Using the Real Data: Improving Product Reliability of automotive sunroof systems

HI Reliability seminar - October 14th, 2021

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- > What are the **challenges** within automotive sunroof development?
- When is a design and assembly process reliable?
- How does Inalfa improve its products using Real Data?
- > Outlook, what could we do more in the future?





Company profile – Inalfa Roof Systems



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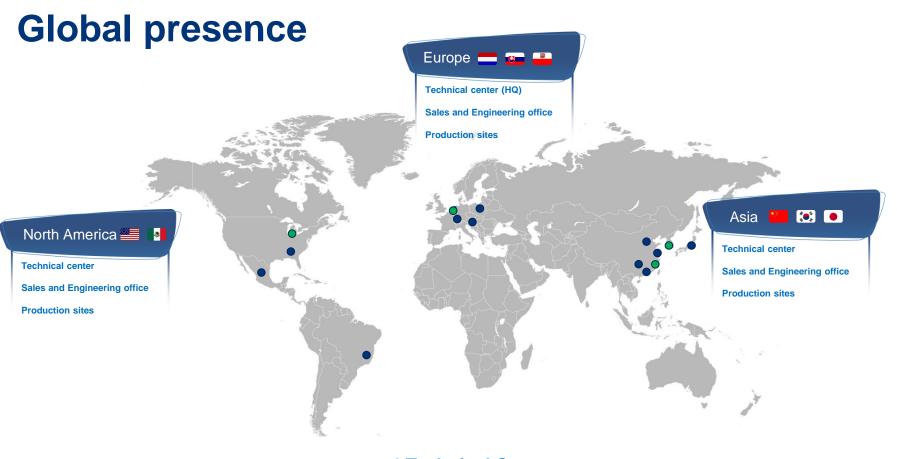


First Tier automotive supplier of roof systems to all premium OEM's

One of the three independent **<u>Global Players</u>**

Headquartered in Venray, the Netherlands





• 4 Technical Centers

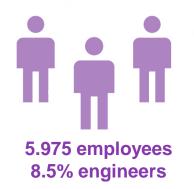
15 Production locations worldwide





oof systems

Key figures 2020





5.5 mio roofs & EUR 1,2 bio turnover



over 40 brands and **120 running projects**



790 life patents EUR 60 mio R&D





What are the challenges within automotive sunroof development?



Product portfolio





Exploded view of a sunroof system

Main **<u>sub systems</u>**:

- Frame
- Sun blind
- Mechanism
- Mechatronics
- Glazing
- Wind deflector







Product complexity

Road and vehicle conditions



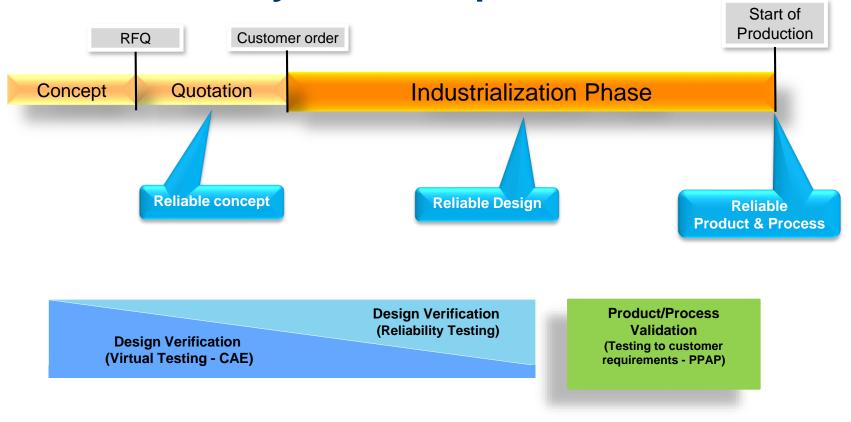




When is a design and assembly process reliable?



Product Reliability: DV & PV phases





VALIDATION (DV) CAE / FEA

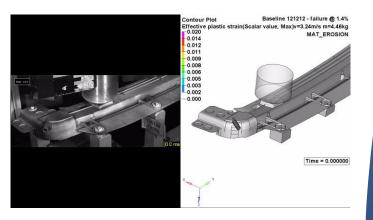


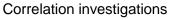
- Design optimization
 - Topology optimization

- Seal simulation
- Manufacturing simulations
 - Mold flow
 - Metal forming
- Design Verification
 - Frontal/rear/side impact
 - Push-out
 - Ball drop
 - Aerodynamic load
 - Vibration load (fatigue)

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- Natural frequency
- Modal analysis

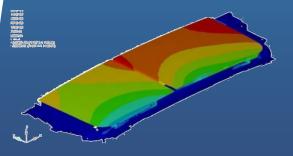












VALIDATION (DV + PV) TESTING





Environmental conditions



Acoustic performance



Vibration and endurance - Fatigue



Impact



Wind load simulation



Sun simulation



Water



How does Inalfa improve its products using Real Data?



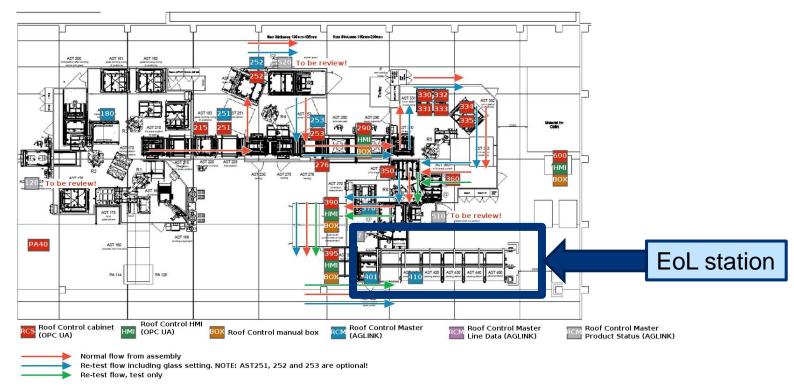
What kind of data do we collect?

1. Product data from End Of Line stations in production lines

2. Issue management system: Problem solving & Lessons Learned <u>data</u>



Example 1: data collection @ production Layout of a sunroof assembly line







Data collection in the EoL station



Objective 1

Secure the product quality as agreed with the customer

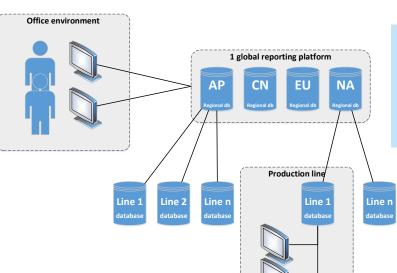
Objective 2

Data analysis / find trends Indicator/signal for:

- Geometrical changes
- Wear of tooling
- Process quality
- Variation of noise

Future objective: Artificial Intelligence? Develop an algorithm for a self learning End Of Line station

E.g. which noises we don't know yet, could be detected?



Data acquisition

- 1. Current
- 2. Anti trap forces
- 3. Noise (vibration)
- 4. Glass panel setting



Example 2: Issue management system



Inalfa LESSON LEARNED Management System

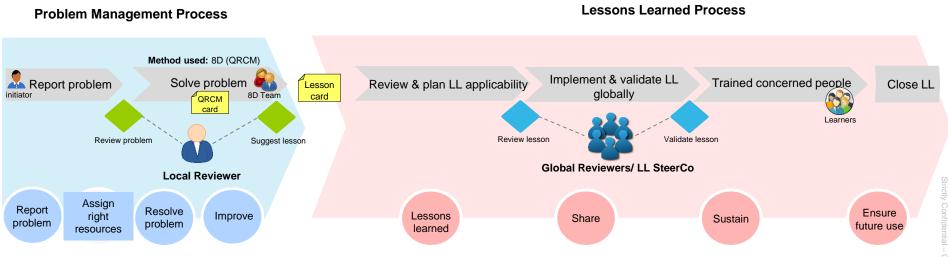
Our determination to learn and execute creates the difference

LLMS is a business tool that enables Inalfa to learn from our mistakes and achievements. The system will help you to solve the problem in a structured way and share your learnings with your colleagues, supported with right governance.



Governance of the Lessons Learned Management System (LLMS)





LL: Lessons Learned

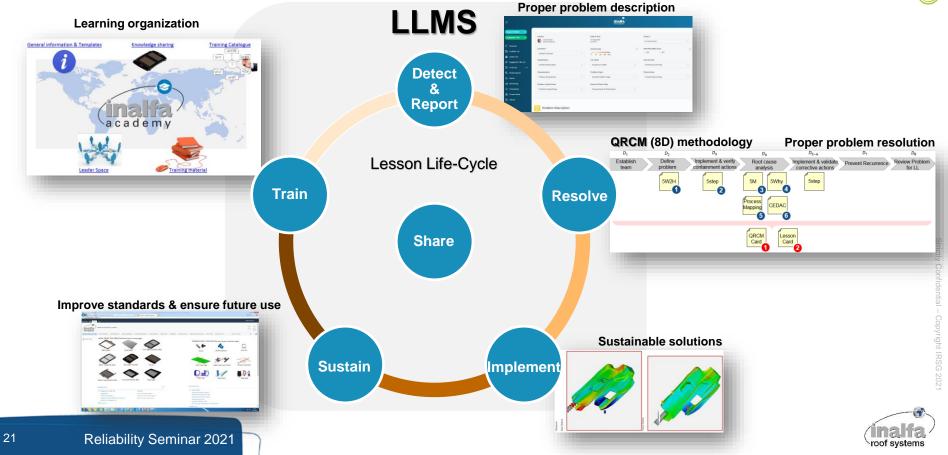
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Lesson Life Cycle

Problem solving & Lessons Learned data







Outlook: What can we do more?



Future: More data, better products...

Collect Validation (test) data

- Laboratory Information Management System (LIMS)

Collect data from the field (End-users)

- Climatic conditions
- Vibration profiles
- Number of times roof operation by end-user









Thank you for your attention.





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