Ciclo de vida de la medida en el desarrollo de componentes electrónicos para la automoción

Tres Cantos – Madrid
20 de Mayo 2016

Xavier Secall
Laboratory Manager
Electrical Engineering Europe & Africa
xsecall@lear.com
www.lear.com

LEAR CORPORATION

This is Lear

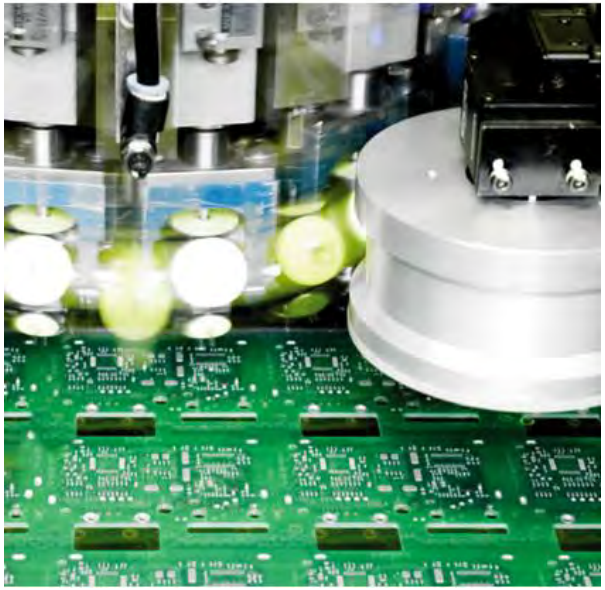
Seating and Electrical Capabilities

Seating

- **Strong Market Position** -- One of two independent seat suppliers with global scale and complete component capabilities; 2014 sales of $13.3 billion
- **Key Capabilities** -- Complete automotive seat systems, seat covers (including cut & sew, fabric and leather), mechanisms & structures and foam

Electrical

- **Strong Market Position** -- One of four suppliers with global capability in both traditional and high-power electrical distribution systems; 2014 sales of $4.4 billion
- **Key Capabilities** -- Traditional electrical distribution systems, emerging high-power systems and related components, including connectors, smart junction boxes and battery chargers



Global Capabilities with Low-Cost Footprint

235 FACILITIES IN **34** COUNTRIES

- ARGENTINA
- AUSTRALIA
- CANADA
- FRANCE
- GERMANY
- ITALY
- JAPAN
- NETHERLANDS
- SINGAPORE
- SOUTH KOREA
- SPAIN
- SWEDEN
- UNITED KINGDOM
- UNITED STATES

- BRAZIL
- CHINA
- CZECH REPUBLIC
- HONDURAS
- HUNGARY
- INDIA
- INDONESIA
- MALAYSIA
- MEXICO
- MOLDOVA
- MOROCCO
- PHILIPPINES
- POLAND
- ROMANIA
- RUSSIA
- SLOVAK REPUBLIC
- SOUTH AFRICA
- THAILAND
- TUNISIA
- VIETNAM

LOW-COST FOOTPRINT **20** COUNTRIES

136.000
EMPLOYEES

We Serve All of the World's Major Automakers

electrical+electronics technologies

Electrical

POWERING IDEAS THAT DELIVER™

By providing our customers the best ideas, industry-leading innovation and breakthrough technology from the best go-to team in the industry, Lear's Electrical Power Management Systems is able to combine performance, global resources and systems-level knowledge to meet our customers' high standards with uncompromising value. Lear's Electrical + Electronics product portfolio includes:

ELECTRICAL DISTRIBUTION SYSTEMS

- Wire Harnesses
- Smart Execution Process™
- Alternative Wire Solutions
- Global, low-cost footprint

BODY ELECTRONICS

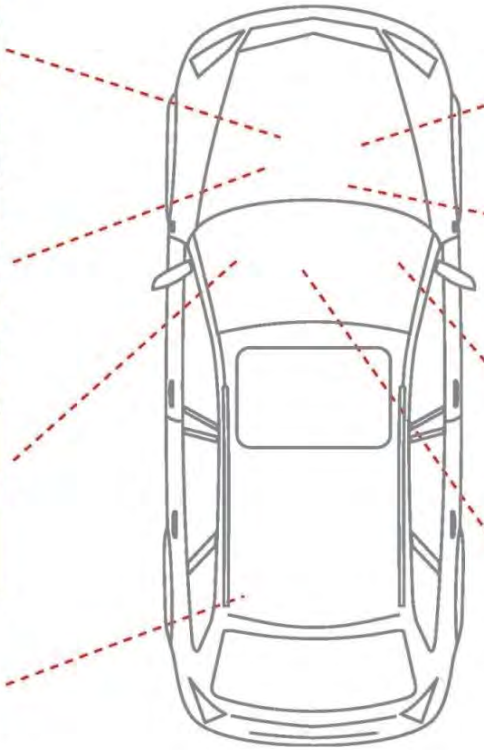
- Advanced, highly integrated core body controllers
- Gateway Modules
- Door Zone Modules
- Seat Controls
- Battery Monitoring Systems

TERMINALS & CONNECTORS

- Full T&C Systems
- High Power T&C Systems
- High Voltage T&C Systems
- Pin Headers
- Fuse & Pre-Fuse Boxes
- Bus Bars

WIRELESS TECHNOLOGY

- Passive Entry Systems
- Remote Keyless Entry



HIGH POWER

- Charging Systems (included wireless)
- High Power Distribution Systems
- High Power Energy Management

JUNCTION BOX

- Passive Junction Boxes
- Smart Junction Boxes
- Solid State Junction Boxes

AUDIO

- 2 – 22 Channel Audio Amplifiers
- Sound system integration and tuning expertise

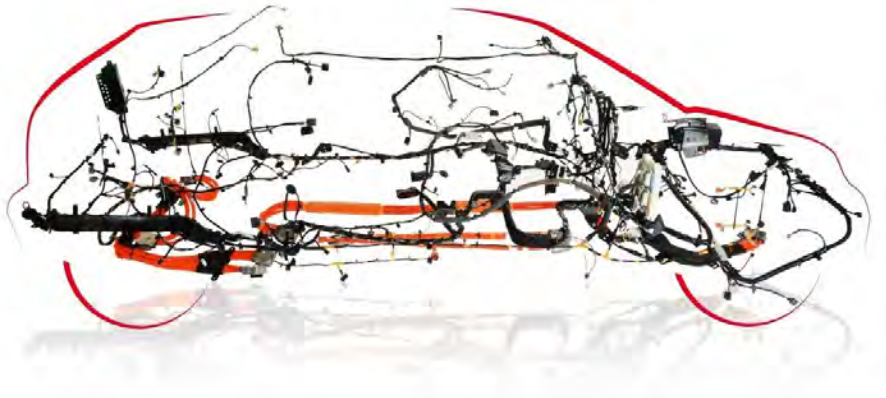
LIGHTING

- Interior LED Lighting Control
- Exterior Lighting Control
- Adaptive FrontLight Systems
- LED Signal
- LED Matrix

Lear Electrical Innovation

Efficiency

- **Copper-Clad Steel Wire**
- Traditional and High-Power
- Aluminum Terminals
- Aluminum Wire
- **Solid State Smart Junction Box™**
- **Most Highly Integrated Body Control Module**
- Custom Terminals & Connectors
- Highest Power to Size Ratio Terminals
- **Aluminum Printed Circuit Board**
- **Conductive Plastics**
- 96% Efficient EV Charging
- Industry-Leading Size and Weight Power Electronics



Connectivity

- **2-way Remote Keyless Entry**
- Advanced Passive Entry / Start
- In-Vehicle Wireless Connectivity
- EV Charging and Grid Communication

Advanced Features

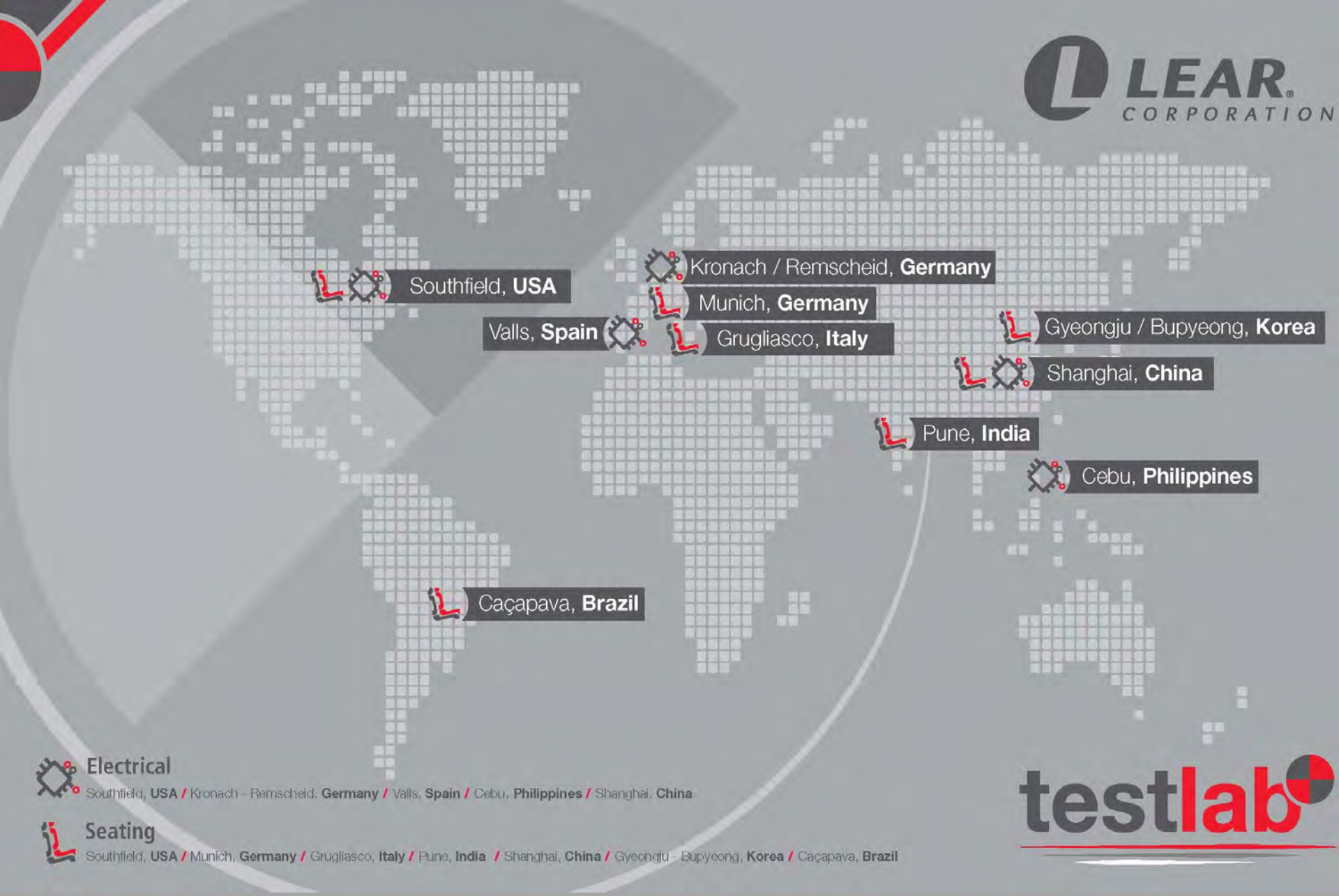
- **LED Matrix Beam Control**
- Seat Massage Contour Module
- Wireless EV Charging
- Ambient Lighting
- Audio Amplifiers and Controls

Process

- High Output T&C Tooling
- Miniaturized Terminal Crimping
- Modular Frameless Power Distribution Box

First-to-Market Innovations

Laboratory Capabilities Overview

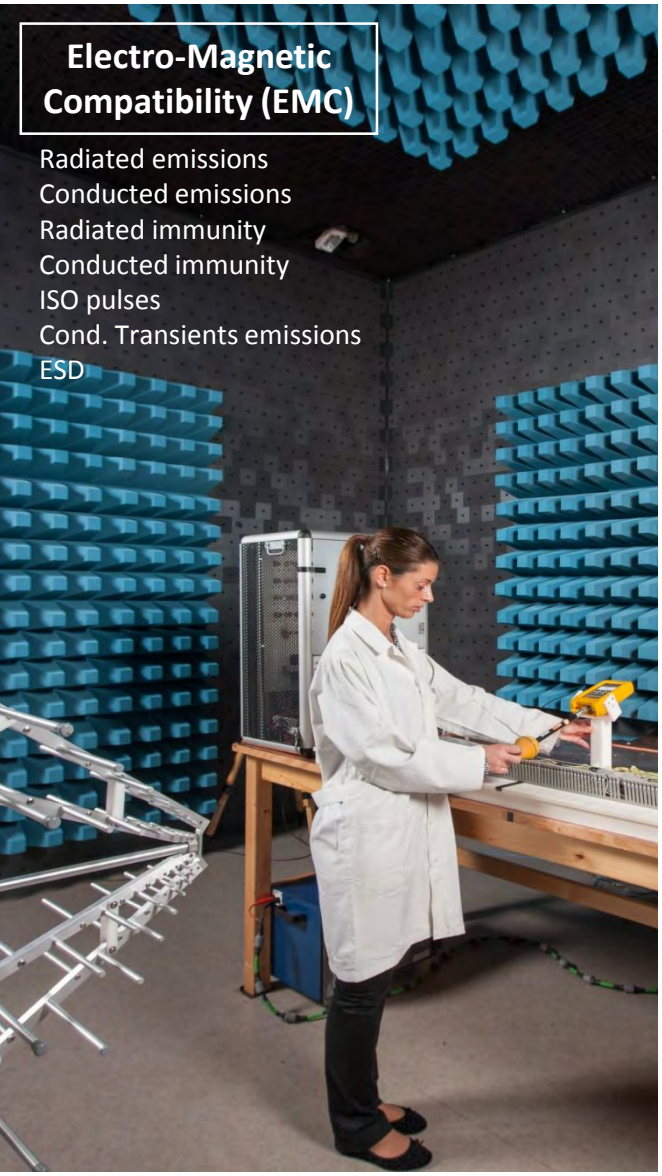


Validation Laboratory Capabilities

testlab valls spain

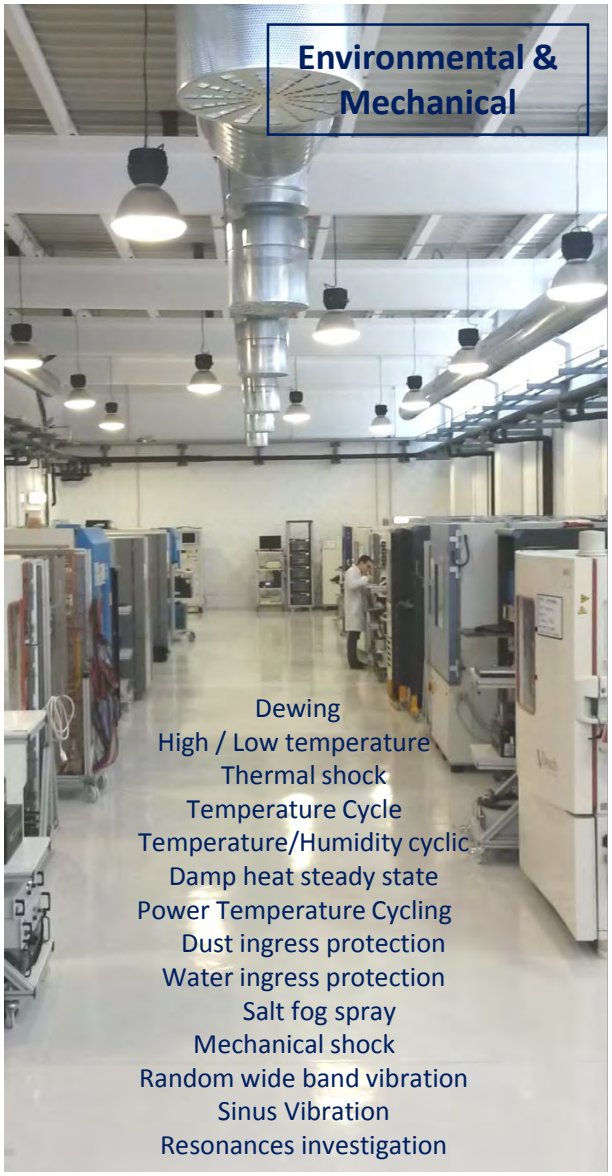
Electro-Magnetic Compatibility (EMC)

Radiated emissions
Conducted emissions
Radiated immunity
Conducted immunity
ISO pulses
Cond. Transients emissions
ESD



Environmental & Mechanical

Dewing
High / Low temperature
Thermal shock
Temperature Cycle
Temperature/Humidity cyclic
Damp heat steady state
Power Temperature Cycling
Dust ingress protection
Water ingress protection
Salt fog spray
Mechanical shock
Random wide band vibration
Sinus Vibration
Resonances investigation



Reliability & Failure Analysis

Photo documentation Optical
Microscope inspection
Cross sectioning analysis
Components de-capsulation
Thermal imaging

Validation Laboratory - Capabilities

testlab valls spain

Electro-Magnetic Compatibility

ISO 17025 Accredited Lab
ENAC 1082/LE2133

8.800 hours test / year

- **Radiated emissions**
- **Conducted emissions**
- **Radiated immunity**
- **Conducted immunity**
- **ISO pulses**
- **ESD**

Validation Laboratory - Capabilities

testlab vallsspain

Environmental and Mechanical

ISO 17025 Accredited Lab
ENAC 1082/LE2133

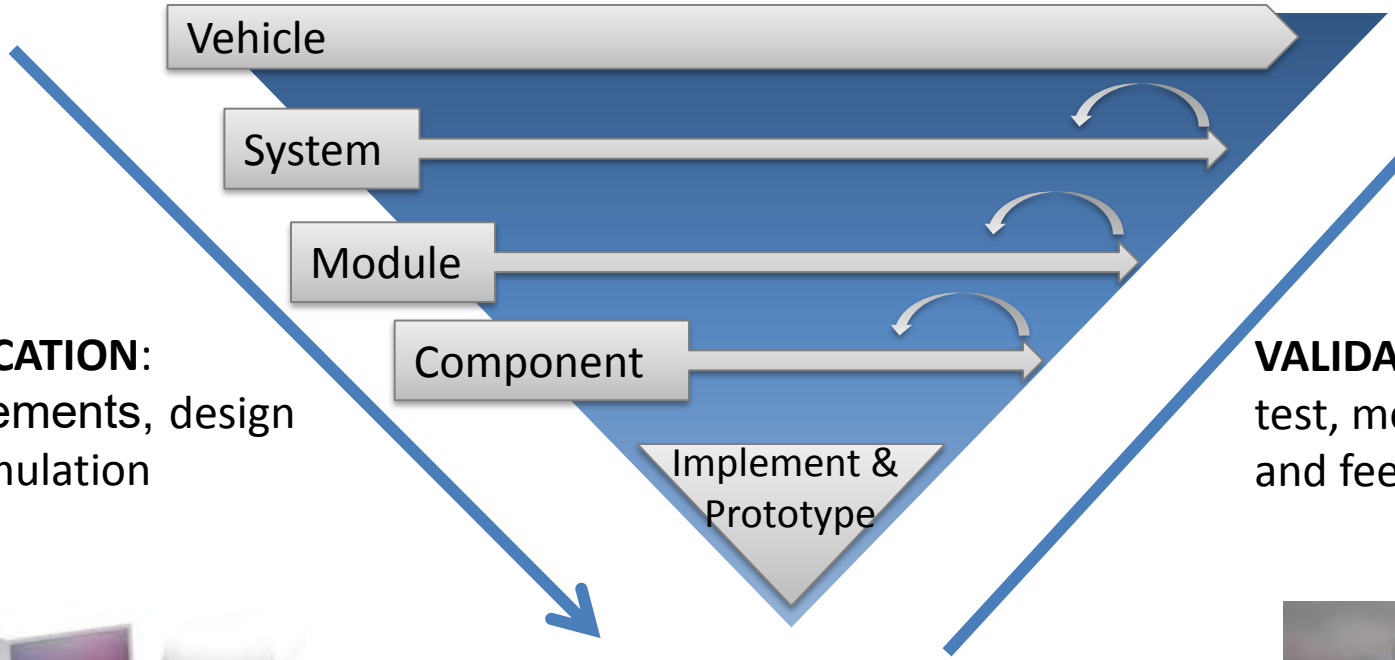
202.000 hours test / year

- Dewing
- High / Low temperature
- Thermal shock
- Temperature Cycle
- Temperature/Humidity cyclic
- Damp heat steady state
- Power Temperature Cycling
- Dust ingress protection
- Water ingress protection
- Salt fog spray
- Mechanical shock
- Random wide band vibration
- Sinus Vibration
- Resonances investigation

Engineering, Test and Validation

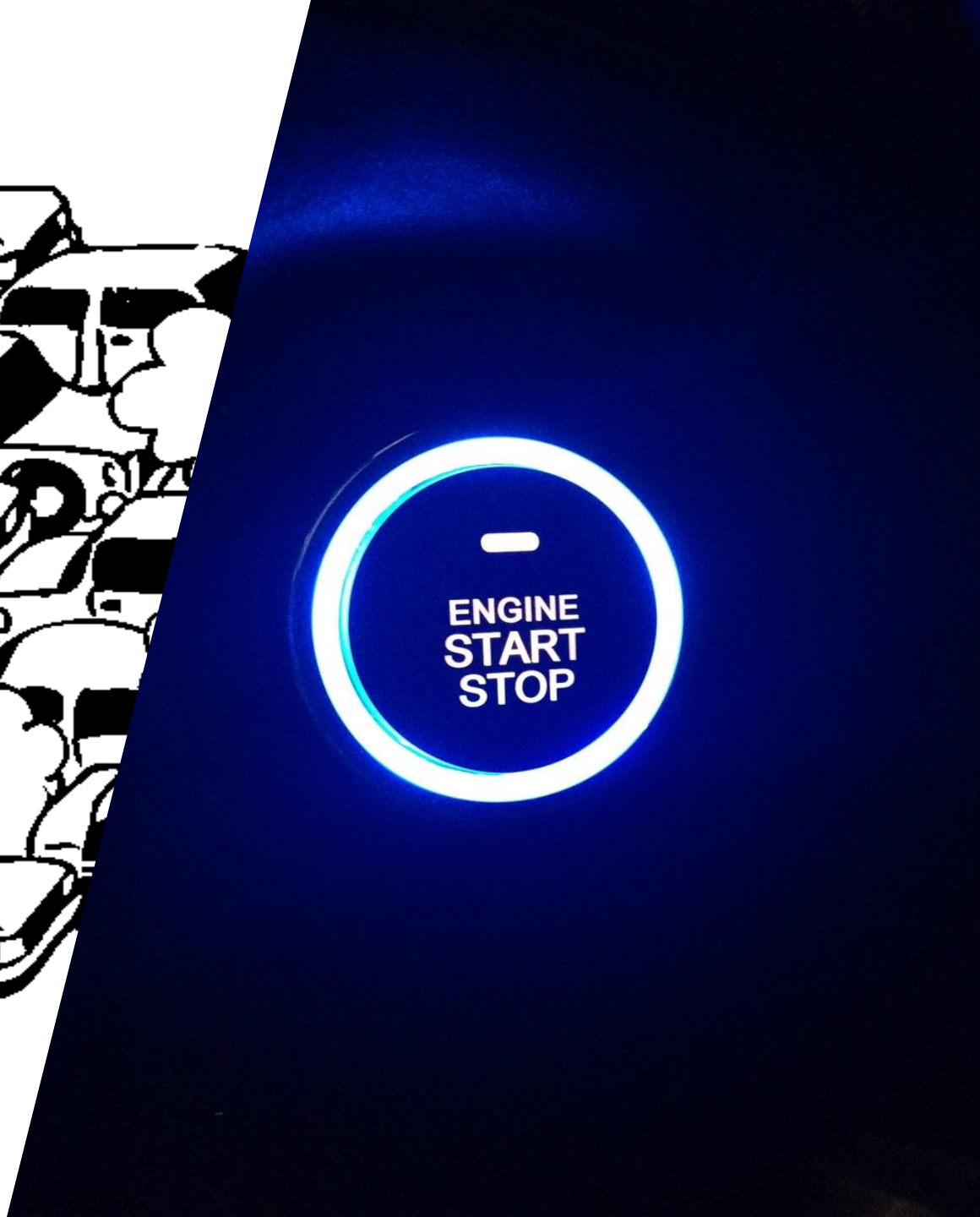
“V” Model in Automotive Industry

The same engineering workspace environment from design to physical testing



VERIFICATION: requirements, design and simulation

VALIDATION: test, measure, analyze and feedback


ENGINE
START
STOP

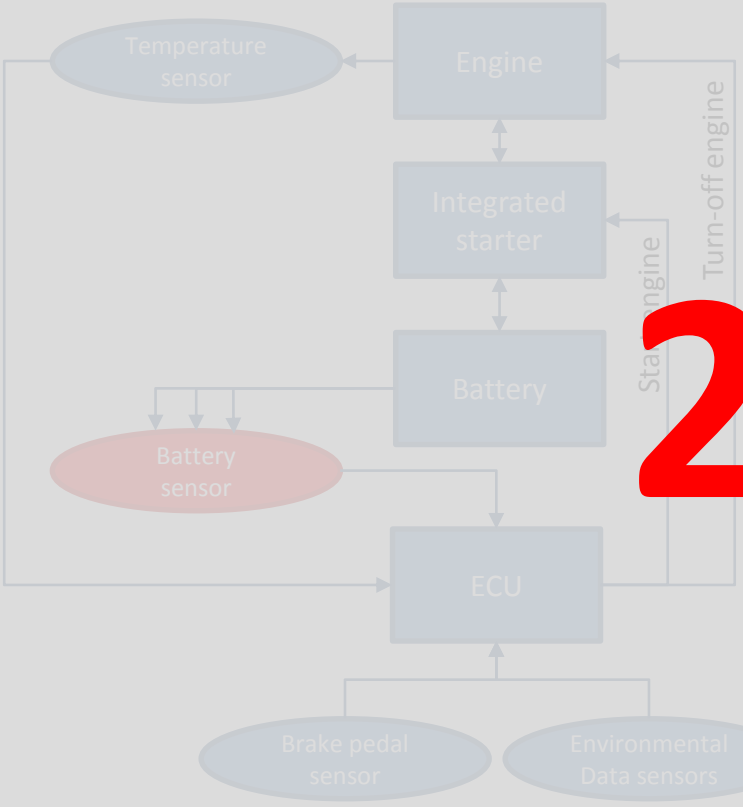
Battery Monitoring System (BMS)

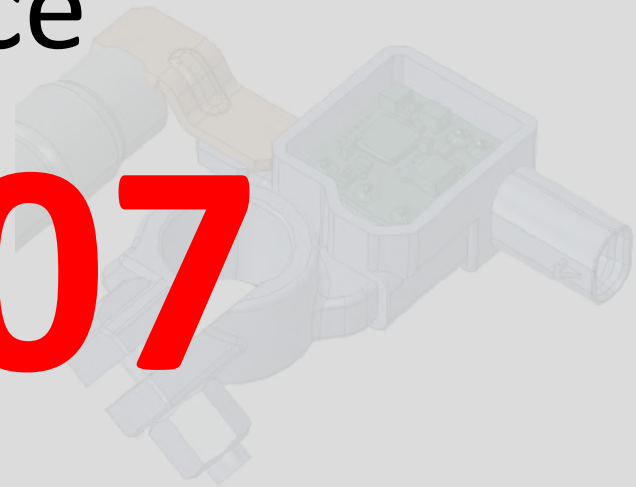
LEAR Battery Monitoring System measures current, voltage and temperature to help maintain overall performance and life of the battery while helping with fuel economy

7 million parts

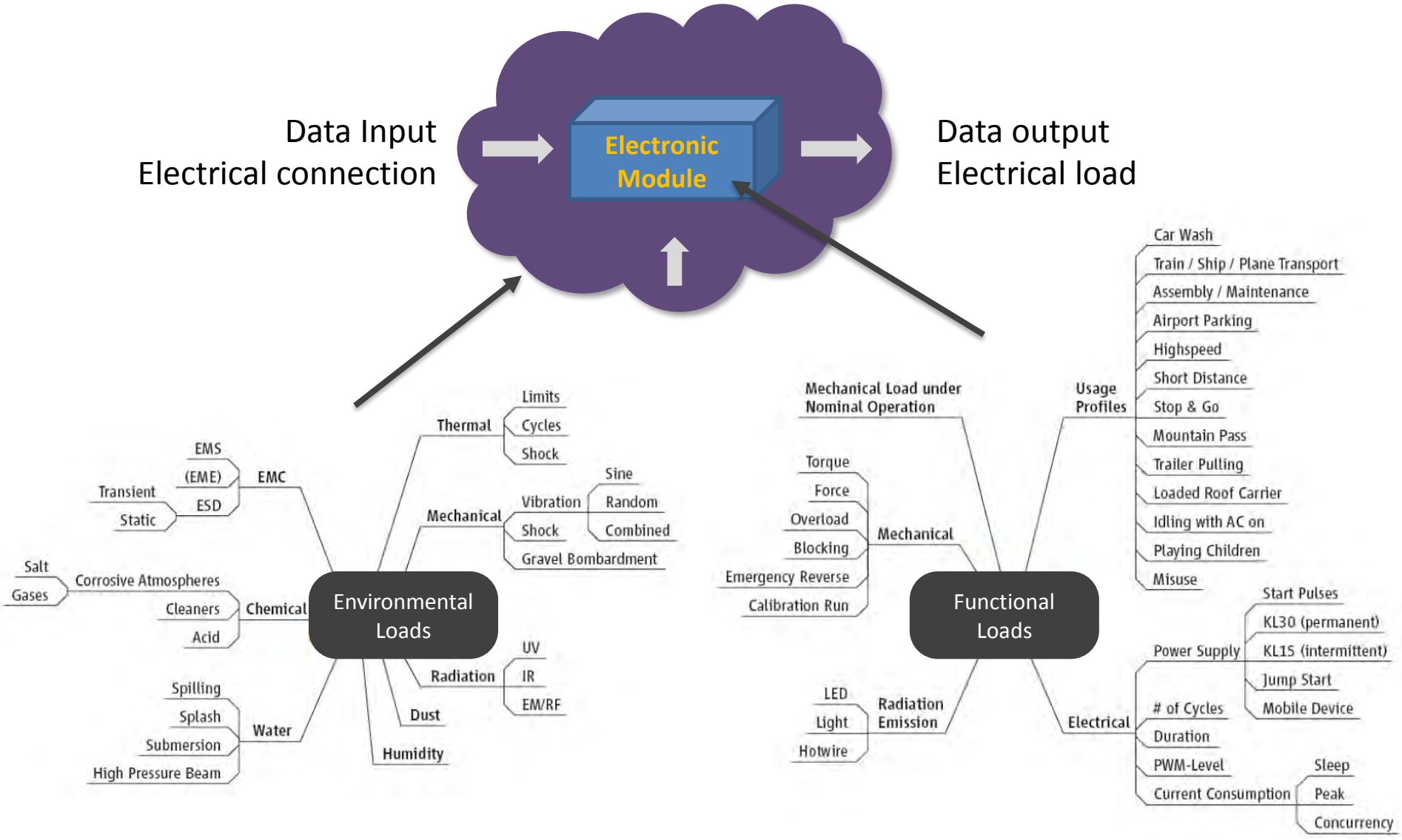
Since

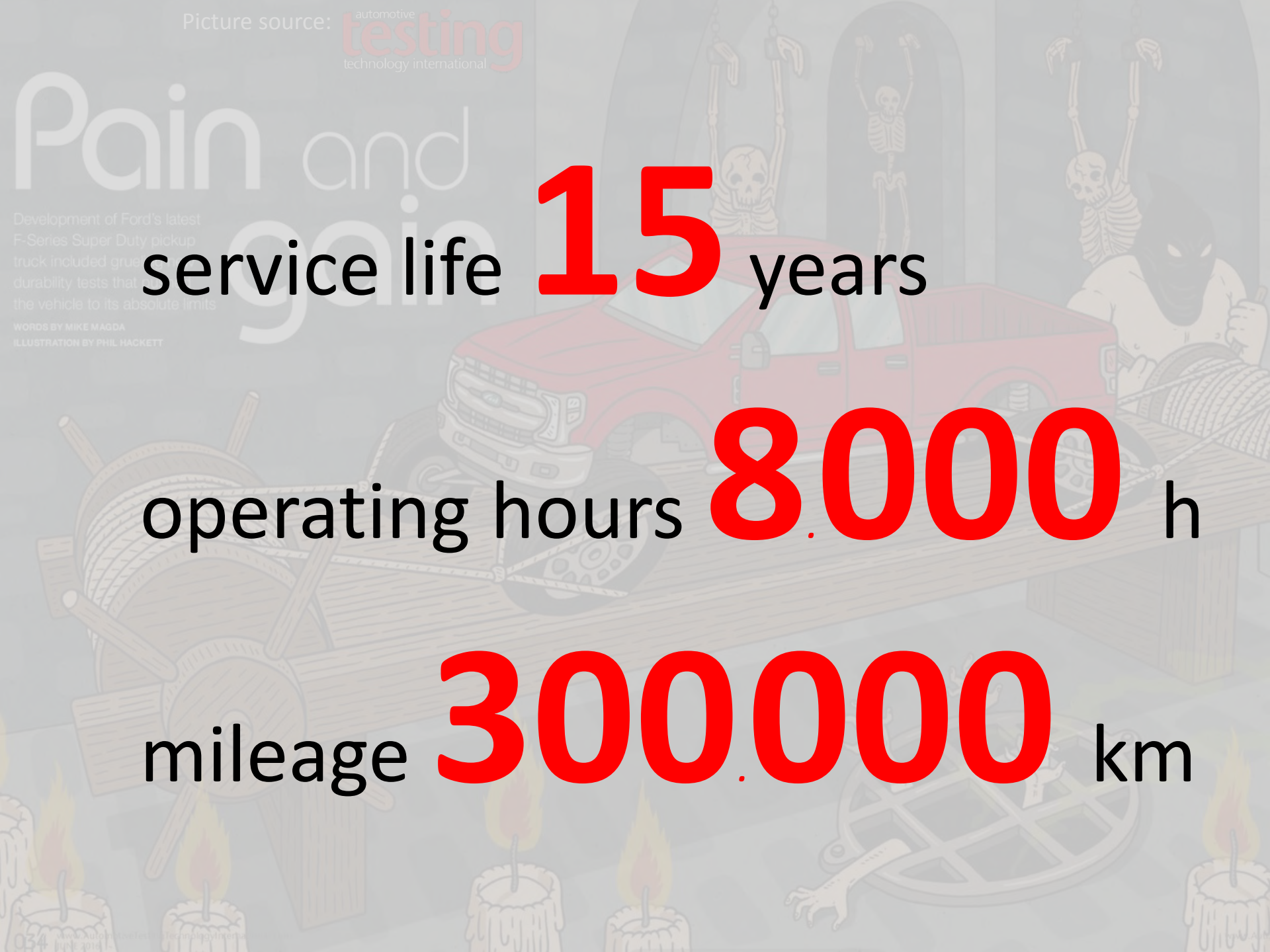
2007





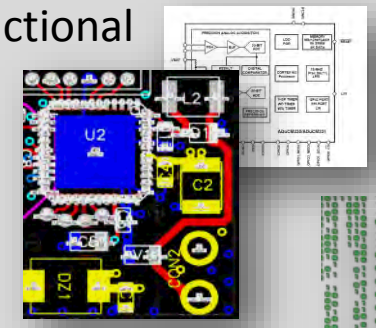
Stress factors and loads during service life



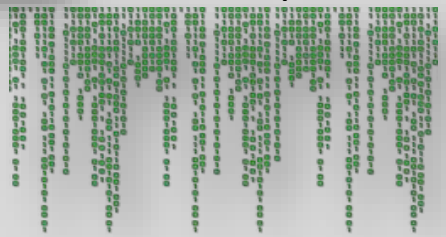

Picture source:
automotive testing technology international
Pain and gain
Development of Ford's latest F-Series Super Duty pickup truck included gruelling durability tests that pushed the vehicle to its absolute limits
WORDS BY MIKE MAGDA
ILLUSTRATION BY PHIL HACKETT
service life 15 years
operating hours 8.000 h
mileage 300.000 km

Requirements VERIFICATION

Functional



SW development



Vehicle

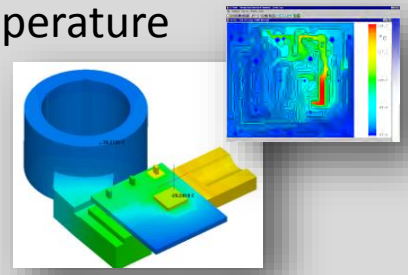
System

Module

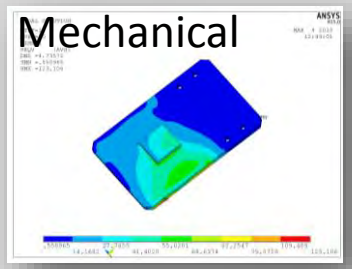
Component

Implement & Prototype

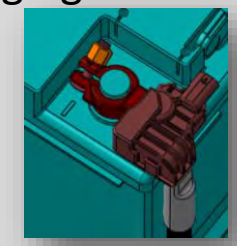
Temperature



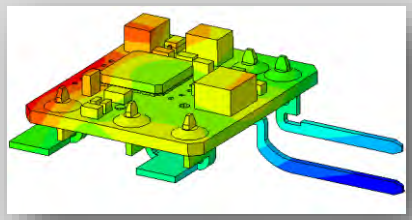
Mechanical



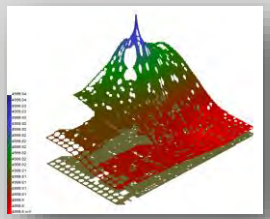
Packaging



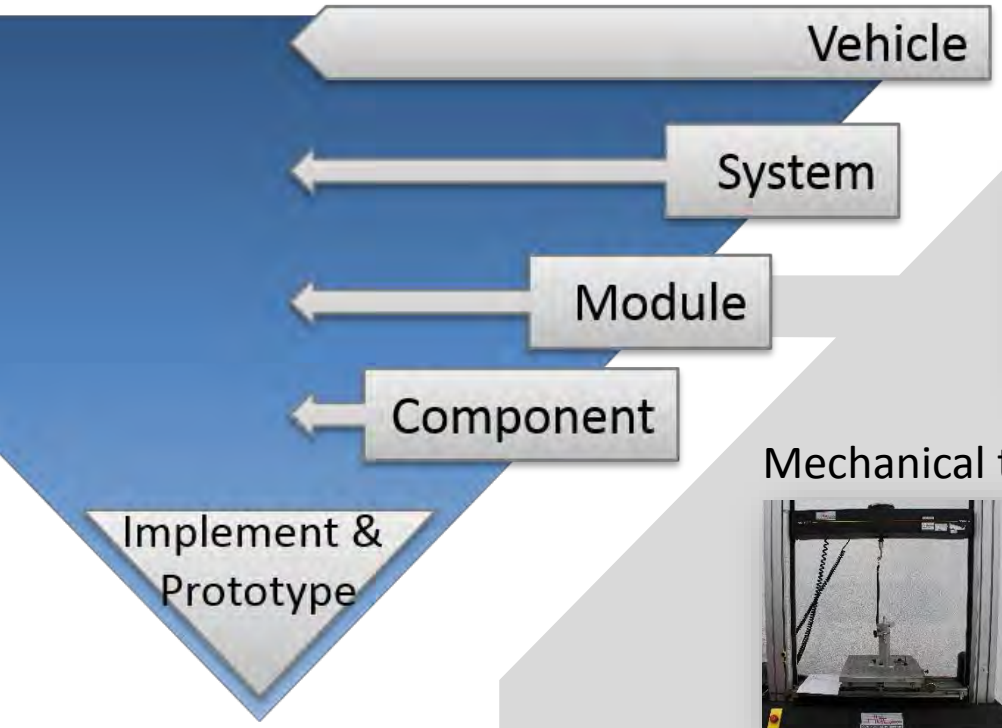
Stress & strain



EMC



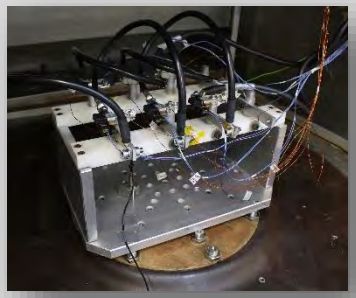
Measure and VALIDATION Test



EMC

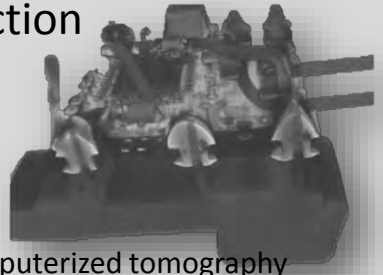
Humidity and Salt fog

Mechanical traction



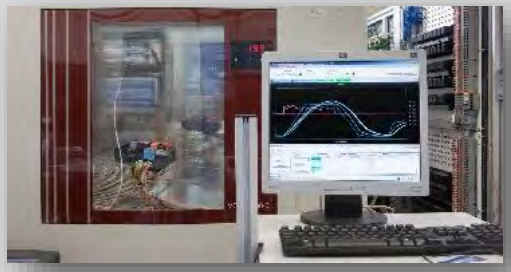
Vibration combined with temperature

Inspection



X-Ray Computerized tomography

Thermal Cycle



Hardware in the loop - HIL

Example of VALIDATION Life Test

Service life test: Power Thermal Cycle Endurance (PTCE) – LV124 : ISO 60068-2-14

1200

thermal cycle

with function load

3000

test hours

11.3 L-03 Life test - temperature cycle test

11.3.1 Ai…

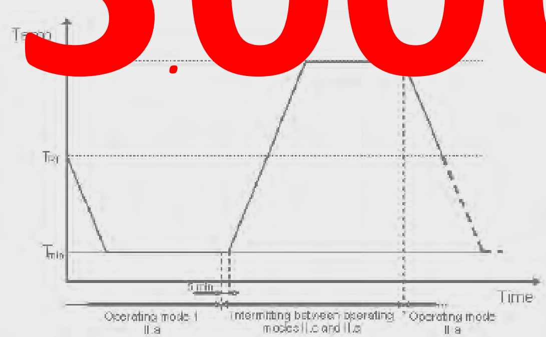
This test simulates in … act form the thermal … of th… mponen… ing temperature changes … ccur during vehicle … e life … The test serves to veri… quality and reliab… the c… nent wi… sp… faults that occur due to therm… chanical load, … ng and … ing in s… ed … s, adhesive joints and we… joints, in bon… nections as … as in s… or h… ngs.

11.3.2 Tes…

The test is carried out acc. to DIN EN 60068-2-14 with the following parameters:

Table 85: Test parameters L-03 Life test - temperature cycle test

DUT operating mode	Intermitting operating mode II.c and operating mode II.a acc. to Figure 38.
Temperature profile	Acc. to Figure 38
Minimum test temperature	T_{min}
Maximum test temperature	T_{max}
Temperature gradient	4 °C/min If the temperature gradient cannot be produced by the testing device, it can be reduced to values up to a minimum of 2 °C/min in coordination with the purchaser.
Holding time at T_{min} and T_{max}	15 min after the component has achieved the condition at which it … s the tem… Secti…
Number of cycles	To … culated … to Se… 12. … nd to … ecifi… the Co… ent Pe… ance S… cat…
Number of DUT…	



12.4 Calculation models for the life test 'temperature cycle test'

12.4.1 Coffin-Manson model

The calculation of the test duration for the temperature cycle test life test is based on the average temperature changes of the component in the field ΔT_{Feld} and the number of temperature cycles during service life in the field $N_{TempZyklenFeld}$.

Depending on the average temperature change in the field, the acceleration factor of the Coffin-Manson model is calculated as follows:

$$A_{CM} = \left(\frac{\Delta T_{Test}}{\Delta T_{Feld}}\right)^c \quad (3)$$

Where:

A_{CM} Acceleration factor of the Coffin-Manson model

ΔT_{Test} Temperature difference during a test cycle ($\Delta T_{Test} = T_{max} - T_{min}$)

ΔT_{Feld} Average temperature difference during service life in the field

c Parameter of the Coffin-Manson model … in this standard a … value of 2,… used for c.

The total number of test cycles is calculated acc. to

$$N_{Prüf} = \frac{N_{TempZyklenFeld}}{A_{CM}} \quad (4)$$

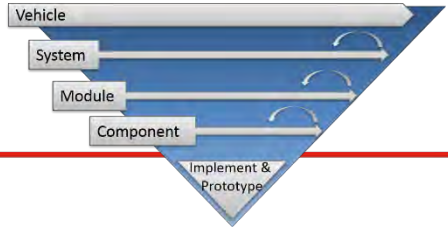
Where:

$N_{Prüf}$ Required number of test cycles

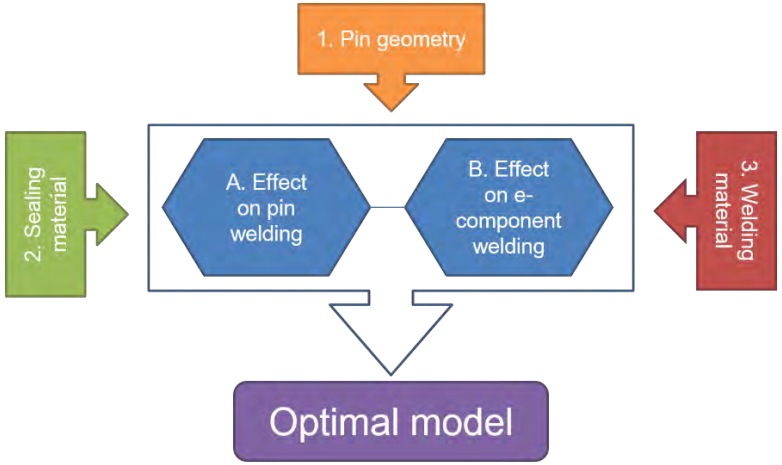
$N_{TempZyklenFeld}$ Number of temperature cycles during service life in the field

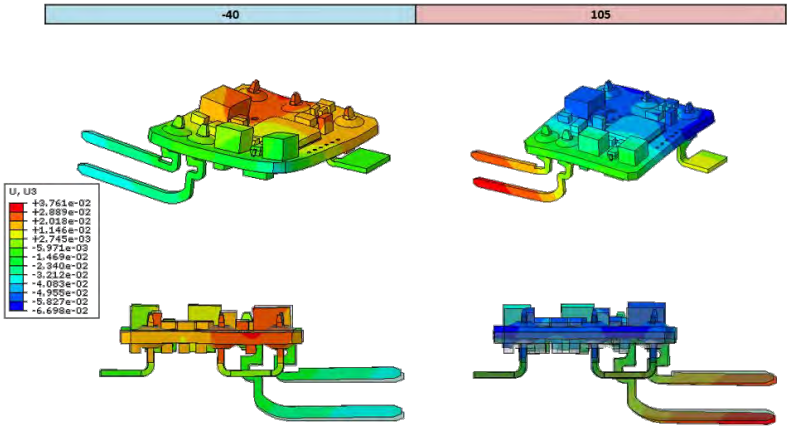
A_{CM} Acceleration factor of the Coffin-Manson model acc. to equation (3)

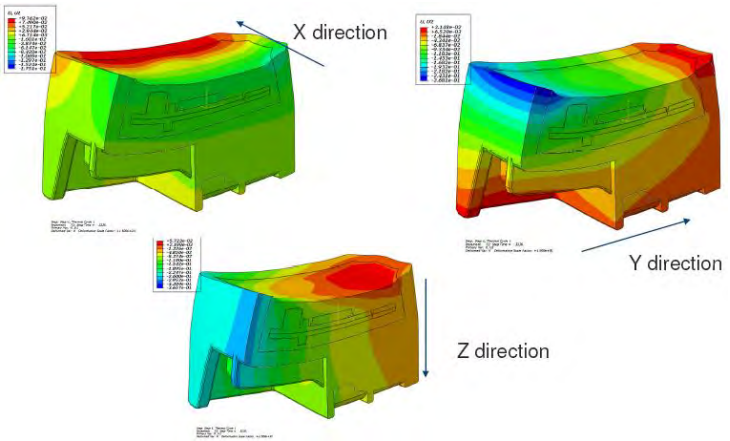
Power Thermal Cycle Endurance Test



Simulation: FEA analysis. Study of variables and effects







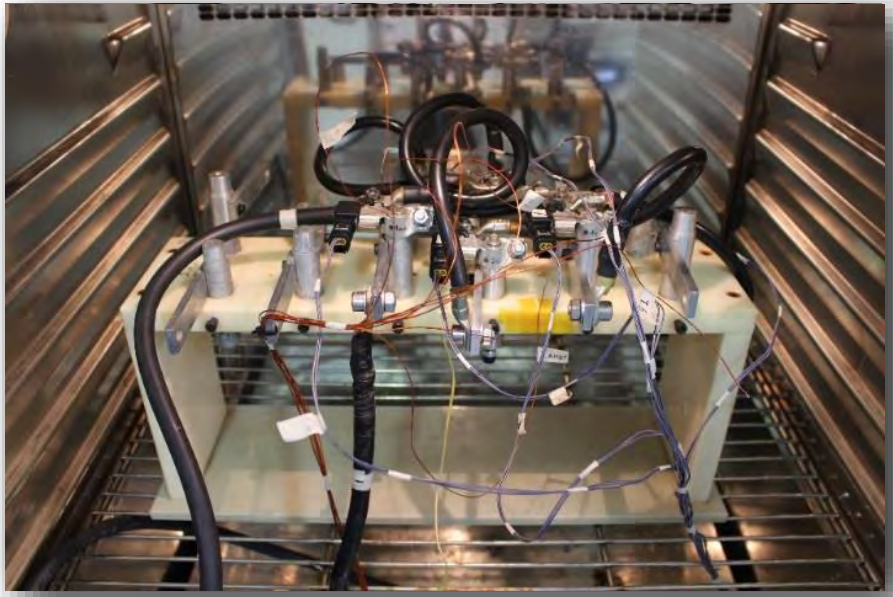
DOUBLE-S-PIN	e-component welding			
	SnPb37		SnAg	
Epoxy	Limit	5.7%	Limit	4.2%
Silicone	OK	1.5%	OK	1.2%

Criteria according to experience correlation FEA results/lab.
Tests on pin weld:

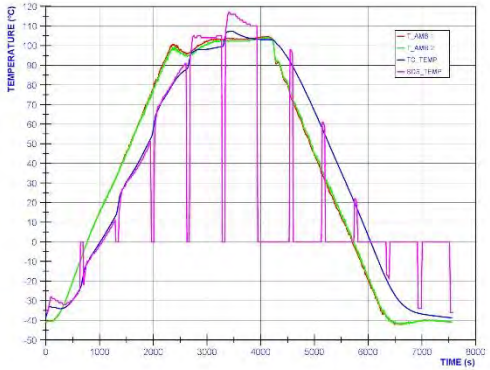
>7% NOK
2-7% Limit
<2% OK

Power Thermal Cycle Endurance Test

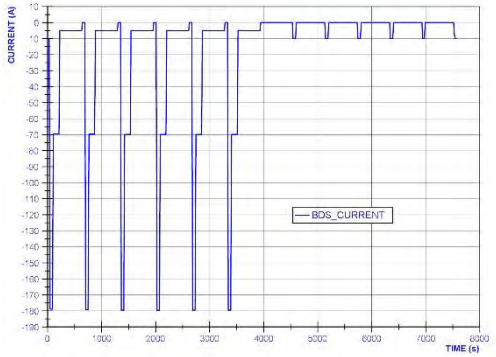
Test set-up



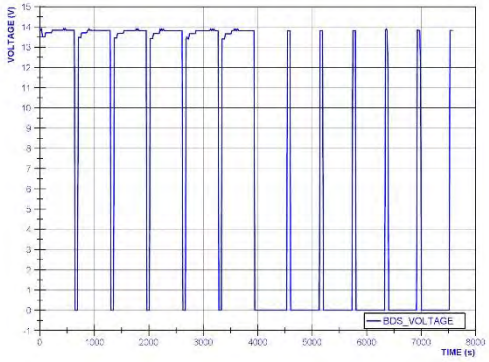
Temperature (ºC)



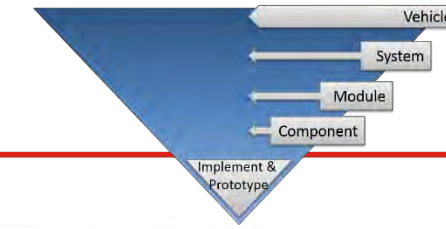
Current (A)

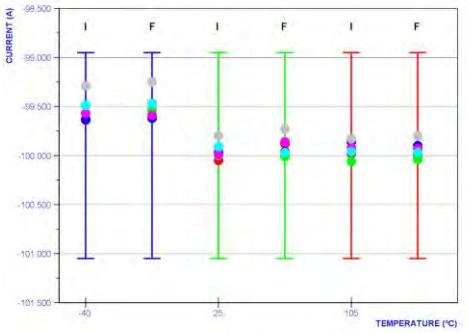


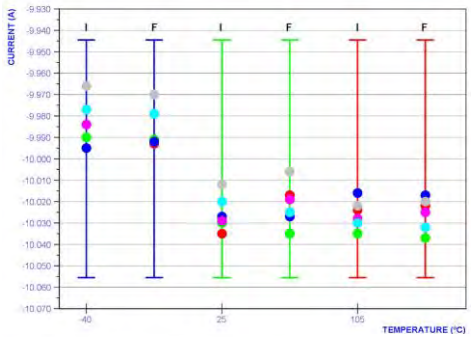
Voltage (V)

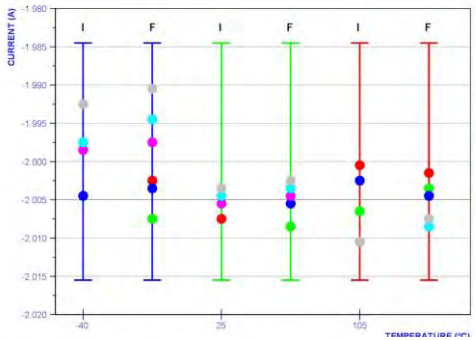


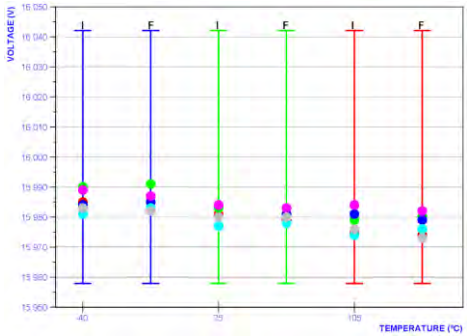
Power Thermal Cycle Endurance Test

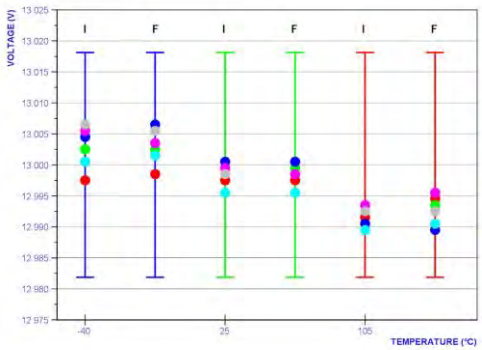


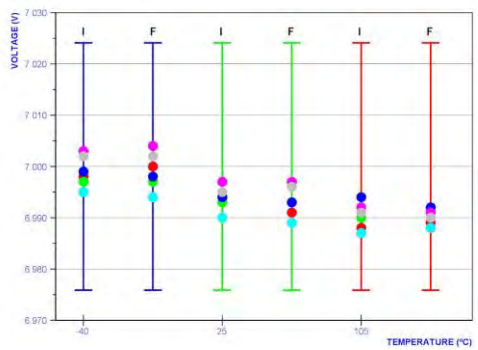


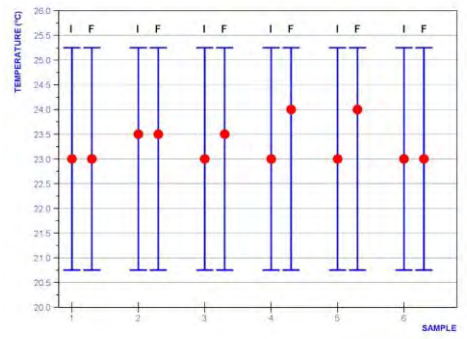


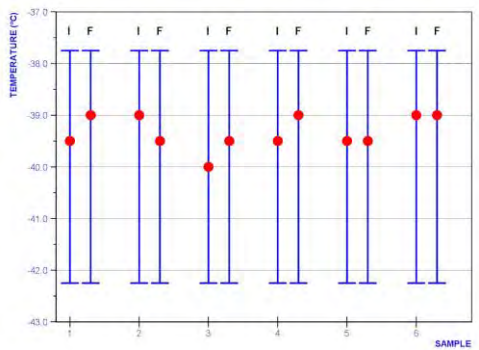


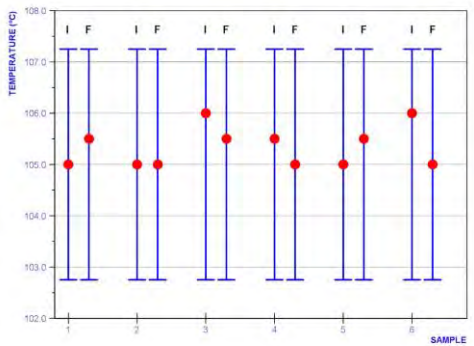


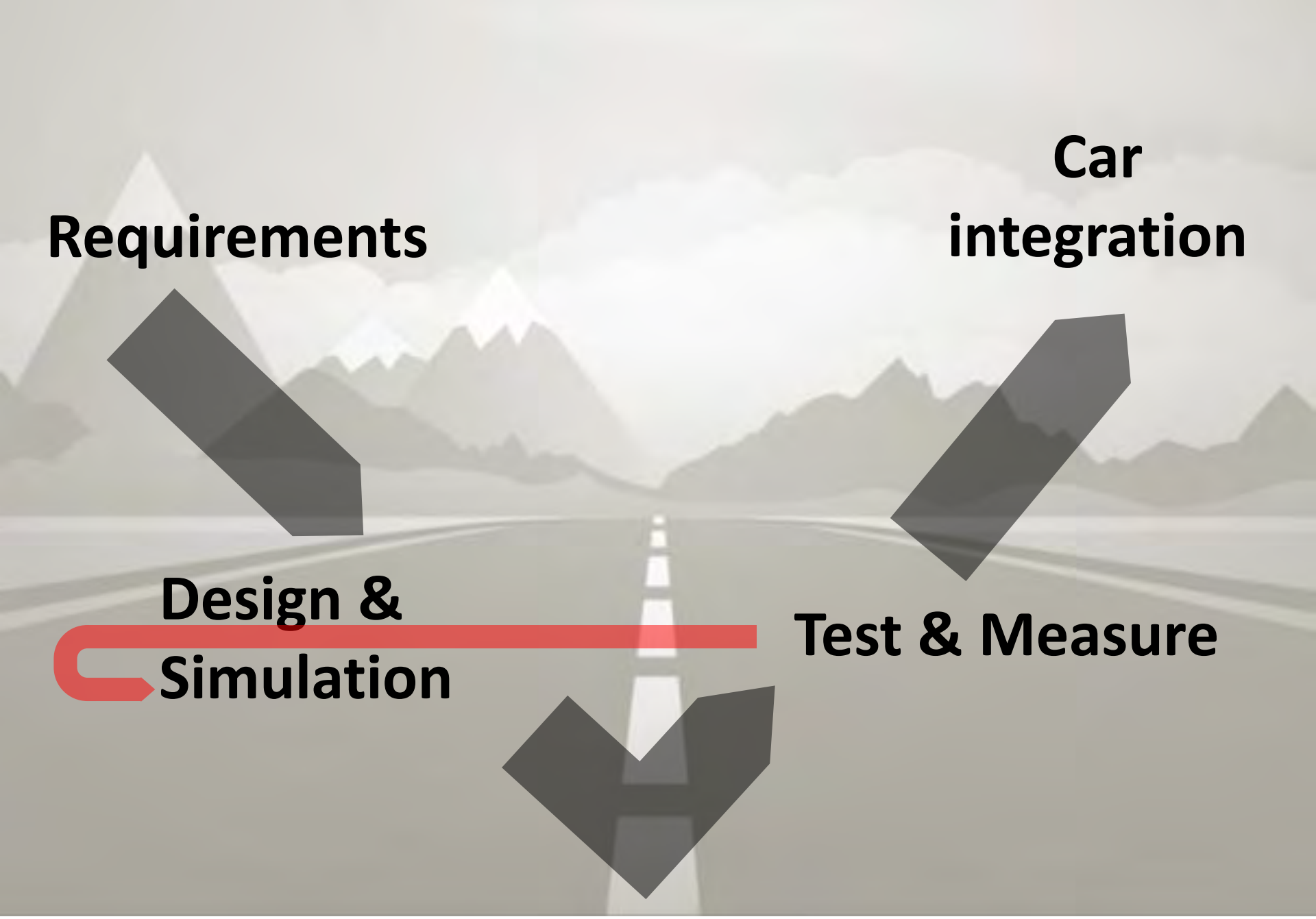












Gracias por su atención