

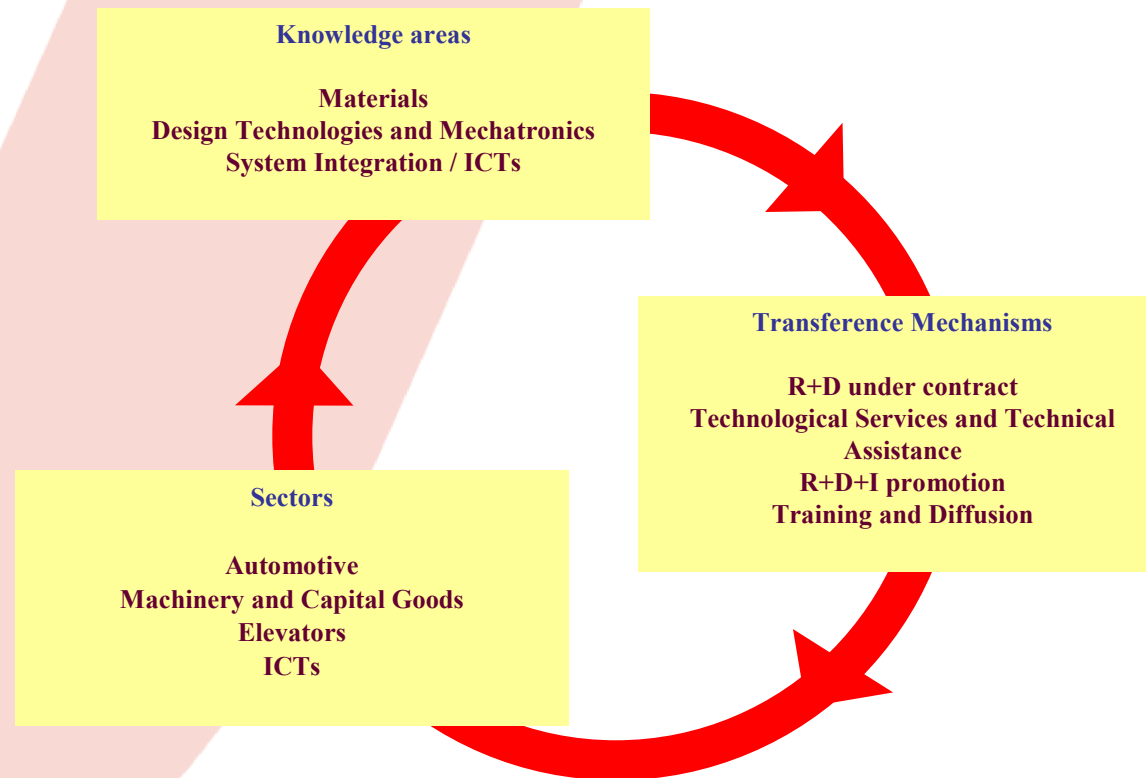
# Research and Development on Electrical Vehicles: Functional Safety & EMC

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# Instituto Tecnológico de Aragón



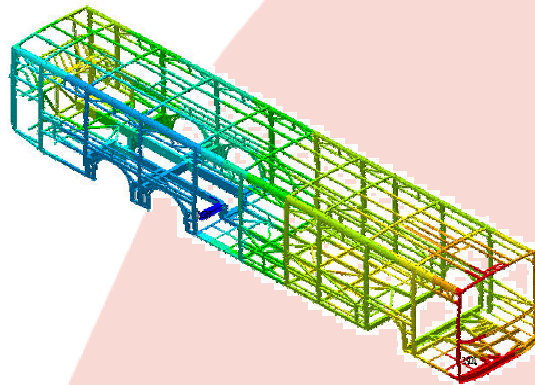
The Aragon Technology Institute (ITA) is a nonprofit technology centre whose main objective is to promote competitiveness in the industrial sector and support the growth of business sectors by means of the development, acquisition, adaptation, transfer and diffusion of innovative technologies in a multi-agent collaborative framework.



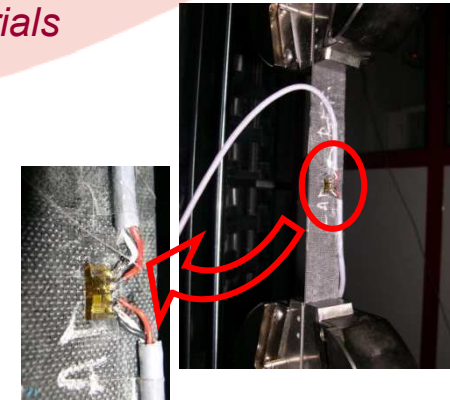
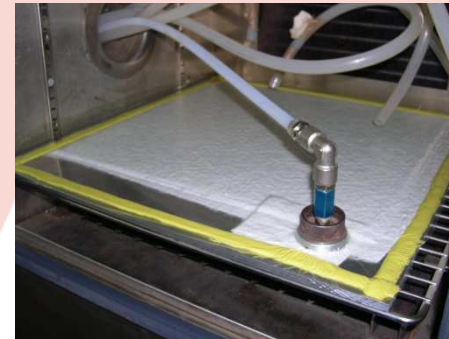
# Materials for electrical vehicles

- Structural Materials

*Structural design of frame body*



## Composite Materials

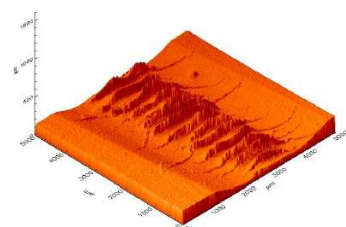
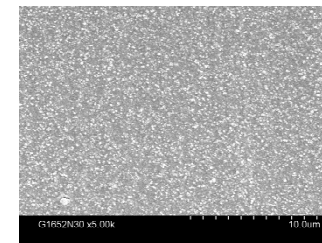
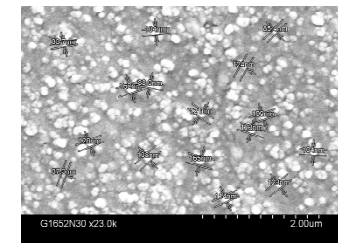


- Nanomaterials

*TPE with self-monitoring capabilities*

*Nanocomposite polymer for magnetic insulation*

*Nanocomposite with improvements in mechanical, tribological and photocatalytic properties*



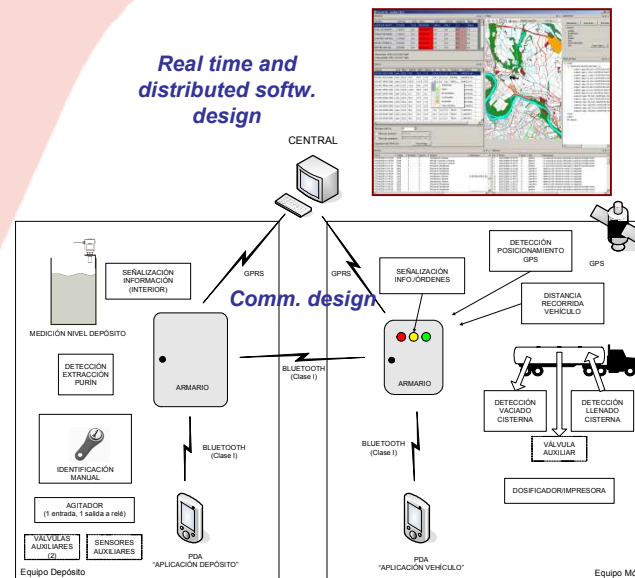
# System Integration in electrical vehicles

- System Integration / Embedded Systems

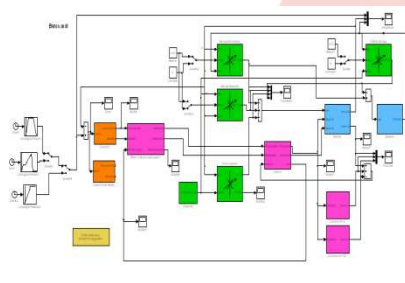
*Autonomous agricultural vehicle*



*Fleet Management /  
Infraestructure Management*



*Hard. Platform*



*Algorithms for  
energetic  
management  
control*

- Logistic and ICTs

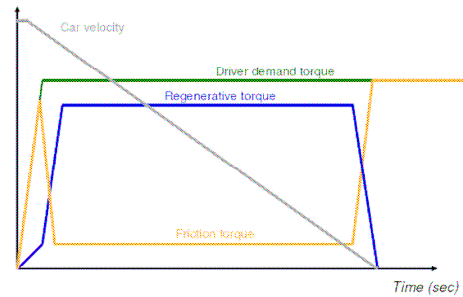
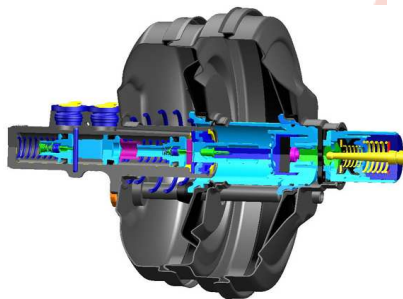


*Fleet Management*

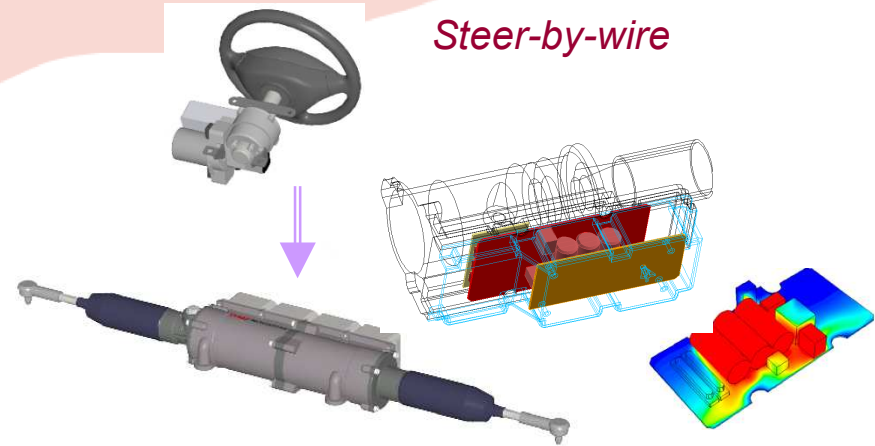
# Mechatronics in electrical vehicles

- New components and systems

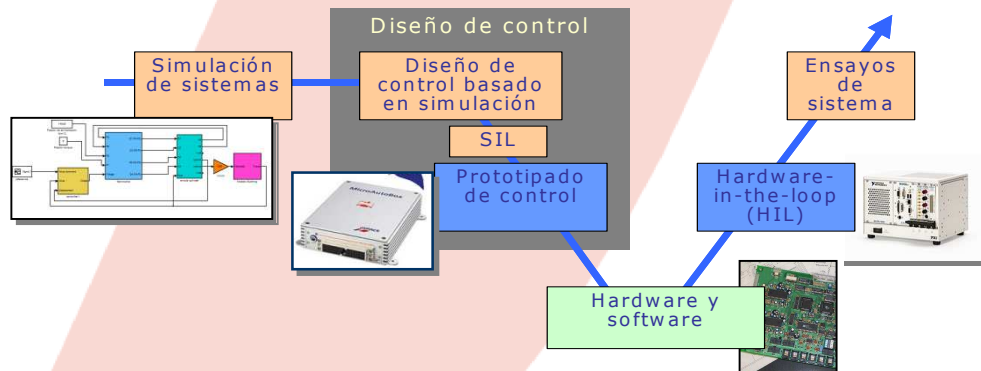
*Friction Braking Systems, as a complement of regenerative systems*



*Steer-by-wire*



*Permanent magnet systems and inverters*



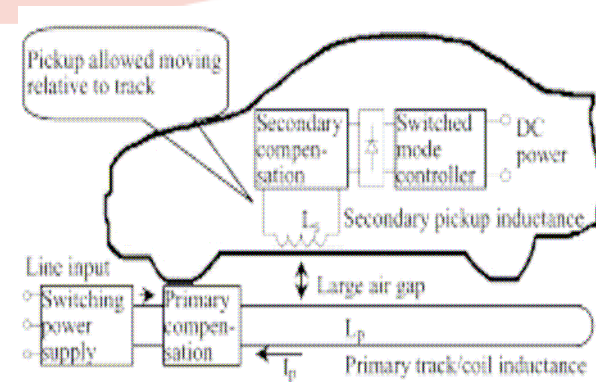
# Mechatronics in electrical vehicles

- Storage/transference

*Ultracapacitors: performance and reliability evaluation*

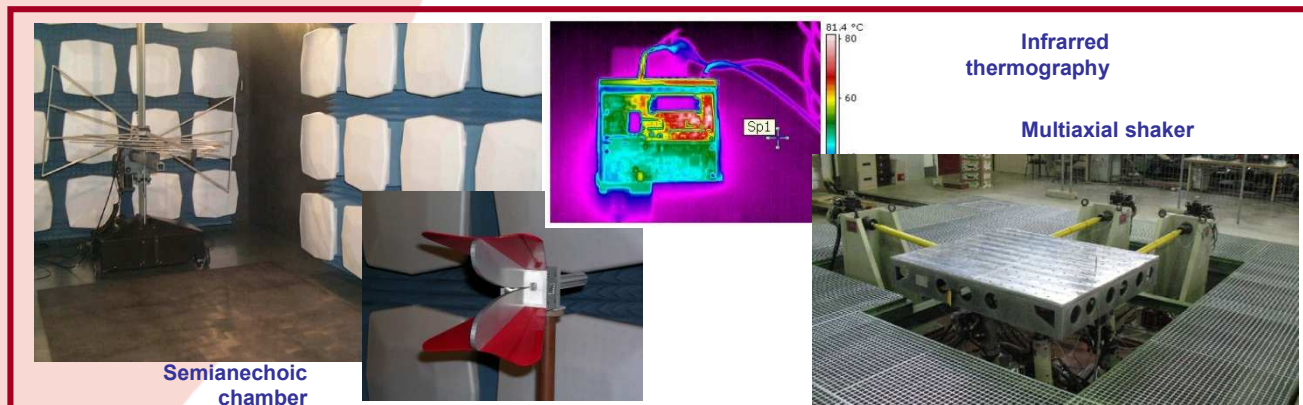


*Energy transfer by induction technologies*



- Integrity / safety / reliability

*Procedures development and test execution for the functional safety evaluation in on-board electronical systems*



# Functional Safety & EMC



New hybrid vehicles are characterized by the coexistence of several electronic loads, wires and electrical commuted sources



This scenario is forcing to the current products and installations to :

- Guarantee system or installation performance – **Performance**
- Adequate system integration – **EM Compatibility**
- Life and failure mechanism prediction – **Reliability**
- Guarantee the system safety – **Safety**

# Functional Safety & EMC

*RAMS Procedure (UNE EN 61508)*



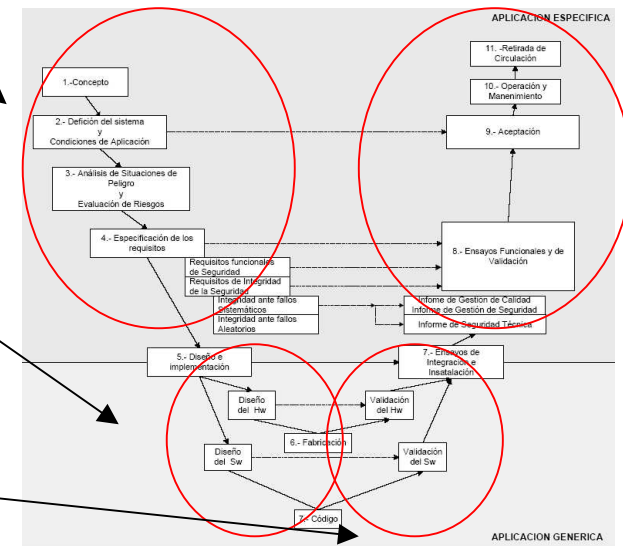
Previous analysis  
(RAM)

Risk List (S)

Conceptual  
Design

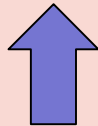
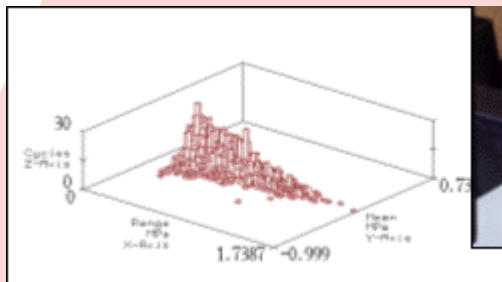
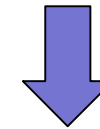
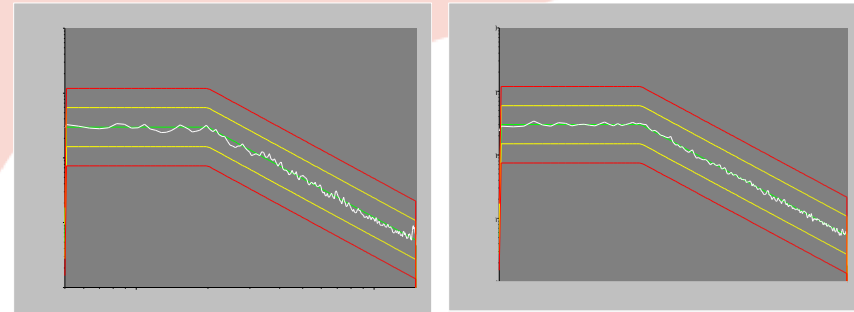
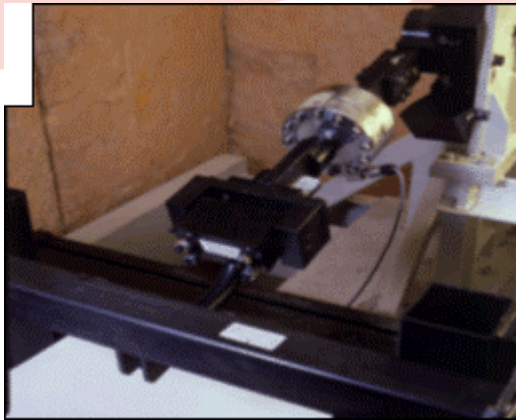
Design  
development  
RAM analysis  
Hazard Log (S)

Validation  
Reliability  
guarantee



# Functional Safety & EMC

*Complete approach: structural integrity, functional safety & EM compatibility*

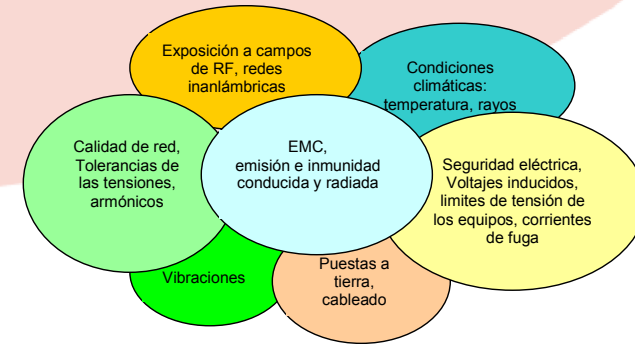
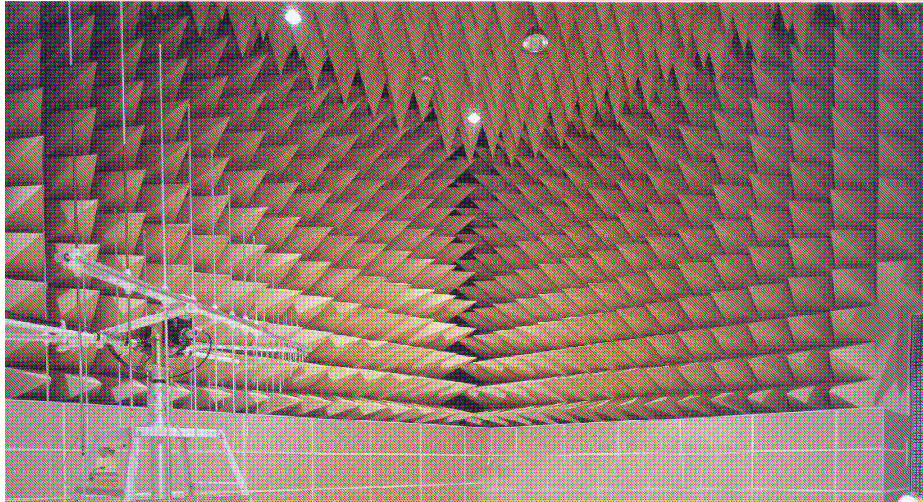


Fatigue functional characterization:  
random loads

Vibration tests (random spectrum)

# Functional Safety & EMC

## Electromagnetic Characterization and Integration of complex systems



## RAMS: RAM Analysis (Reliability, Availability & Maintainability) & S (Safety)

## Model and simulation focused on system functional safety

