AERONÁUTICA,
ESPACIO Y DEFENSA

MBSE application for Aircraft Systems Modification

AIRBUS Single Aisle Passenger to Freighter Conversion – Flight Warning System

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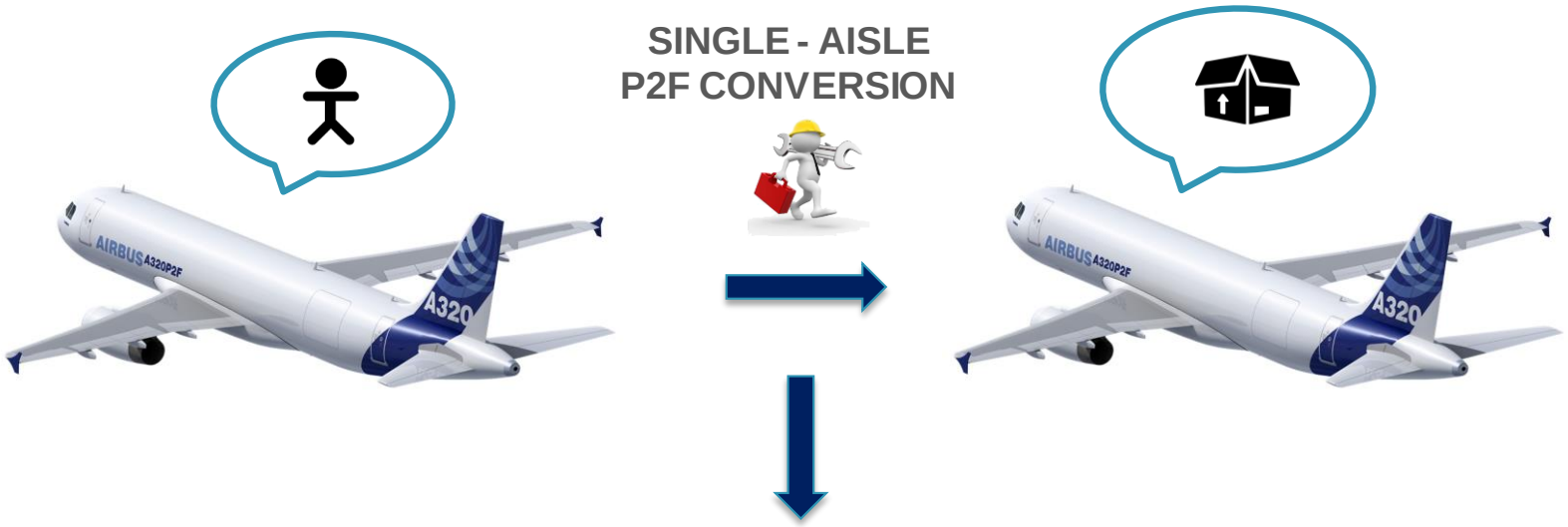
Motivation



PROJECT CHALLENGES

- Tight development schedule
- Short available time to perform tests on aircraft before delivery
- High technical complexity
- Modifications impact many systems of the aircraft.

AIRBUS

Design and integration of Cockpit Computers modifications

ST Aerospace
A company of ST Engineering

Design and integration of Cabin & Cargo modifications

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MBSE Team

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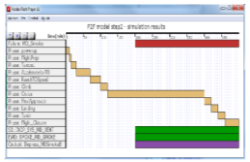
Project Strategy

Project Challenges

Tackled by



MBSE Approach

Expected Benefits

- Obtain better understanding of the changes
- Ensure consistency of the changes
- Master changes and prevent side effects
- Mitigate risks associated to the time constrains

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System Context

SINGLE- AISLE P2F CONVERSION

Implies many changes

- Access doors modification
- Main Deck area reorganization
- Modification of existing lavatory air extraction
- New Smoke Detection System in Main Deck

Impacts on many systems (ATA chapters)

Priorities:

- ATA21 - Air Conditioning
- ATA26 - Fire Protection
- ATA52 – Doors
- **ATA31 – Indicating and Recording Systems (AIRBUS SW development)**

SYSTEM OF INTEREST

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Context

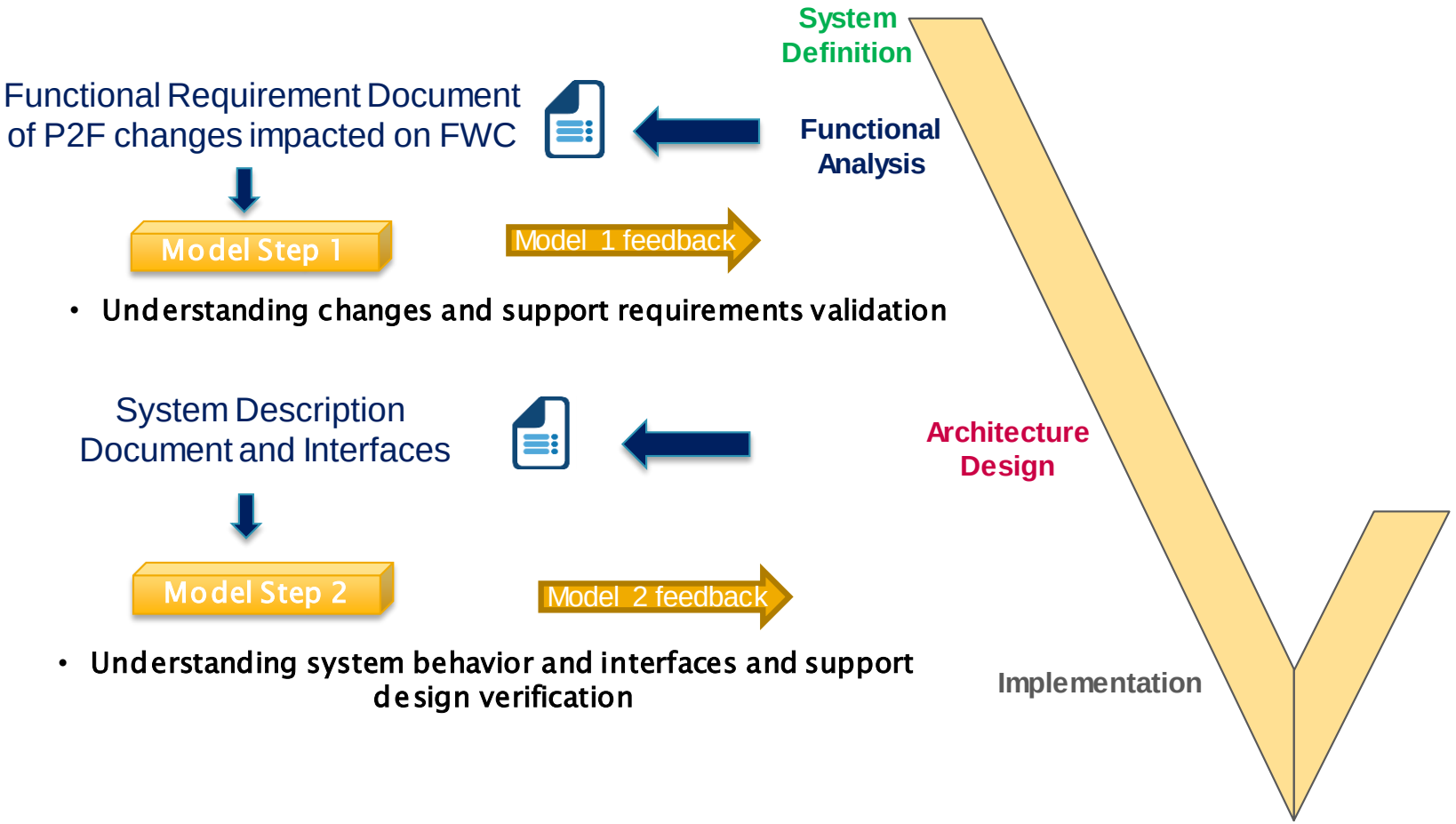
SYSTEM OF INTEREST	ENABLED SYSTEMS	ACTORS

• **ATA31 - Indicating and Recording Systems**
  • **Cockpit Computers**
  • **System Data Acquisition**
  • **Flight Data Interface Unit**
	• ATA21 - Air Conditioning
	• ATA26 - Fire Protections
	• ATA52 – Doors
		• Flight Crew

Objective:

Support specifications of the P2F modifications applied to Cockpit Computers based on models

Technical Process



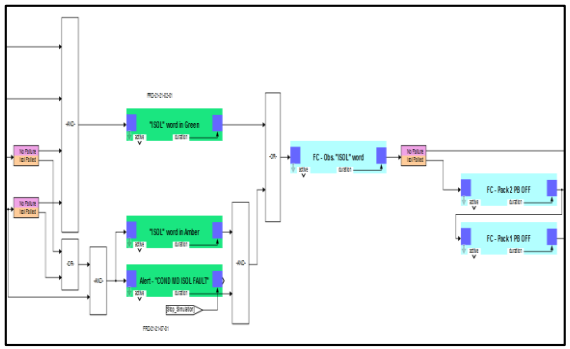
Methods

Step 1 Model: Functional Model

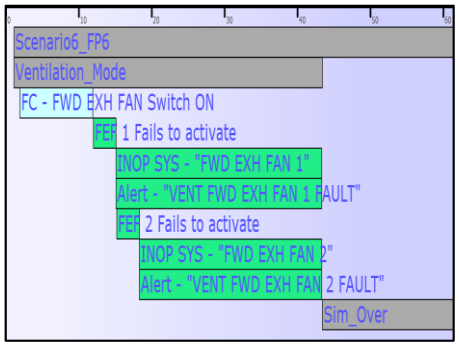
Functional Requirement Document

Operational scenarios

FFBD



Chronogram



- Operational scenarios:
  crew actions, components failures, events

- Each scenario triggers functions sequences represented by FFBDs.
- Executable model
- Tool: MATLAB/Simulink.

- Simulation results
- Output Visualization: Gantt Diagram

- Identification weaknesses, incompleteness or inconsistencies in the definition of changes
- Provide a global view of the system dynamic interdependencies related to P2F changes

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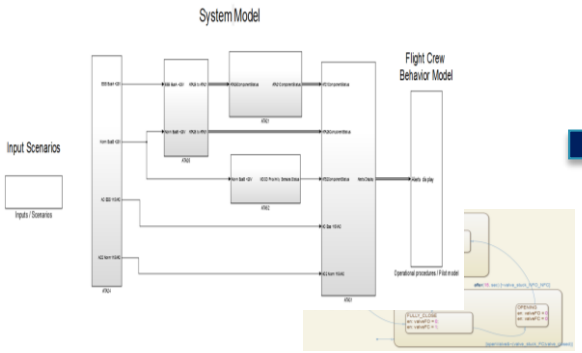
Methods

Step 2 Model: Behavioural Model

System Description Documents

System Interfaces

Behavioural Model



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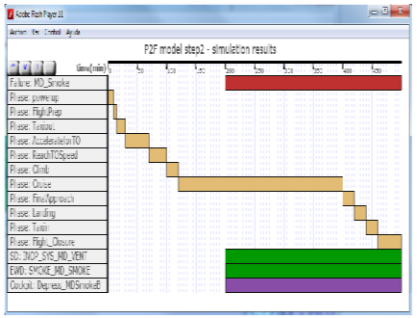

- Operational scenarios: crew actions, components failures, events

- System Architecture
- Components behaviour by state machines diagrams
- Executable model
- Simulink/Stateflow

- Simulation results
- Output Visualization: Gantt Diagram

- Verification of the proposed solution reach the needs defined in step 1.

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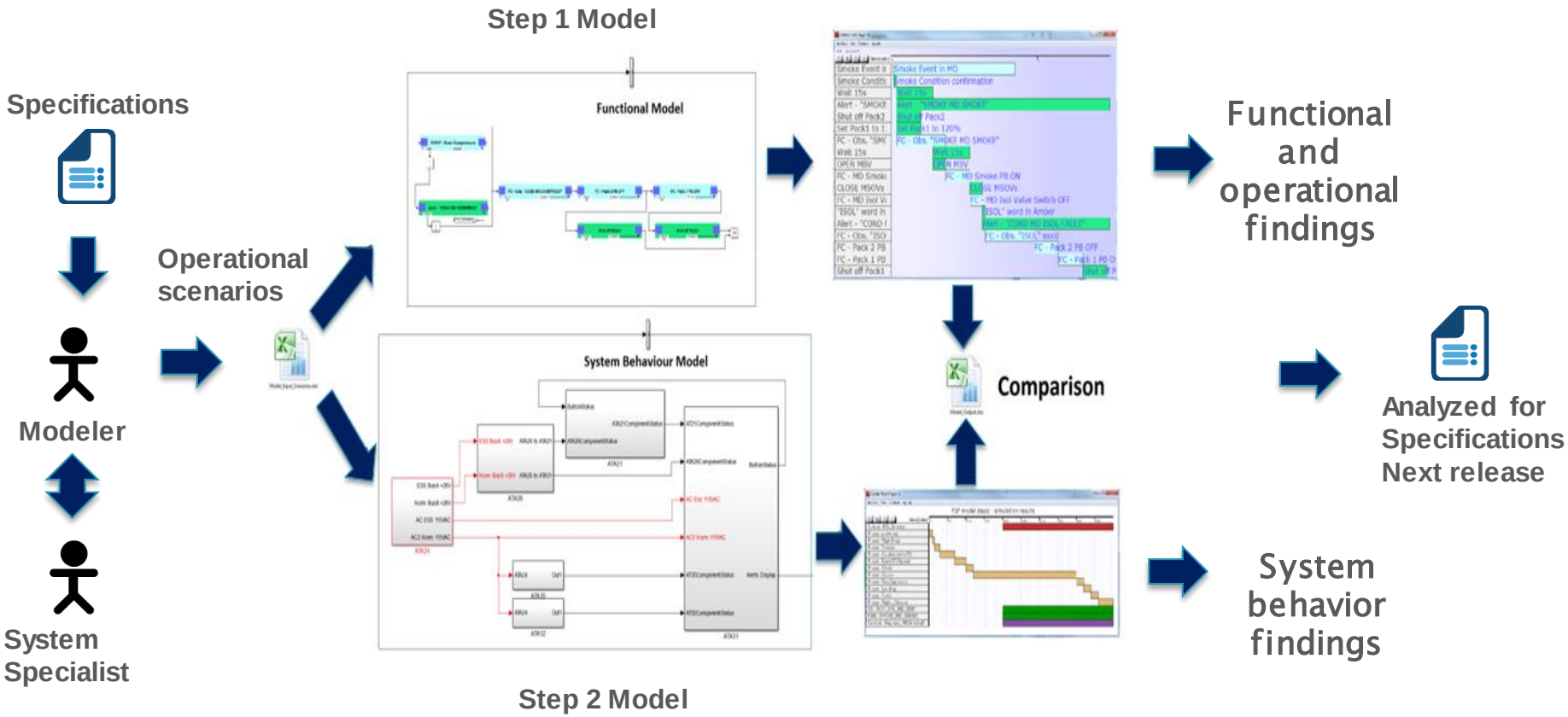
Analysis and Results

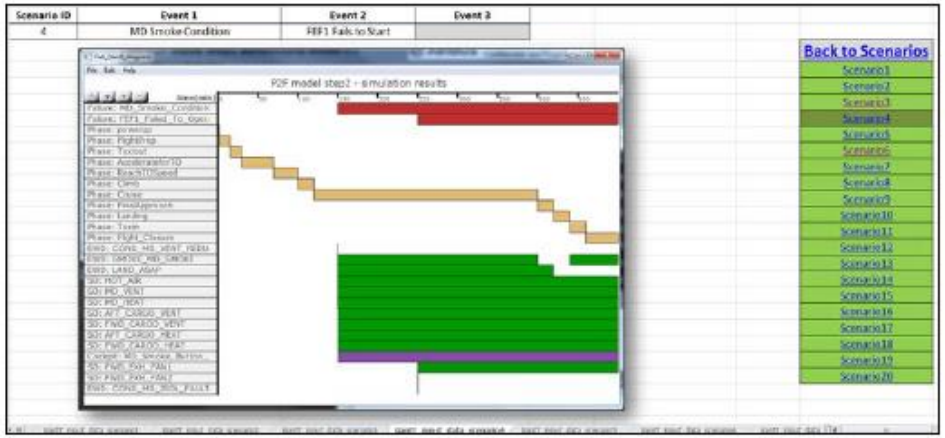


Results

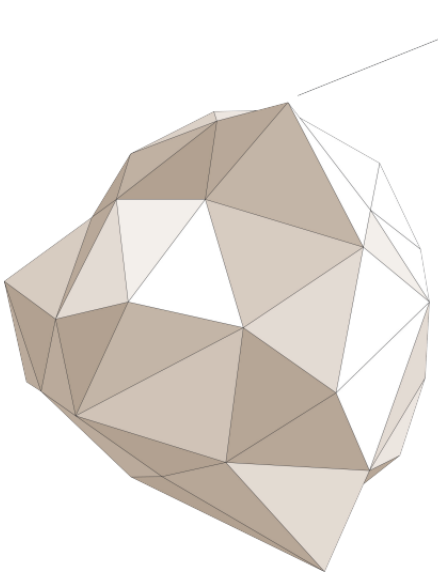
- During the activities of requirement analysis and systems modelling, several findings were identified during phase 1 and 2.
    - Missing information
    - Inconsistencies between simulations and expected behaviour
    - Inconsistencies between requirements

- Information provided to AIRBUS aircraft Systems Design Office.

- Findings analysed by the Systems Engineers of STA and Airbus and taken into account in the next steps of the design.



INNOVATION MAKERS



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