Reliability :

Mission Profile - methodologies

David DELAUX

GROUP RELIABILITY DIRECTOR
VICE-PRESIDENT EUROPEAN RELIABILITY CONFEDERATION

8 December 2015

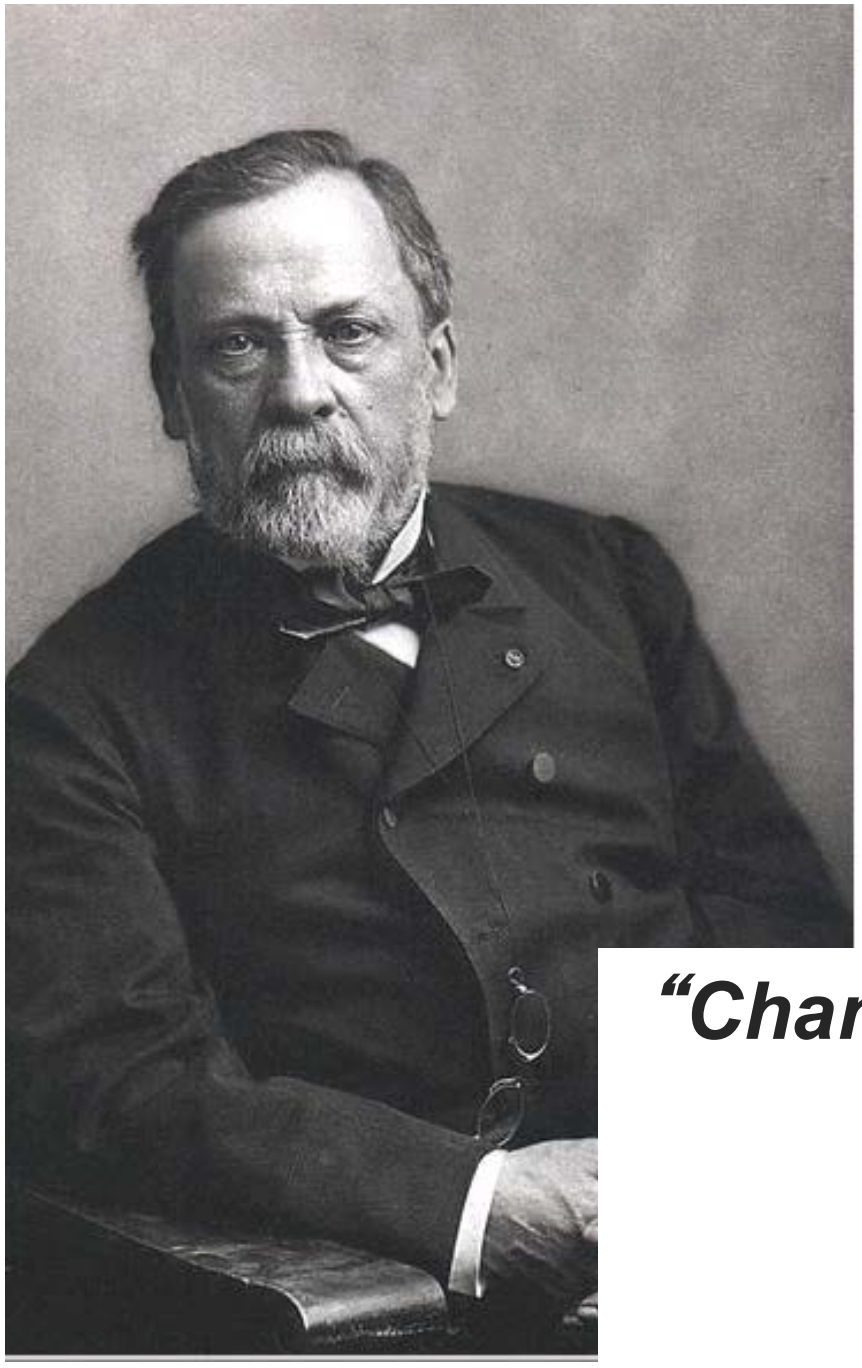
FiRST-MFP

16e AAP FUI

National Research Program

MECHATRONIC RELIABILITY for HIGH POWER SYSTEM

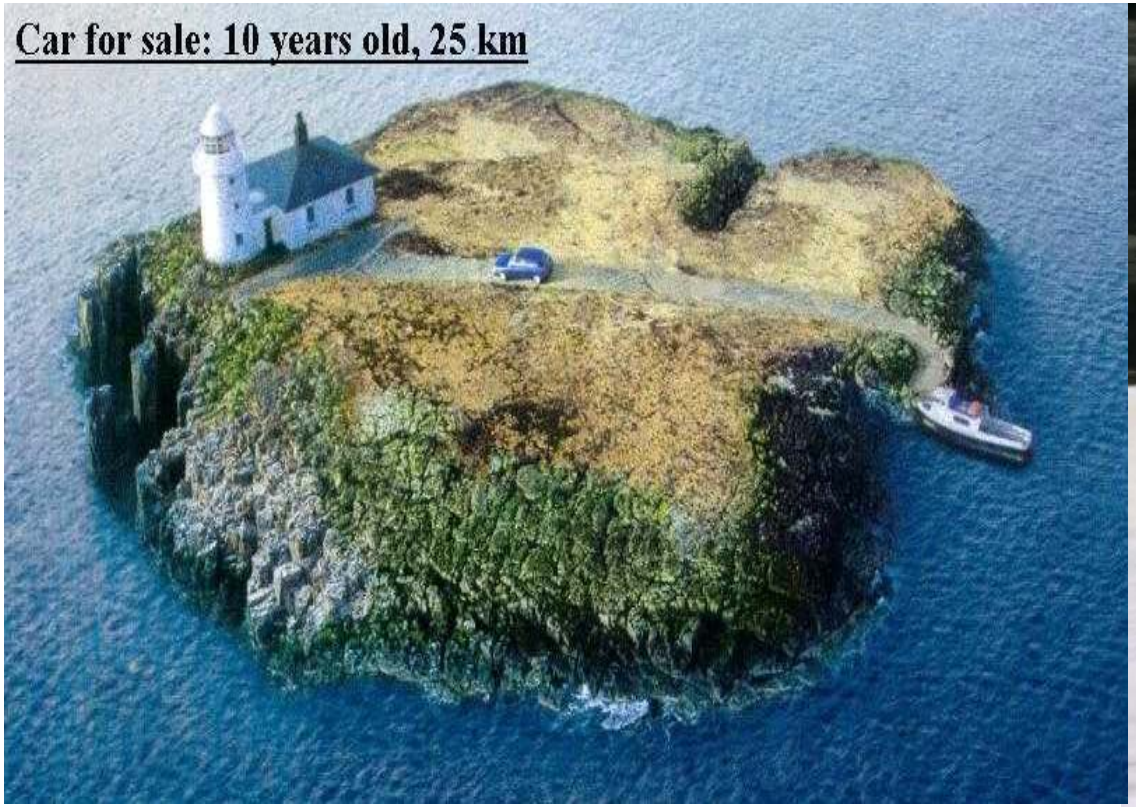
Introduction



"Chance favors the prepared mind."

Louis Pasteur
(1822-1895)

Reliability : Mission Profile



Reliability : Mission Profile

Context & Problematic

MISSION PROFILE

Conclusion

Methods & Tools

Reliability : Mission Profile

Context

2015

Competitive

100 ECU

100 million Lines Code

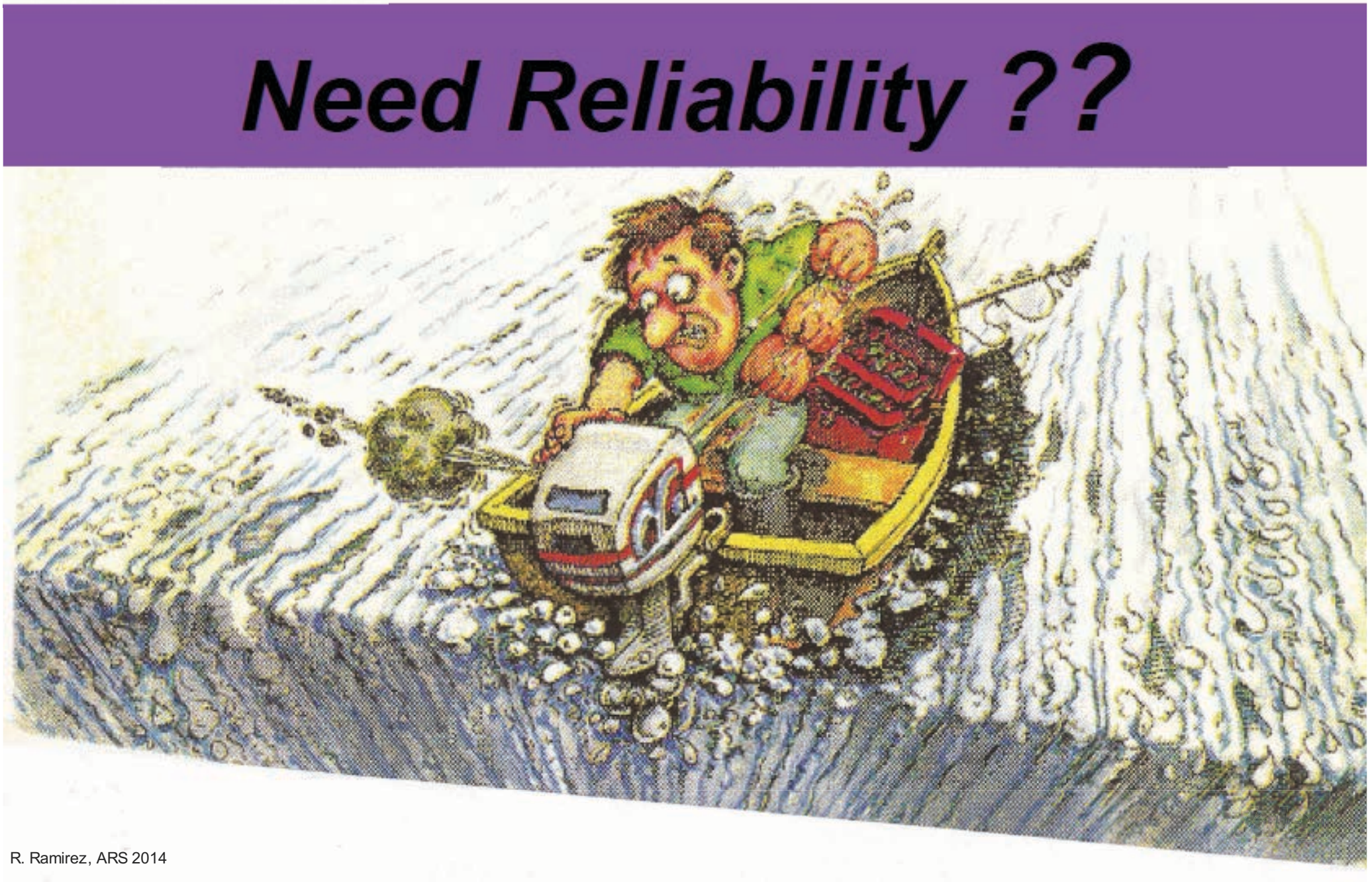
> 20 PC power

High volume

Warranty

(*) : assumptions 2014
70 million cars produced with warranty cost of 2% of sales based on, 15.000€ average car price

Reliability : Mission Profile



R. Ramirez, ARS 2014

Mission Profile: DEFINITION

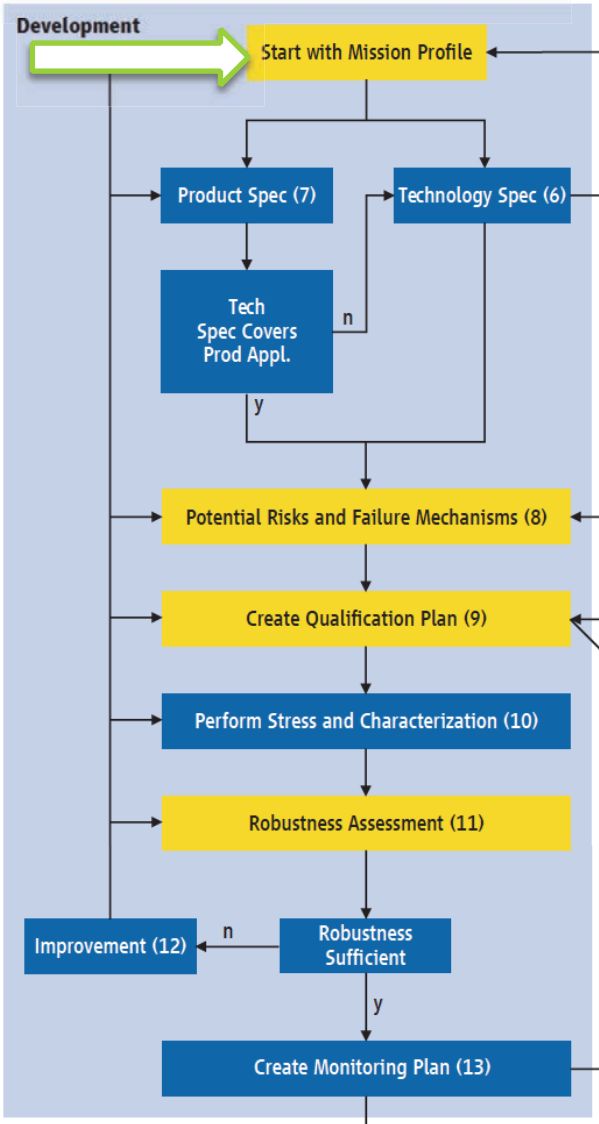
Problematic

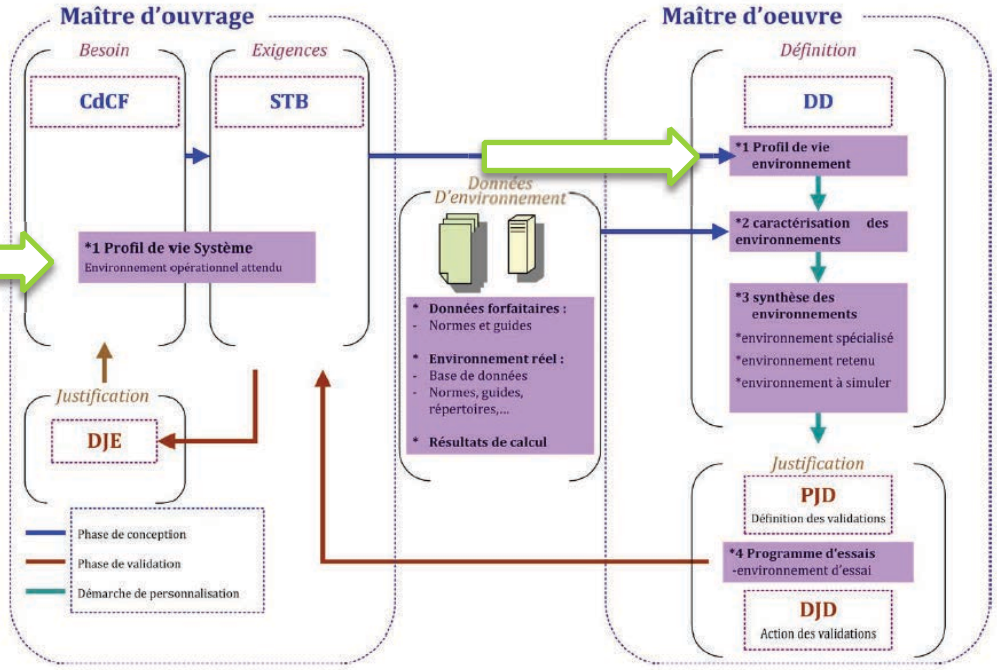
IEEE Reliability Society 2006 (2)
"Reliability is a **design engineering discipline** which applies **scientific knowledge** to assure a product will perform its intended function for the required duration within a given environment."

MISSION PROFILE

REAL- USAGE PROFILE

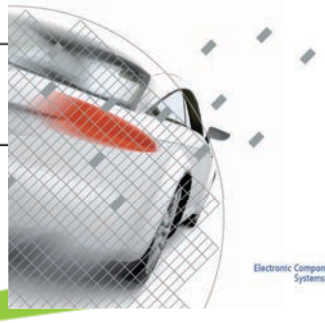
Mission Profile: DEFINITION





ZVEI: Die Elektroindustrie

Handbook for Robustness Validation of Semiconductor Devices in Automotive Applications



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ICS : 03.120.10 ; 17.020 ; 19.040

Démonstration de la tenue aux environnements — Conception et réalisation des essais en environnement — Partie 2 : Guide de la démarche de personnalisation en environnement

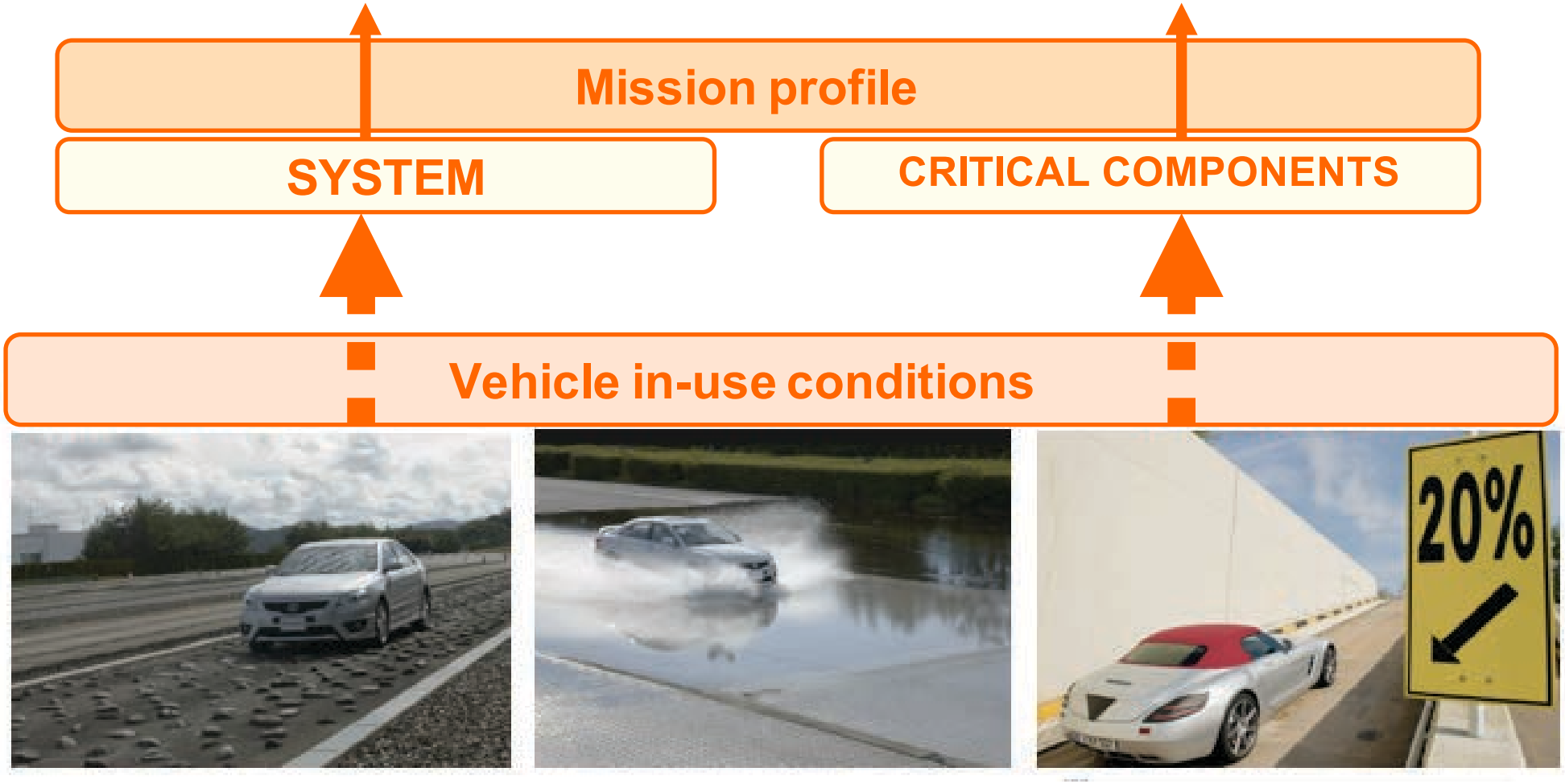
E : Demonstration of the resistance to environmental factors — Design and execution of environmental tests — Part 2: Guidelines for the approach of customisation to the environment

D : Nachweis der Widerstandsfähigkeit gegen Umweltfaktoren — Ausführung und Durchführung von Umweltprüfungen — Teil 2: Leitfaden zum Konzept der Anpassung an die Umwelt

(4)

Mission Profile: DEFINITION

Mission profile is composed of SYSTEM and CRITICAL COMPONENTS.



(5)

Mission Profile

SYSTEM

System life cycle profile :

"The system life cycle profile is a description of the various operational service conditions liable to be experienced by the system at every stage of its life, from factory gate to retirement.

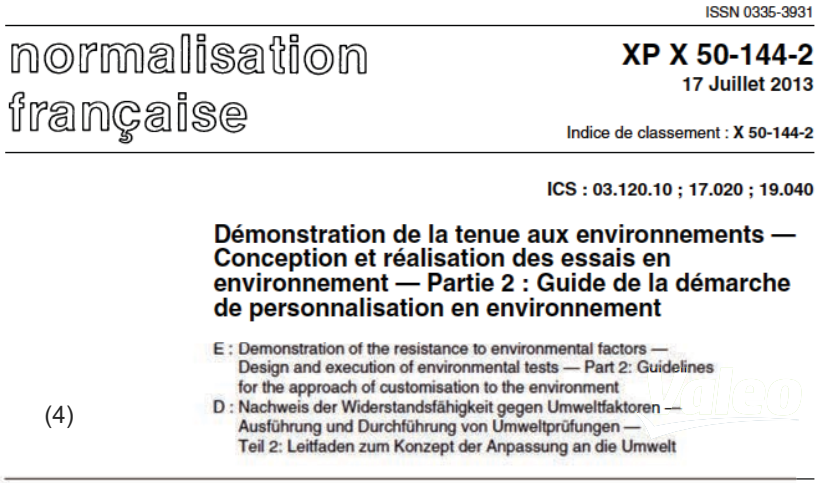
In particular, this description covers:

— all operational usage scenarios (including variants, user profiles, etc.);

— required operational environmental conditions (levels, proportions, durations and occurrence);

— special provisions associated with certain conditions of use;

— service life required for the complete system or for certain specific functions."



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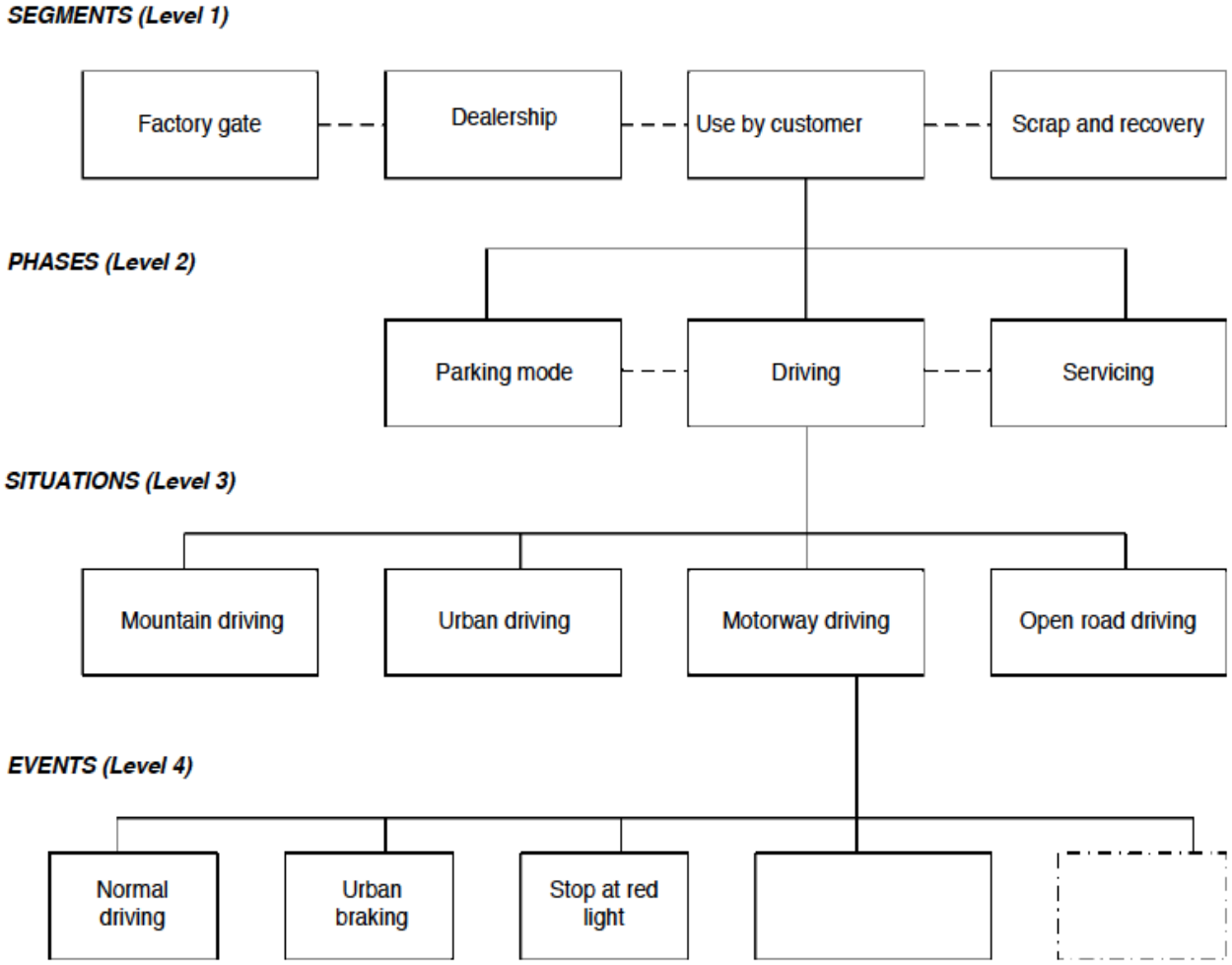
Mission Profile: SYSTEM

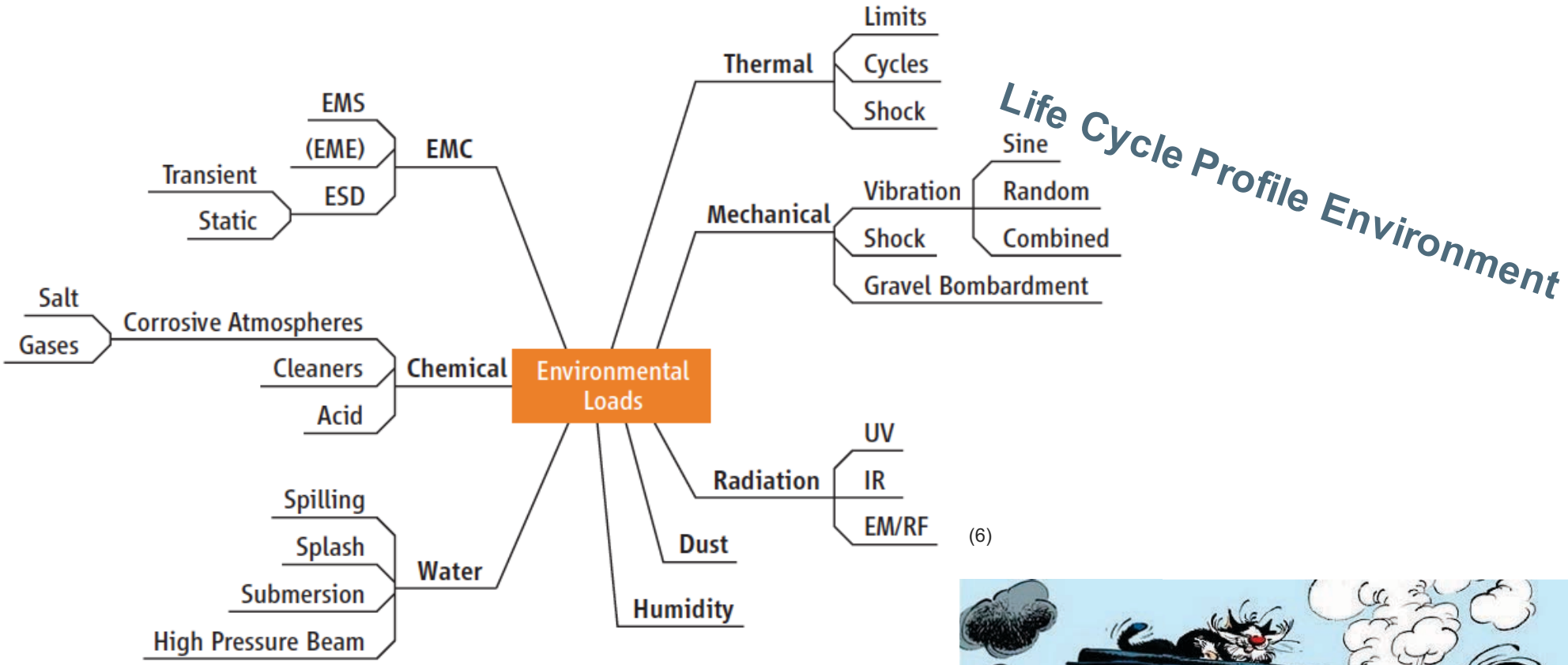
- **SYSTEM is characterized by its level and occurrence**



(4)

Mission Profile: SYSTEM

- **SYSTEM is characterized by its level and occurrence**



(6)

- **Neighboring equipment behavior**

Mission Profile: SYSTEM

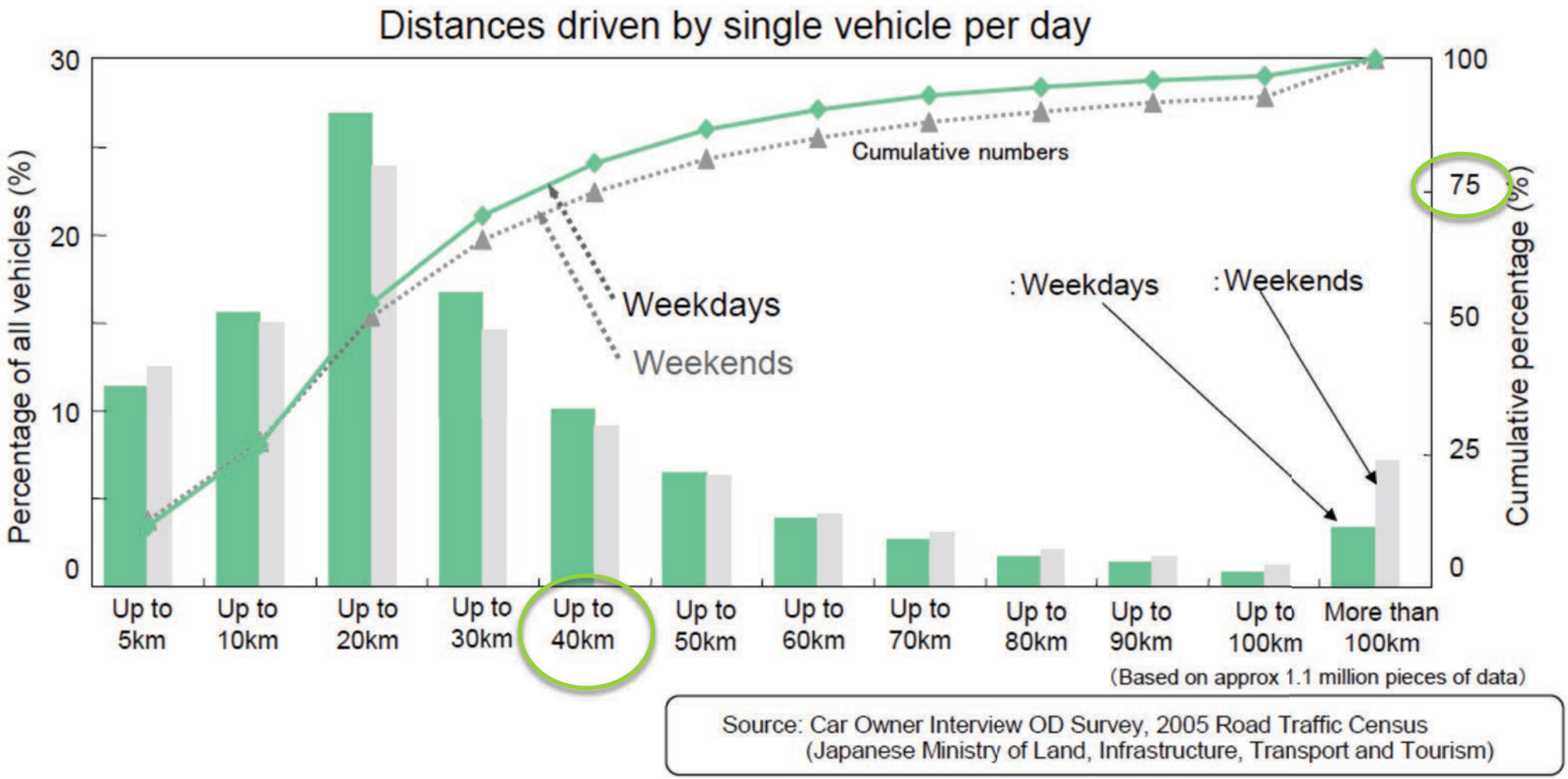
Example

Mechatronic Transmission Control Module

Operated in the vehicle (EEM on time)	Temperature profile [1] (Ambient temperature of the component at the mounting location) [2]	Temperature	Distribution
		- 40°C	2%
		23°C	18%
		100°C	70%
		130°C	9%
		140°C	1%
	Humidity [3]	Relative humidity up to 100% Condensation and icing	
Installed in the vehicle without operation (EEM non operating time)	Temperature	Minimum temperature: -40°C Maximum temperature: 140°C Typical temperature: +23°C	
	Humidity	Relative humidity up to 100 %; Condensation and icing Mean 65% relative humidity [4]	
Transportation	Temperature	Minimum temperature: -50°C Maximum temperature: +95°C	
	Transportation time	Max. 24 hrs. Uninterrupted at minimum temperature Max. 48 hrs. Uninterrupted at maximum temperature	
Storage [5]	Temperature	Minimum temperature: -10°C Maximum temperature: +55°C	
	Storage time	5 years	
	Humidity	Max. 85% relative humidity	

Mission Profile: SYSTEM

Example



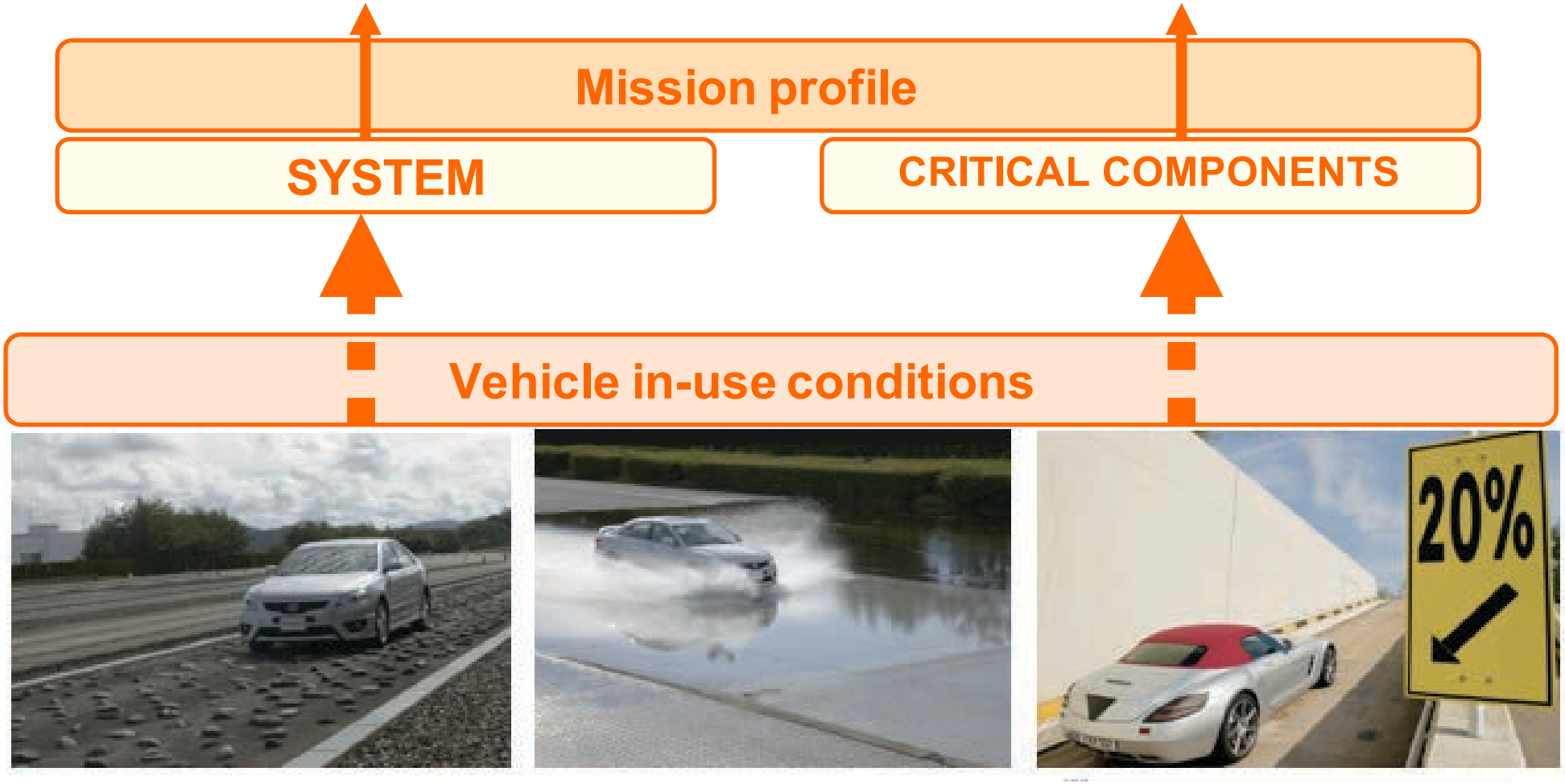
Source: Car Owner Interview OD Survey, 2005 Road Traffic Census
(Japanese Ministry of Land, Infrastructure, Transport and Tourism)

Mission Profile: SYSTEM

Example

Source : Le point 24/03/2015

Mission Profile: CRITICAL COMPONENTS



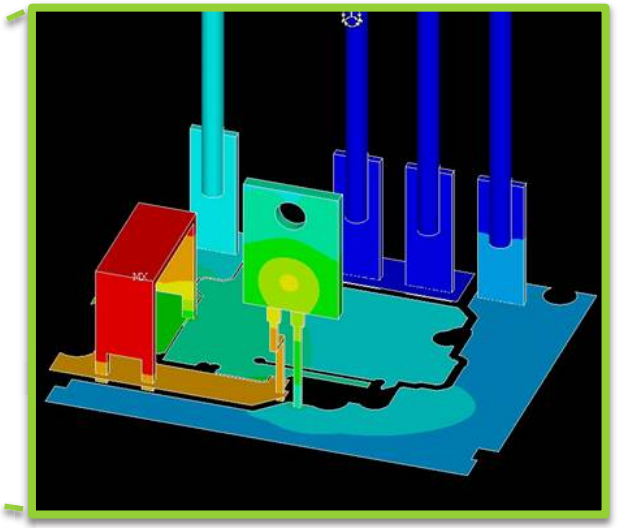
(5)

Mission Profile: CRITICAL COMPONENTS

- **CRITICAL COMPONENTS are characterized by their level and occurrence and how the Equipment is used.**

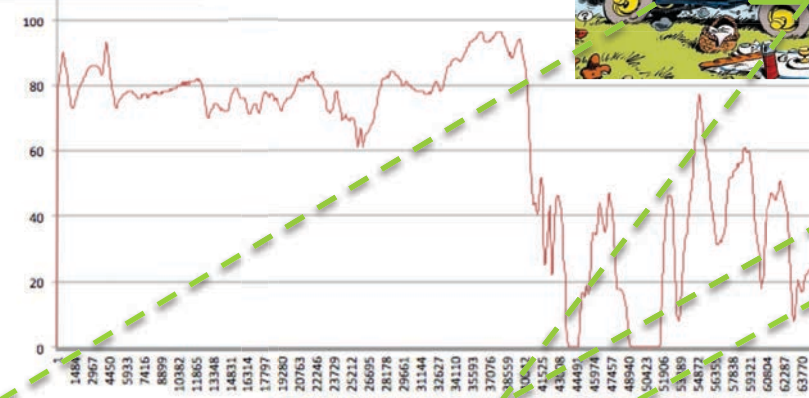
  - **The equipment use depends on outside environment or/and vehicle in-use profile.**

  - **Its occurrence can be: time, number of cycles, number of revolutions, cumulative angle, or mileage.**

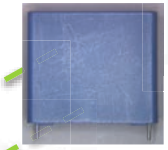


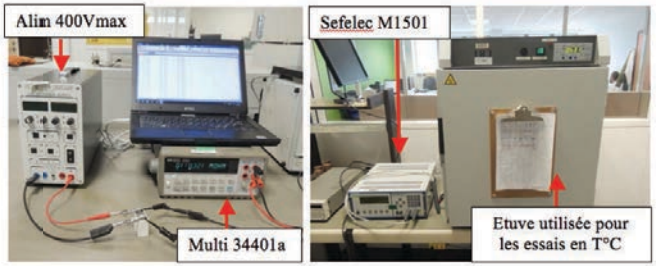
Mission Profile: CRITICAL COMPONENTS

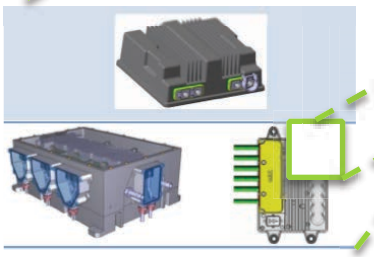
VEHICLE



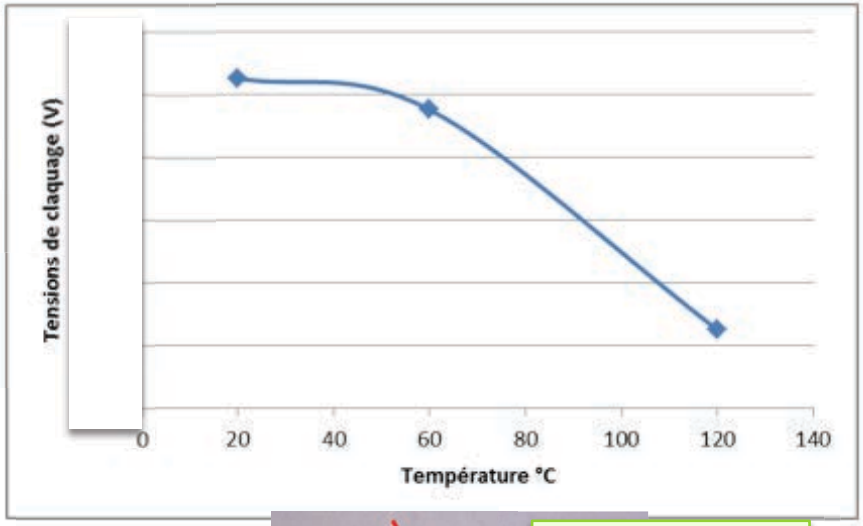
CRITICAL COMPONENT

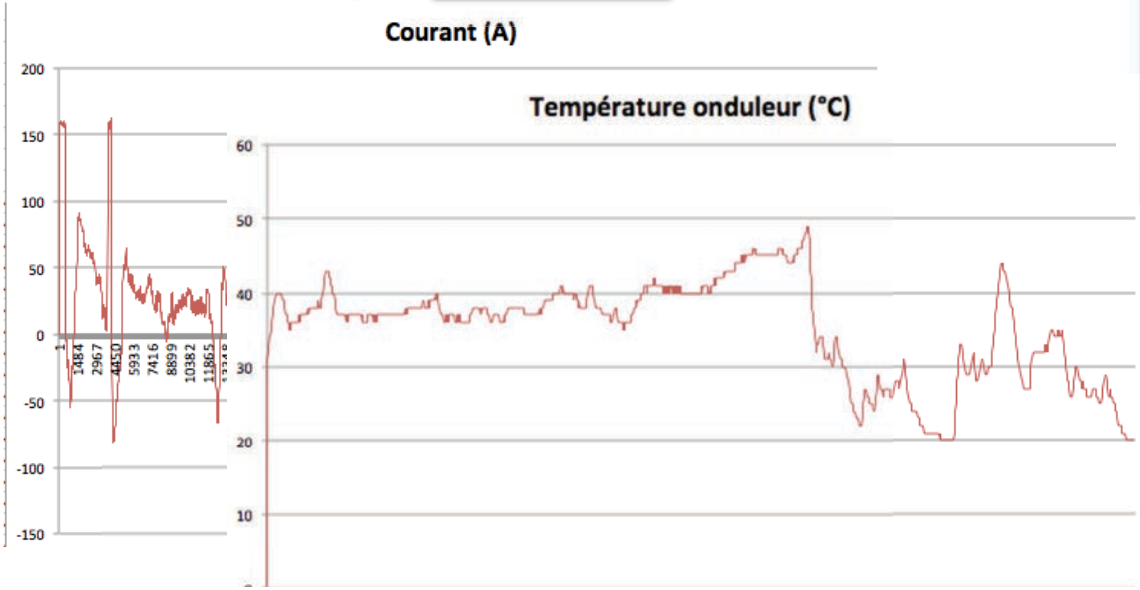




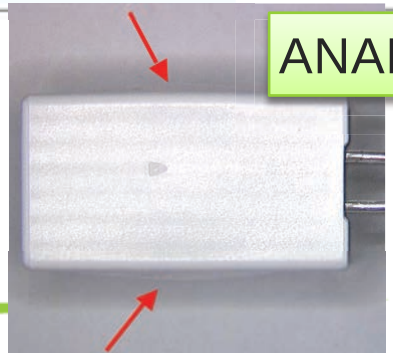


SYSTEM





ANALYSIS



Valeo

System Reliability : FOR WHAT ?

SYSTEM

CRITICAL COMPONENTS

Mission profile

PREDICTIVE Reliability

FIDES – MIL HDBK 217
Electronic Reliability

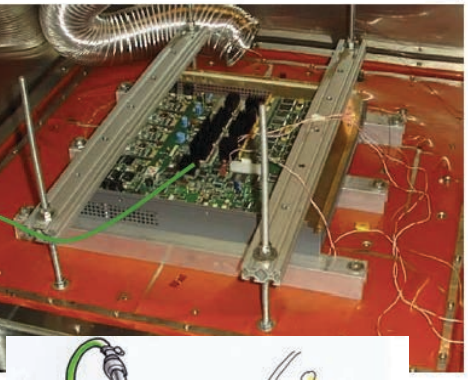
TEST

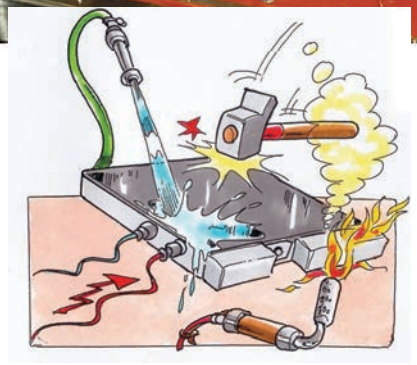
N2 speed

fixturing

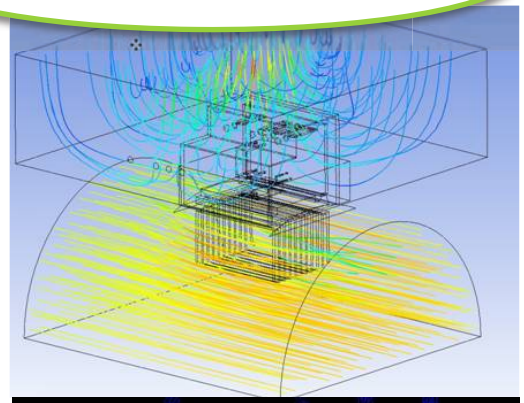
temperature

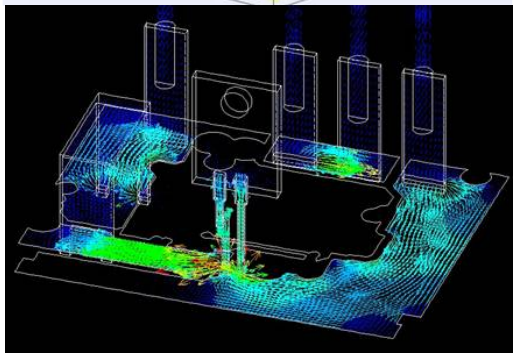
vibrations



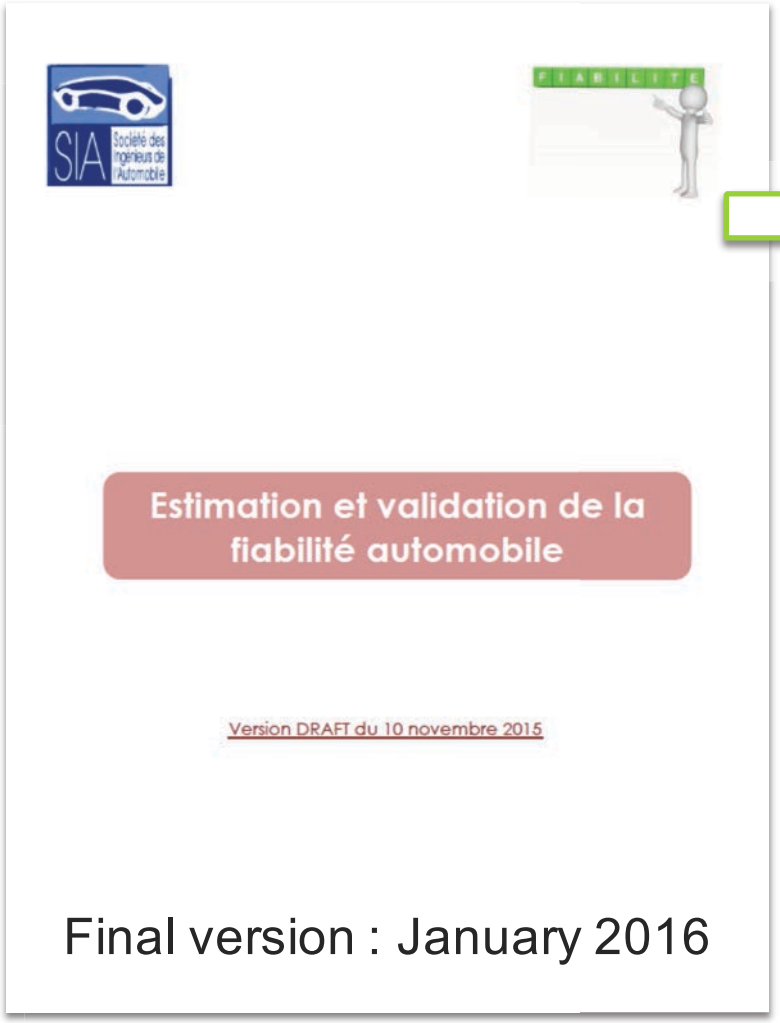


SIMULATION





Do Not Forget !



Authors : PSA, Renault, Volvo, Hutchinson, Valeo, Sector

Phases	Acteurs	Durée (Répartition en %)
1. Analyse qualitative de risque	Constructeurs Equipementiers	20
2. Identification des mécanismes physiques, des facteurs endommageants et des moyens de simulation associés	Equipementiers Constructeurs	20
3. Récupération des données disponibles	Equipementiers Constructeurs	25*
4. Dimensionnement du plan de validation	Equipementiers Constructeurs	25
5. Estimation de la fiabilité clientèle	Equipementiers Constructeurs	10

* Attention, si les profils de sollicitations ne sont pas disponibles, la caractérisation de ces derniers peut prendre jusqu'à 80% du temps de l'étude globale (peut nécessiter des campagnes de mesures longues).

Mission Profile

TOOLS

PRESS
HANDBOOK
STANDARDS

CARMAKER
FLEET
TAXI

INREST
INSEE
NHTSA

INTERNET

IN-HOUSE
SIA
ASTE
IEEE

RECOLT

ANALYSIS

CAPITALIZE

MAINTAIN

Mission Profile

METHODS

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Décembre 2000

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Essais

Conception et réalisation des essais — Essais en environnement

Partie 1 : Bases de la démarche

E : Tests — Test design and realization — Test in environment — Part 1: Bases of the process

French & English

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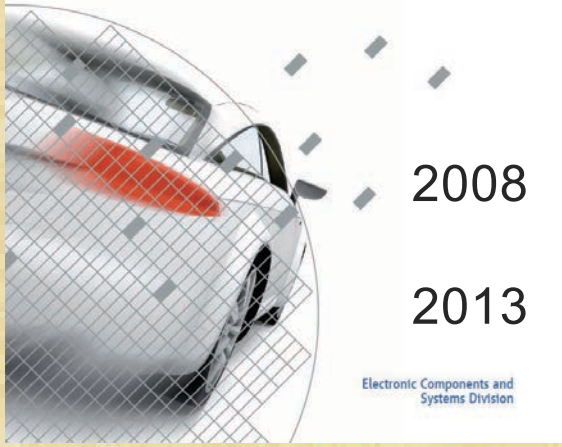
Handbook for Robustness Validation
of Semiconductor Devices
in Automotive Applications



2008

2013

Electronic Components and Systems Division

SIA Société des Ingénieurs de l'Automobile

FIABILITE

Estimation et validation de la fiabilité automobile

Version DRAFT du 10 novembre 2015

January 2016

aste ANNEXE GENERALE CLIMATIQUE TOME 1 PROFIL DE VIE PR ASTE 01-02

Climatic Guideline

ANNEXE GENERALE CLIMATIQUE

TOME 1

PROFIL DE VIE

PR NORMDEF 0101

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE LA DÉFENSE

NORME DÉFENSE

PR NORMDEF 0101
Édition 01
JUILLET 2009

ICS : 95.020

TITRE FRANÇAIS : Guide d'application de la démarche de personnalisation en environnement mécanique

TITRE A
armament program

nt in an

Mechanical Guideline

aste ASSOCIATION POUR LE DÉVELOPPEMENT DES SCIENCES ET TECHNIQUES DE L'ENVIRONNEMENT

www.aste.asso.fr

Do Not Forget

Questions

Thank you for your attention.

System Reliability : Methods & Tools

BIBLIOGRAPHY

(1) www.statistica.com *"Worldwide automobile production from 2000 to 2014 (in million vehicles)"*

(2) IEEE Reliability Society (2006), http://www.ieee.org/portal/site/relsoc

(3) ZVEI - "Handbook for Robustness Validation of Semiconductor Devices in Automotive Applications" – revised edition Feb. 2013

(4) AFNOR – "Démonstration de la tenue aux environnements – Conceptions et réalisation des essais en environnement" – NFX 50-144-2 – ISSN 0335-3931

(5) Valeo "Mission Profile Guideline" – GEI-RD-H01-0000-171

(6) ZVEI SAE – "Handbook for Robustness Validation of Automotive Electrical/Electronic Modules" – April 2018

Biography

David DELAUX (engineer graduated from Centre Etudes Supérieures Industrielles Engineering School of Paris, France) is the **Group Reliability Director** at Valeo. David joined Valeo in September 1997 in Engine Cooling Business Group.

He is responsible for leading the global competency development and the reliability strategy for Valeo world wide. In addition, he is **Chairman of a National Research** program called FiRST focus on the Reliability study of Mecatronic System for High Power.

As of Oct 2014, David has been nominated as **Vice-President of European Reliability Confederation** (CEEES - 1000 industries, 100 universities, 12 nations).

As a Reliability Senior Expert, David has been involved in different **Scientific Societies as Board of Directors** : ASTE (Association des Sciences et des Techniques d'Environnement) - European Confederation on Reliability CEEES (Confederation of European Environmental Engineering Societies).

Automotive technology, naturally