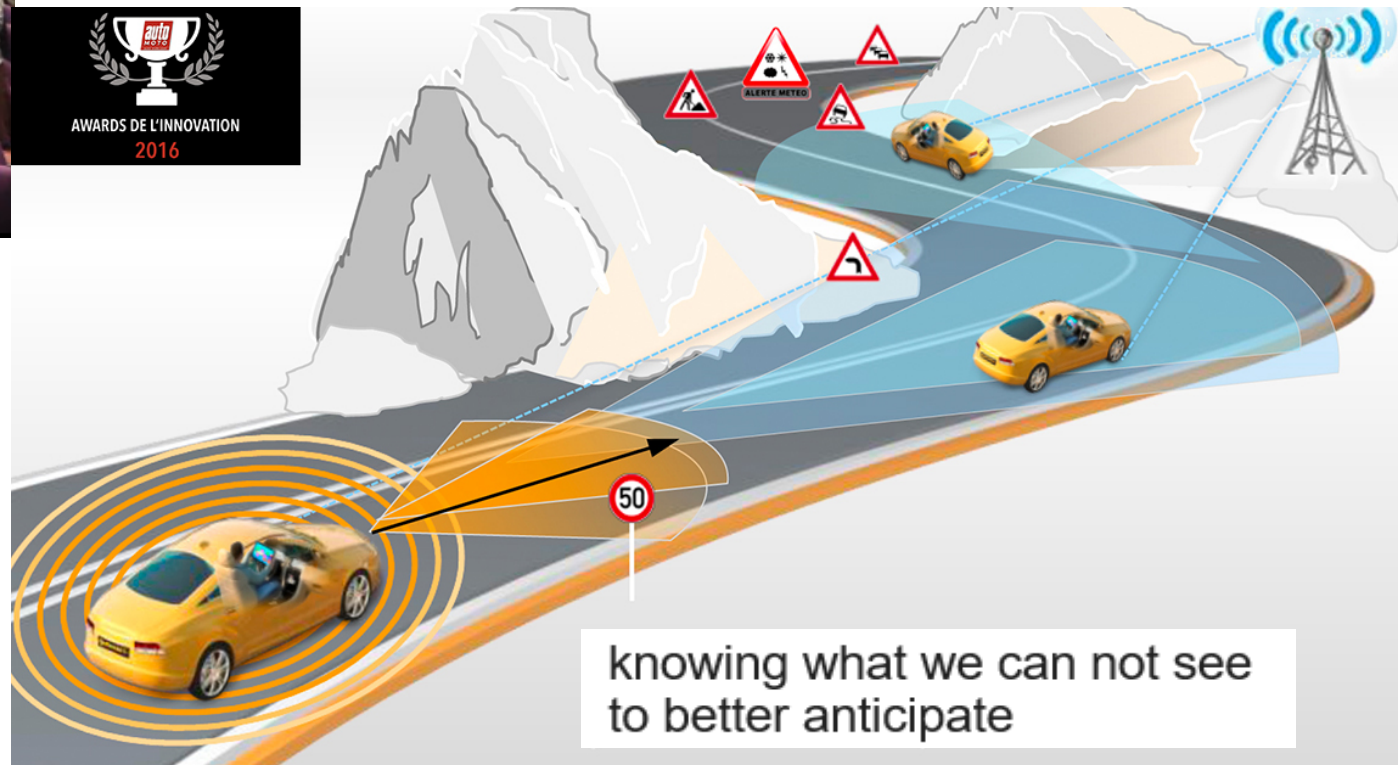
System Engineerning
- System Architecture
- Safety Concept
- Tests & Validation

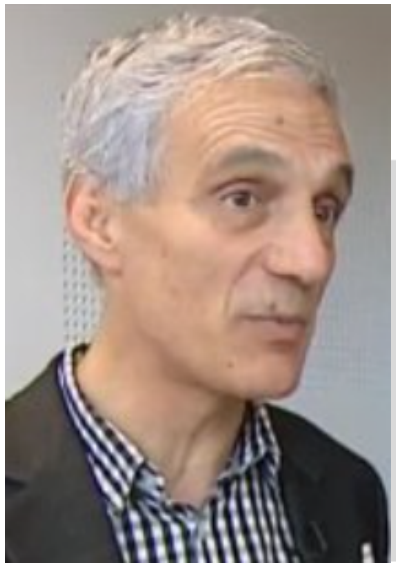


150 Passionated designers connecting cars with the Cloud @ Continental Digital Services Toulouse

AWARDS DE L'INNOVATION 2016

LAAS CNRS





Robotique autonome

Le guidage des navettes autonomes

Michel DHOME
06 700 150 71
michel.dhome@uca.fr

EASYMILE : Autonomous Shuttle as Toulouse ligthhouse

R&D workforce with LAAS inside

Pierre Guglielminotti	Internship	2017
Olivier Lefebvre	PhD	2003-2006
Quentin Gaudel	PhD	2013-2016
Laurent Denarie	PhD	2013-2017
Arnaud Degroote	PhD	2007-2013
Pierrick Koch	PhD	2012-2016
Cyril Roussillon	PhD	2008-2013
Bruno Celariès	Internship	2013
Alexandre Hamez	Post-doc	2010-2011
Olivier Roussel	PhD	2012-2015
Alexandre Ravet	PhD	2012-2015
Gabriel Bustamante	PhD	2013-2017
Julien Cornier	Internship	2011/2012

Happy birthday to all LAAS colleagues

bring more opportunities and synergies

IVECO

AUTONOMOUS TECHNOLOGY BROUGHT TO BUS BY EASYMILE

16 OCT 2017

TLD AND EASYMILE ANNOUNCED A PARTNERSHIP TO DEVELOP TRACTEASY, THE FIRST AUTONOMOUS BAGGAGE TRACTOR

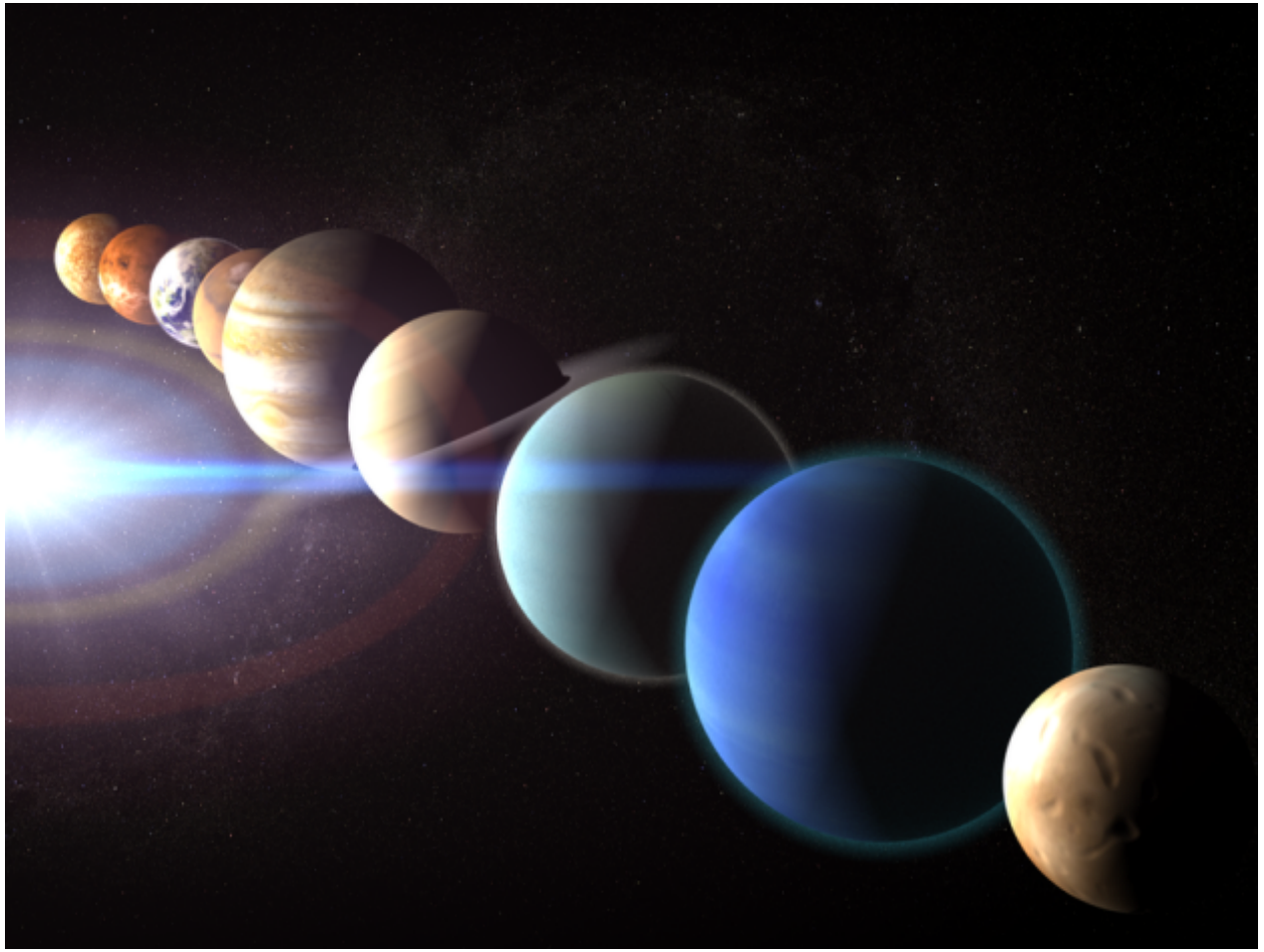
ACTIA®

Off-road leader and founder of RobAgri

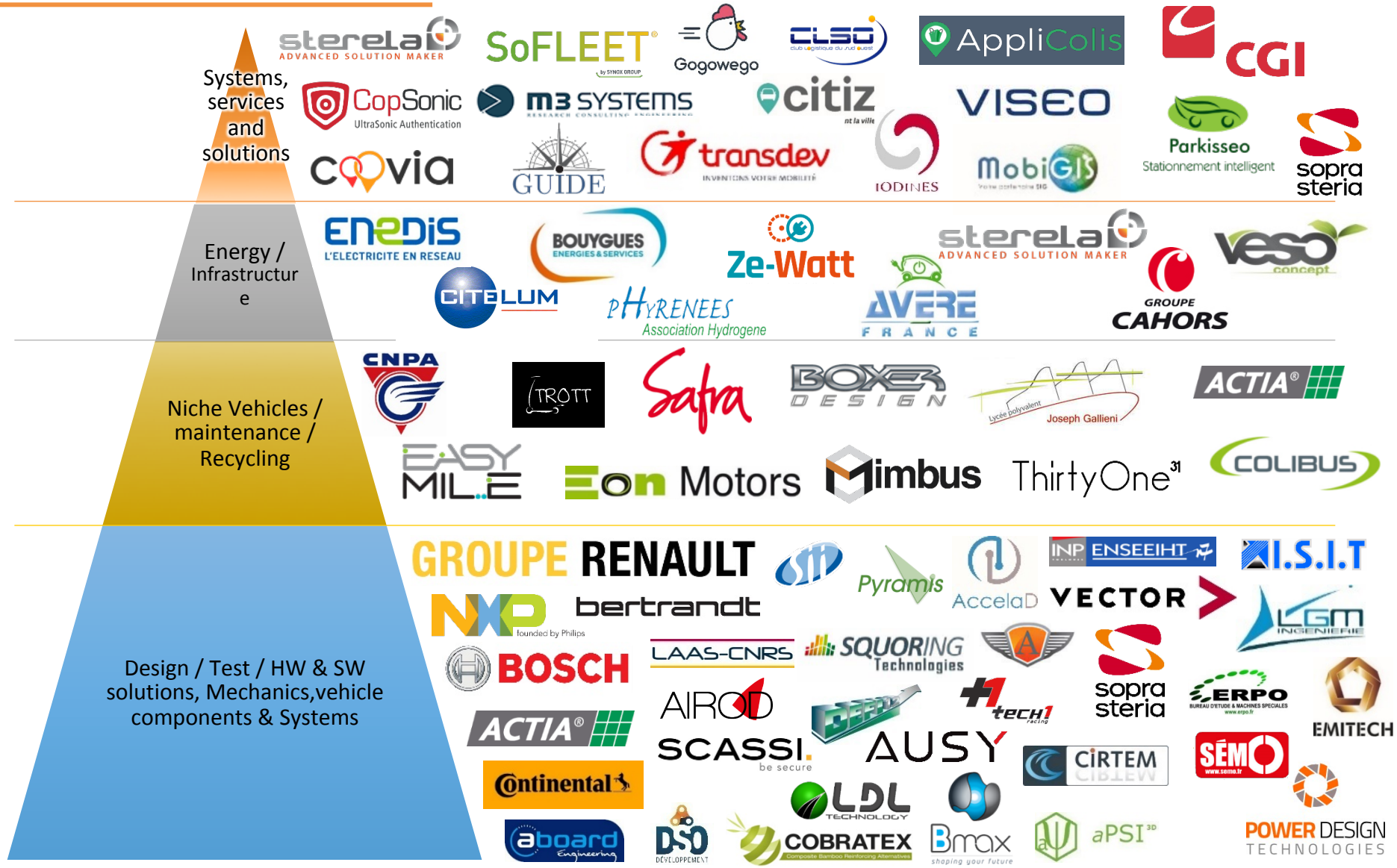
The voice of **Ethics** is well received ww from Toulouse TSE

- Jean-François Bonnefon (Ph.D., cognitive psychology) is a Research Director at the French **Centre National de la Recherche Scientifique.** He works at the **Toulouse School of Economics**, His work deals with decision-making, reasoning, and moral preferences.
- **He is currently interested in the kind of ethics people want for self-driving cars and other machines.**

The planets are aligned



Régional Automotive cluster : intelligent transportation systems architect



Francazal : Robotic Village and R&D integration & test center for Autonomous Transport of the future

EASY MILE

robotics PLACE

Robotique industrielle
Robotique de service
Drones

autOcampus

A **New Living lab** for **Autonomous** and
Connected vehicles with 36 000 potential users in Toulouse university campus.
Bouderyless innovation center for academia, industry, high schools and citizens end users.
Interdisciplinary Know how capitalization
Multimodal transport interfaces
Links with Toulouse public transport

STRATÉGIE RÉGIONALE DE L'INNOVATION
Occitanie / Pyrénées - Méditerranée

UNIVERSITÉ TOULOUSE III PAUL SABATIER
Université de Toulouse

aerospace valley

neOcampus

académie Toulouse

REGION ACADEMIQUE OCCITANIE

MINISTÈRE DE L'ÉDUCATION NATIONALE

MINISTÈRE DE L'ENSEIGNEMENTSUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION

CHANCELLERIE des UNIVERSITES de TOULOUSE
Service de Gestion et d'Exploitation

Toulouse is ready for more Automotive Attractiveness

- **the power of irresistible attraction**

allure, animal magnetism, appeal, captivation, charisma, charm, enchantment, fascination, force field, glamour , magic, magnetism, oomph, pizzazz , seductiveness, witchery

Thank you for your attention & to Marise for inviting to « COME TOGETHER »

Listen to Road Abbey tube: https://www.youtube.com/watch?v=_HONxwhwmgU

- **Jean-Luc Maté**, président et fondateur de JLM Conseil « from ideas to money »
- Président du Conseil de prospective de Toulouse Tech
- ex Vice Président Stratégie & Business Développement de Continental Engineering Services France & Espagne
- Fondateur et ancien vice-président de la plateforme Européenne de Recherche sur le Transport terrestre : ERTRAC.
- Fondateur et Président d honneur du Cluster régional de la filière automobile en Occitanie AUTOMOTECH en charge de la stratégie et du développement international.
- Fondateur et président d'honneur du Cluster R&D Européen EUREKA EURIPIDES² sur les systèmes électroniques intelligents.
- Administrateur de la société française des ingénieurs de l'automobile SIA

Jean-Luc Maté est un des pionnier de l'électronique automobile moderne qui a vu le jour a Toulouse par la localisation de la filiale électronique de Renault et de Bendix : Renix en 1979. Il a personnellement contribué en entrepreneur passionné depuis plus de 38 ans à l'introduction a l international d'innovations majeures dans tous les domaines du véhicule automobile moderne.