3DEXPERIENCE

EMBEDDED SYSTEMS WEEK

DASSAULT SYSTEMES

3DEXPERIENCE Platform & Ellidiss Software AADL Inspecter

5 October 2016

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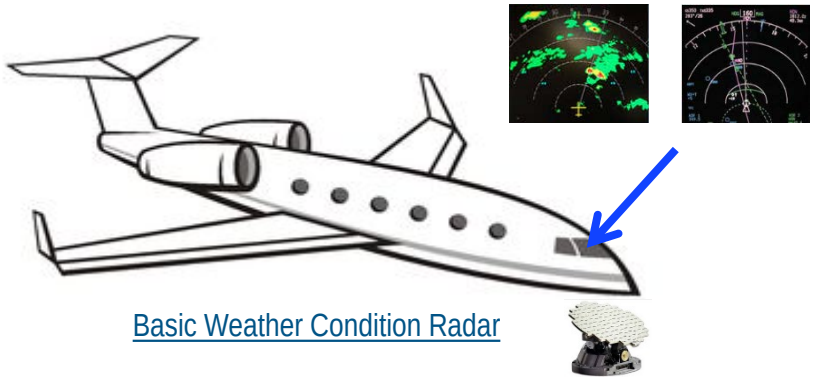
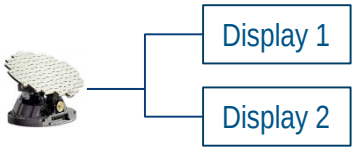
Context: Lightning Sensor System (LSS) capability & modification

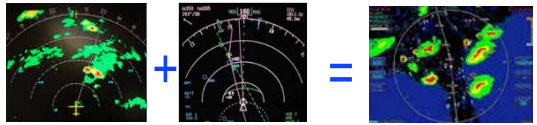
Dedicated pages on cockpit screens

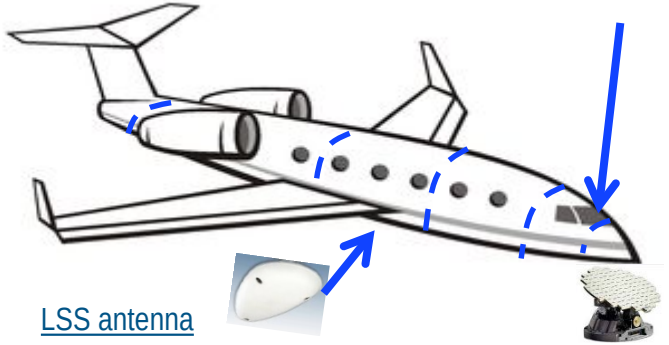


Basic Weather Condition Radar



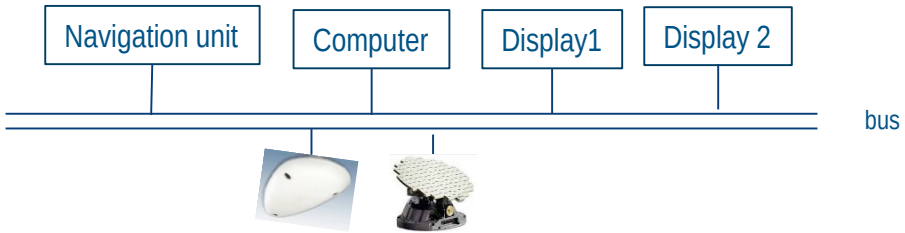
Primary Display Unit (PDU) screens & data fusion





LSS antenna

Basic Weather Condition Radar



High Level DS Scenarios Organization

Duplication Avoidance: Scenario elements are interdependent.

Mission
UAS Ice-Breaker
Product Experience

Main MBSE
Business Jet
Weather RADAR System

IVCV
Flutter Suppression System
Trades & Results Analytics

System Implications:
Safety, Embedded Systems,
& Protocol Dependent
AADL & Safety

A

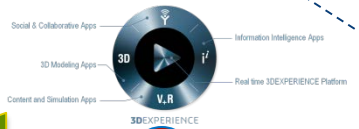
B

Change:
Implementation
Phase

C

Validation,
Certification,
Verification
Impact

D



G

Platform "Ilities"
Openness, Security,
Extensibility, etc.,

F

Integration of Multi-
Physics Models with
Architecture
Landing Gear

E

Change Governance
Lighting Sensor System

Architecture is taken to mean: Requirements,
Functional, Logical, Physical, and Integrated Modular

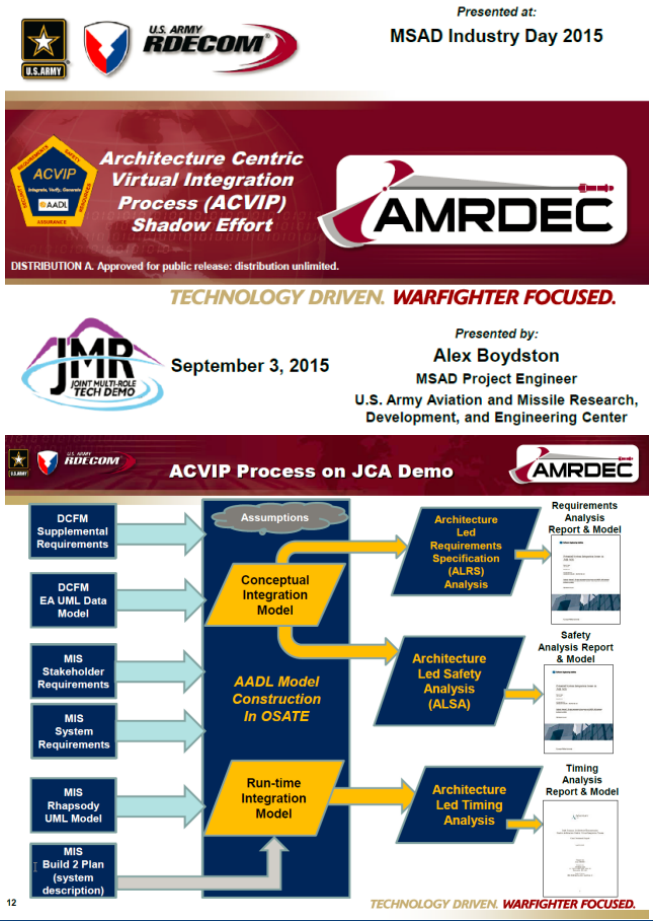
JMR/FVL Stated Values

- Approach: Model-Based Engineering Enhanced Modeling and Simulation Support throughout the Lifecycle
  - Model-Based Specification & Acquisition for Improved Validity
  - Enhanced Consistency, Reduced Redundancy, Increased Focus on Ambiguous, Conflicting, or Missing Definition Aspects
  - Enhanced Tool Interoperability
  - Enhanced Quality, Communications, and Productivity (reduced churn).
- Process: Architecture-Centric Virtual Integration Process (ACVIP)
  - Early Identification of Defect and Integration Issues
  - Single Truth Architecture Models
  - Mature Tool Usability, and qualification including associated methods and processes
  - Government—Industry Mutual adoption/Buy-in

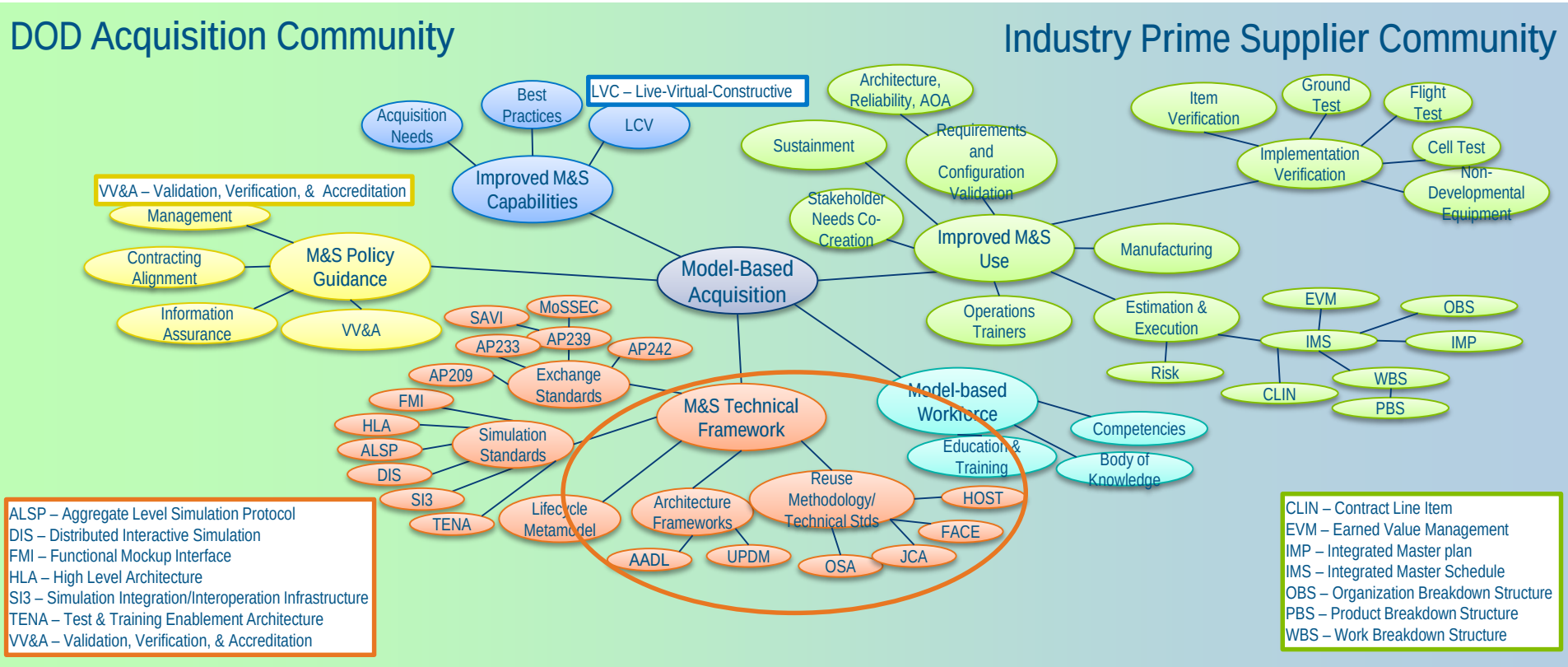
- Technical Standards and Reuse Basis: OSA/JCA/FACE/HOST
- A set of Reference Architectures that Facilitate Good Architecture Principles Practice of Modularity, Functional Isolation, etc.
  - While Constraining and Enforcing Compliance for Enhanced Evolution Aspects, including decomposition, interfaces, COTS Standards, & Data rights.
  - Facilitates Commonality, Variability, and Reuse
  - Facilitates Component-level competition and innovation.

Overview

- 3DEXPEIRENCE platform
- EEA Application
- AADL Introduction
  - Benefits early & enduring timing, fault modeling, error-handling, analysis, etc.
  - Enablement: Platform, Bus, Thread-level timing simulation, analysis , & code generation
  - AADL Inspector -- complete AADL model processing toolbox
    - parse, print, query, constrain, transform
    - strong relationships with partners in the AADL community who provide advanced AADL tools such as Cheddar (scheduling), Marzhin (simulation) or Ocarina (code generation)
- The Network LRUs/System Mapping
- Illustrate the Link between the objects in EEA and AADL
- Illustrate the EEA-AADL translation
- Make a snapshot of the results in AADL inspector
- Demonstrate the Simulation



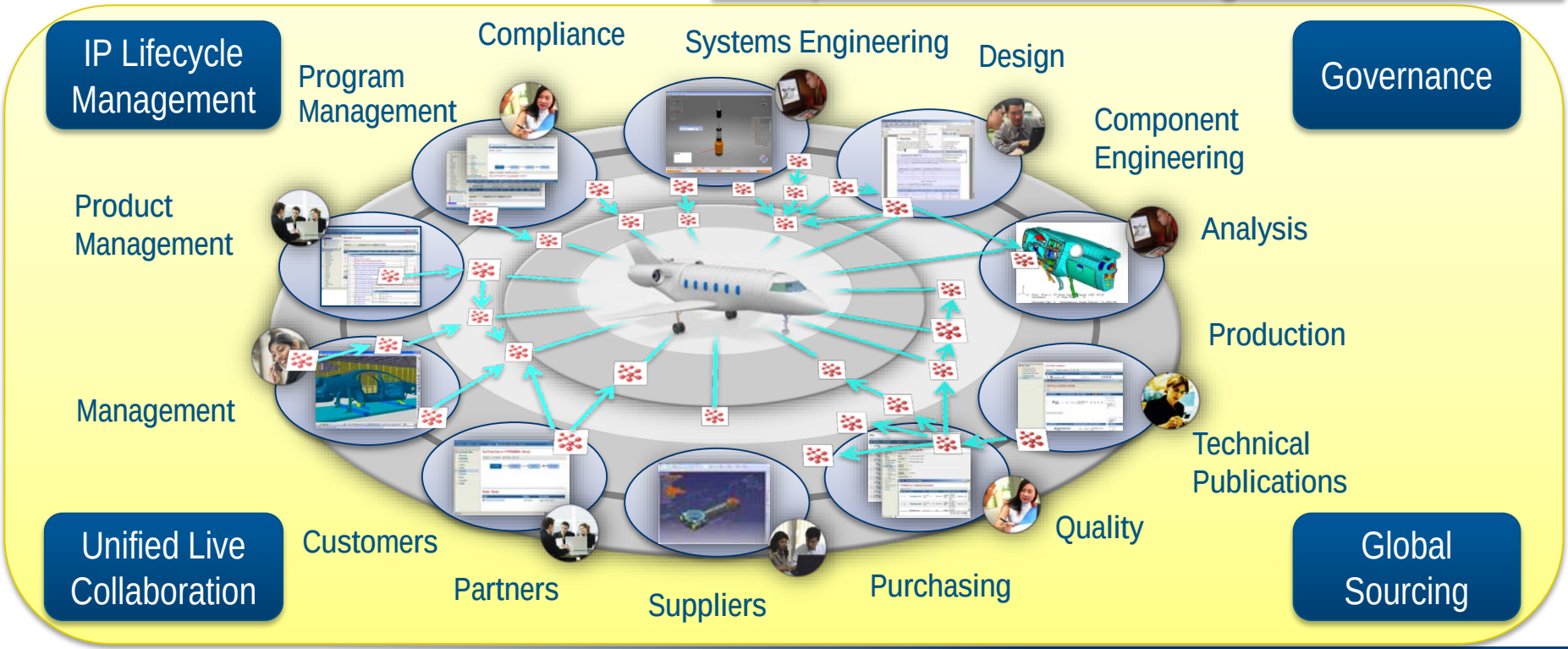
Create the Backbone for MBE while addressing other Competency areas.



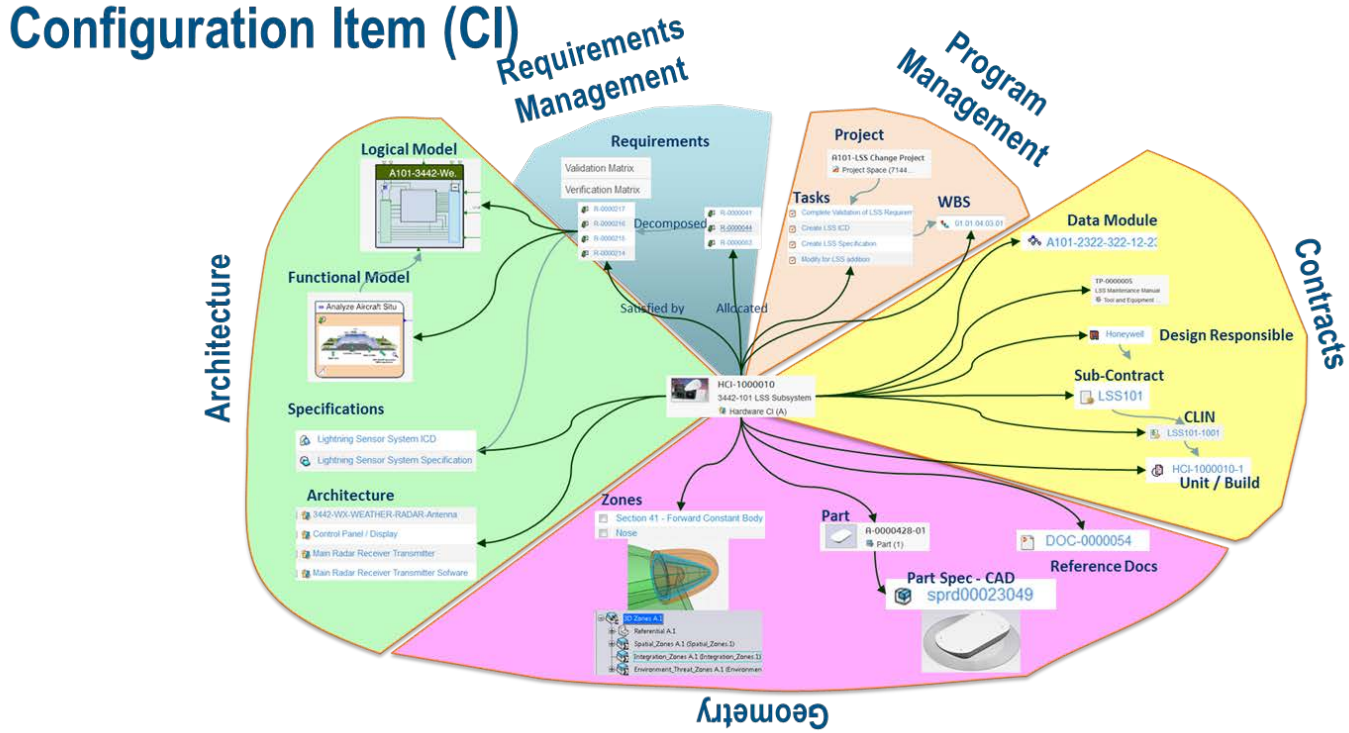
The 3DEXPERIENCE Platform is similar to the iOS

3DEXPERIENCE platform

Single Authoritative Source System of Record →
It is Upon this that is Built the Single Source of Truth



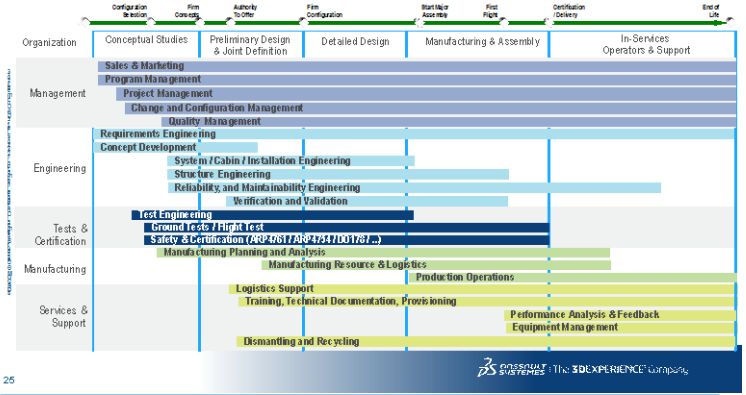
Platform Applications Provide Multi-Perspective Information Access in Context
One of which is EEA – Electrical & Electronic Architecture



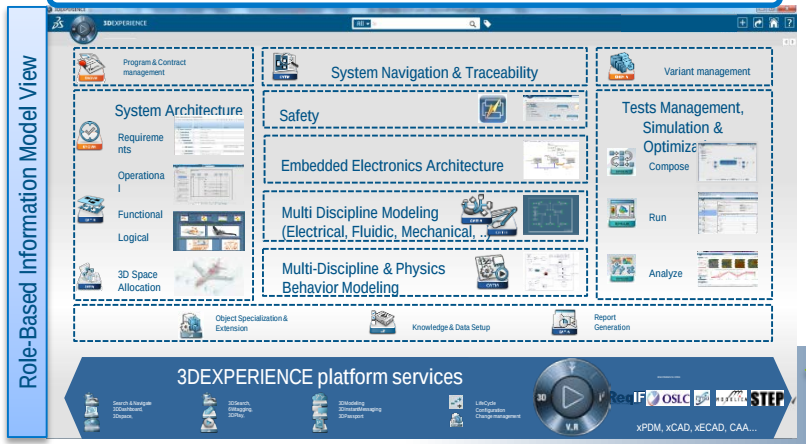
3DEXPERIENCE platform for Systems Engineering

3DEXPERIENCE platform MBSE Openness

A&D Processes



Platform Referential



Data Exchange from Disparate Models

SBA Disparate Data Sources Portal

Disparate Simulation Coordination

Traceability & Reqs Exchange

Impact-Intelligent Model Management

Multi-CAD and Architecture Tools

iSight Multi-Process Optimization

Exalead Unstructured Data

FMI Standard Co-Simulation

Reqtify Connectors & ReqIF

SLM Model Management

Application Neutral DF XML/XPDM

Adaptation Mechanisms

Openness

EEA to AADL Values

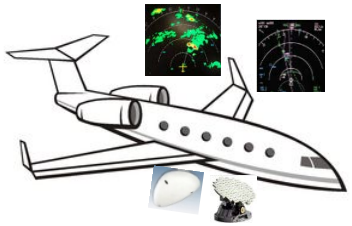
- AADL affords Pulling Timing Considerations into the systems level well in advance of the allocation to LRUs and even well in advance to implementation.
- This affords early exploration of Integrated Modular Avionics approaches, functional allocation based upon a number of architecture considerations including principles of isolation and separation for safety, survivability, etc.
- Downstream as implementation starts occurring the timing allocations can be managed and if one goes over budged trades can be made in the IMA functional distribution to LRUs to explore equally good solutions, and proactively addressing the timing budget issue.

EEA to AADL translator

From System Engineering to Software Engineering

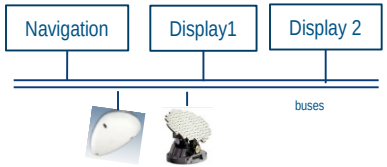
Requirements

Functions



Context:
A101-3100 Indicating /
A101-3400 Navigation

EE Topology
(Hardware Architecture)



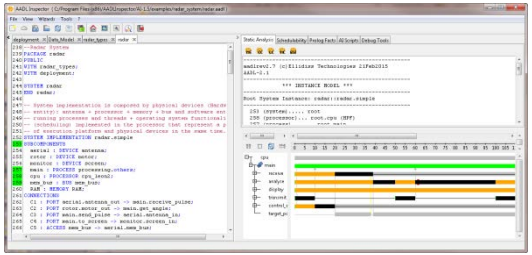
EE Components
(Software)

EE System Mapping

XML format
(.eexml)

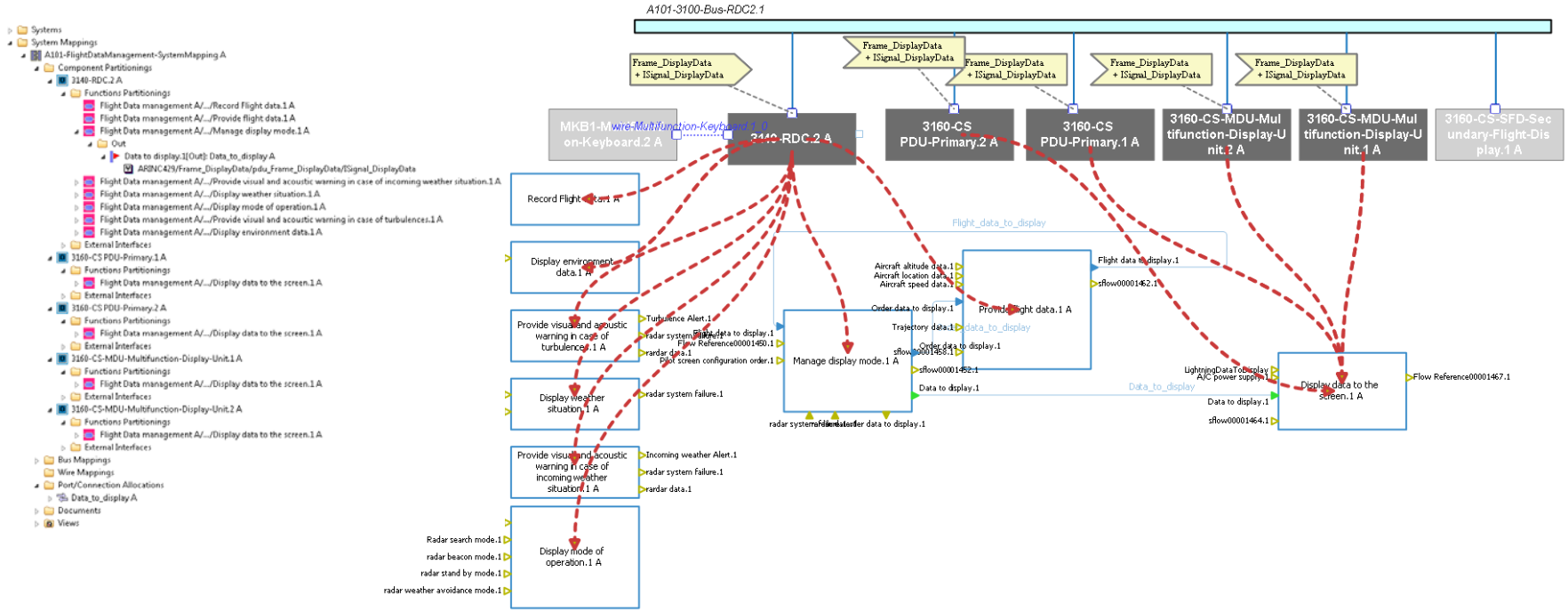
AADL format
.aadl

AADL Tools
Scheduling,
Simulation,
Code generation)



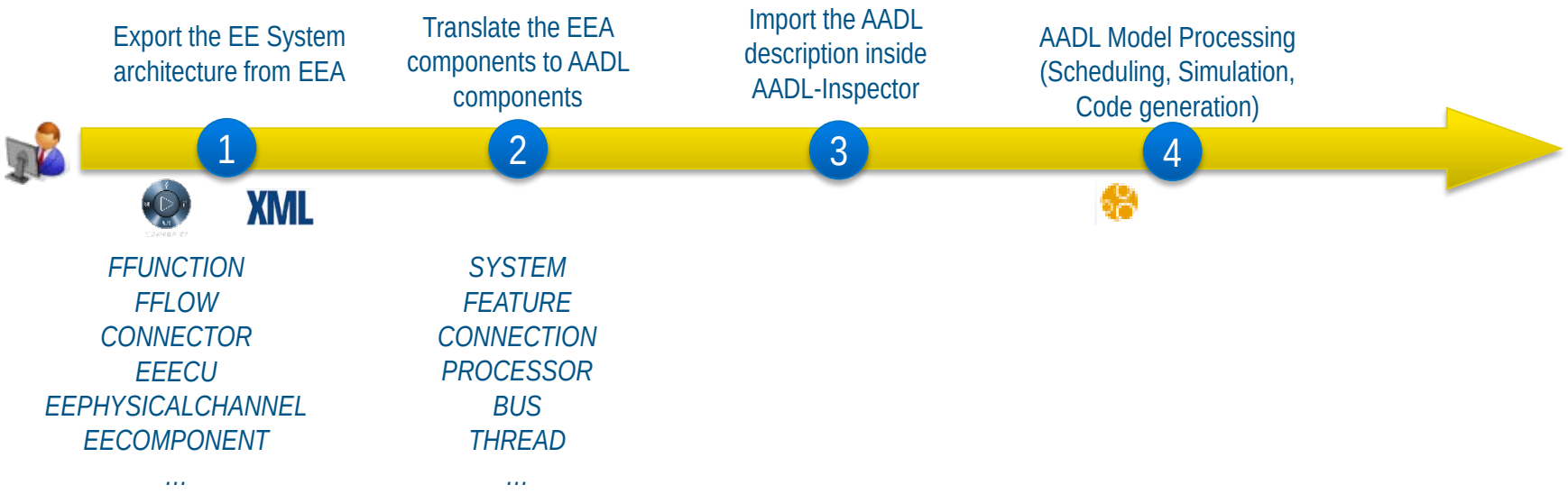
Context: EEA View Flight Data Management

A101-3100 Indicating / A101-3400 Navigation

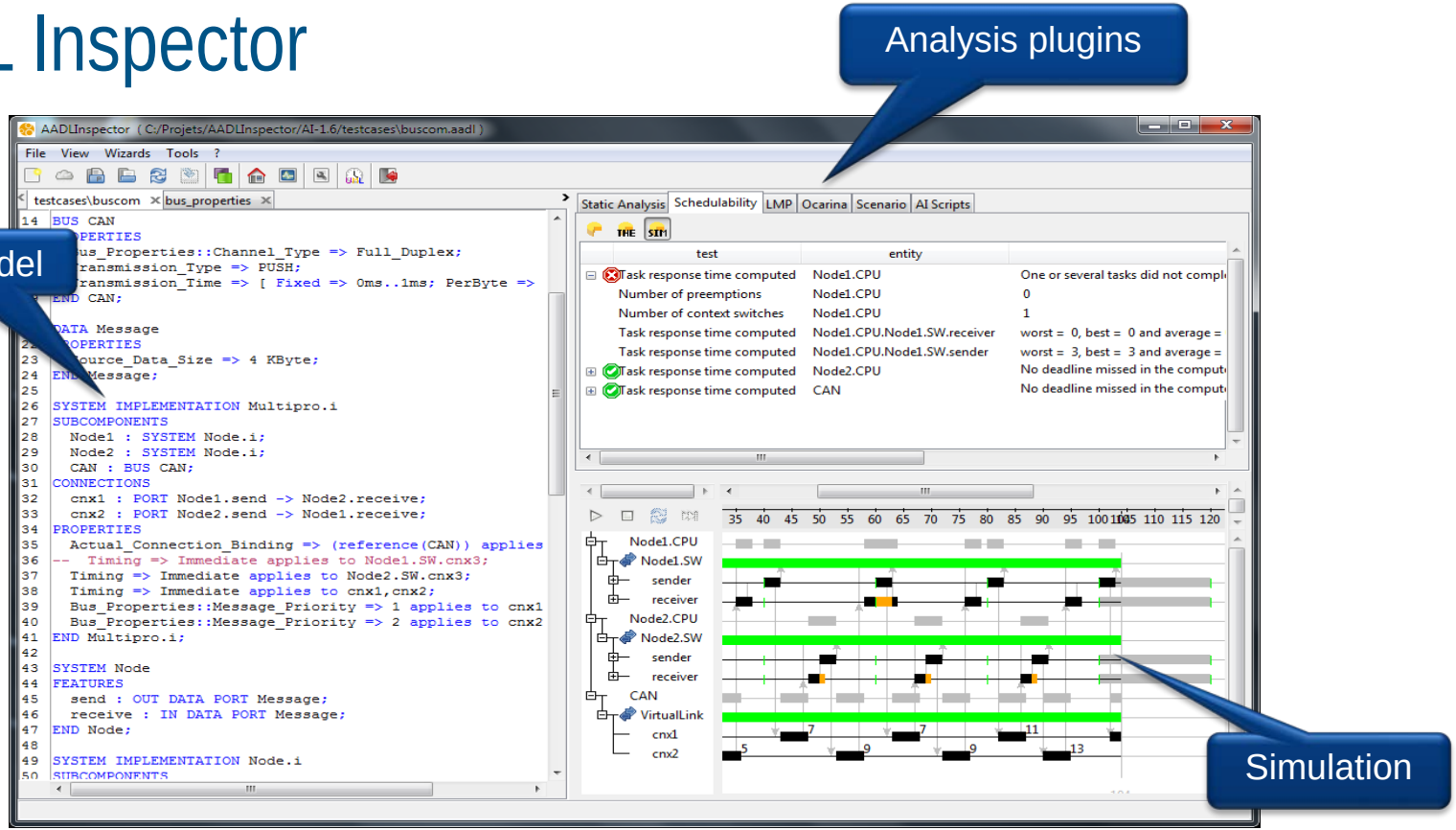


Global scenario

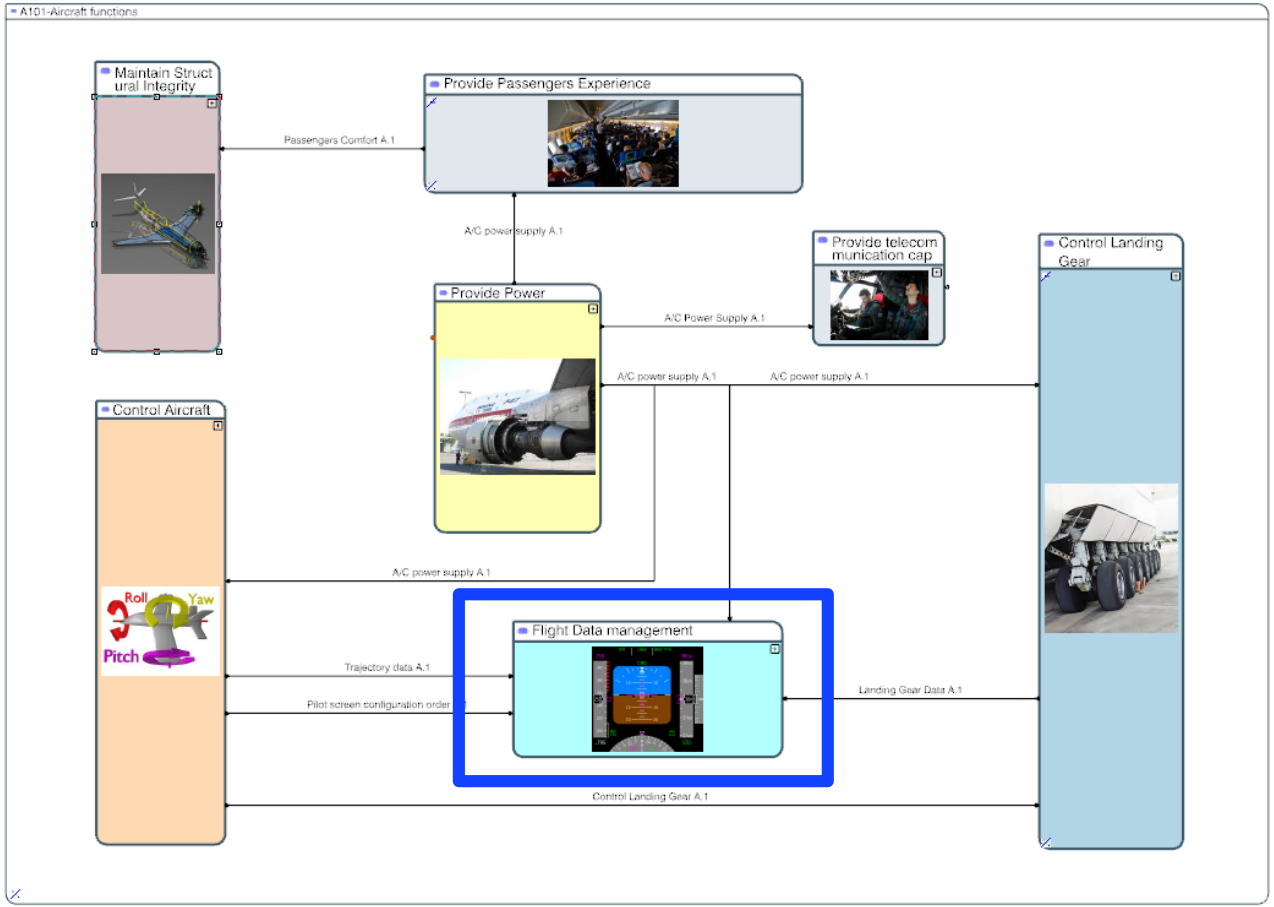
Openness with standard: EEA to AADL



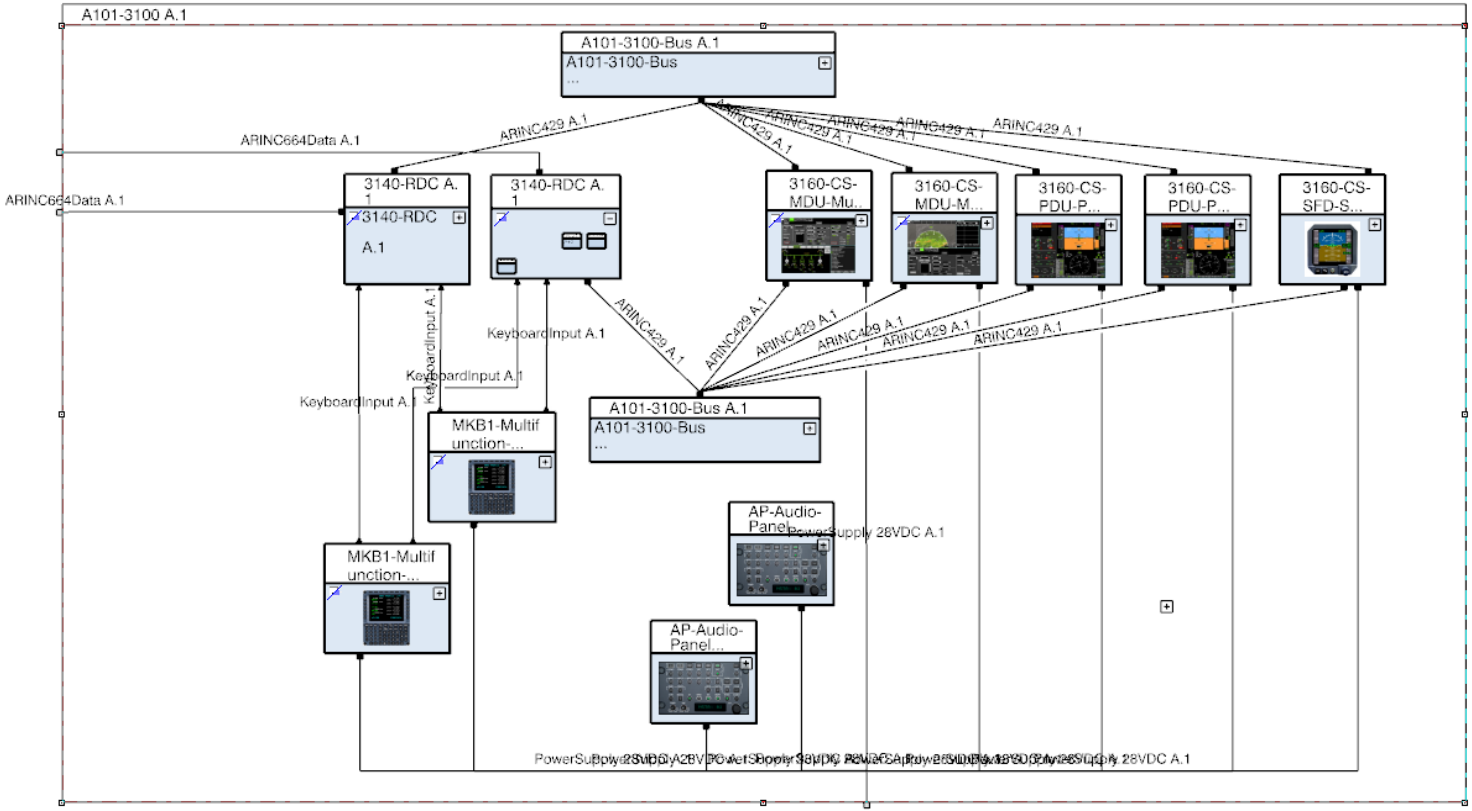
AADL Inspector



Aircraft Functions

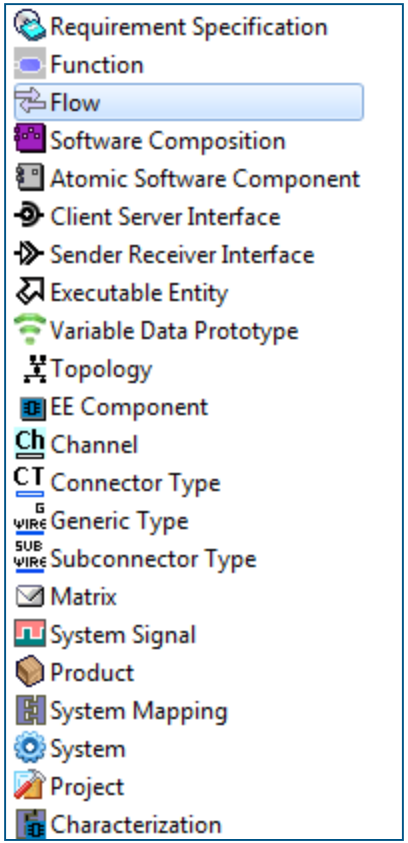


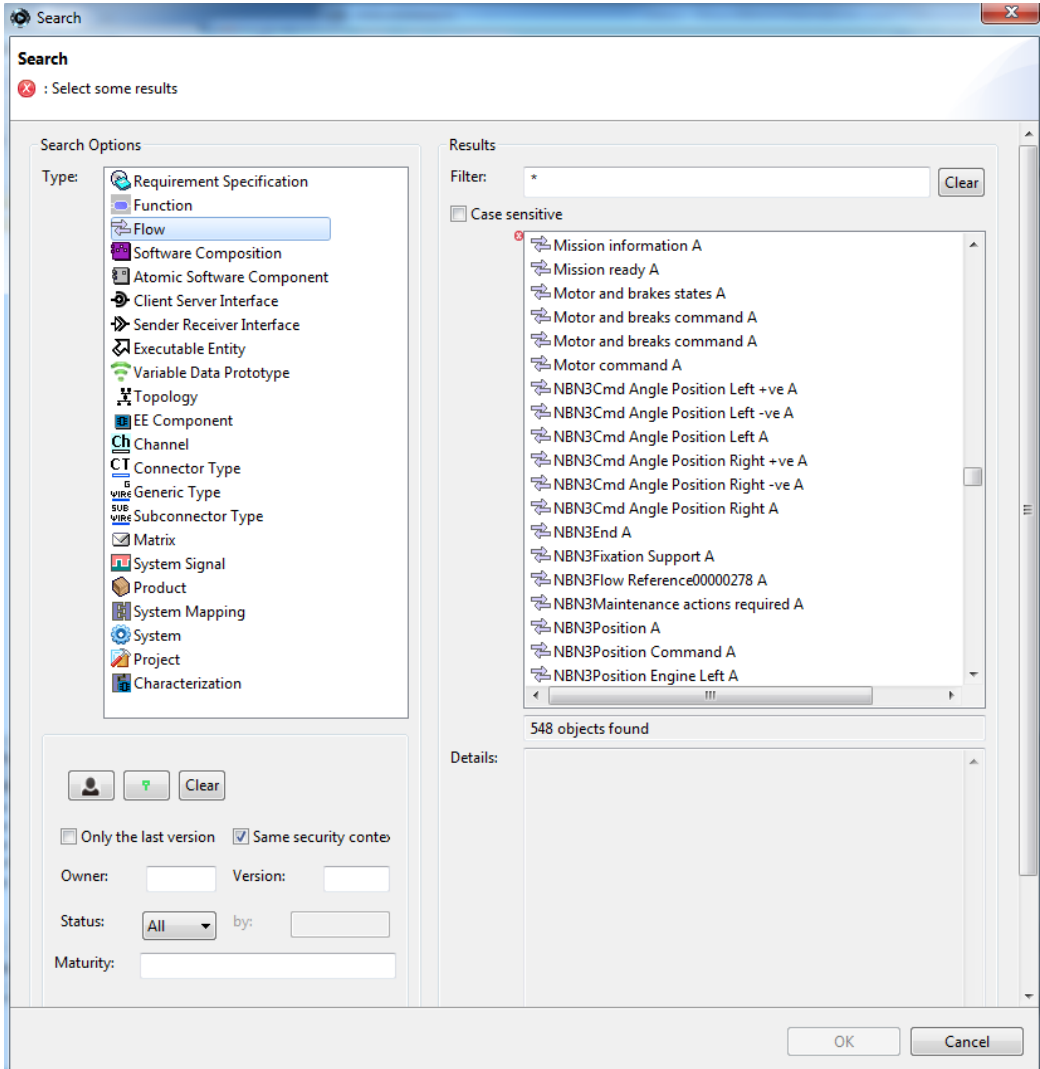
Logical Architecture



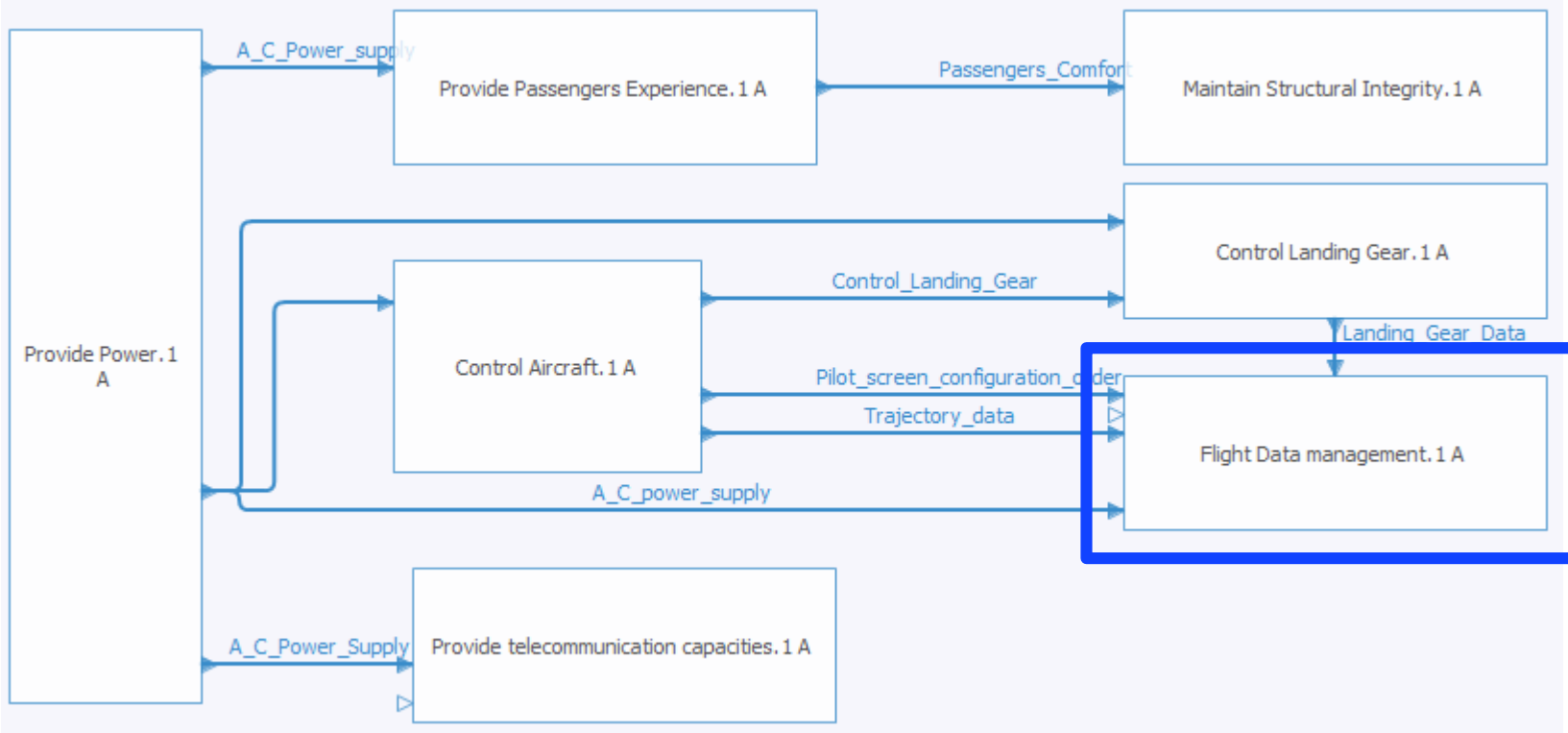
Access the Database

EEA Context

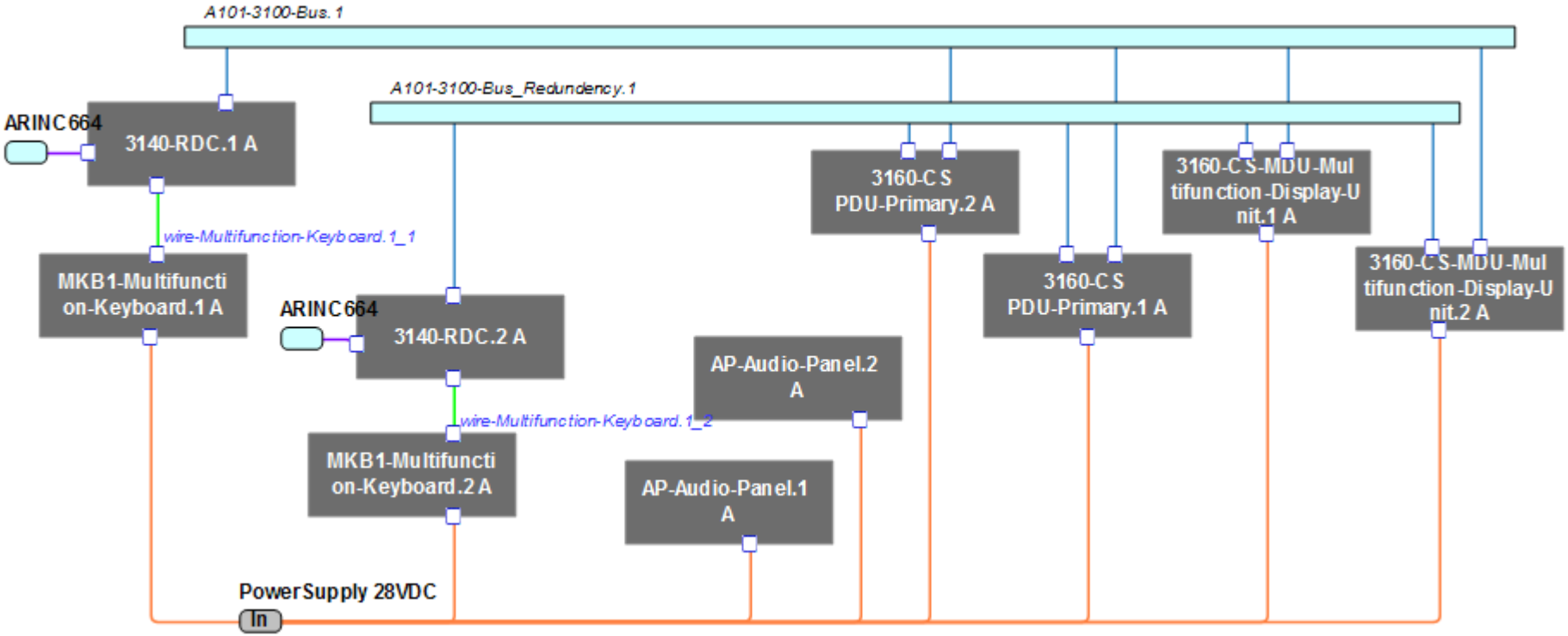




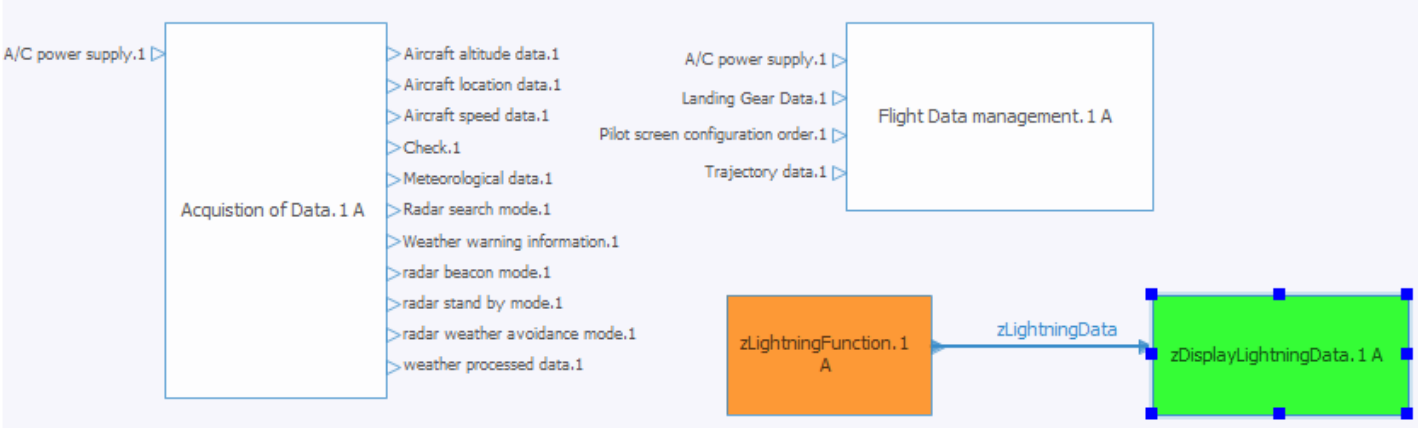
Aircraft Functions EEA view



Logical Architecture EEA view

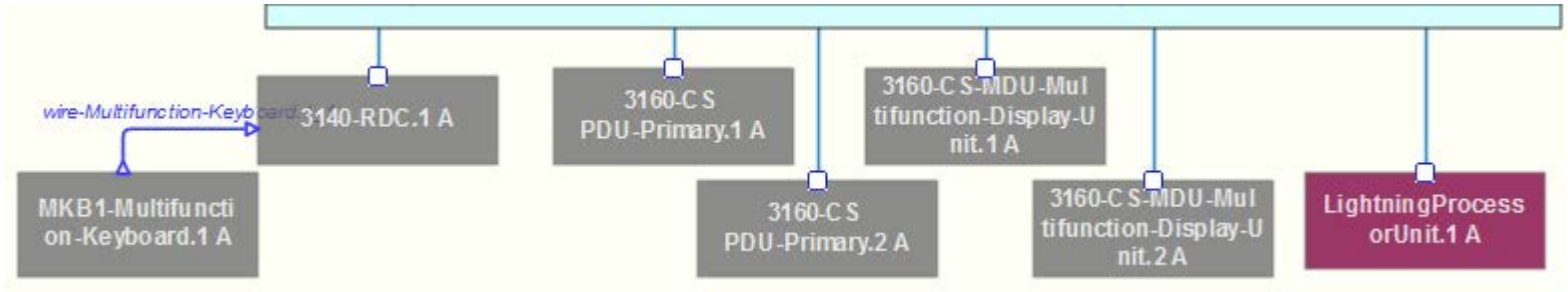


Functional-Logical Mapping EEA view

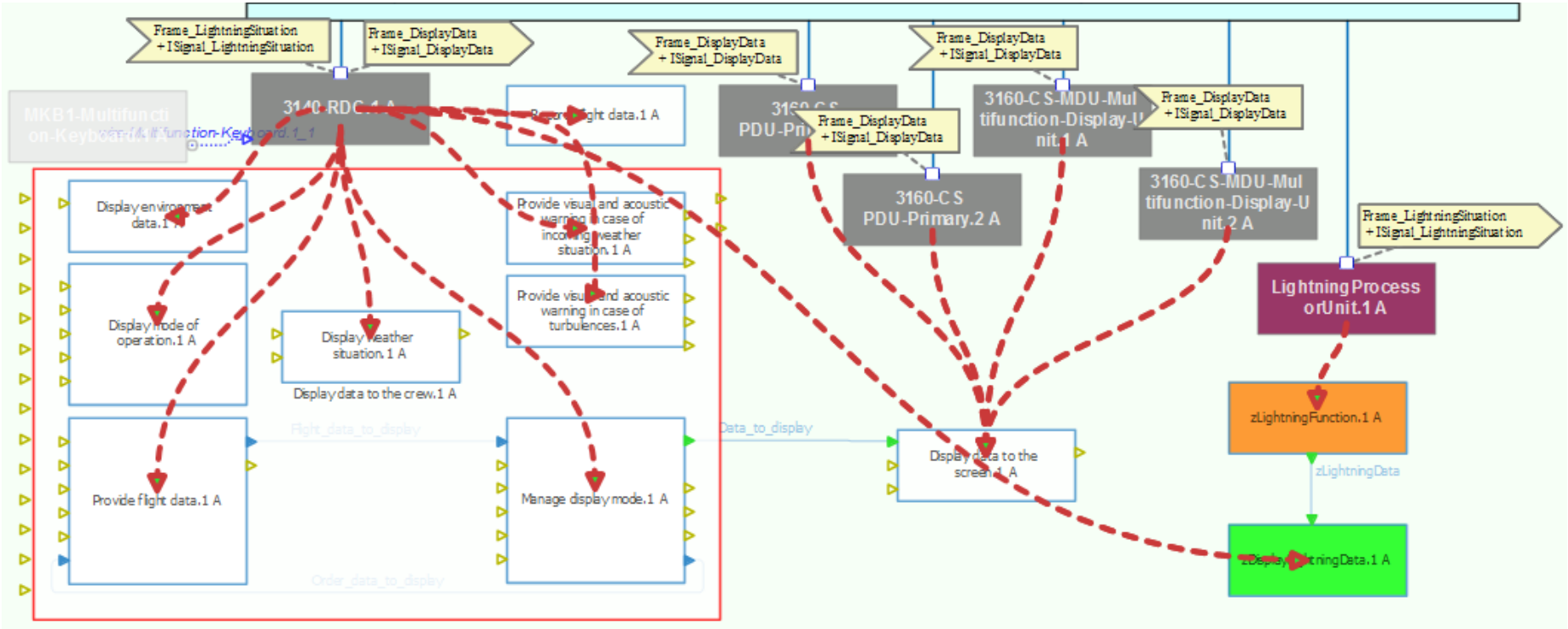


Functional

Logical

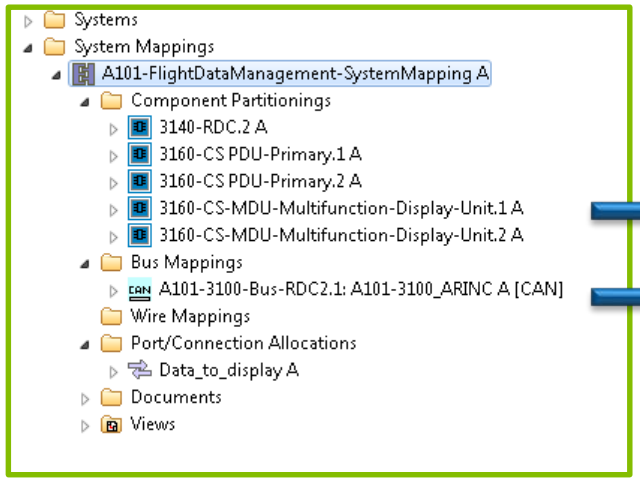


Functional-Logical & Data to Protocol Signal Mapping



EEA / AADL objects relationship

Example

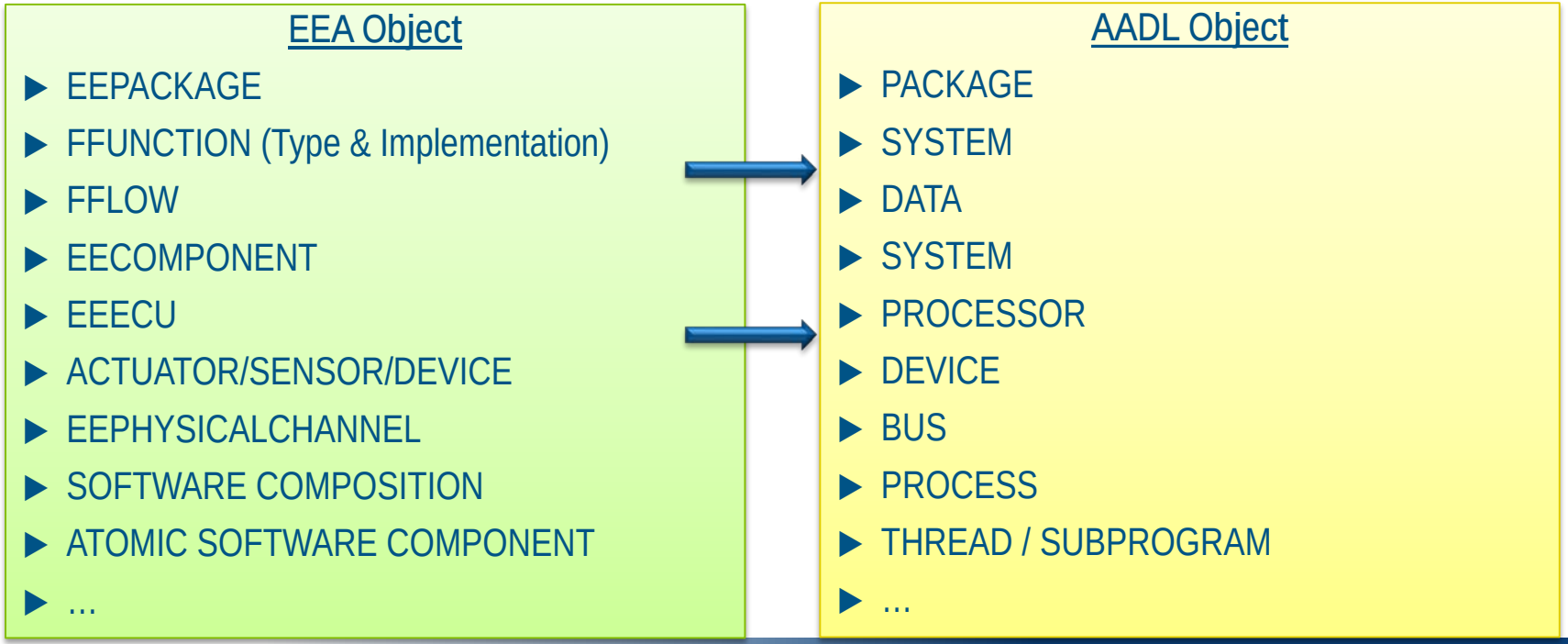



```
SYSTEM A101_FlightDataManagement_SystemMapping
FEATURES
  Landing_Gear_Data_1: IN DATA PORT Landing_Gear_Data;
  Trajectory_data_1: IN DATA PORT Trajectory_data;
  Pilot_screen_configuration_order_1: IN DATA PORT Pilot_screen_configuration_order;
  A_C_power_supply_1: IN DATA PORT A_C_power_supply;
  LightningDataToDisplay: IN DATA PORT LightningDataToDisplay;
END A101_FlightDataManagement_SystemMapping;

SYSTEM IMPLEMENTATION A101_FlightDataManagement_SystemMapping.i
SUBCOMPONENTS
  comp_3140_RDC_2: SYSTEM comp_3140_RDC_2.i;
  comp_3160_CS_PDU_Primary_1: SYSTEM comp_3160_CS_PDU_Primary_1.i;
  comp_3160_CS_PDU_Primary_2: SYSTEM comp_3160_CS_PDU_Primary_2.i;
  comp_3160_CS_MDU_Multifunction_Display_Unit_1: SYSTEM comp_3160_CS_MDU_Multifunction_Display_Unit_1.i;
  comp_3160_CS_MDU_Multifunction_Display_Unit_2: SYSTEM comp_3160_CS_MDU_Multifunction_Display_Unit_2.i;
  A101_3100_Bus_RDC2_1: BUS A101_3100_ARINC.i;
CONNECTIONS
  Connect_3: PORT comp_3140_RDC_2.Check_1 -> Check_Flight_Situation_1.Check_1;
  Connect_7: PORT comp_3140_RDC_2.Turbulence_Alert_1 -> Alert_crew_in_case_of_risk_1.Turbulence_Alert_1;
```

EEA / AADL objects relationship

Short description



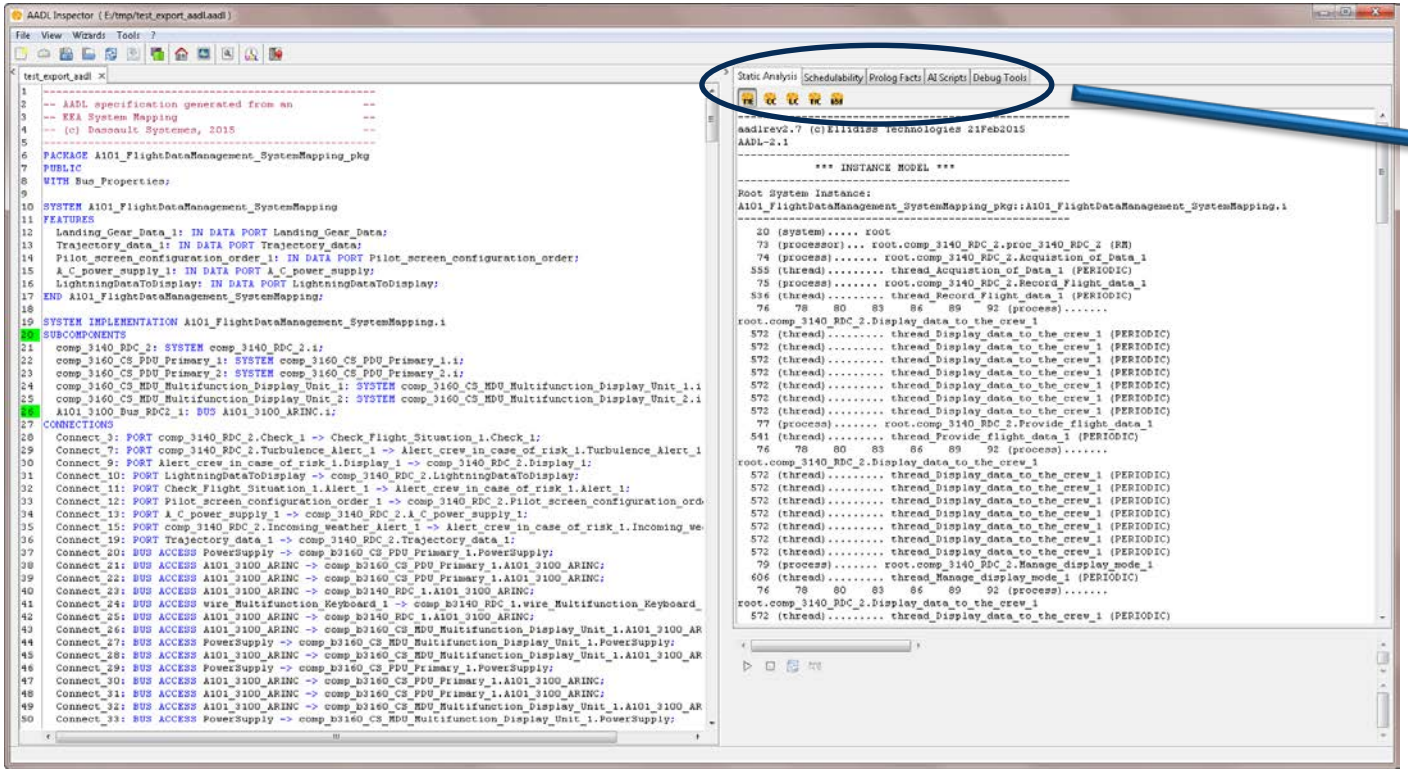
EEA / AADL Translation Demonstration


```
-------------------------------------------------
-- AADL specification generated from an         --
-- EEA System Mapping                           --
-- (c) Dassault Systemes, 2015                  --
-------------------------------------------------
PACKAGE A101_FlightDataManagement_SystemMapping_pkg
PUBLIC
WITH Bus_Properties;

SYSTEM A101_FlightDataManagement_SystemMapping
FEATURES
  Landing_Gear_Data_1: IN DATA PORT Landing_Gear_Data;
  Trajectory_data_1: IN DATA PORT Trajectory_data;
  Pilot_screen_configuration_order_1: IN DATA PORT Pilot_screen_configuration_order;
  A_C_power_supply_1: IN DATA PORT A_C_power_supply;
  LightningDataToDisplay: IN DATA PORT LightningDataToDisplay;
END A101_FlightDataManagement_SystemMapping;

SYSTEM IMPLEMENTATION A101_FlightDataManagement_SystemMapping.i
SUBCOMPONENTS
  comp_3140_RDC_2: SYSTEM comp_3140_RDC_2.i;
  comp_3160_CS_PDU_Primary_1: SYSTEM comp_3160_CS_PDU_Primary_1.i;
  comp_3160_CS_PDU_Primary_2: SYSTEM comp_3160_CS_PDU_Primary_2.i;
  comp_3160_CS_MDU_Multifunction_Display_Unit_1: SYSTEM comp_3160_CS_MDU_Multifunction_Display_Unit_1.i;
  comp_3160_CS_MDU_Multifunction_Display_Unit_2: SYSTEM comp_3160_CS_MDU_Multifunction_Display_Unit_2.i;
  A101_3100_Bus_RDC2_1: BUS A101_3100_ARINC.i;
CONNECTIONS
  Connect_3: PORT comp_3140_RDC_2.Check_1 -> Check_Flight_Situation_1.Check_1;
  Connect_7: PORT comp_3140_RDC_2.Turbulence_Alert_1 -> Alert_crew_in_case_of_risk_1.Turbulence_Alert_1;
  Connect_9: PORT Alert_crew_in_case_of_risk_1.Display_1 -> comp_3140_RDC_2.Display_1;
  Connect_10: PORT LightningDataToDisplay -> comp_3140_RDC_2.LightningDataToDisplay;
  Connect_11: PORT Check_Flight_Situation_1.Alert_1 -> Alert_crew_in_case_of_risk_1.Alert_1;
  Connect_12: PORT Pilot_screen_configuration_order_1 -> comp_3140_RDC_2.Pilot_screen_configuration_order_1;
  Connect_13: PORT A_C_power_supply_1 -> comp_3140_RDC_2.A_C_power_supply_1;
  Connect_15: PORT comp_3140_RDC_2.Incoming_weather_Alert_1 -> Alert_crew_in_case_of_risk_1.Incoming_weather
  Connect_19: PORT Trajectory_data_1 -> comp_3140_RDC_2.Trajectory_data_1;
  Connect_20: BUS ACCESS PowerSupply -> comp_b3160_CS_PDU_Primary_1.PowerSupply;
  Connect_21: BUS ACCESS A101_3100_ARINC -> comp_b3160_CS_PDU_Primary_1.A101_3100_ARINC;
  Connect_22: BUS ACCESS A101_3100_ARINC -> comp_b3160_CS_PDU_Primary_1.A101_3100_ARINC;
```

Exploitation of the EEA data in AADL Inspector



Static Analysis
Scheduling
Simulation
…

Quick Simulation using the Generated AADL Code.