

A380 Cabin & Cargo Customisation



Presented by

Frank Dohrmann

Head of Design Support & Test

DGLR Hamburg
A380 Kabinentechnologie, Integration & Test
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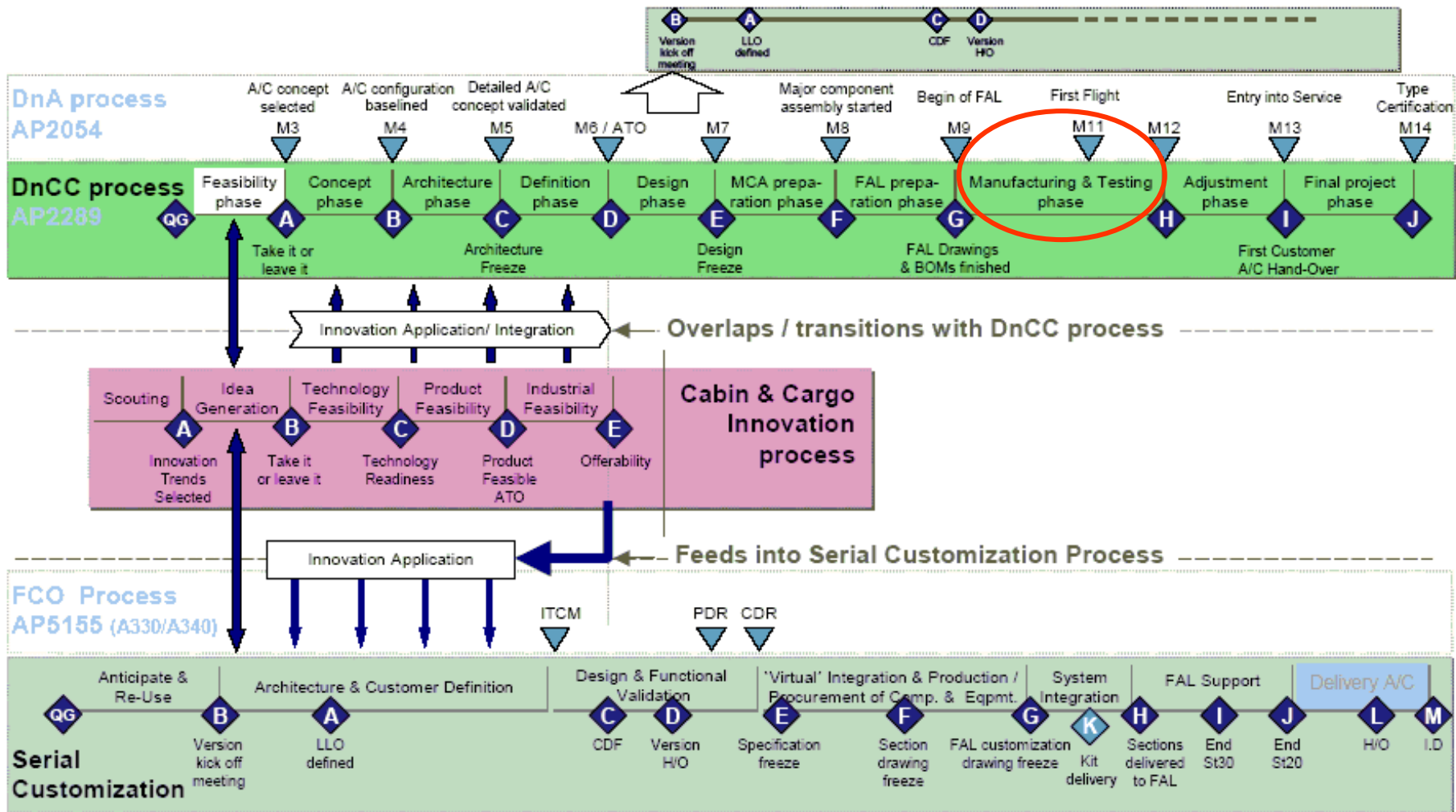
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A/C Development Core Processes



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V&V Process - Definitions

- **Requirements Validation**

- ▶ The purpose of **Requirements Validation** is to ensure that the requirements for a product are sufficiently correct and complete to achieve safety and to satisfy the needs of the customer within program constraints (e.g. cost, schedule).

- **Design Verification**

- ▶ The aim of **Design Verification** is to provide evidence that the design is compliant with the requirements. This compliance evidence is presented during design reviews and it is a key input to decisions on the choice of design solution and whether to proceed to the next stage of development.

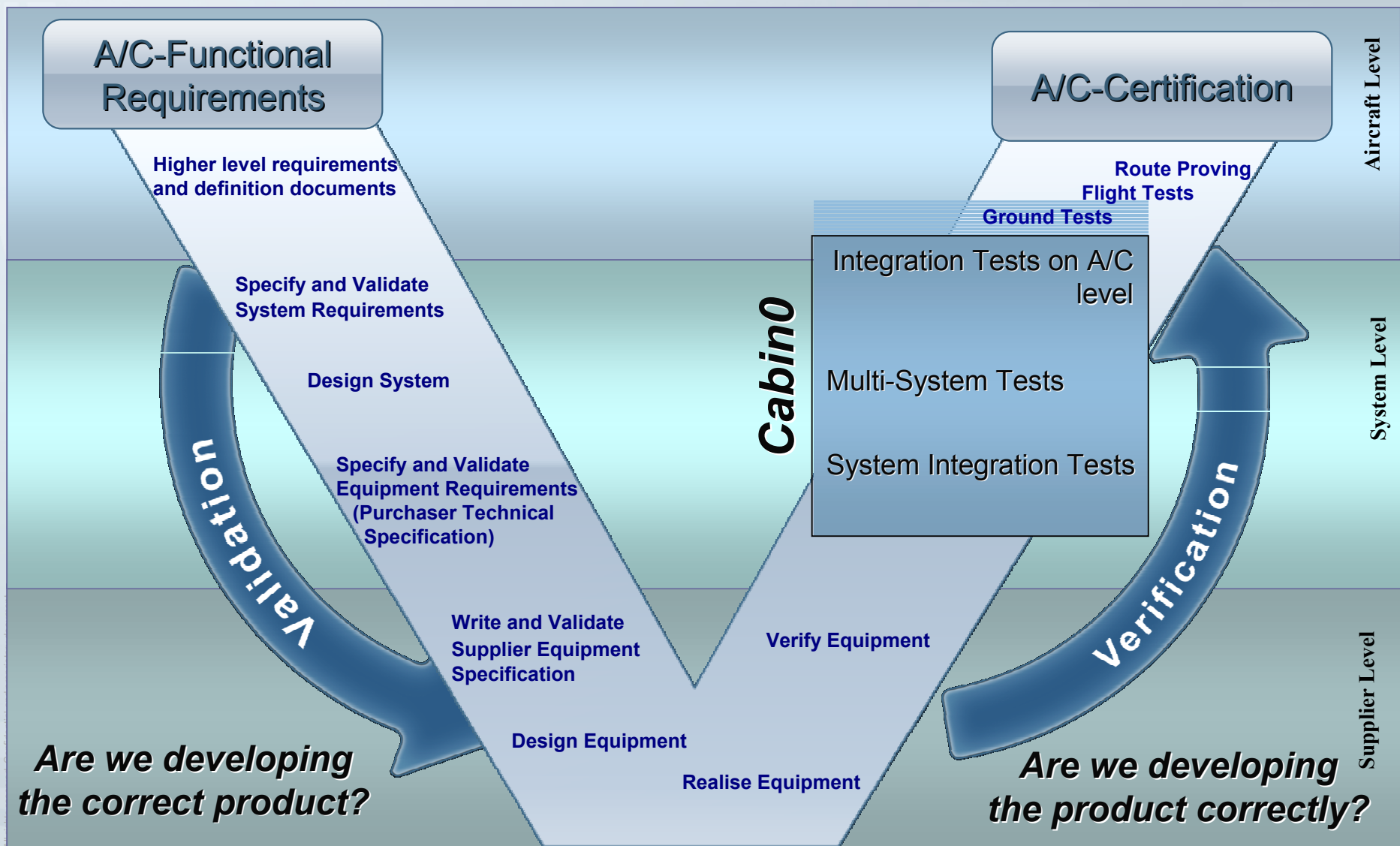
- **Product Verification**

- ▶ The aim of **Product Verification** is to ensure that the product meets the requirements

- **Product Validation**

- ▶ **Product Validation** activities aim to demonstrate that the product meets the implicit needs of the customer

A380 Kabinentechnologie, Integration & Test V&V Process General View



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Classical vs. Advanced Test Approach A380

Classical Test Approach

- **System Tests**
performed on System Integration Benches (SIB).
Focused on inherent System Functions, I/O to other Systems simulated.
- **Multi System Tests**
involve two or more Systems realized on SIBs to a Multi-SIB.
Focused on Interfaces and Integration Aspects.

Advanced Test Approach for A380

- **Aircraft Level Integration Tests**
involve SIBs and Multi-SIBs mechanically, electrically and electronically linked to the Cabin Integration Test Rig (CITR).
Focused on Interfaces and System Dependencies.
- **Cabin Virtual Flights (CVF)**
execute Flight-Test Scenarios involving all available Cabin Systems.
Focused on overall Cabin Aspects e.g. Human Factors and Cabin Operation. For each A380 HoV a dedicated CVF is planned.

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A380 Cabin0 Scope



cabin Integration



Cabin Supply
& Safety
Systems



Cabin Electronics

A380 Cabin0 comprises of

- ... a ground-based engineering Mock-up (Frame 15 to 45), rear part embraced with Artic Cell
- ... a fully EMI shielded 3-Deck configuration
- ... 23 mechanical and electrical System Test Benches incorporated
- ... more than 50 engineers permanently deployed
- ... verification of about 250 Cabin & Cargo System Functions



Air Conditioning
& Cooling



Air Generation
& Mixing



Bleed System &
Auxiliary Power
Unit

Airbus A380 Cabin0 is the facilitator to enhance the Cabin Maturity prior to EIS.

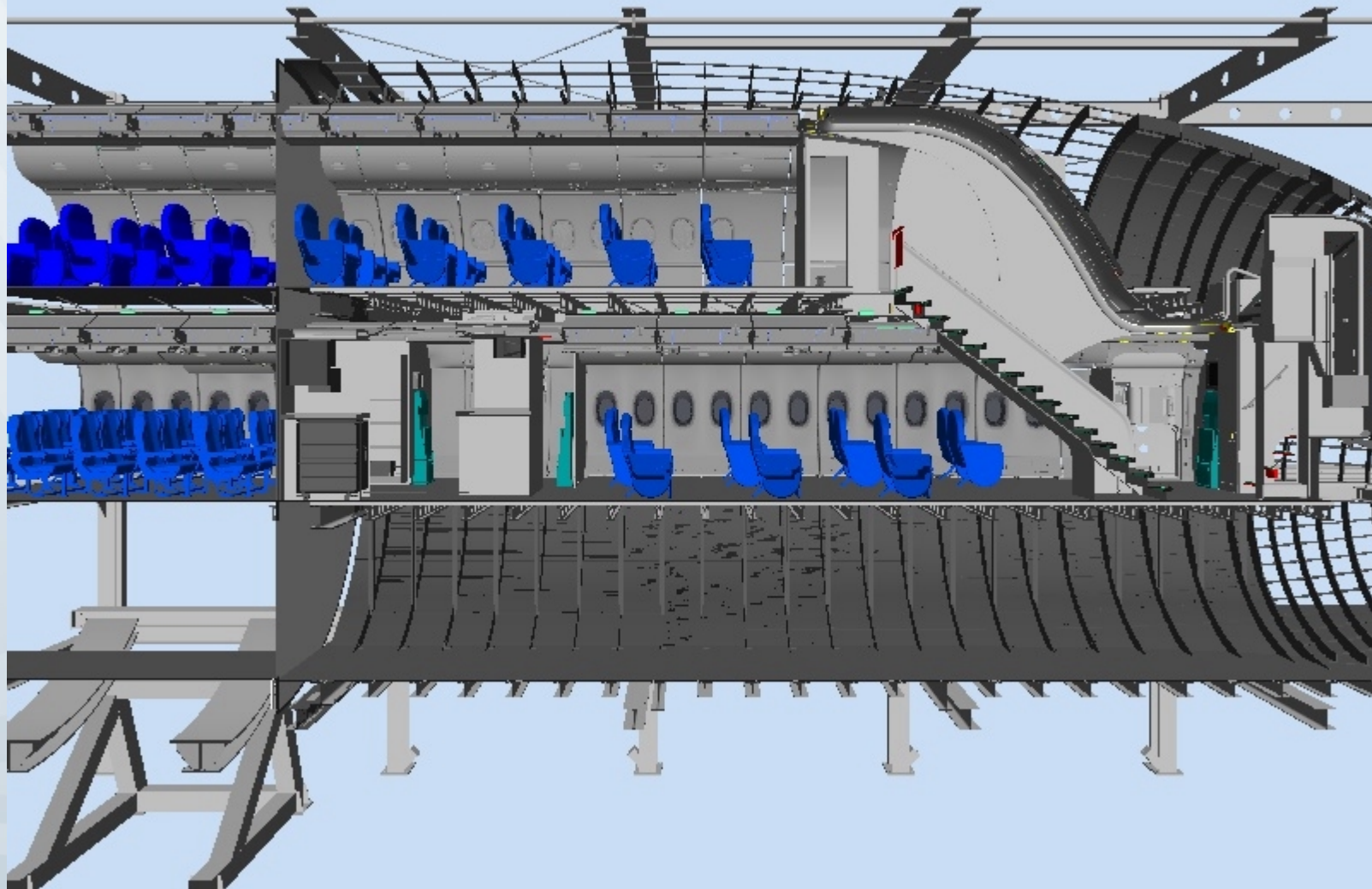
A380 Cabin0 because of:

to test inherent functions and interfacing functionality of Cabin Systems

- ... in a comprehensive scope from Sub-System, System to A/C Level
- ... to ensure the required and specified functionality
- ... to detect system misbehavior in the development process
- ... to support the Ground & Flight Tests
- ... to achieve the required Operational Reliability at EIS

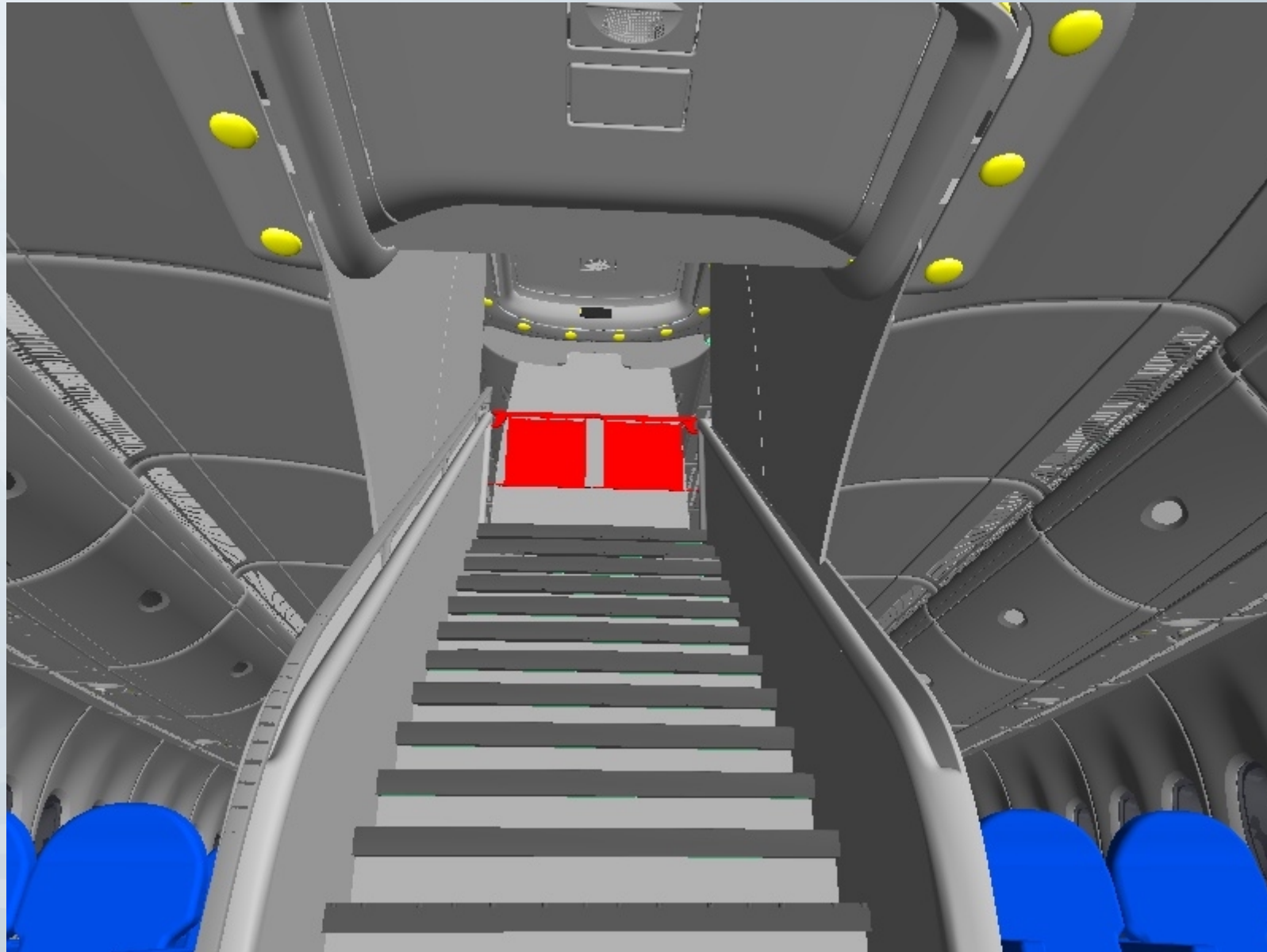
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A380 Cabin0 – Half Cut Fuselage



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A380 Cabin0 – Stairway view



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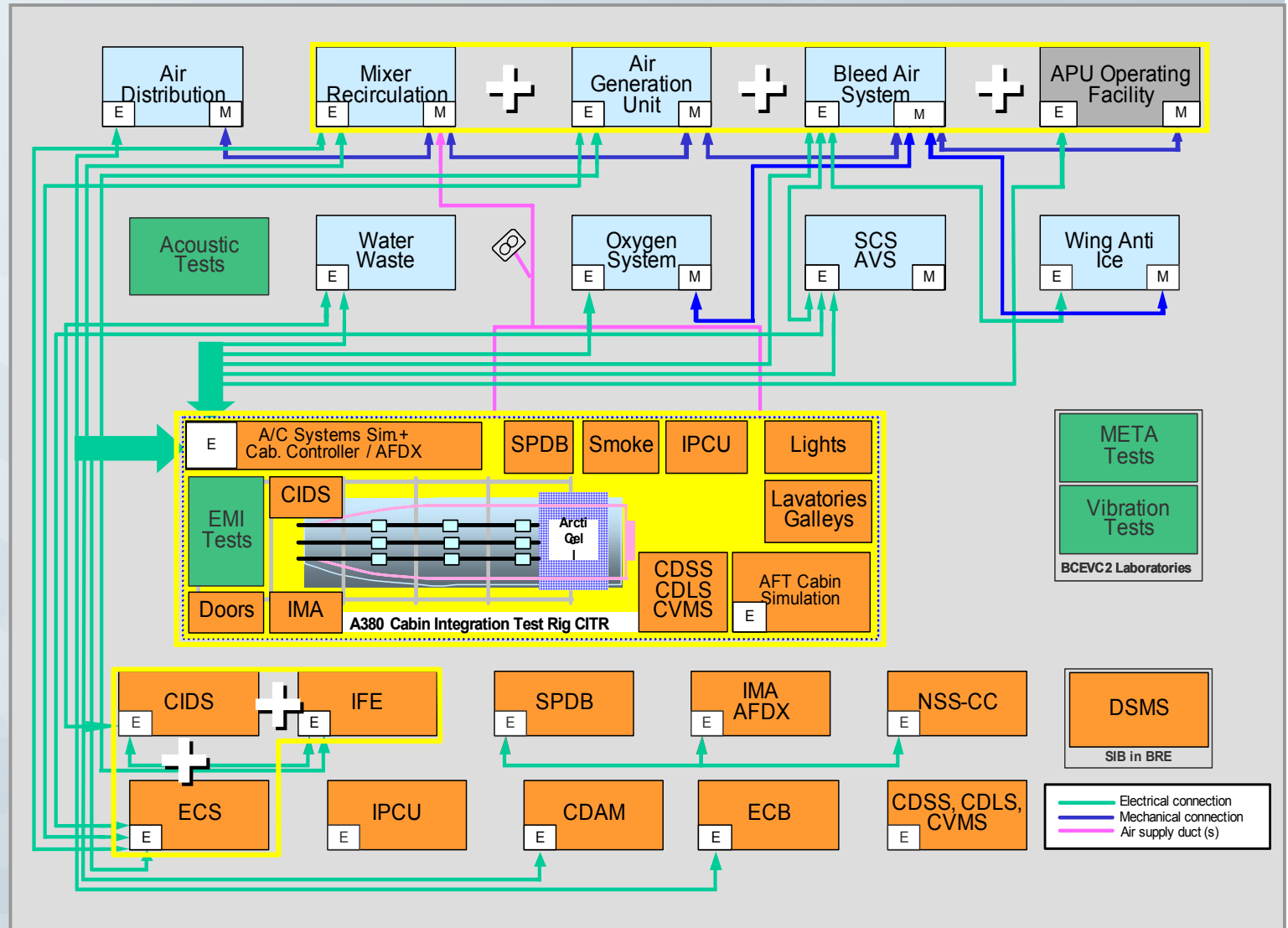
A380 Cabin0



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A380 Cabin0 Composition of Systems

- ✓ **System Integration Bench (SIB)**
- ✓ **Multi System Integration Bench (Multi-SIB)**
- ✓ **Cabin Integration Test Rig (CITR)**
- ✓ **Cabin0 (CITR + SIB's)**



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A380 Cabin0 – Artic Cell

Outside

Cooling and heating of a complete 7-frame fuselage section similar to real flight and ground conditions

Temperature Envelope **-30°C to +50°C**

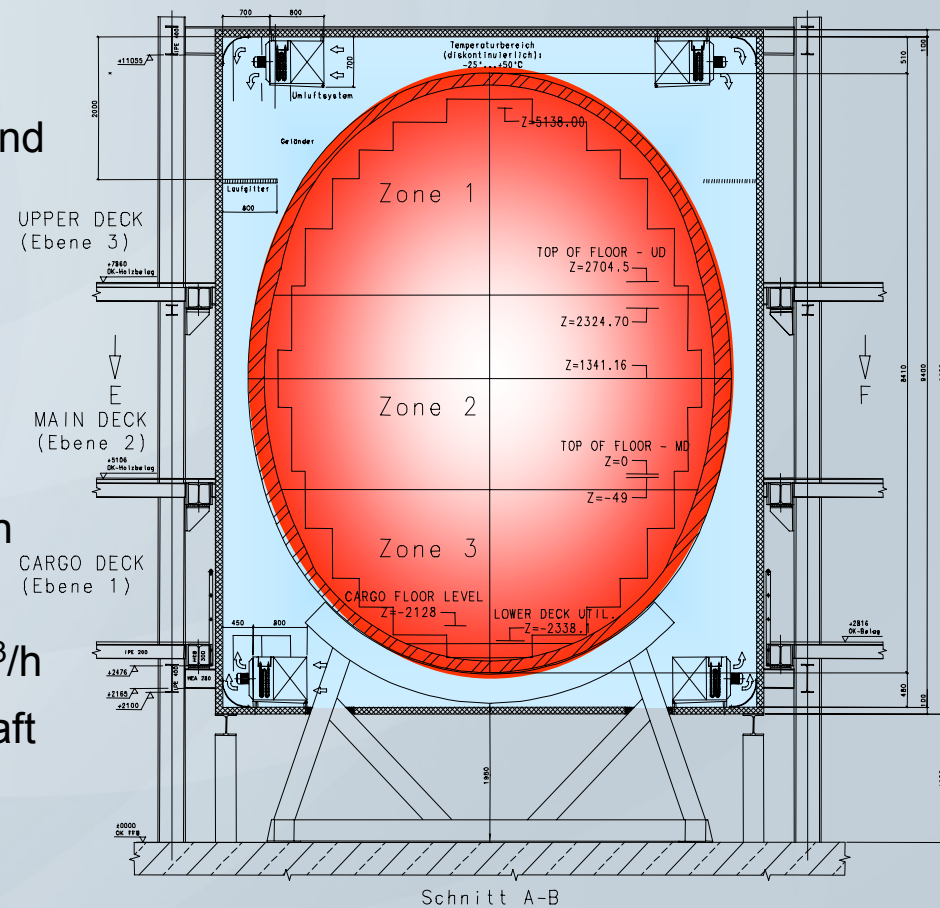
Cabin

Air conditioning close to reality with regard to

- Temperature 10°C to 50°C inside cabin
- Humidity 2g/kg to 18g/kg
- Air flow UD1440m³/h, MD1800m³/h
- Air distribution Calibrated as in the aircraft

Complete furnishing of a fuselage section for realistic conditions of thermal comfort and airflow measurements

Permanent operation up to more than two weeks possible



The ARCTIC Cell is an important test facility to optimize comfort characteristics inside Airbus cabins.

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A380 Cabin0 Assets

Airbus View:

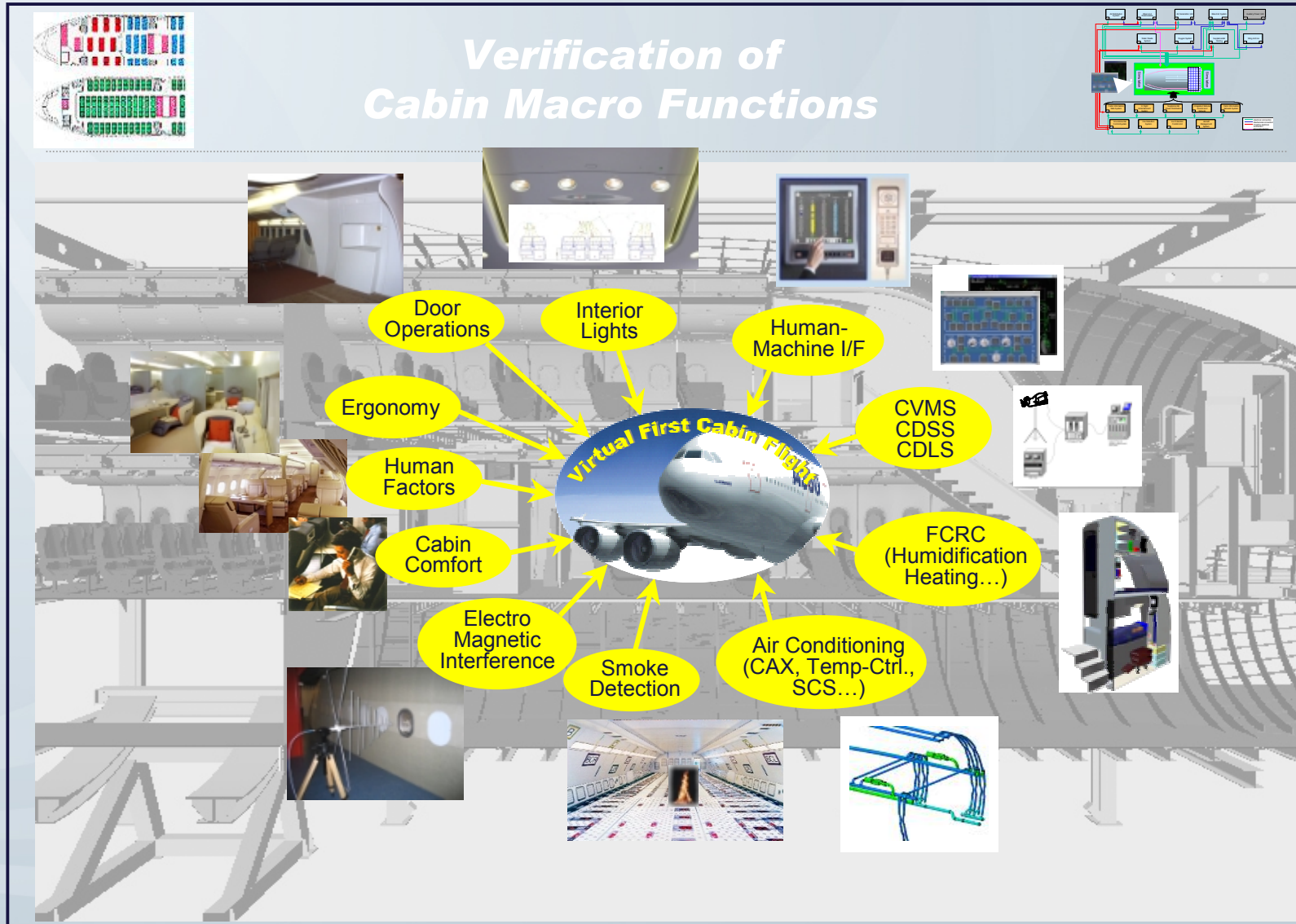
- ✓ Explore Integration and I/F Misalignments before starting Ground- and Flight-Tests
- ✓ Ground- and Flight-Tests campaigns essentially reduced thanks to prior Cabin0 tests
- ✓ Ground- and Flight-Test parameters specified more accurately based on extensive Cabin0 testing
- ✓ Re-play of Ground- and Flight-Test scenarios (cabin operation, failure case scenarios) in Cabin0 allow an efficient development of design solutions

Customer's View:

- ✓ Early familiarisation with new Cabin Systems (e.g. HMI, Maintenance)
- ✓ Beyond the EIS of the A380, the Cabin0 is the adequate mean for
 - solving In-Service Problems of the Cabin Systems prior to EIS
 - customisation purposes

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A380 Cabin0 First Virtual Flight



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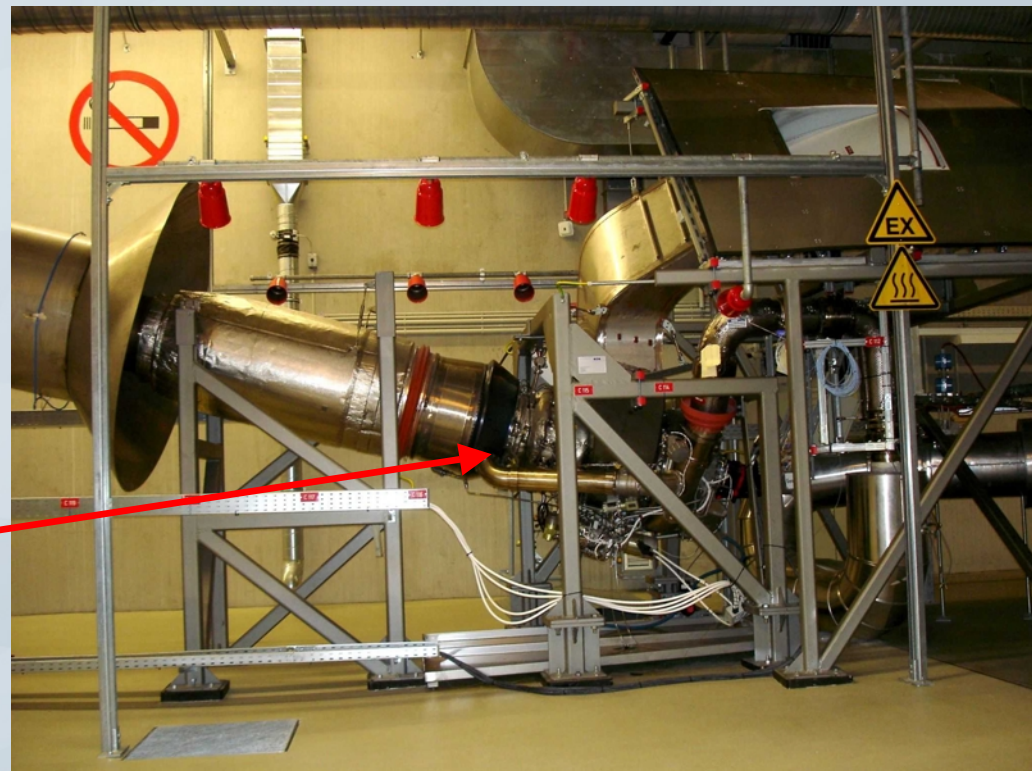
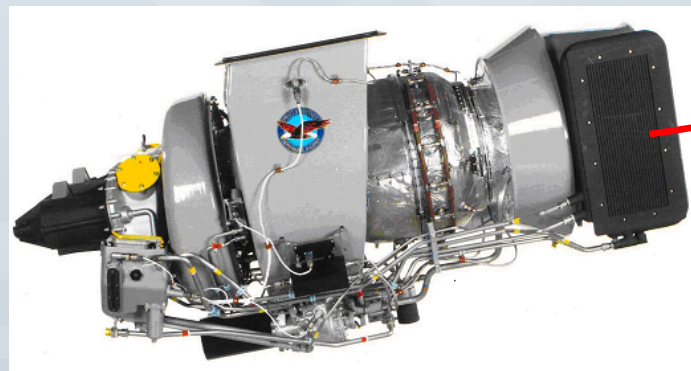
A380 Cabin0 – APU (Auxiliary Power Unit)

Operation APU (Auxiliary Power Unit)

- APU air supply to the AGU/Mixing System Integration Bench
- Exchange of data signals via AFDX
- Electrical power generation for the industrial air heater within the APU-Bypass duct to simulate hot day and extreme hot day conditions
- APU pneumatical Power: 900 kW, electrical Power 300 kVA => total Power of appr. 1.2 MW

Operation Pneumatic-Power Test Bench

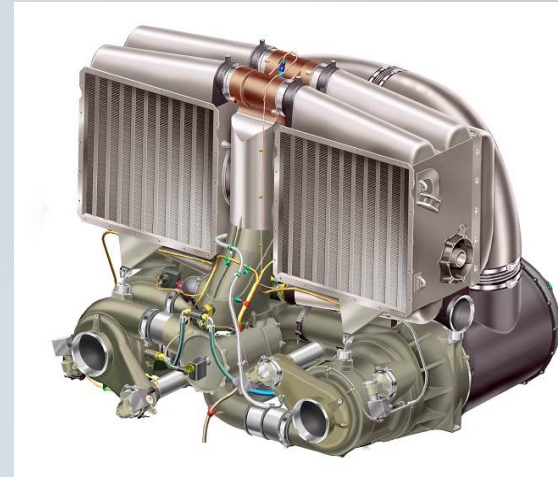
- Execute of Request for Tests for, Bleed Air System, Engine Bleed Air System



A380 Cabin0 – Air Generation Unit Test Rig (AGU)

Major features:

- Air Generation Unit consists of 2 units (LH/ RH)
- Compact design without any long ducting
- Cooling power appr. 450 kW
- Air Flow to Cabin: 2.5 – 2.7 kg/s
- Ram Flow 6.5 kg/s
- Air Exchange in the fuselage 20times/ hour (1 time/ 3 min)
- Examination of ice-formation in the Mixer Unit and in the AGU-Outlet-Duct (Icing Tests)
- AGU / Mixer System Integration
 - Temperature, pressure and air flow measurements at all representative positions (Mixing Chamber, Air distribution ducts, Recirc-System, AGU)

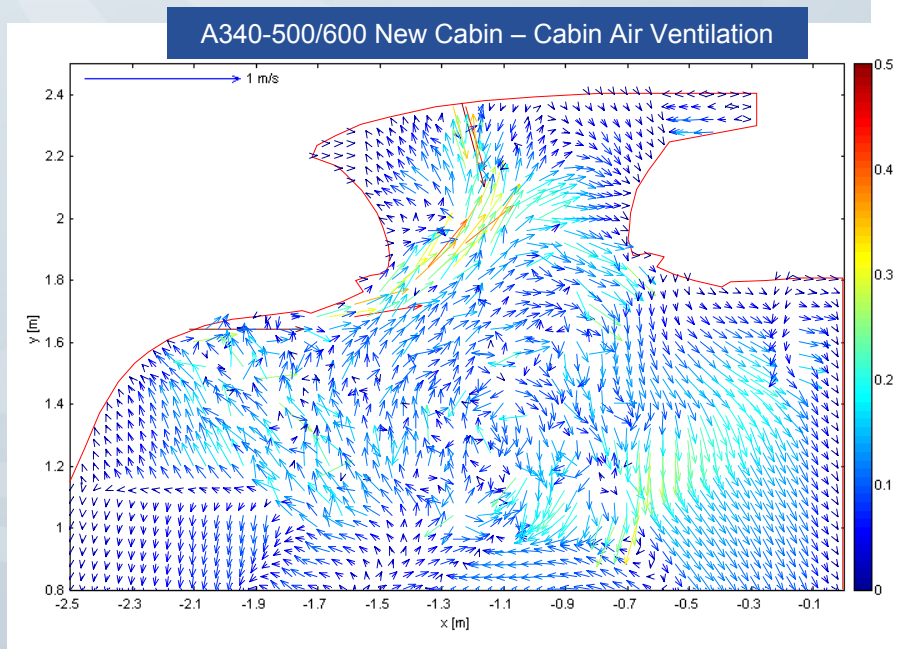
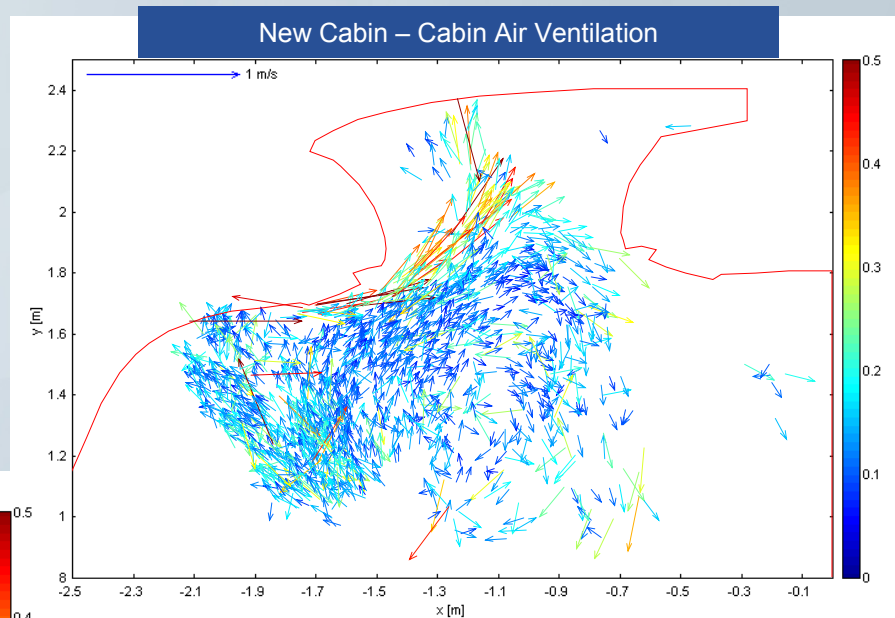
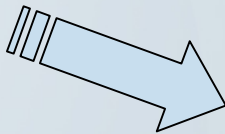


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A380 Cabin0 – Air Flow Distribution PST-System



... a Bubble becomes a Vector ...

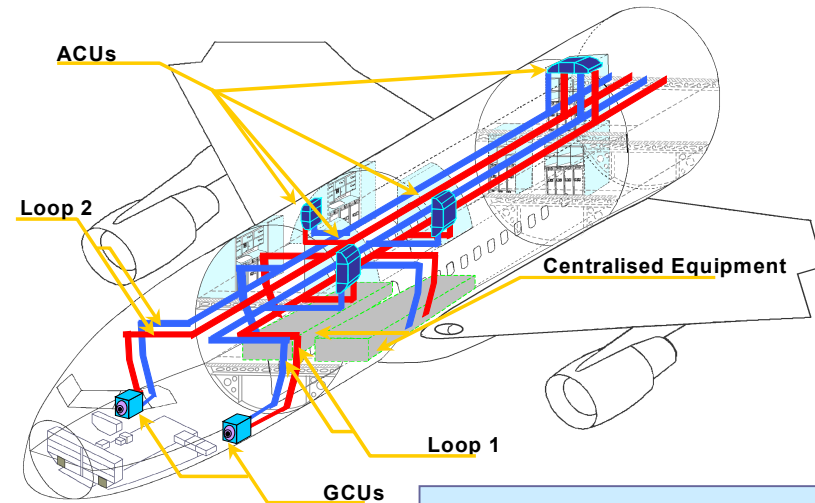


Interpolated Velocity Vectors

PST: Particle Streak Tracking System

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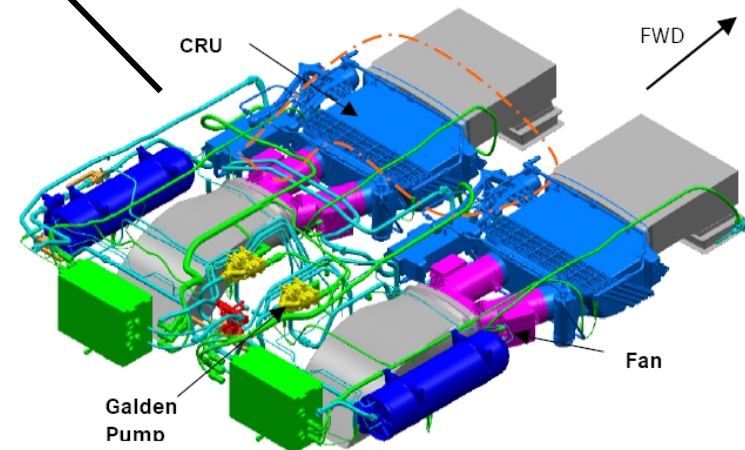
A380 Cabin0 – Supplemental Cooling System



ACU-Air Cooling Unit
GCU-Ground Cooling Unit
-operated when avionic cooling air is $>32^{\circ}\text{C}$
CRU-Centralised Refrigeration Unit

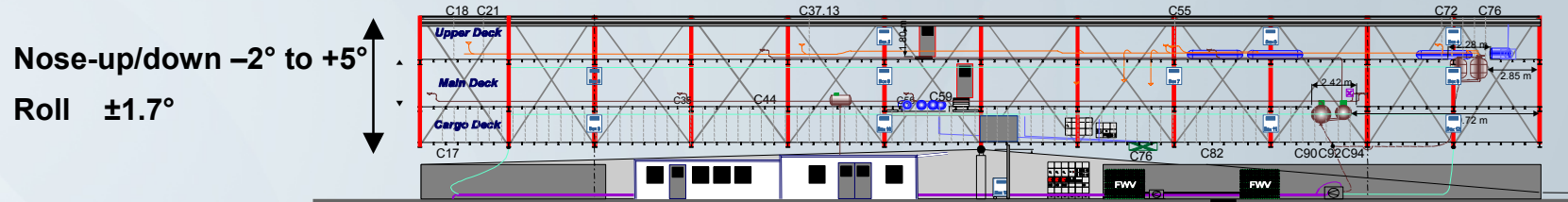
Major features:

- LR/ SA
 - Air Chiller (Refrigerator) in each Galley
 - R134A cooling medium
- A380
 - Centralized Cooling Unit (CRU)
 - Cooling loop distributed towards galleys
 - heat dissipation routed overboard
 - Cooling power appr. 15kW (150 home refrigerators)



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A380 Cabin0 – Water/ Waste Test Rig



- Vacuum toilet system incl. lower deck lavatories and options
- Potable water and waste water system incl. options (e.g. Shower, etc.)
- Disinfection and water treatment system
- Galley inserts



Logical Tests

- Usage
- Modes
- Safety

Electrical Tests

- Over/Undervoltage
- Inrush
- Transients



Physical Tests

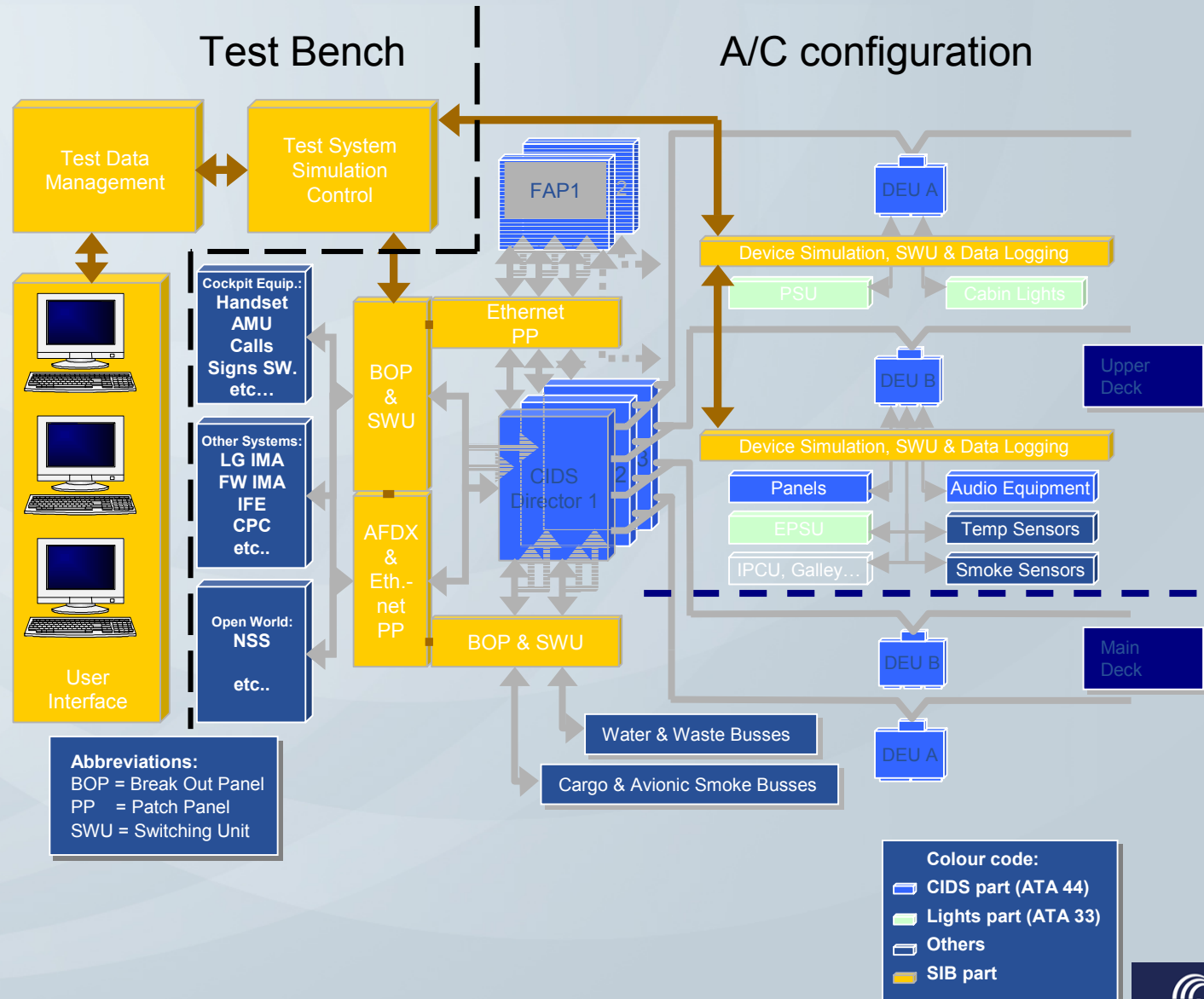
- Flow
- Temperature
- Drainage

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A380 Cabin0 – CIDS (Cabin Data Intercommunication System)

Main SIB features:

- Complete original A/C equipment from Directors via Data Busses to Decoder Encoder Units
- Partial original A/C equipment for flight attendant and passenger related units
- Representative customer configuration of SIB for each HoV possible
- System integration with all other original cabin systems possible (Cabin 0 concept)



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