Faurecia Seating FEA Strategy

C. Lemaitre

Faurecia Sièges d'Automobile

Technical perfection, automotive passion

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Automotive Seating

Faurecia Automotive Seating FEA Strategy

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9th German LS-DYNA forum 2010
12th-13th October 2010, Bamberg, Germany

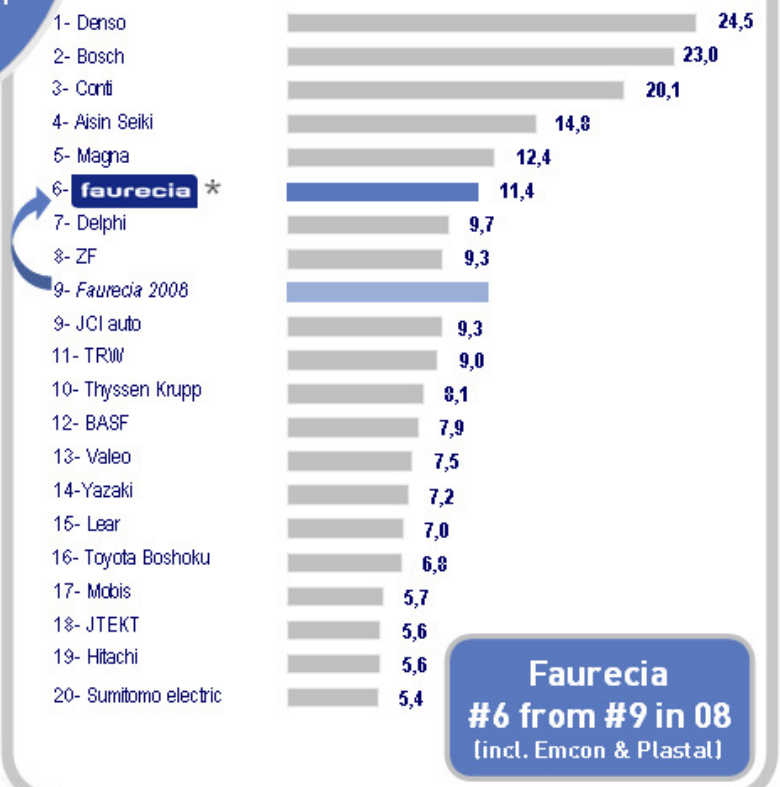
Faurecia overview

Key figures 2009

- **62,000** employees
- **200** sites
- **33** R&D centers
- **32** countries
- Sales: **€11.3 billion***
  - Europe: 73%
  - North America: 14%
  - Asia: 8%
- Listed on Euronext Paris (SBF 120 - compartment A)

6th largest equipment manufacturer worldwide

World's top automotive equipment manufacturers (2009 sales in billions of euros)

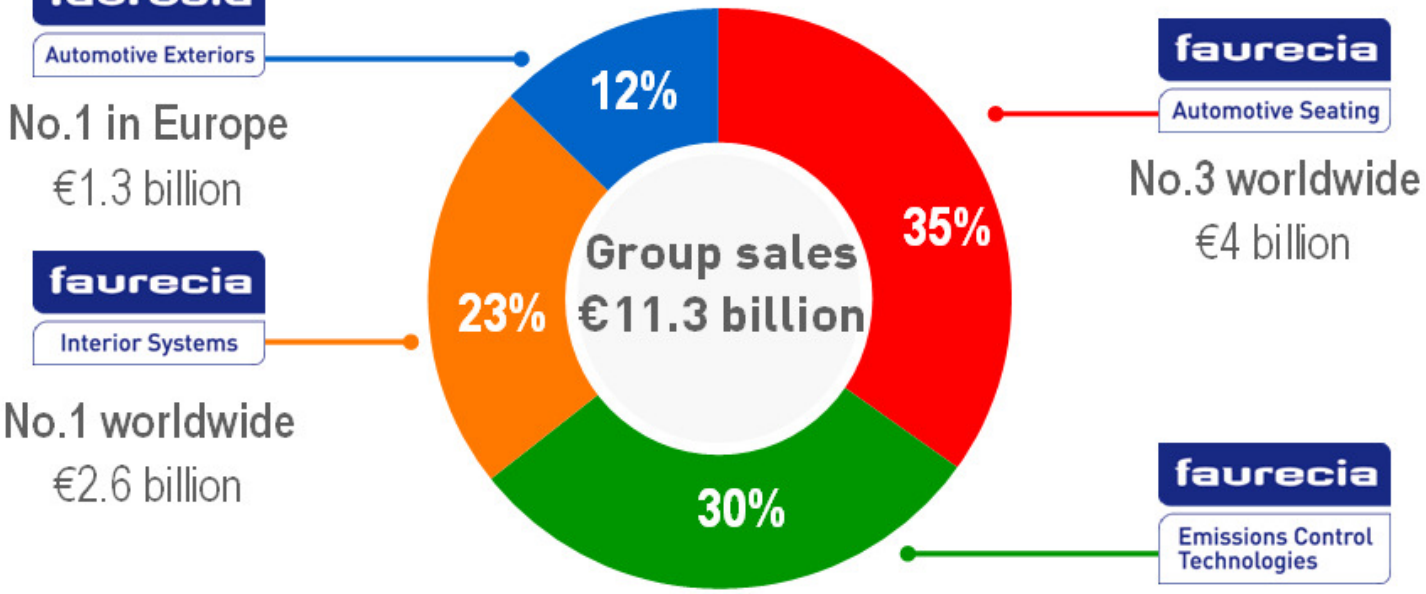


Faurecia #6 from #9 in 08 (incl. Emcon & Plastal)

*Total Sales, including Emcon and Plastal Germany pro forma

Leader in four core Business Groups

2009 sales by Business Group*



* Information given in this presentation includes pro forma figures for Emcon and Plastal Germany.

Faurecia Automotive Seating at a glance

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€ 3.7 bn
Product Sales 2009
(**€ 5 bn** 2014)

27,000
employees

73 plants

20 countries

Challenging CAE topics on a key automotive product !

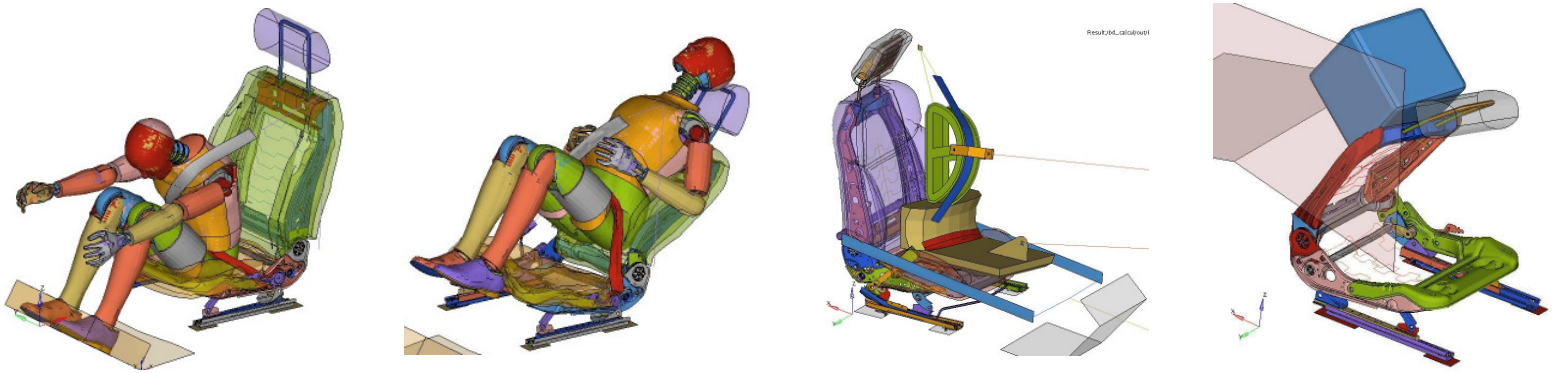
Our game field

Regulations : ECE 14 / ECE 17 / FMVSS210 / FMVSS201 / Low speed FMVSS202a / ...

Safety : Front crash / Rear crash / Luggage impact / Low speed Whiplash / ...

Functional : Static & Dynamic comfort / Mechanical resistance / Misuse / Climate ageing / Cycling / Vibration ageing / Squeak & Rattles / ...

Red = simulable by FEA



Different materials behaviors : Steels / Foams / Plastics

Different modeling scales : seat frame / seat mechanisms

Integration of restraint systems

Integration of dummies

Main OEMs expectations

Cheaper products :

- More Product & Process desi
- Lower engineering costs (

Shorter development ti

Lighter parts

More product requi

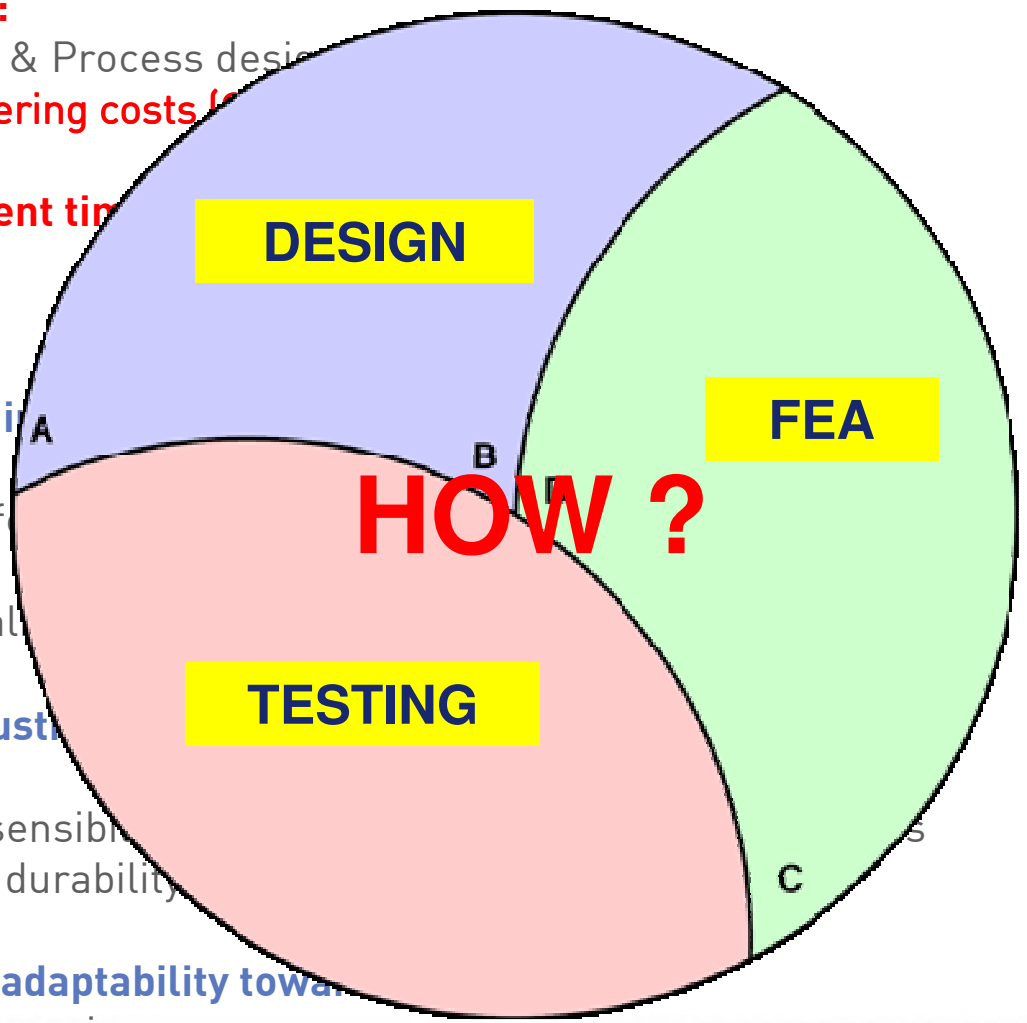
- Regulations
- Occupants saf
- Comfort
- Perceived qual

More quality / robust

- Less PPM
- Low product sensibi
- More product durabilit

Higher reactivity / adaptability towa

- More product versions
- More changes on styling / specifications / functions during development



Our 5 Validation Fundamentals (VALIDATION = FEA + TEST)

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Focus FEA/Test pilots on results analysis & product design

High integration and involvement of FEA/Test pilots into R&D projects

Use Innovative + Robust + Lean FEA/Test standards

High interaction between FEA and TESTING

Use FEA as an upfront design tool (CAE ➔ CAD)

From our 5 Validation Fundamentals to our Validation roadmap

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Validation on projects

- FEA/Test Pilots organization
- Pilots skills development
- Validation tools
- Project KPIs

Lab operations

- Labs equipments
- Labs quality system
- Standard test methods
- OEMs lab certifications
- Measurements uncertainties
- Lean testing

FEA operations

- FEA equipments
- OEMs FEA certifications
- Advanced FEA T&M
- FEA LCC
- FEA quality system

From our 5 Validation Fundamentals to our Validation roadmap

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FEA and TEST people integration on R&D projects
Previous organization

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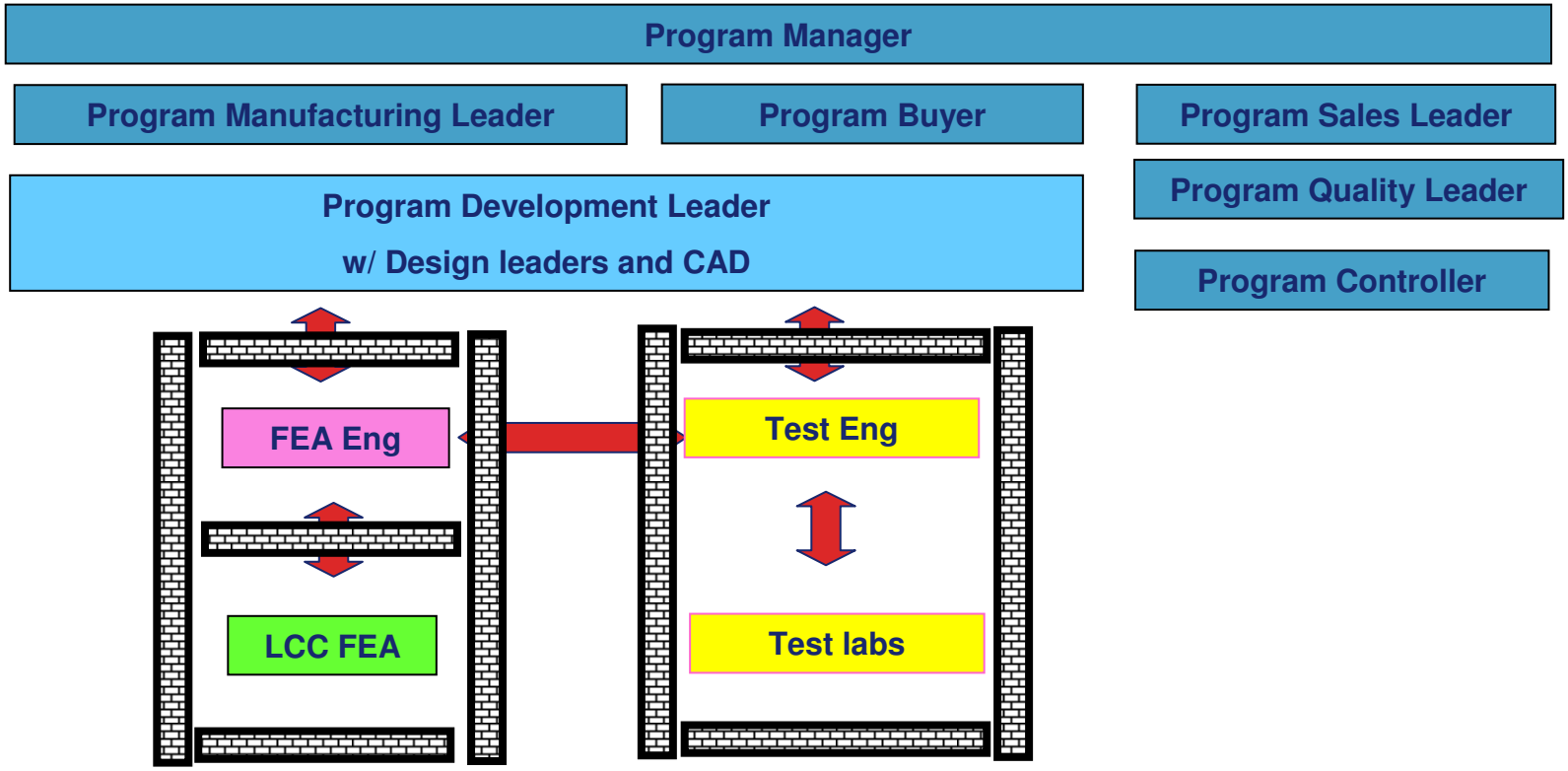

Working modes:

- FEA Eng = FEA results provider
- Test Eng = Test results provider
- LCC FEA = meshing/models provider
- FEA/Test managed by 1 “non expert” leader

Consequences :

- Low motivation of FEA/Test Eng in project
- FEA used as validation tool ➔ more CAD cost
- High risk of bad FEA/Test correlations
- Low FEA/Test interaction ➔ no cost optimization

Organizational chart
FAS R&D / Validation Department

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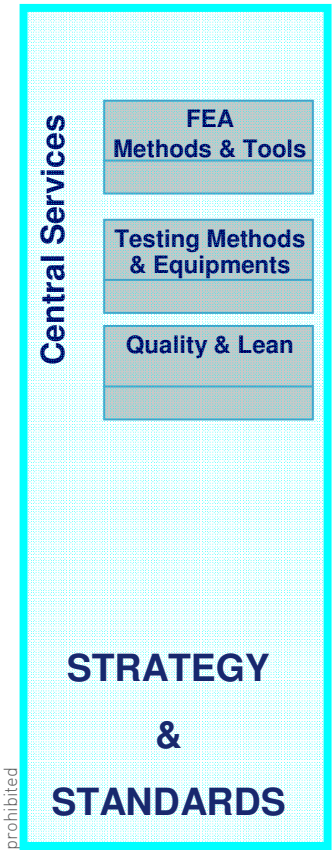

DELIVER INNOVATIVE + ROBUST + LEAN FEA and TEST STANDARDS

Organizational chart
FAS R&D / Validation Department

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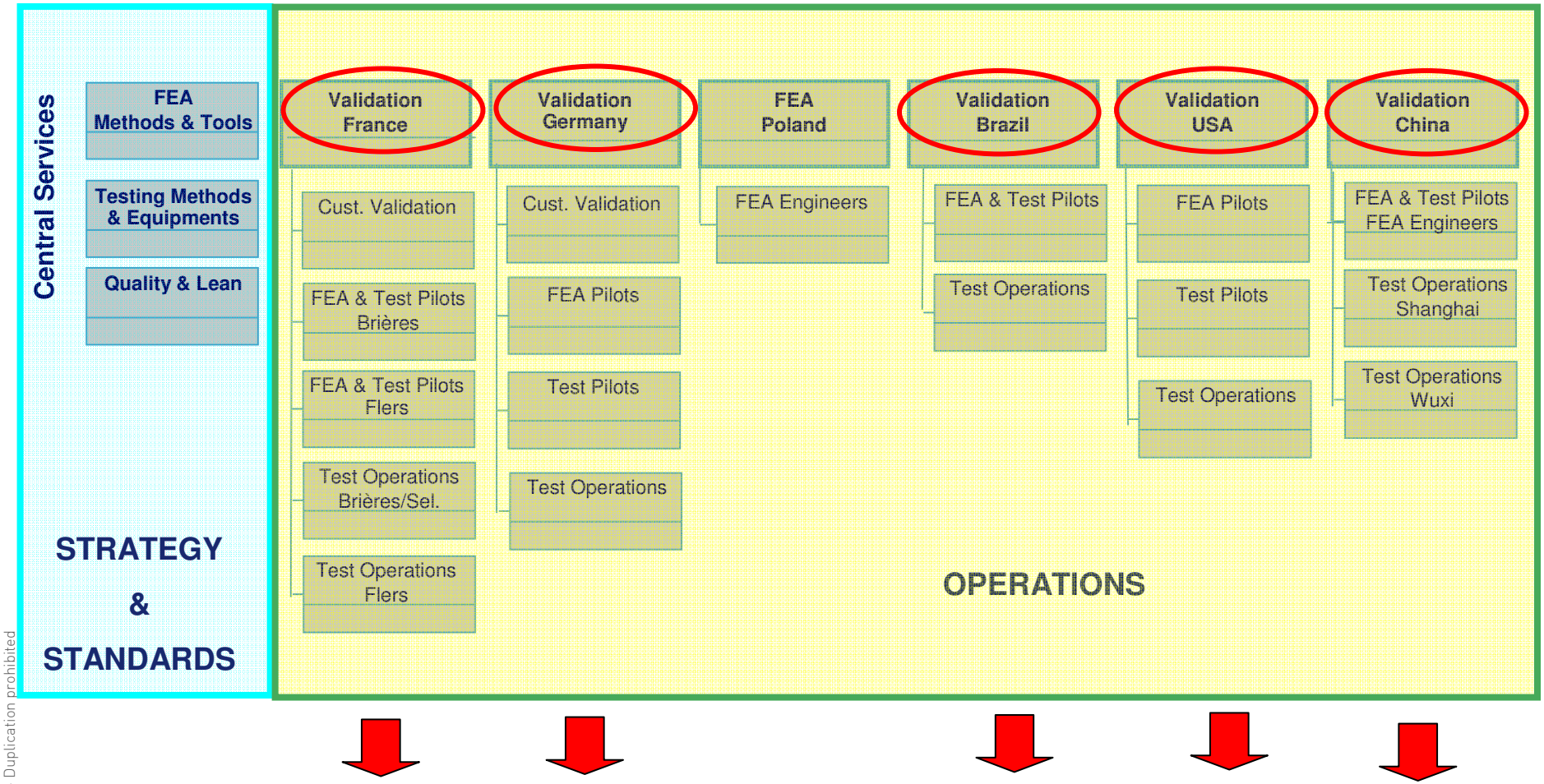

APPLICATION OF FEA and TEST STANDARDS ON PROJECTS

FEA + TEST PEOPLE IN 1 DEPARTMENT ➔ 1 UNIQUE MANAGER

Organizational chart
FAS R&D / Validation Department

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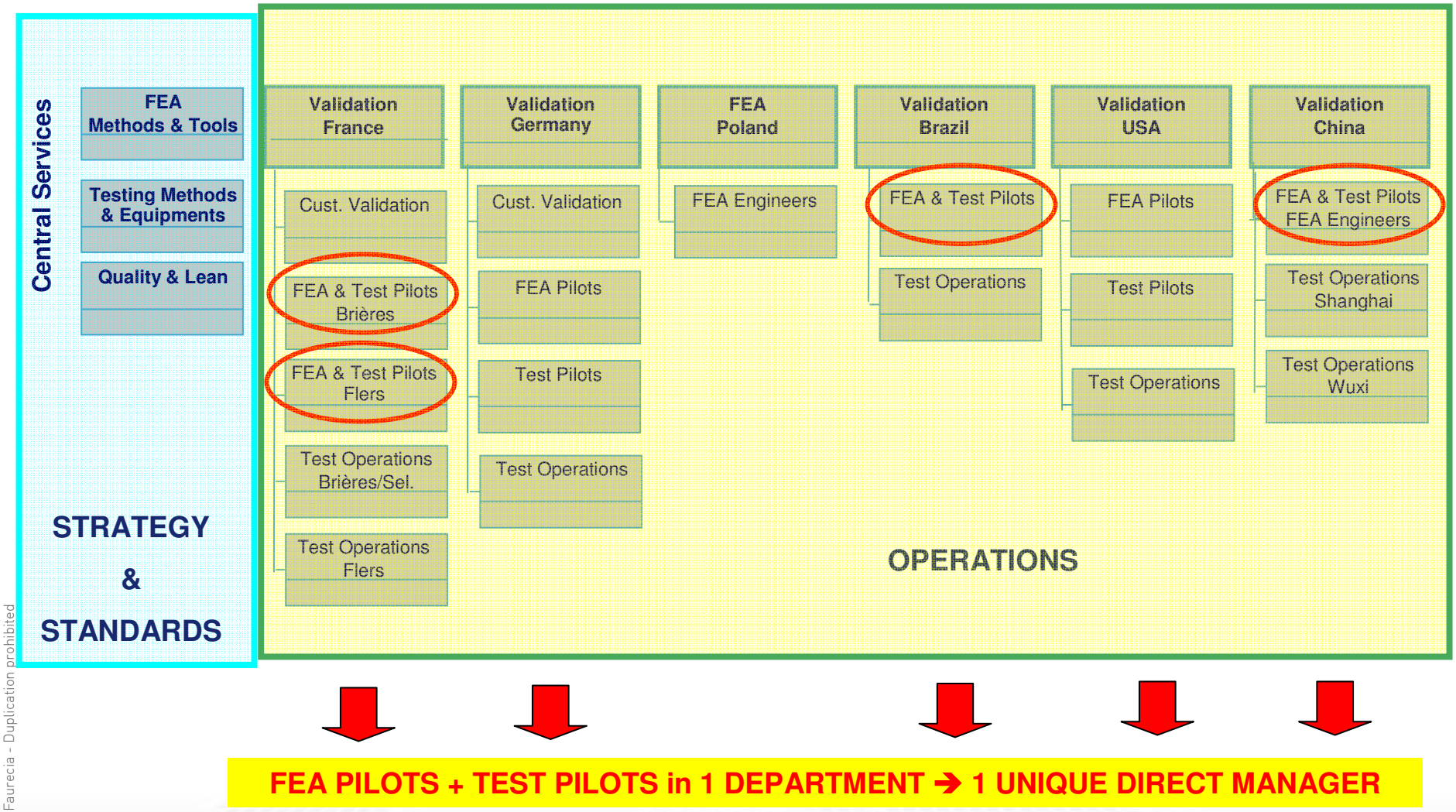
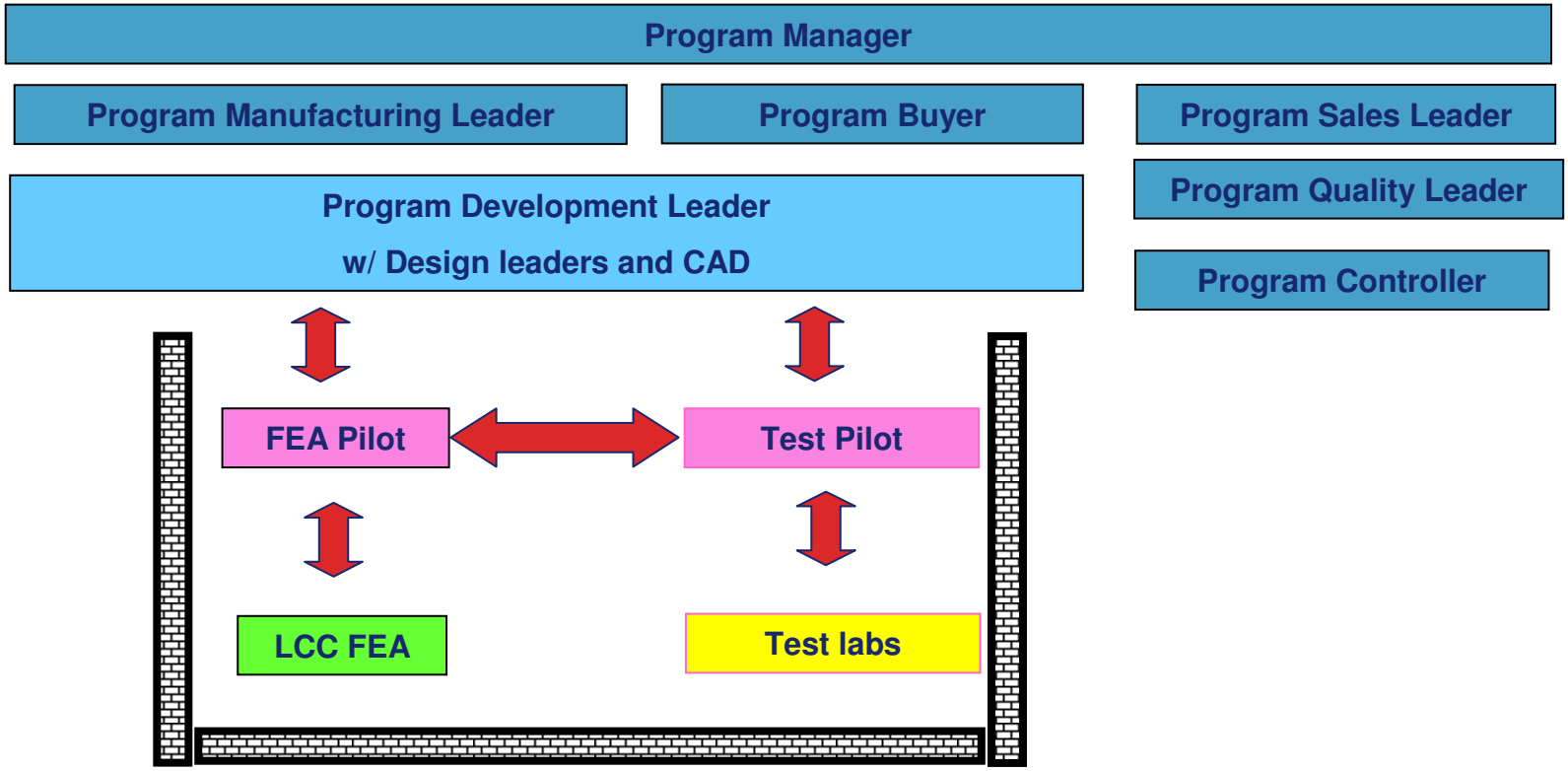


FEA PILOTS + TEST PILOTS in 1 DEPARTMENT ➔ 1 UNIQUE DIRECT MANAGER

Pilots integration on R&D projects
Current organization



Working modes:

- FEA Pilot = Design by FEA engineer
- Test Pilot = Design by Test engineer
- LCC FEA = FEA Calculations & Analysis provider
- FEA/TEST managed by 2 expert engineers

Consequences :

- High motivation of FEA/Test Pilots in project
- FEA used as design tool ➔ less CAD cost
- Low risk of bad FEA/Test correlations
- High FEA/Test interaction ➔ cost optimization

Pilots integration on R&D projects
Best organization

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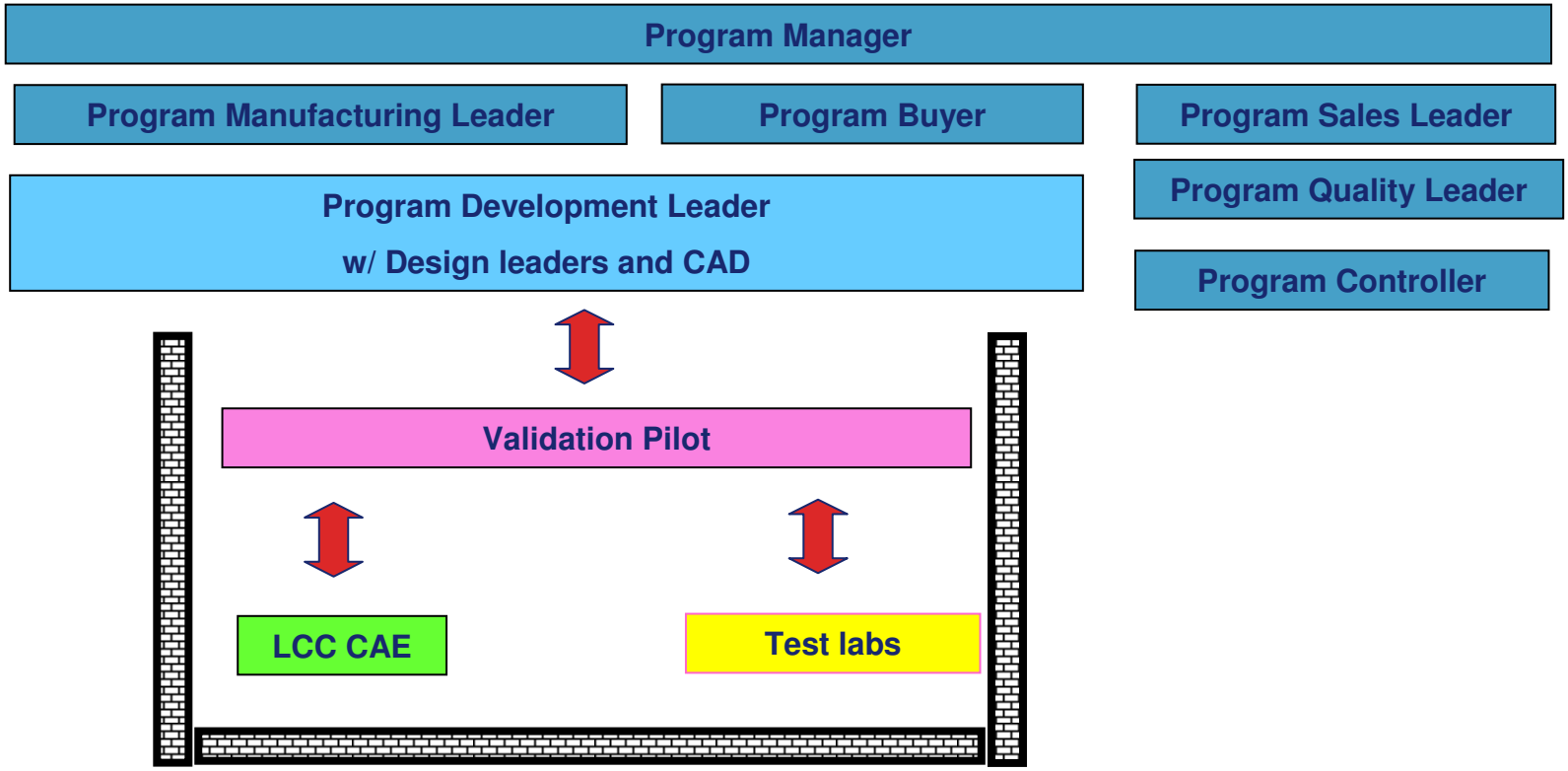

Working modes:

•Validation Pilot = Design by FEA/Test engineer

• LCC FEA = FEA Analysis & Design solutions provider

•FEA/TEST managed by 1 expert engineer

Consequences :

•High motivation of FEA/Test Pilots in project

•FEA used as design tool ➔ less CAD cost

•No risk of bad FEA/Test correlations

• Automatic FEA/Test interaction ➔ cost optimization

FEA LCC
What the FEA HCC think about FEA LCC ?

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Need long email or powerpoint to explain my FEA request

Don't understand my FEA request

Pure FEA provider, no support on my design issues

Not reactive, quicker if done by myself

Their FEA skill is too weak, why should I train them ?

FEA PILOT (HCC)

Quality is low

THEY ARE TAKING MY JOB !

FEA LCC
What the FEA LCC think about FEA HCC ?

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Always pressing me by giving short deadlines

Not able to formalize a clear FEA request

Need long email or powerpoint to ask details on FEA request

Give me only basic FEA operations : no results analysis, no design proposal

Don't want to give me more data on the project

FEA LCC Engineer (HCC)

Think I am not as skilled in FEA as him

WHY SHOULD I BE MORE PROACTIVE OR MOTIVATED ?

LCC FEA
HCC/LCC FEA new organization

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1 Validation Pilot (HCC)

STANDARD FEA TOOLS & METHODS
1 standard for FEA hardware & softwares
1 FEA quality system w/ internal audits
1 worldwide FEA database (dummies, raw materials, weldings, screws...)
1 efficient shared desktop tool
1 library of FEA training modules

Dedicated FEA Engineers (LCC)

(Calculations / Analysis / Design)

FEA Pool (LCC)

(Meshing / Model preparation)

PILOT MISSION :
- By using FEA & Testing, to design a robust product compliant with all requirements (specifications, regulations, weight, cost, ...)
- To minimize the prototyping and testing costs.

PILOT FOCUS :
- FEA and test results analysis
- Find design solutions by relaunching FEA or testing
- Communication w/ project team and customer

CONSEQUENCES for PILOT :
- Need to outsource more key FEA tasks to LCC
- Need to get full involvement in his project
- Need to get full proactivity on design

➔Permanent communication
(goals, issues, decisions, OEM feedback...)
is KEY SUCCESS FACTOR

LCC FEA
HCC/LCC FEA new organization

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RESULT = WIN / WIN between FEA HCC and LCC engineers

Significant increase of key competencies :

- Pilots : product design, project management, leadership, communication, negotiation, customer relations management…
- FEA LCC engineers : FEA analysis, product design,…

Higher project involvement and design proactivity

Less resignations and people turnover in LCC

Increase of LCC FEA on HCC projects ➔ X m€ dev. cost saving !

HCC pilots satisfaction on LCC FEA LCC engineers :

57% meet expectations
+ 25% above expectations
= 82% positive expectations

From our 5 Validation Fundamentals to our Validation roadmap

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Validation on projects

- FEA/Test Pilots organization
- Pilots skills development
- Validation tools
- Project KPIs

Lab operations

- Labs equipments
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FEA operations

- FEA equipments
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- Advanced FEA T&M
- FEA LCC
- FEA quality system

Pilots skills development

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Targets :

- to help integration of new people
- to assess and manage skills
- to help present people mobility
- to standardize and improve skills of present people
- to capture / structure / redeploy knowledge + know how + best practices

Specific trainings modules :

FEA operations	Product performances
Testing operations	Product & Process design
Validation leading	Soft skills

Pilots skills development

A. FEA Operations	
TA1	Overview and basics on FEA
TA2	Faurecia FEA environment & tools
TA3	Faurecia FEA quality system
TA4	Faurecia FEA standards
TA5	Hyperworks
TA6	LS-Dyna
TA7	Abaqus (Case by case if requested)
TA8	Materials Modeling
TA9	Weldings & Fasteners Modeling
TA10	Mapping tools
TA11	Correlation process & tools

B. Testing operations	
TB1	Overview and basics on Testing
TB2	Faurecia testing standards
TB3	Test practice
TB4	Test uncertainties

C. Validation operations leading	
TC1	Leading FEA on projects
TC2	Leading Testing on projects
TC3	Statistics and DOE

Pilots skills development

D. Product Performances	
TD1	Safety
TD2	Regulations
TD3	Comfort
TD4	Functions
TD5	Perceived quality (if requested)

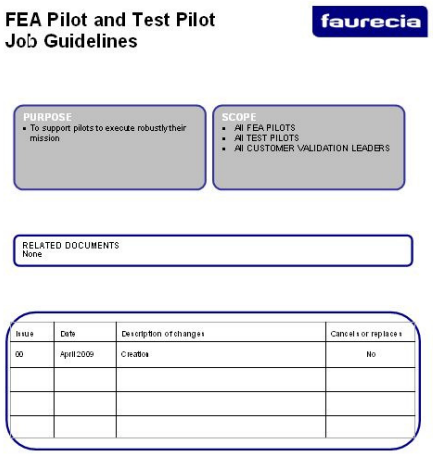
E. Product & Process Design	
TE1	Frame products
TE2	Mechanism products
TE3	Seating Components
TE4	Seating systems, interfaces & modularity
TE5	Steel materials
TE6	Foam materials
TE7	Plastic materials
TE8	Manufacturing

Soft skills	
NT1	English
NT2	Rigour & disciplin
NT3	Communication
NT4	International ability
NT5	Leadership
NT6	Teamwork
NT7	Business sense

Pilots skills development

Key document = "FEA Pilot & Test Pilot" job guidelines :

- To help pilots to run their job
- To help integration and training of new pilots
- To improve rigor and discipline in work execution
- To standardize validation actions & deliverables on all projects
- To increase robustness of our products development
- To help projects follow up and review by management



FEA Pilot and Test Pilot
Job Guidelines

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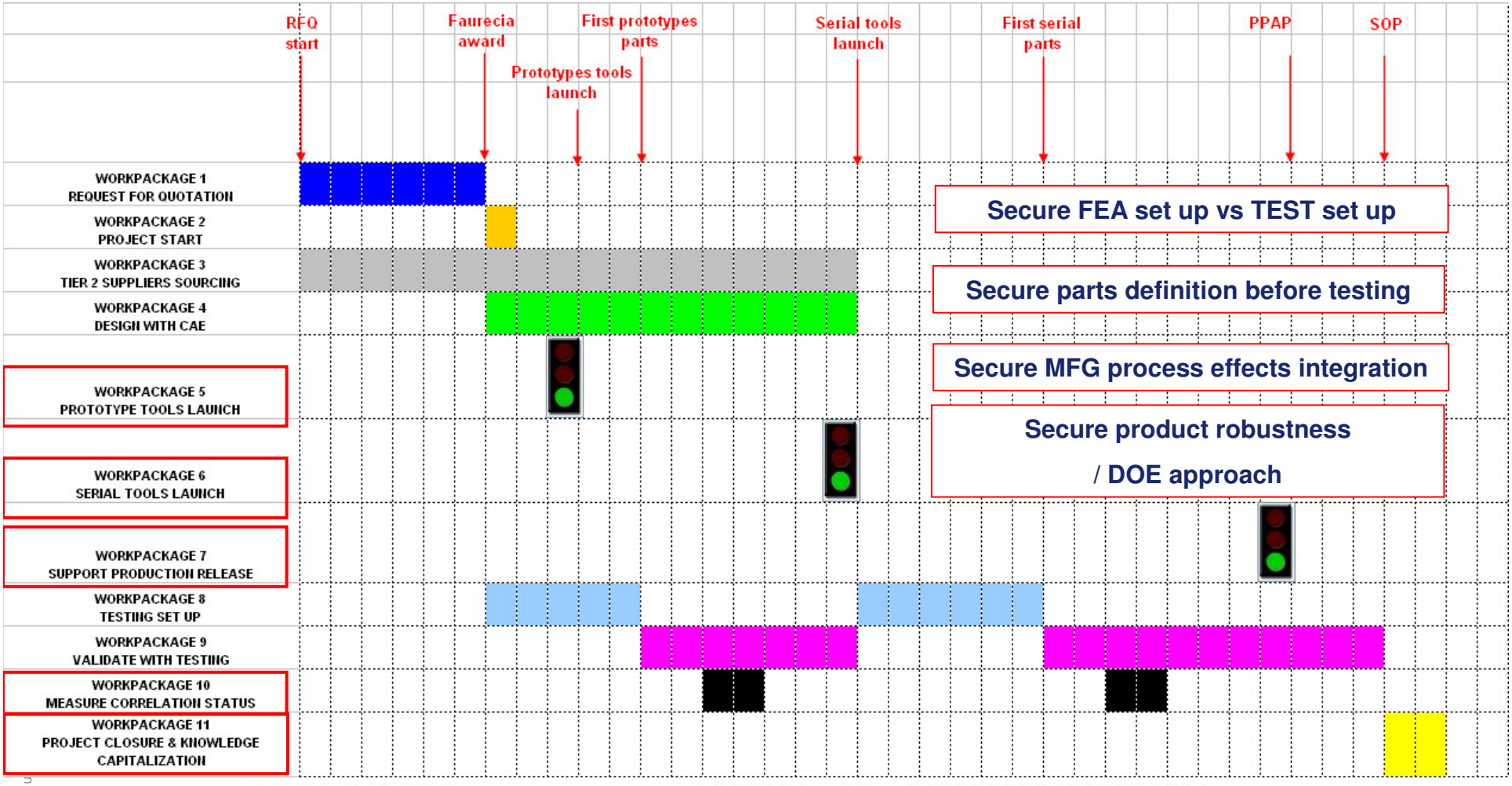
PURPOSE
- To support pilots to execute robustly their mission

SCOPE
- All FEA PILOTS
- All TEST PILOTS
- All CUSTOMER VALIDATION LEADERS

RELATED DOCUMENTS
None

Issue	Date	Description of changes	Cancels or replaces
00	April 2009	Creation	No

Pilots skills development



From our 5 Validation Fundamentals to our Validation roadmap

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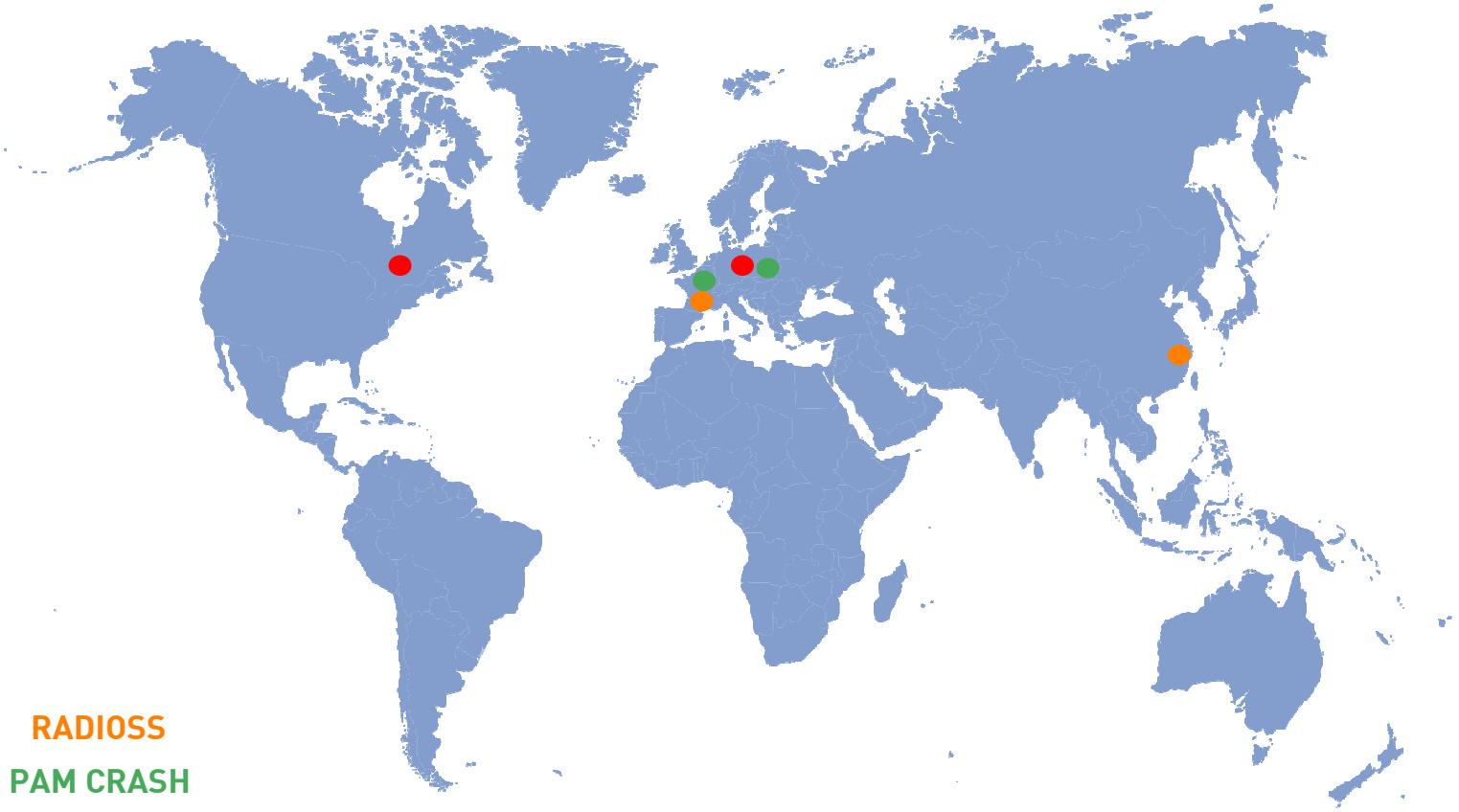
FEA operations

- FEA equipments
- OEMs FEA certifications
- Advanced FEA T&M
- FEA LCC
- FEA quality system

FEA softwares strategy
2008 status



RADIOSS

PAM CRASH

LS DYNA

How to deliver the same FEA quality for all customers on all projects ?

How to reduce cost to get best FEA quality ?

FEA softwares strategy
2008 status

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Consequences for faurecia :

- Significant cost to maintain competencies on all softwares
- Difficulties to manage differences in FEA results because softwares
- FEA pilots spend more time in FEA issues than design products
- No standardization FEA tools & methods & databases
- No optimization of softwares licenses costs
- Difficulties to capitalize correlations and best/bad practices
- High cost to develop and deploy new advanced FEA
- Inefficiencies to share and exchange FEA models between products
- High cost to integrate new collaborators
- High training cost
- Less headcount flexibility between projects and sites
- ...

Consequences for customers :

- Able to integrate directly faurecia FEA models
- But not the best FEA models from faurecia

FEA softwares strategy Since 2009

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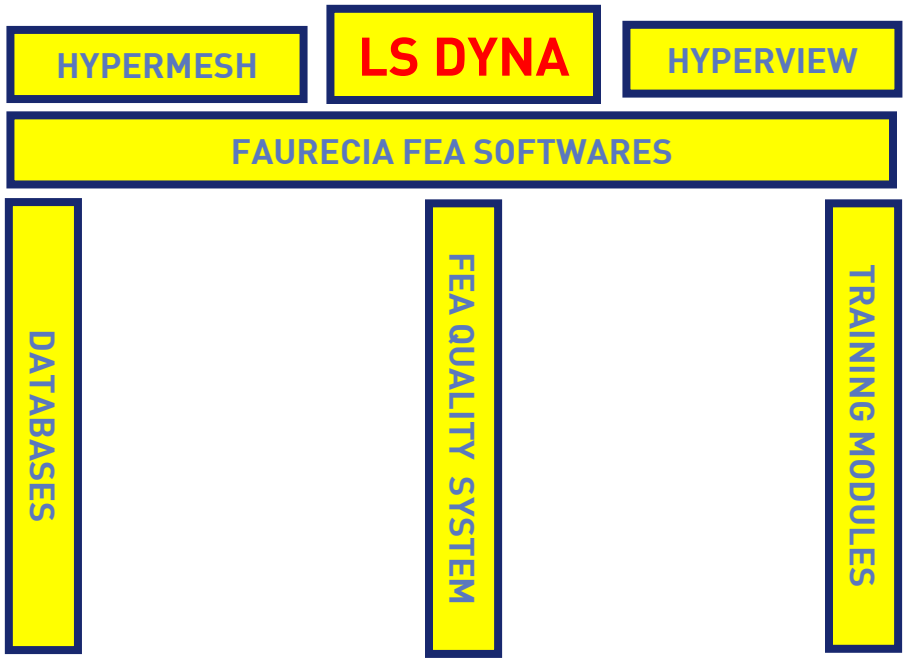
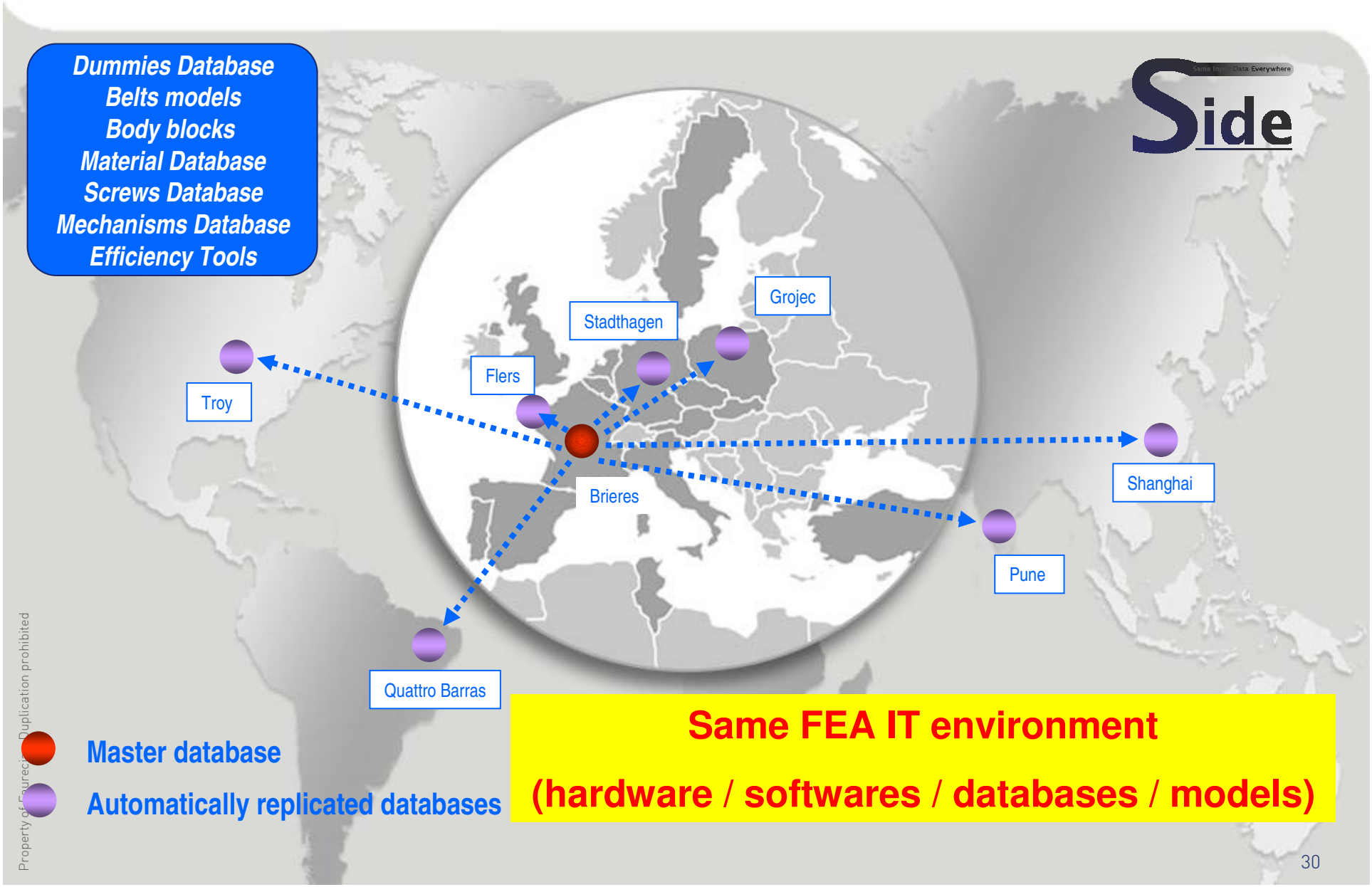
1 WORLDWIDE STANDARD FEA SYSTEM



Key benefits :

- Same FEA Quality for all customers on all projects
- Huge possibilities for standardization / knowledge capitalization / FEA improvements
- Costs reductions :
  - Training : -60%
  - Licences : -33%

FEA softwares strategy
Since 2009



FEA softwares strategy
Interface w/ customers

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TRANSPARENCY and TRUST

Faurecia :

- Uses its FEA system and is responsible of its results
- Is responsible to design a seat compliant w/ specifications
- Delivers FEA models compliant w/ customer requirements @ key project milestones
- Provides support for models conversion
- But can not be responsible of differences in FEA results between softwares
- Organizes regular exchanges w/ customers to share FEA best practices
- Develops a policy of OEM FEA certifications

FEA softwares strategy
FEA OEM certifications

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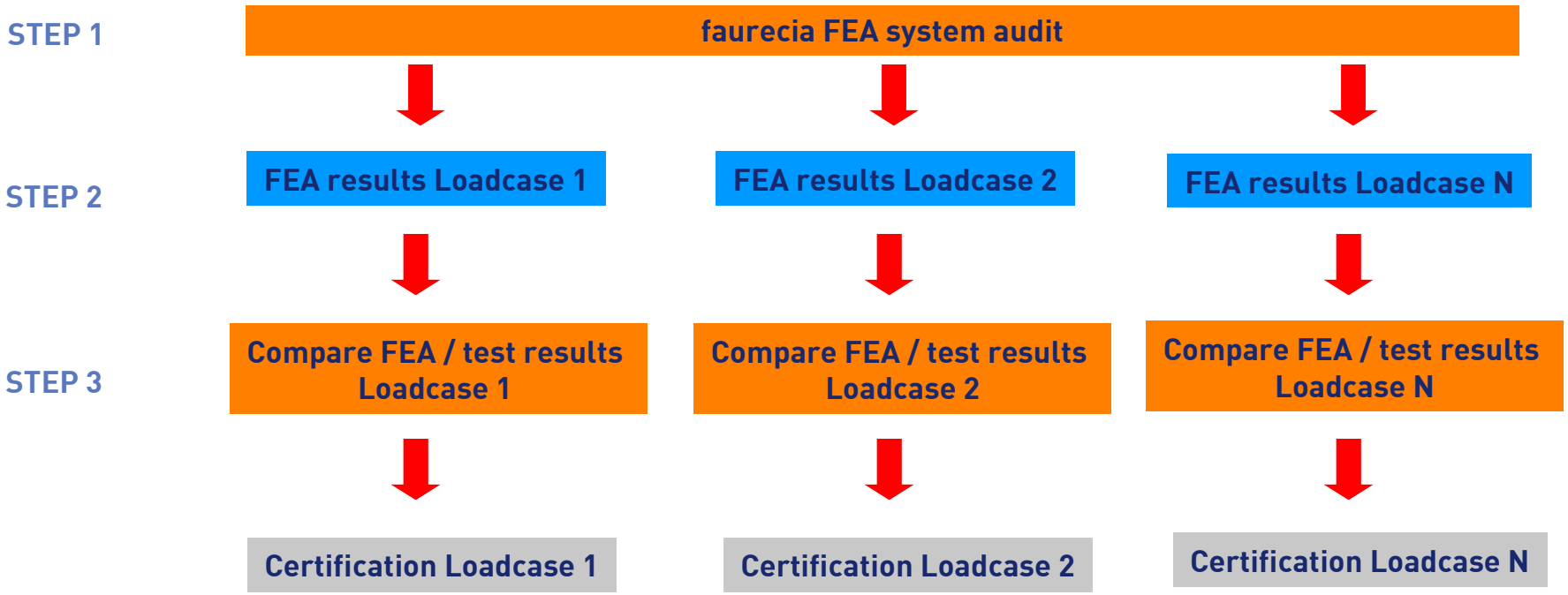
Process = AUDIT + BLIND TEST



FEA softwares strategy
FEA OEM certifications

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Faurecia benefits :

- Strong competence recognition
- Reduce sterile discussions about FEA results robustness
- More responsibilities on FEA results

OEM benefits:

- Deep knowledge of faurecia FEA robustnesss
- Sort suppliers on FEA robustness
- Reduce FEA cost by not remaking FEA already done faurecia

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Standard test methods

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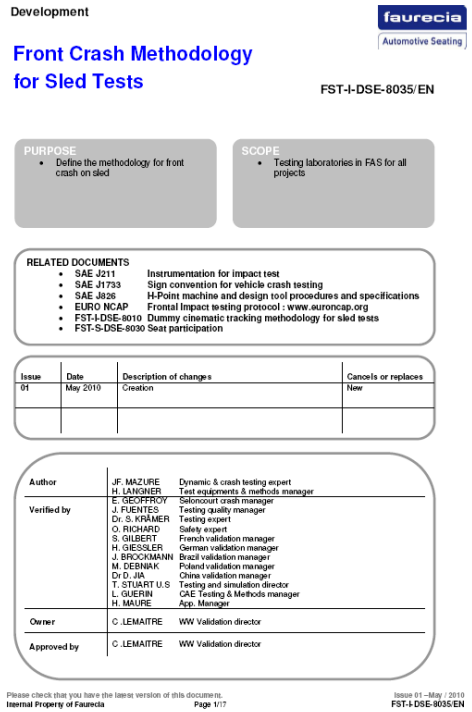
Objectives :

- To standardize execution of testing between labs
  - Same reading and understanding of OEMs specifications & regulations
  - Same test set up and measurements set up
  - Same testing execution
  - Same quality of testing deliveries
  - Same best practices
- To reduce test results variability & uncertainty
- To help people learning and integration
- To improve test methods by capitalizing knowledge & experiences



Development

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Front Crash Methodology for Sled Tests

FST-I-DSE-8035/EN

PURPOSE
- Define the methodology for front crash on sled

SCOPE
- Testing laboratories in FAS for all projects

RELATED DOCUMENTS

SAE J211	Instrumentation for impact test
SAE J1733	Sign convention for vehicle crash testing
SAE J826	H-Point machine and design tool procedures and specifications
EURO NCAP	Frontal Impact testing protocol : www.eurocap.org
FST-I-DSE-8010	Dummy cinematic tracking methodology for sled tests
FST-S-DSE-8030	Seat participation

Issue	Date	Description of changes	Cancels or replaces
01	May 2010	Creation	New

Author	JF. MAZURE	Dynamic & crash testing expert
	H. LANGNER	Test equipments & methods manager
Verified by	E. GEOFFROY	Seloncourt crash manager
	J. FUENTES	Testing quality manager
	Dr. S. KRÄMER	Testing expert
	O. RICHARD	Safety expert
	S. GILBERT	French validation manager
	H. GIESSLER	German validation manager
	J. BROCKMANN	Brazil validation manager
	M. DEBNIAK	Poland validation manager
	Dr D. JIA	China validation manager
	T. STUART U.S	Testing and simulation director
	L. GUERIN	CAE Testing & Methods manager
	H. MAURE	App. Manager
Owner	C .LEMAITRE	WW Validation director
Approved by	C .LEMAITRE	WW Validation director

Please check that you have the latest version of this document. Issue 01 – May / 2010
Internal Property of Faurecia Page 1/17 FST-I-DSE-8035/EN

Standardization process = TEAM WORK

Testing experts

FEA Tools & Methods team

Product performances experts

Standard test methods

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Test method content :

- Faurecia test method = default method :
  - Recommended equipments
  - Test preparation and set up
  - Measurements preparation and set up
  - Checklists before, during, after testing
- Specificities by OEM
- 3 quality levels :
  - Test for FEA correlation
  - Application test
  - COP test
- Technical internal audits to control application standard test methods

	Available
Standard test methods	Front crash Rear crash Whiplash & FMVSS208 ECE 14 & FMVSS210 HRMD Squeak & Rattles ECE 17 backrest ECE 17 headrest ECE 17 luggage Luggage crash Maximum recliner torque 45/15 Acoustic measurements Vibration durability Modal analysis Egress/Ingress

FEA Quality System

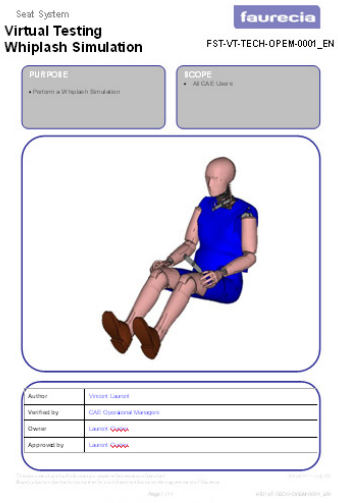
1 Worldwide FEA quality system

Objectives :

- To facilitate people learning & integration
- To standardize FEA know how / processes / best practices
- To reduce results variability induced by FEA people
- To secure quality of FEA deliveries and design decisions
- To improve correlations between FEA & Test results
- To improve FEA quality by capitalizing knowledge & experiences

Tools :

- Documents :
  - FEA guidelines
  - Standard FEA method
- Technical internal audits to control application of FEA quality system



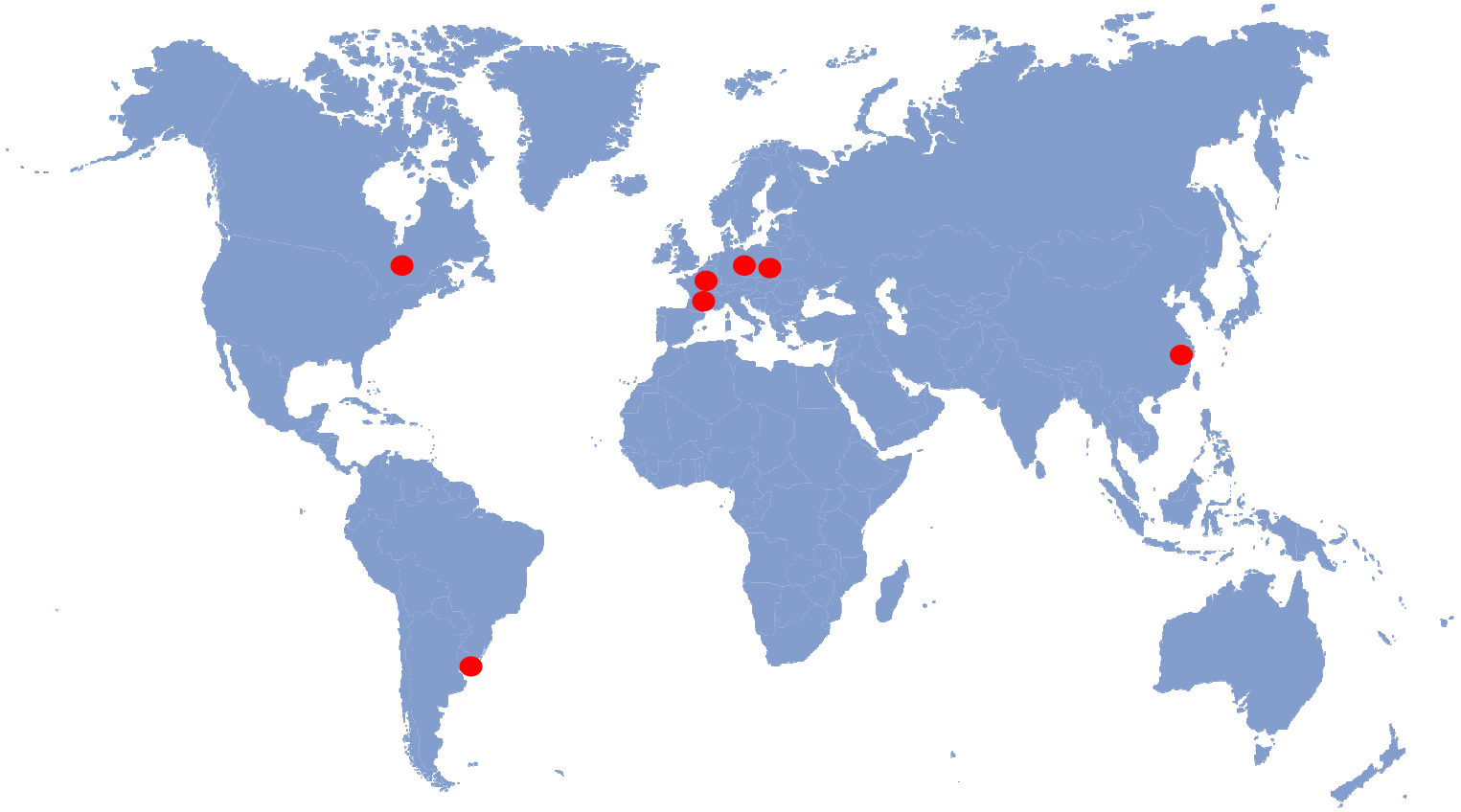
FEA Quality System

FEA Quality docs :

	Available
Guidelines	LS Dyna core guidelines FEA audit process FEA LCC outsourcing process FEA report Correlation process DOE process ...
FEA method	Front crash & Rear crash Whiplash & FMVSS208 ECE 14 & FMVSS210 H point and HRMD ECE 17 backrest ECE 17 headrest Static comfort and pressure mapping ...

Standard FEA method prerequisite = Standard Test method !

FEA quality sytem + Standard test methods



1 QUALITY SYSTEM → SAME FEA/TEST RESULTS BETWEEN R&D CENTERS

Conclusions

Mindset change of R&D people

Huge steps towards FEA & Testing standardization

Same FEA / Test results and services between R&D centers

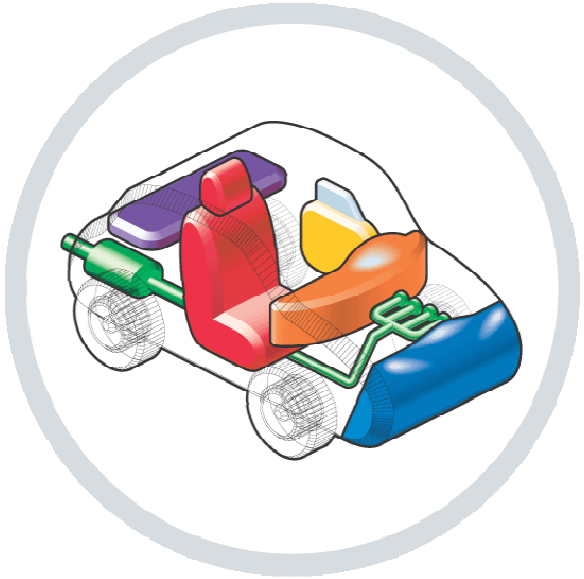
Very positive feedback from project teams and customers

Our original approach needs talented people… join faurecia !

Significant testing costs reduction… for evidences join 8th European LS-DYNA Users Conference, 23rd-24th May 2011, Strasbourg, France

THANK YOU

FOR YOUR LISTENING !



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Technical perfection, automotive passion.