

ICAS Biennial Workshop 2015

Krakow (Poland), 31/08/2015

Electrical Systems Engineering & Integration in AIRBUS

Presented by

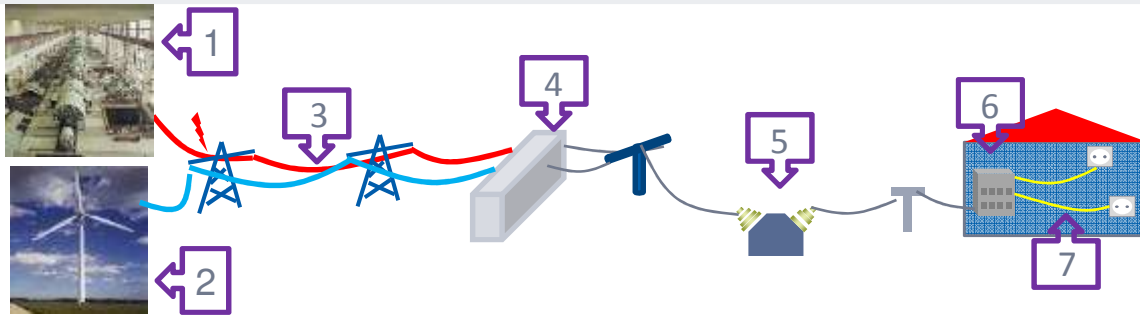
Stefan ROEMELT

Vice President - Head of
Avionics Platforms & Electrical Systems
Airbus Operations S.A.S. - Toulouse

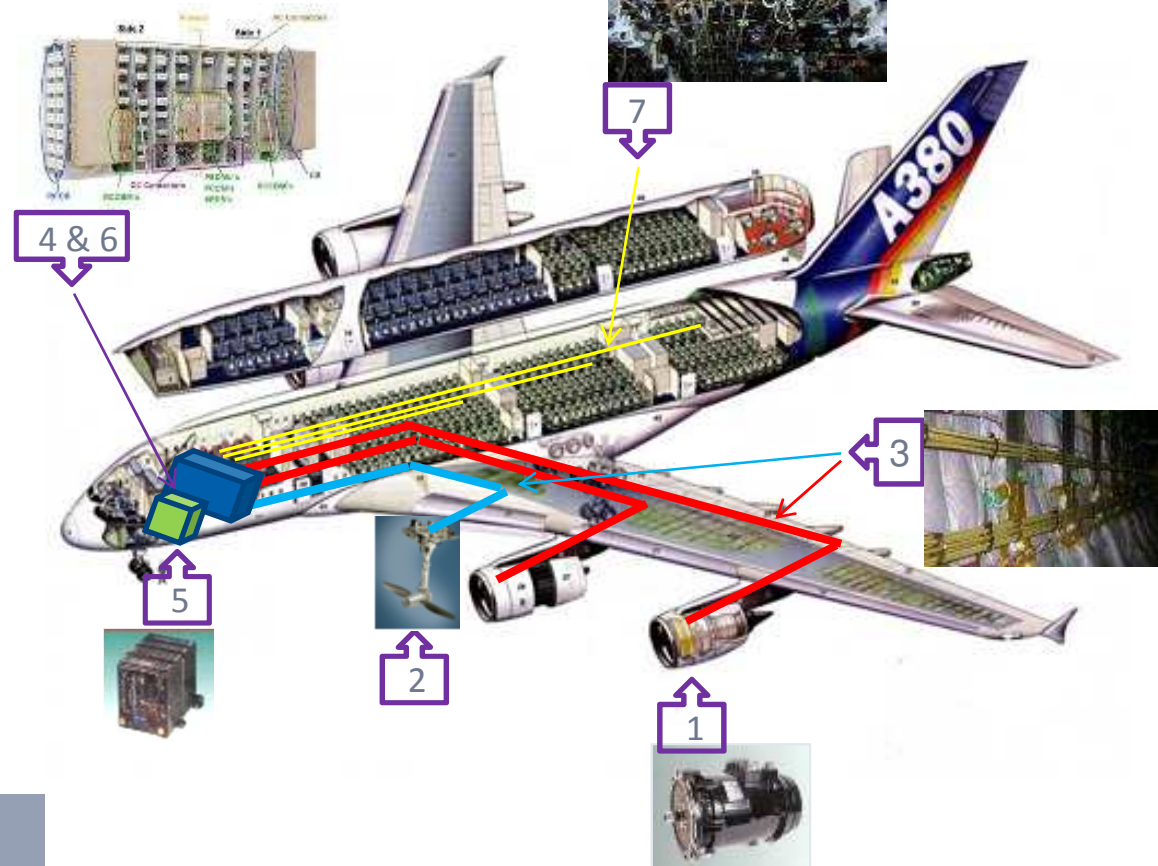
Content

- Electrical System Architecture
- Development Process
- Functional Integration
- Physical Integration
- Electrical Structure Network (ESN)
- Future Trends

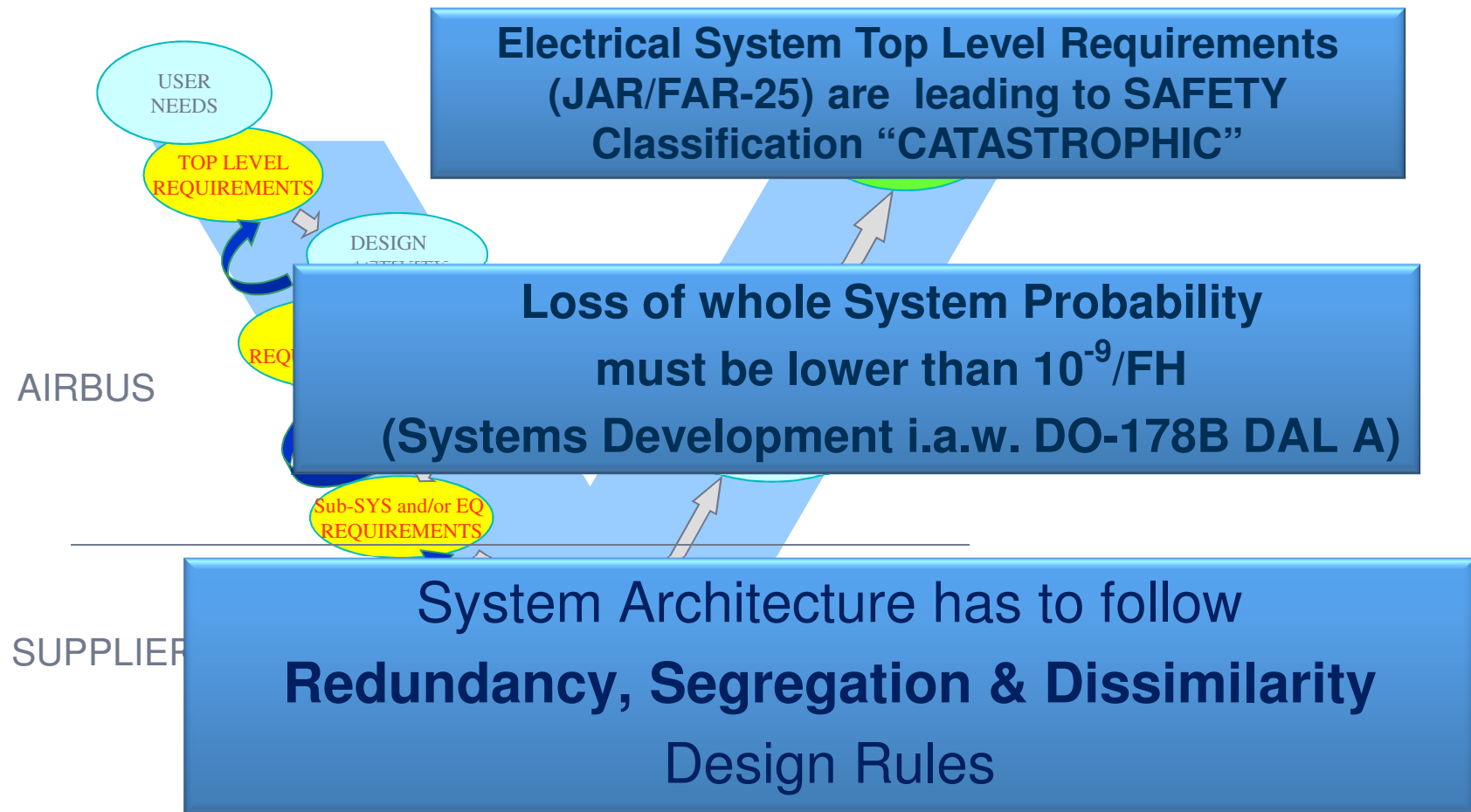
Electrical System Principles (Generation & Distribution)



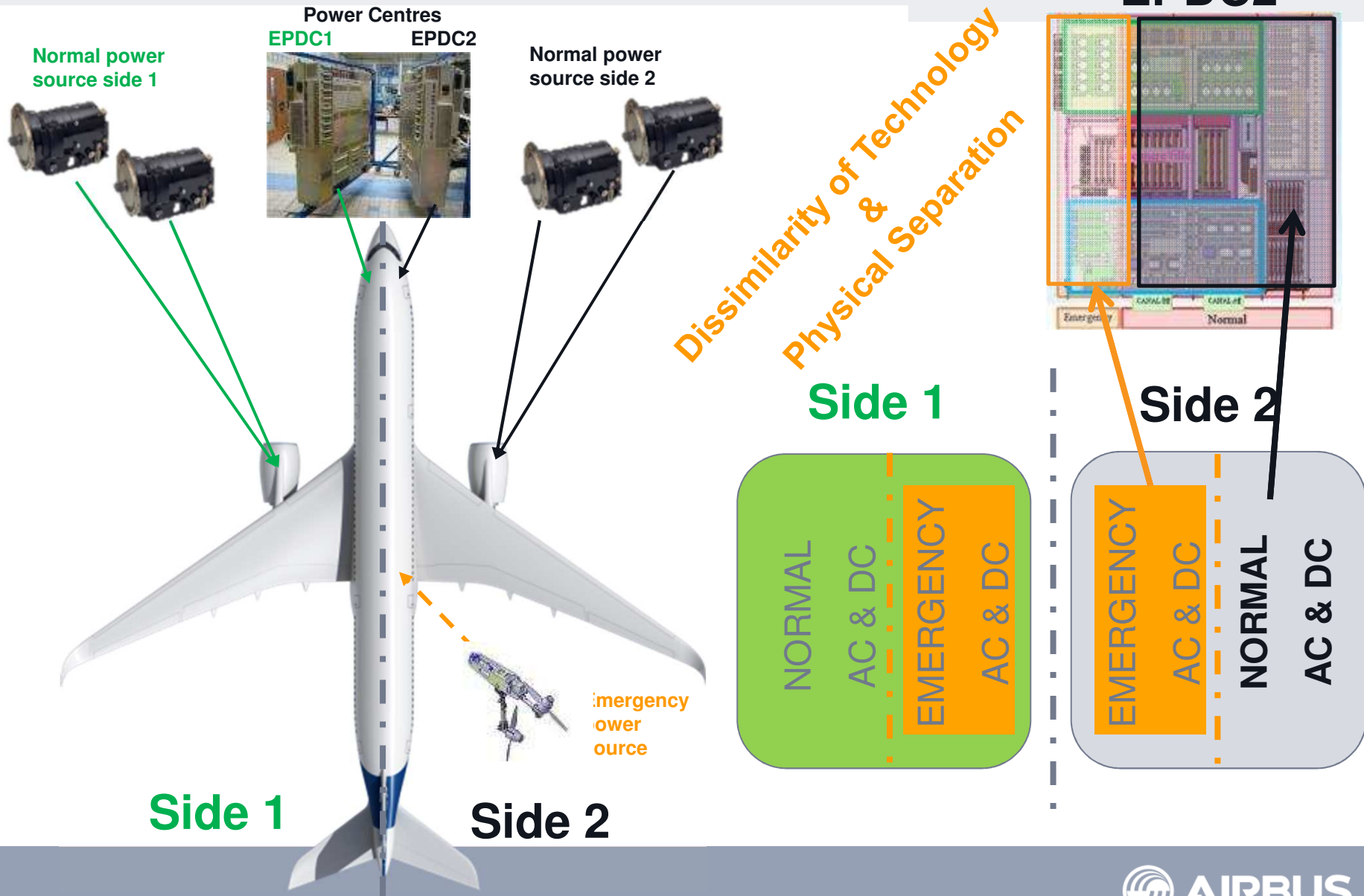
- 1 : Main Generator
- 2 : Auxiliary Generator
- 3 : Electrical Energy Transport
- 4 : Distribution & Protection of Primary Energy
- 5 : Voltage Adaptation (Transformers)
- 6 : Secondary Distribution & Protection
- 7 : Electrical Energy Transport to Consumers



Architectural Design Drivers



A350XWB Electrical System Architecture



Particular Risk Analysis (PRA)

- **Particular Risk Analysis**

- Engine Burst
- Tire Burst
- Bird Strike
- Short Circuit
- Lightning Strike
- EMI/EMC (e.g. Antennas)



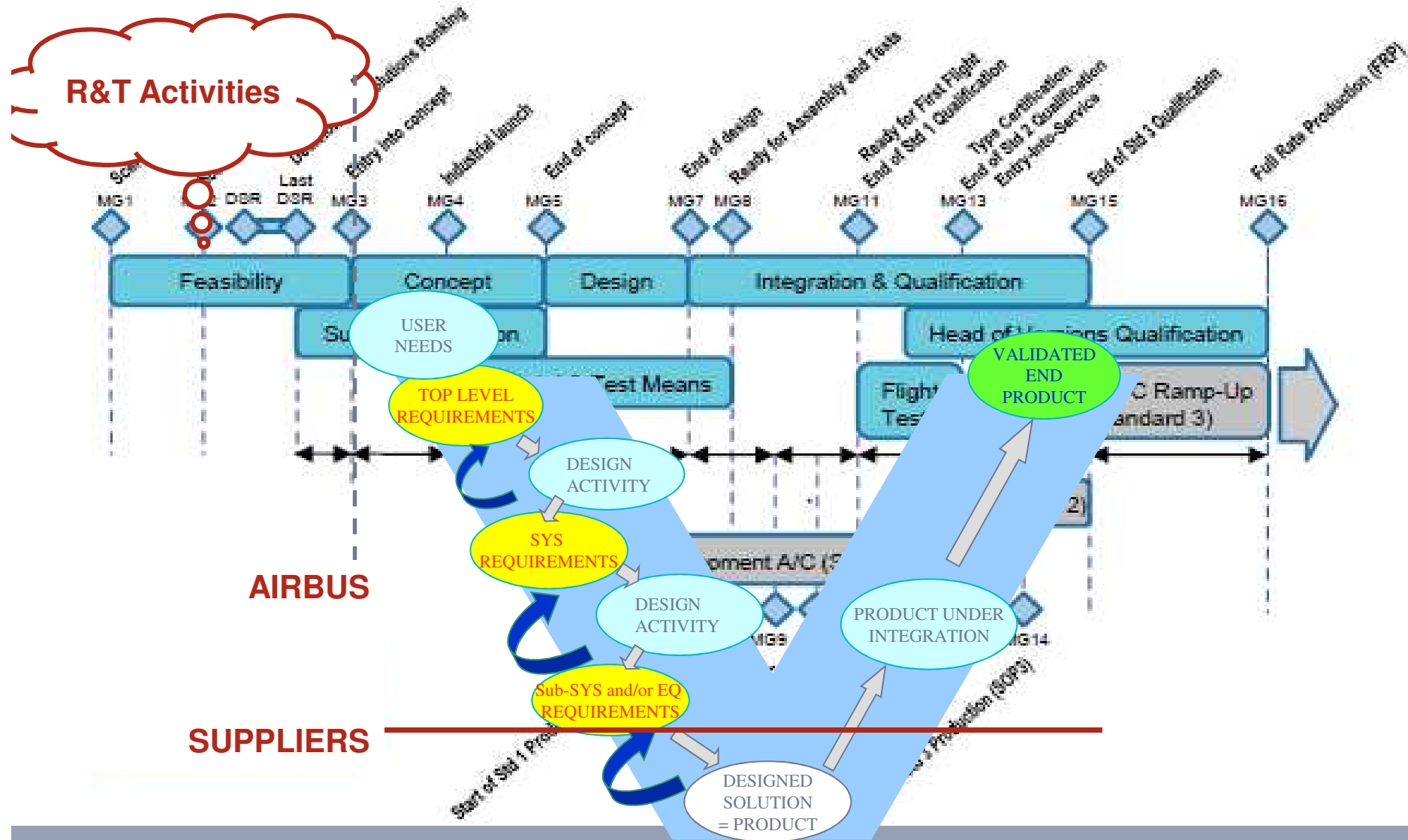
→ **EWIS (Electrical Wiring Interconnection System) Regulation applicable since A380**

Wiring considered as “System” with Analysis of Physical Aspects and Functional Impacts (e.g. Short Circuit etc.) on Wires and Bundles (Safety Analysis)

EWIS Regulation introduced Requirement on **Technology, Segregation and Installation Rules.**



Development Process



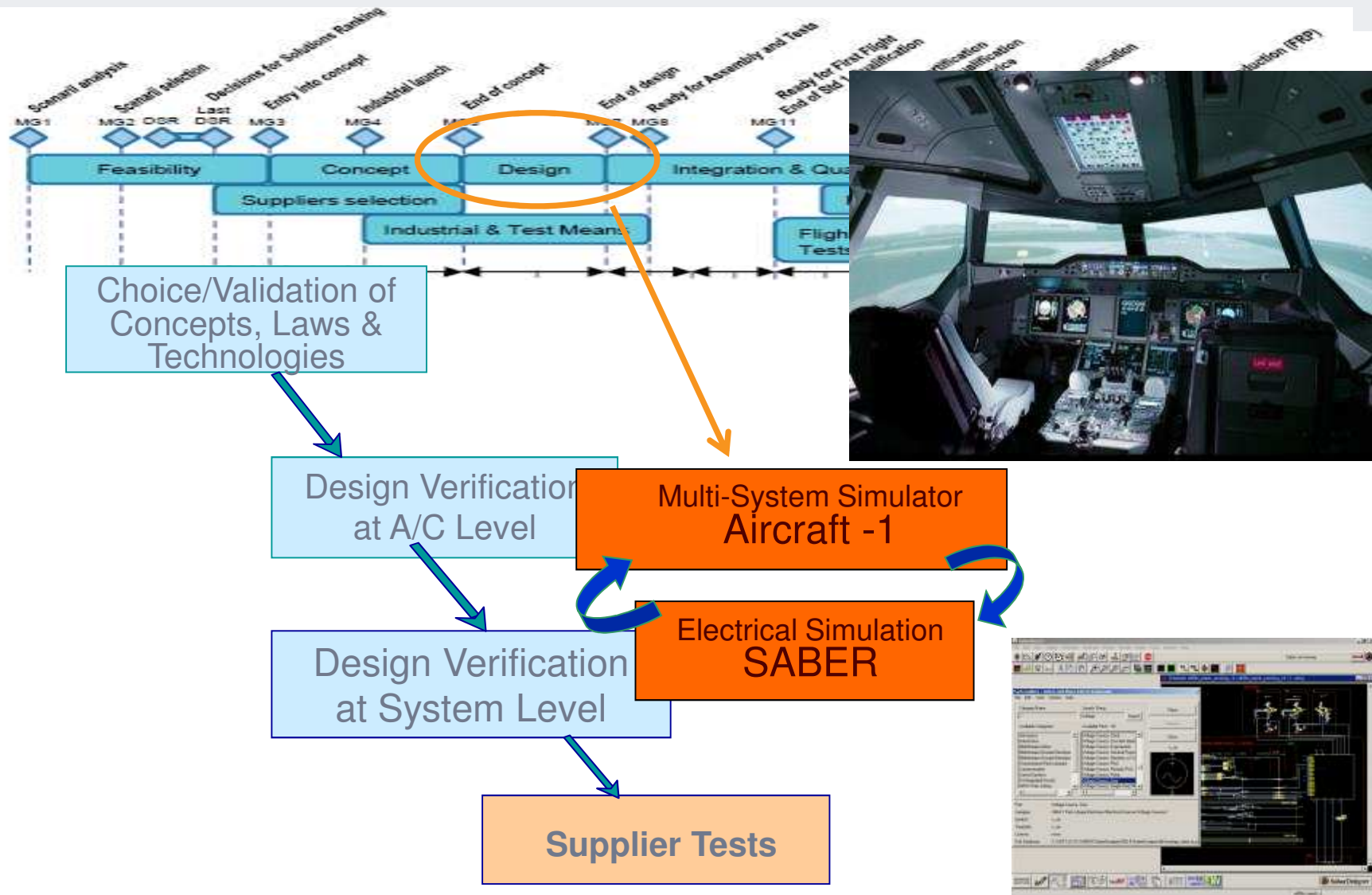
Introduction of new Technology (TRL Criteria)

	TRL1	TRL2	TRL3	TRL4	TRL5	TRL6
Description	Basic principles observed and reported	Technology concept and/or application formulated	Analytical and experimental critical function and/or characteristics proof of concept	Component and/or breadboard validation in laboratory environment	Component and/or breadboard validation in relevant environment	Systems /subsystems model or prototype demonstration in a relevant environment
Maturity phase	Discover		Understand	Adapt		Validate
Main Objective of this phase	Problematic and associated requirements explicitly identified	Design space for potential solution recognized and potential for value assessed	At least one feasible solution identified and evaluated against reference	De-risk of solution(s) critical elements in lab and value of solution(s) confirmed	De-risk of solution(s) at higher level of integration in relevant environment and value of solution(s) confirmed	De-risk of fully integrated solution(s) in relevant environment and value of solution(s) confirmed
criteria	Performance and integration					
	Value and risk					
	Engineering readiness					
	Manuf. and Industrial readiness					
	Operability					
	Roadmap to next steps					

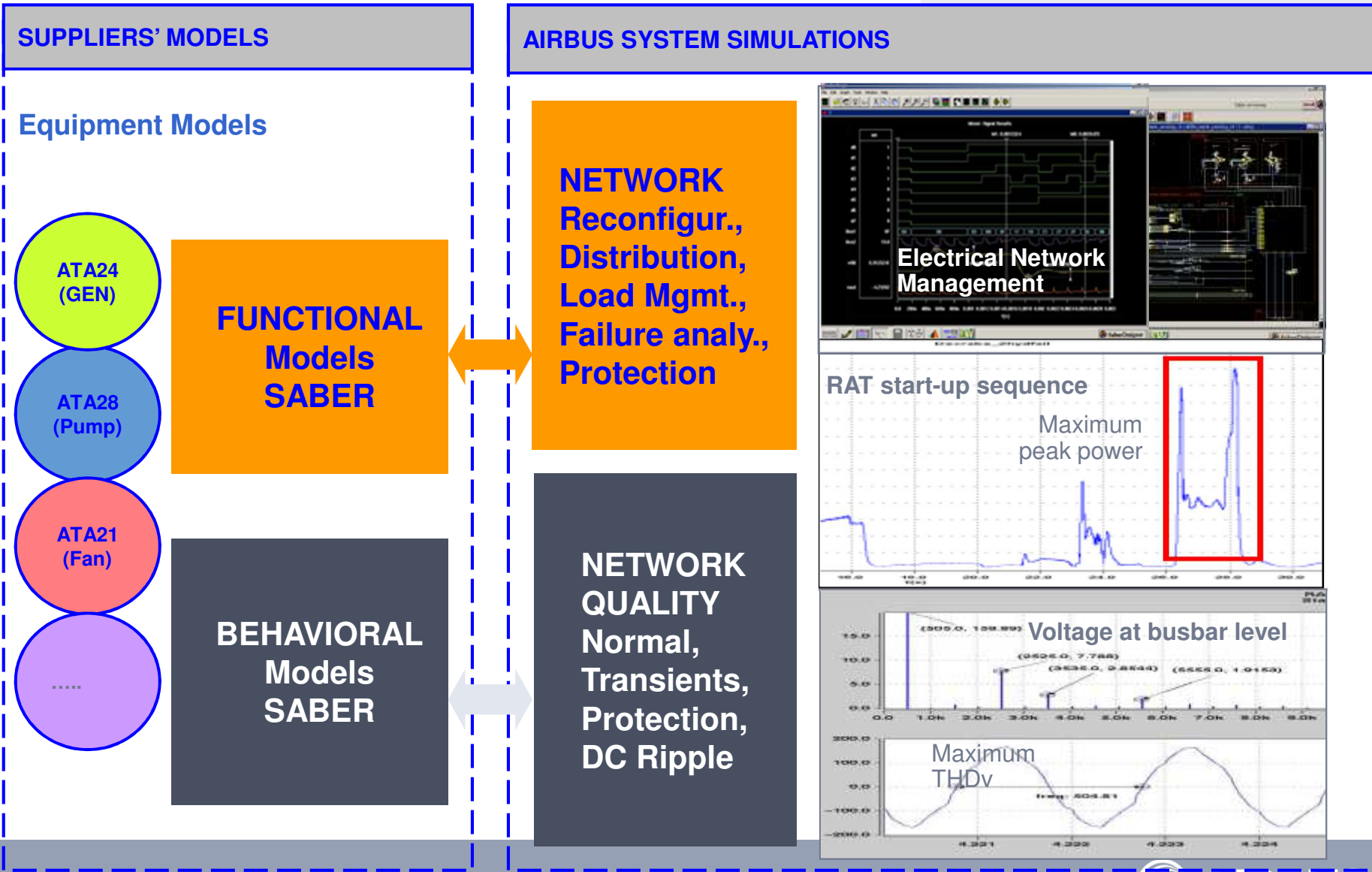
Hand Over to Programs

Assessment with increasing maturity and increasing integration
From Qualitative... to ROM... to demonstration

Early Design Verification through Simulation

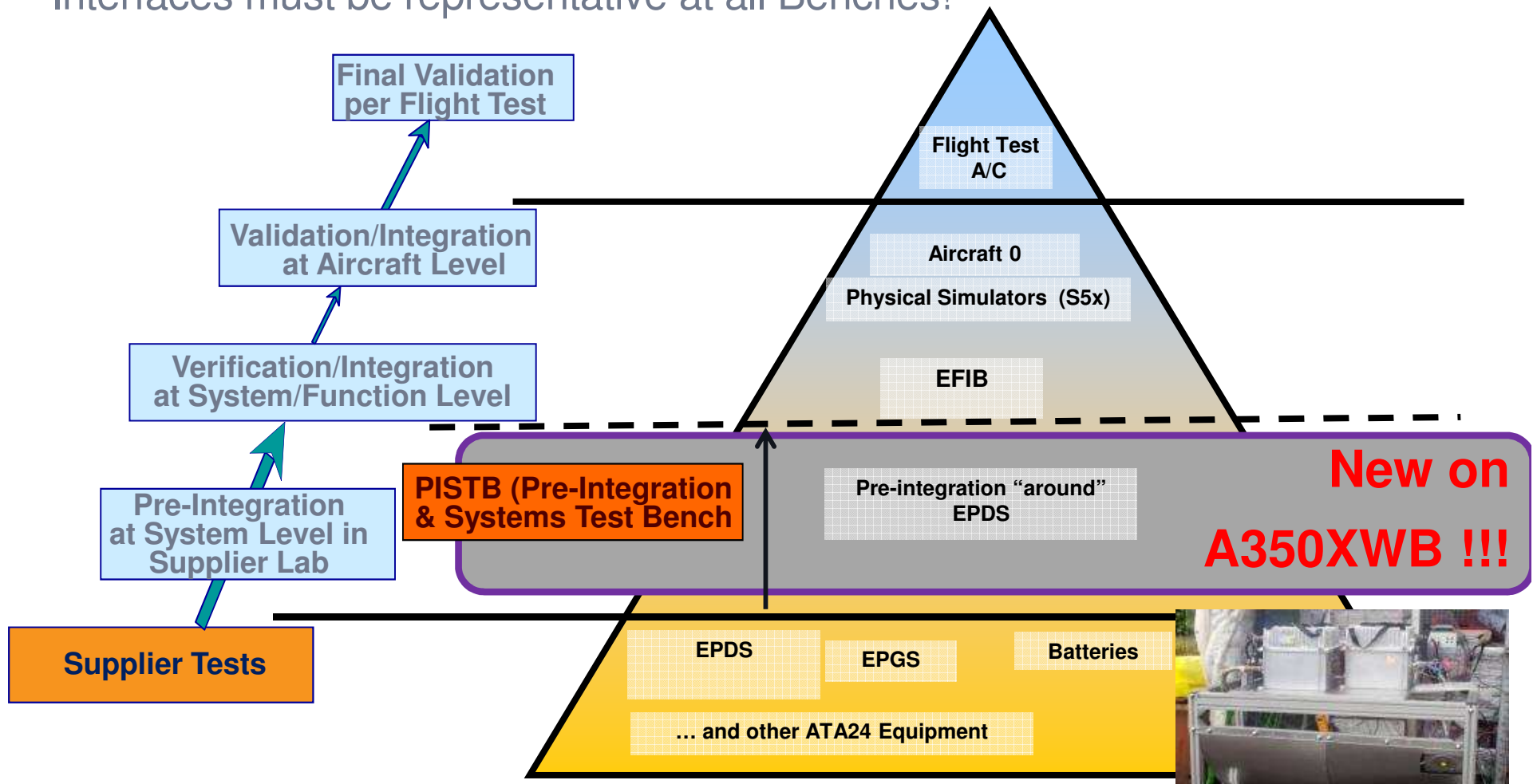


SABER Electrical System Simulation



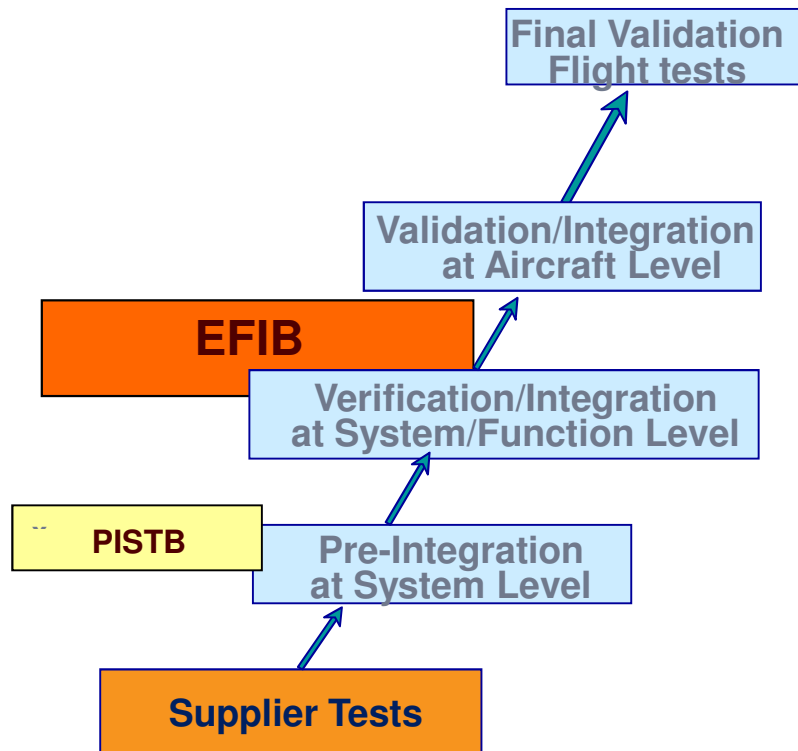
Verification/Validation and Testing Strategy

- Product Verification starts Supplier Level
- Interfaces must be representative at all Benches!



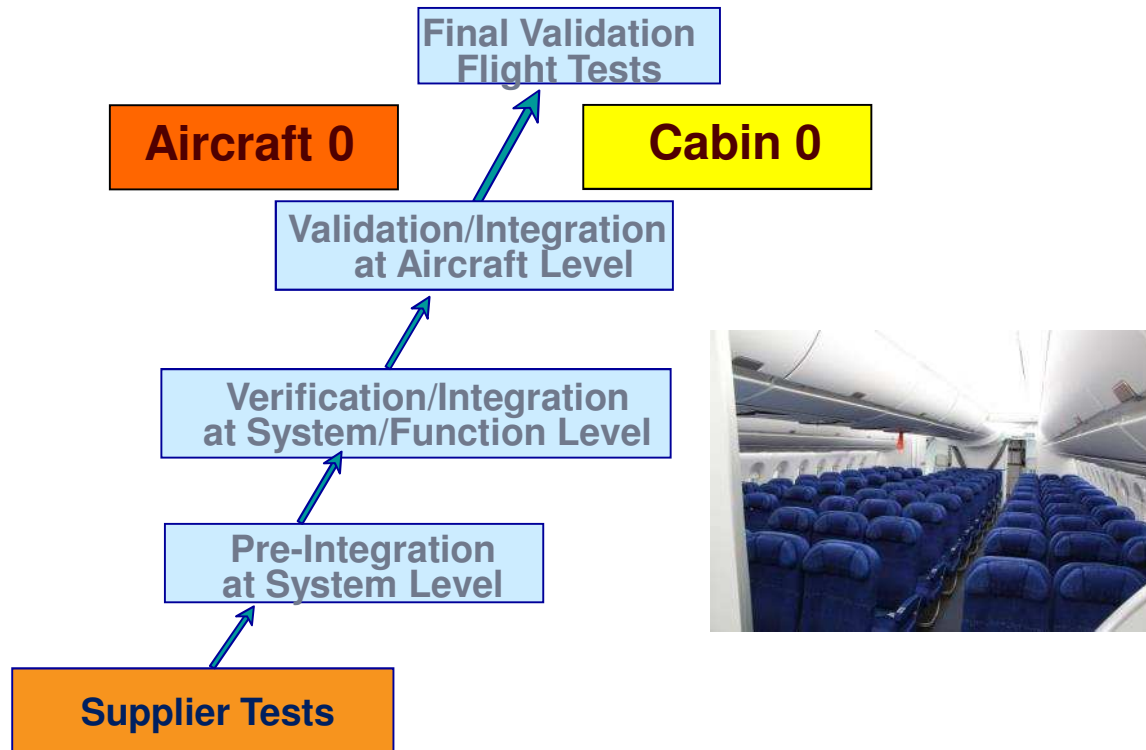
Electrical Systems Test Rig (EFIB)

- Electrical Functional Integration Bench (EFIB)
- Full real Equipment under Test
- Remaining A/C Environment simulated

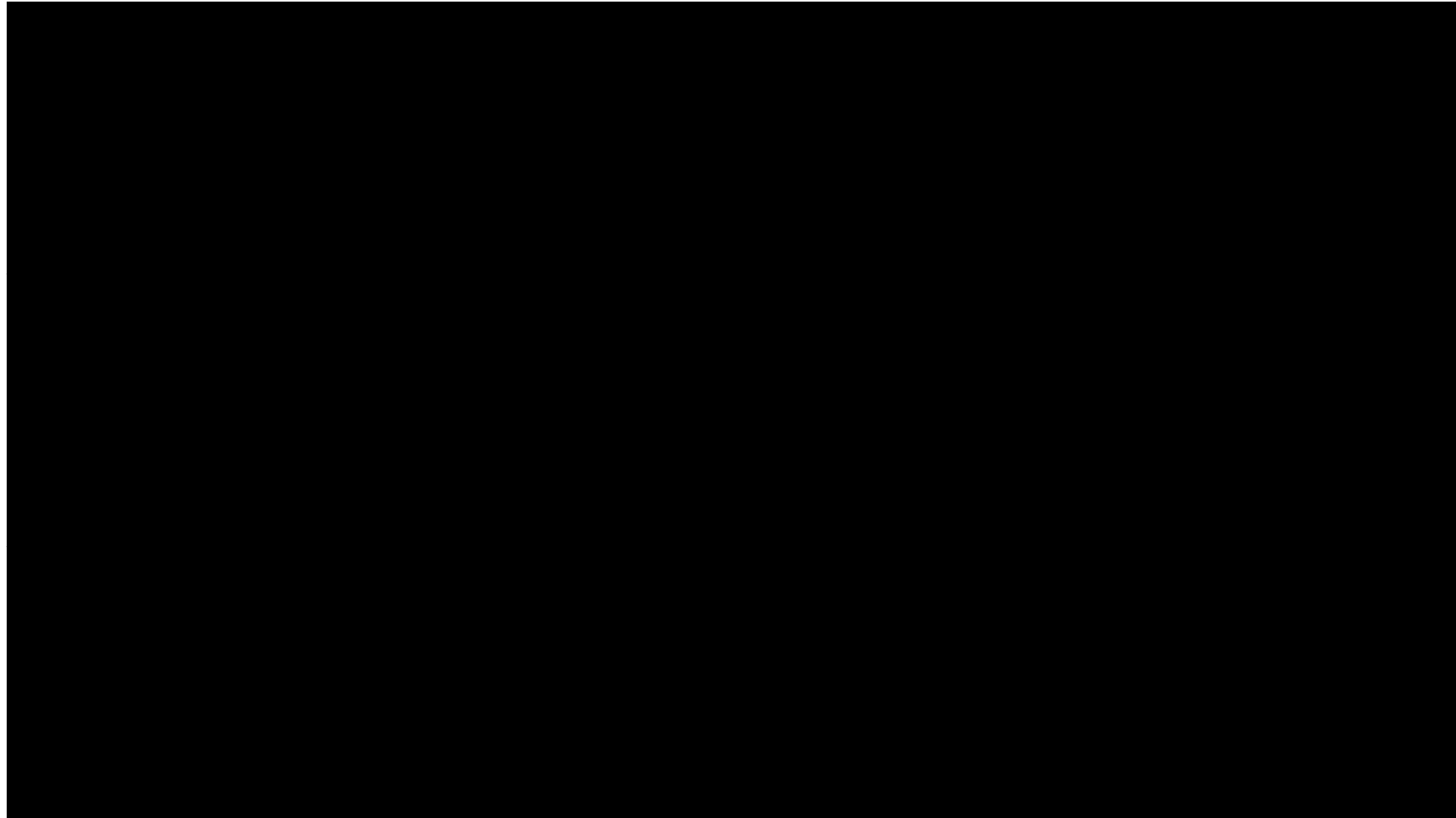


Iron Bird/Aircraft 0 and Cabin 0

- A/C 0 -> Iron Bird coupled to full scale Cockpit Simulator
- Cabin 0 -> Fully integrated Cabin Systems
- Nearly Test A/C Instrumentation
- Key means to prepare First Flight and PAX Operations



Flight Test



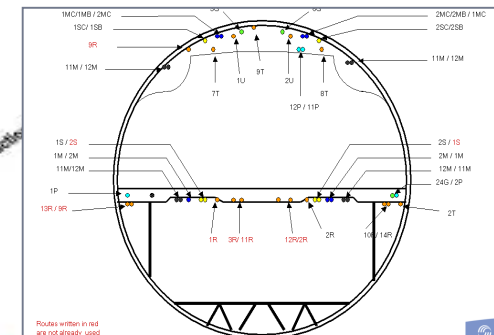
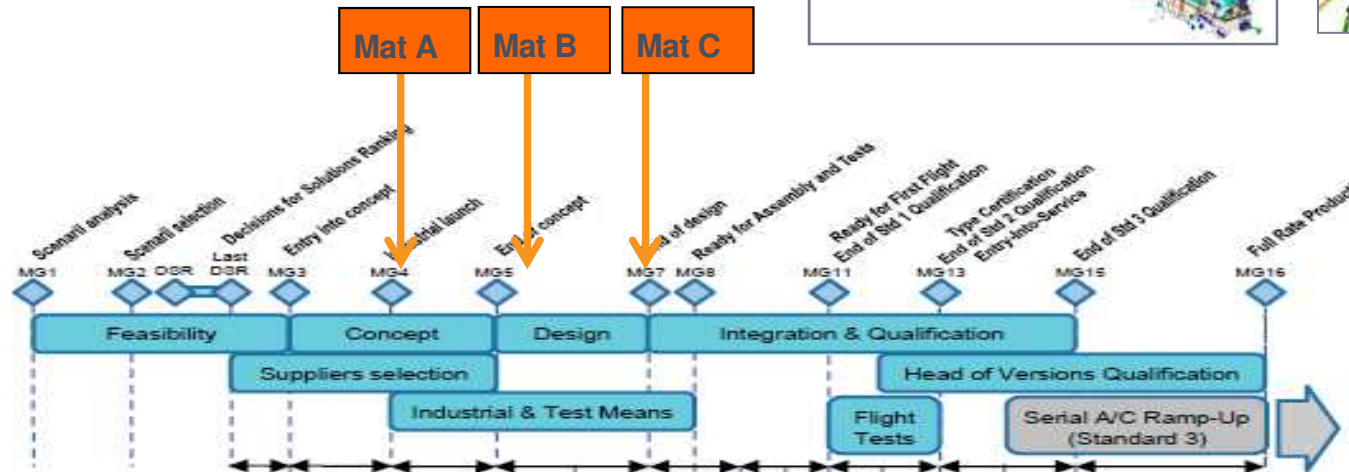
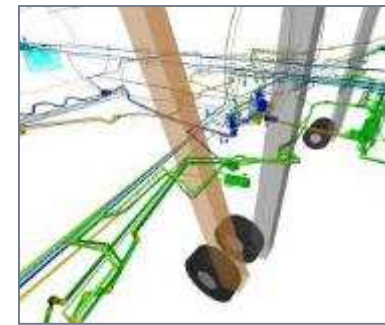
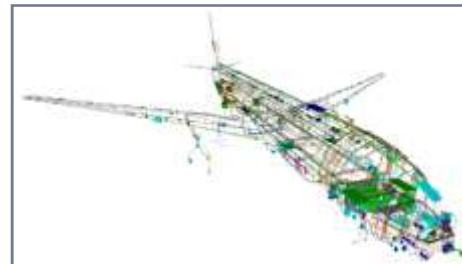
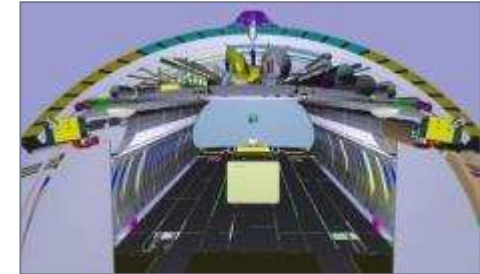
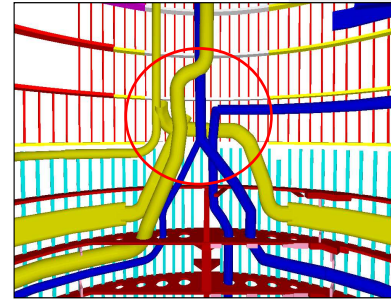
All A350XWB Test A/C are operated like Airline A/C -> “Airline 1”

Physical Integration Strategy

3D Layout Feasibility → Mat A
Integration of “sizing” Systems

3D Layout Integrity → Mat B
System Integration to ensure critical A/C Functions in Particular Risk Scenarios

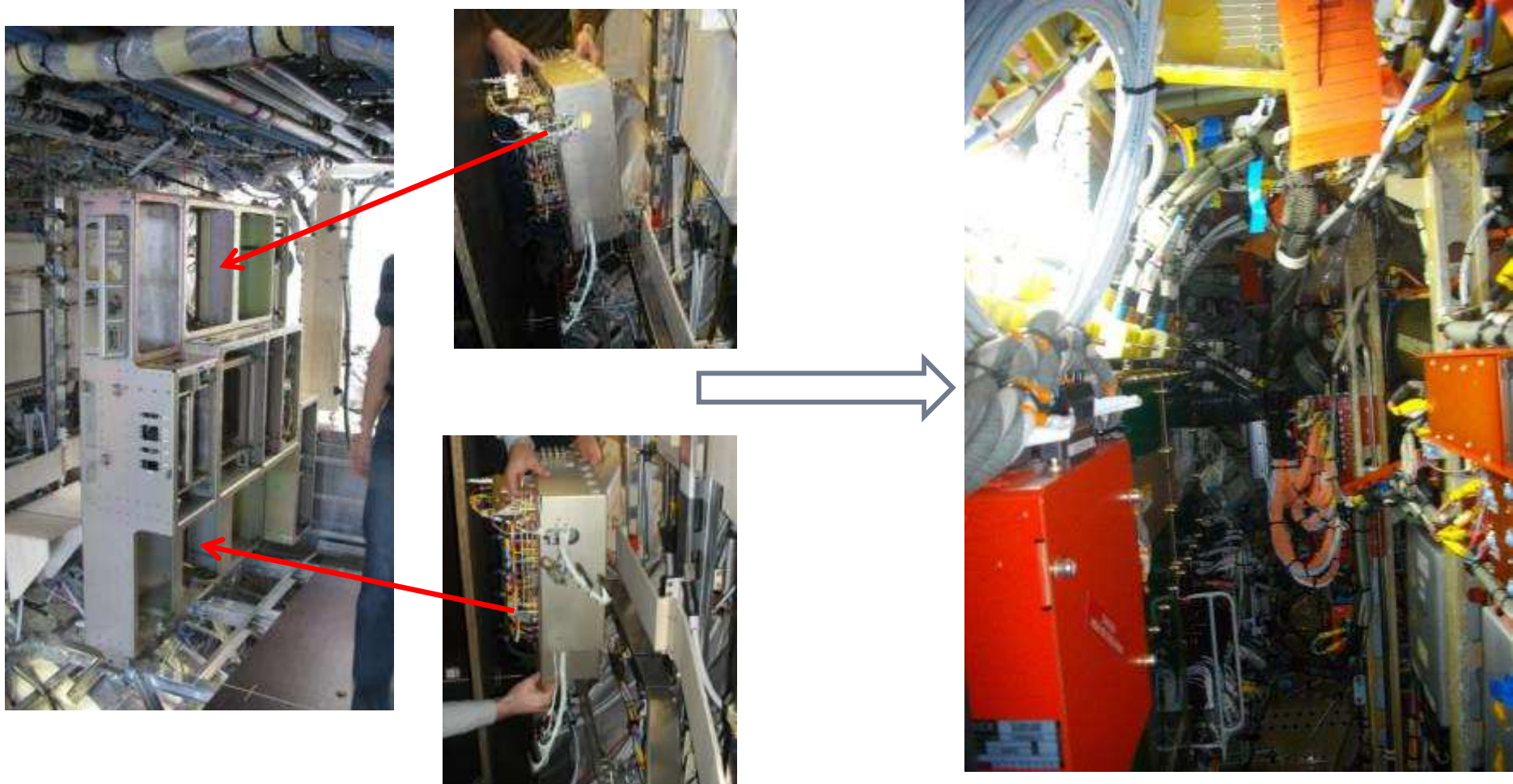
3D Layout Optimization → Mat C
Detailed Design Freeze



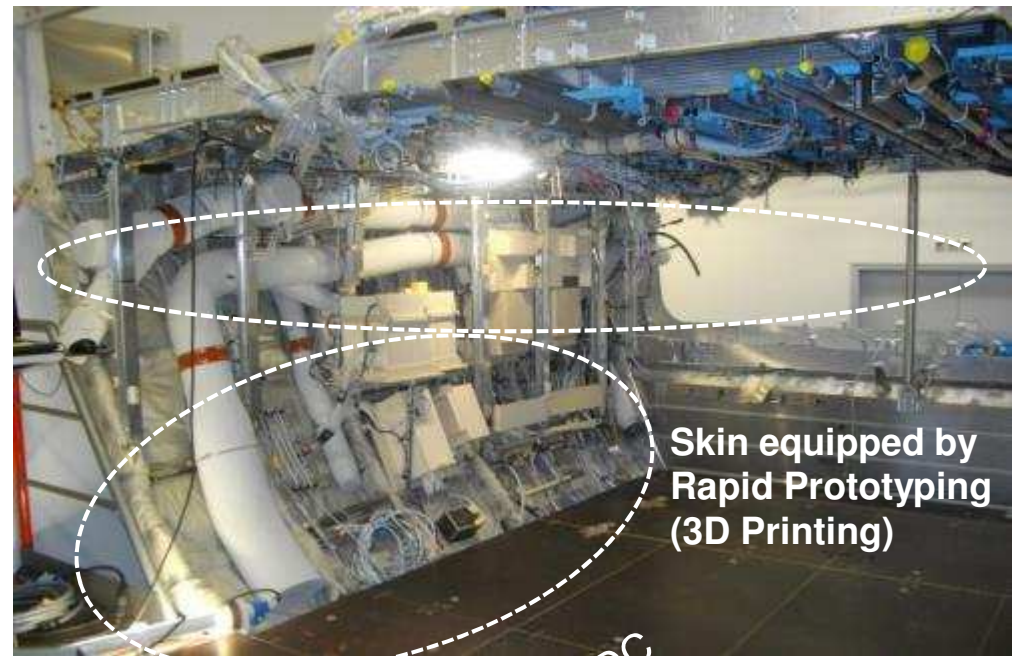
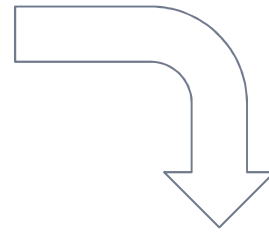
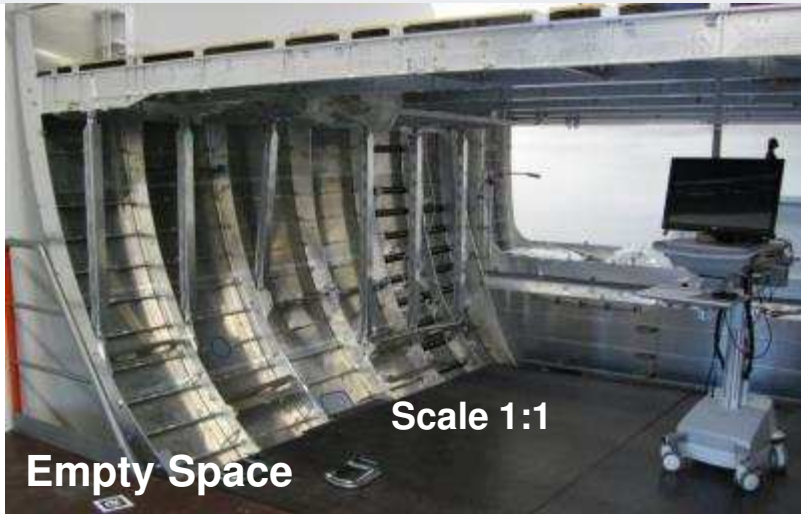
Virtual Reality supports Physical Integration



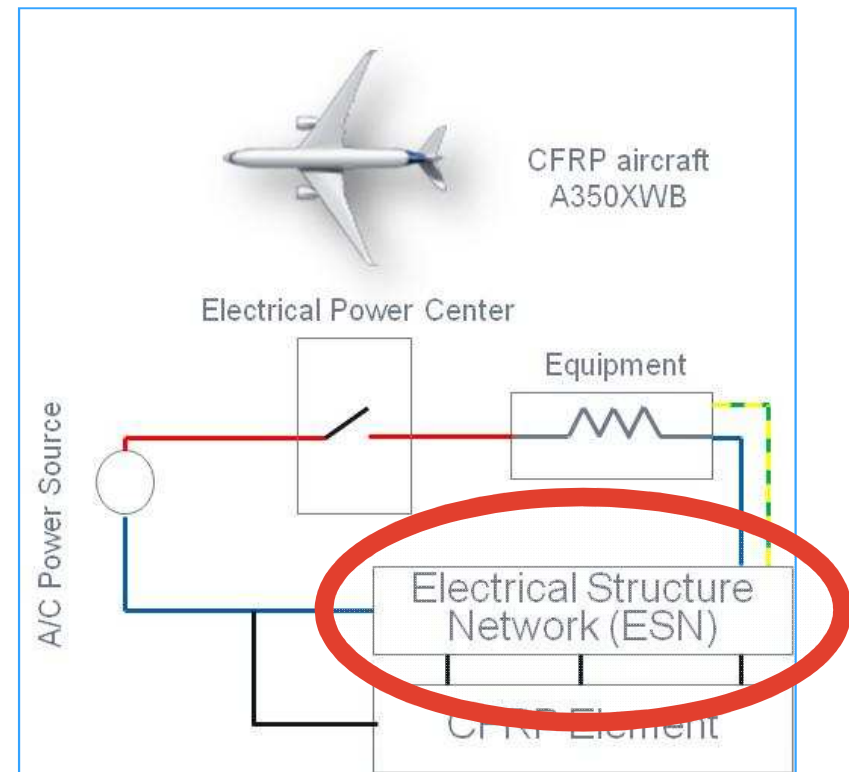
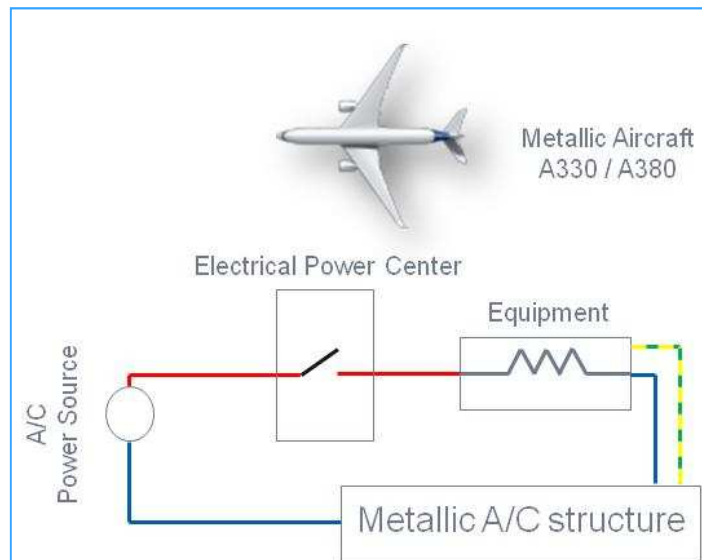
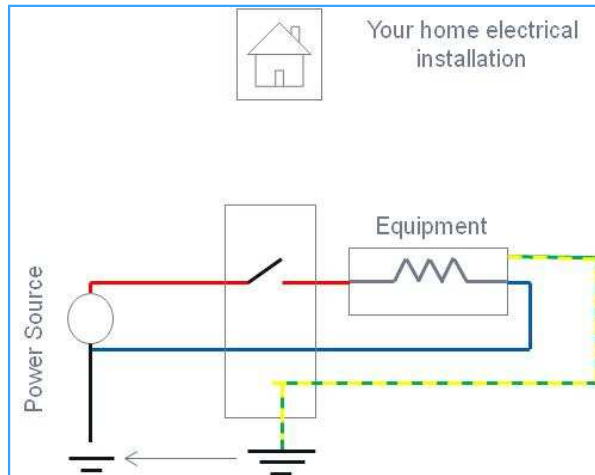
Physical Mock-Ups still mandatory (Case-by-Case)





Application of Rapid Prototyping

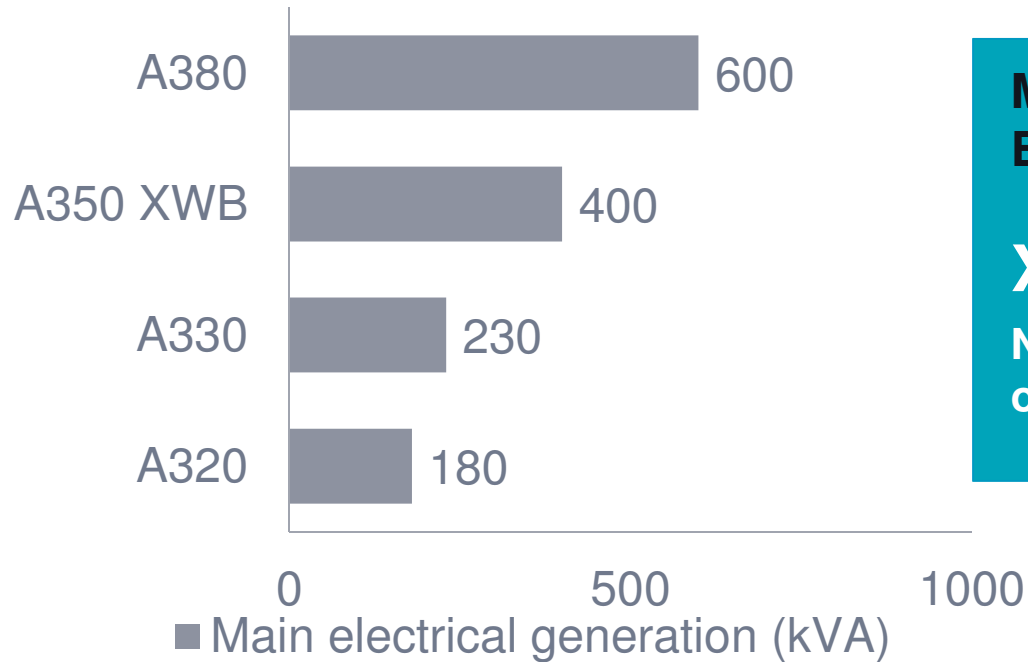


Electrical Structure Network (ESN)



-  Functional current (Grounding)
-  Fault current (Bonding)

Future Trend: More Electrical Aircraft (MEA)



More Demand for Electrical Power

x 3

Number of Electrical Loads on A380 vs. A320



- Enhanced Technologies for A350XWB Systems**
- New 230 VAC network
 - Electrical Trimmable Horizontal Stabilizer Actuator
 - New APU Starter/Generator

MEA Systems Evolution

More

Generate

Essential Main Power Generation



Fuel Cell



IGGB®



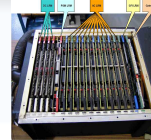
Reversible Electrical Network



Electrical

Convey, Convert, Protect

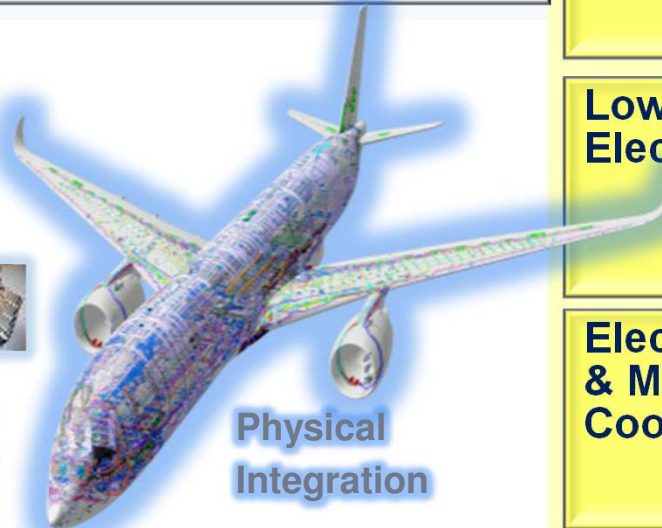
Modular Electrical Centers



Modular Power Electronics Bay



Functional Integration

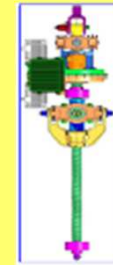


Physical Integration

Aircraft

Use

Flight Control Electrical Mechanical Actuation



Low Power Electrical WIPS



Electrical Pack & Modular Cooling



Questions?



A350XWB (1st European composite A/C) with Junkers F13 (1st world all-metal commercial A/C - 1919) – WISCONSIN (USA)

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document. This document and all information contained herein is the sole property of AIRBUS Operations S.A.S. No intellectual property rights are granted by the delivery of this document or the disclosure of its content. This document shall not be reproduced or disclosed to a third party without the express written consent of AIRBUS Operations S.A.S. This document and its content shall not be used for any purpose other than that for which it is supplied. The statements made herein do not constitute an offer. They are based on the mentioned assumptions and are expressed in good faith. Where the supporting grounds for these statements are not shown, AIRBUS Operations S.A.S will be pleased to explain the basis thereof. AIRBUS, its logo, A300, A310, A318, A319, A320, A321, A330, A340, A350, A380, A400M are registered trademarks.