AIDA study case

Architecture model in Capella

System version : V4.5

Table of content

FRENCH INSTITUTES OF TECHNOLOGY

Copyright

Contributors:

Pierre Virelizier, Tatiana Prosvirnova, Estelle Saez – Initial contribution

Romaric Demachy – System version V4.4 and V4.5

FRENCH INSTITUTES OF TECHNOLOGY

Capella Tool

is modelled with

Capella is an Open Source MBSE tool (Model Based System Engineering). This tool implement the Arcadia method.

Capella software and documentation about the tool and the method are available here : https://www.polarsys.org/capella/

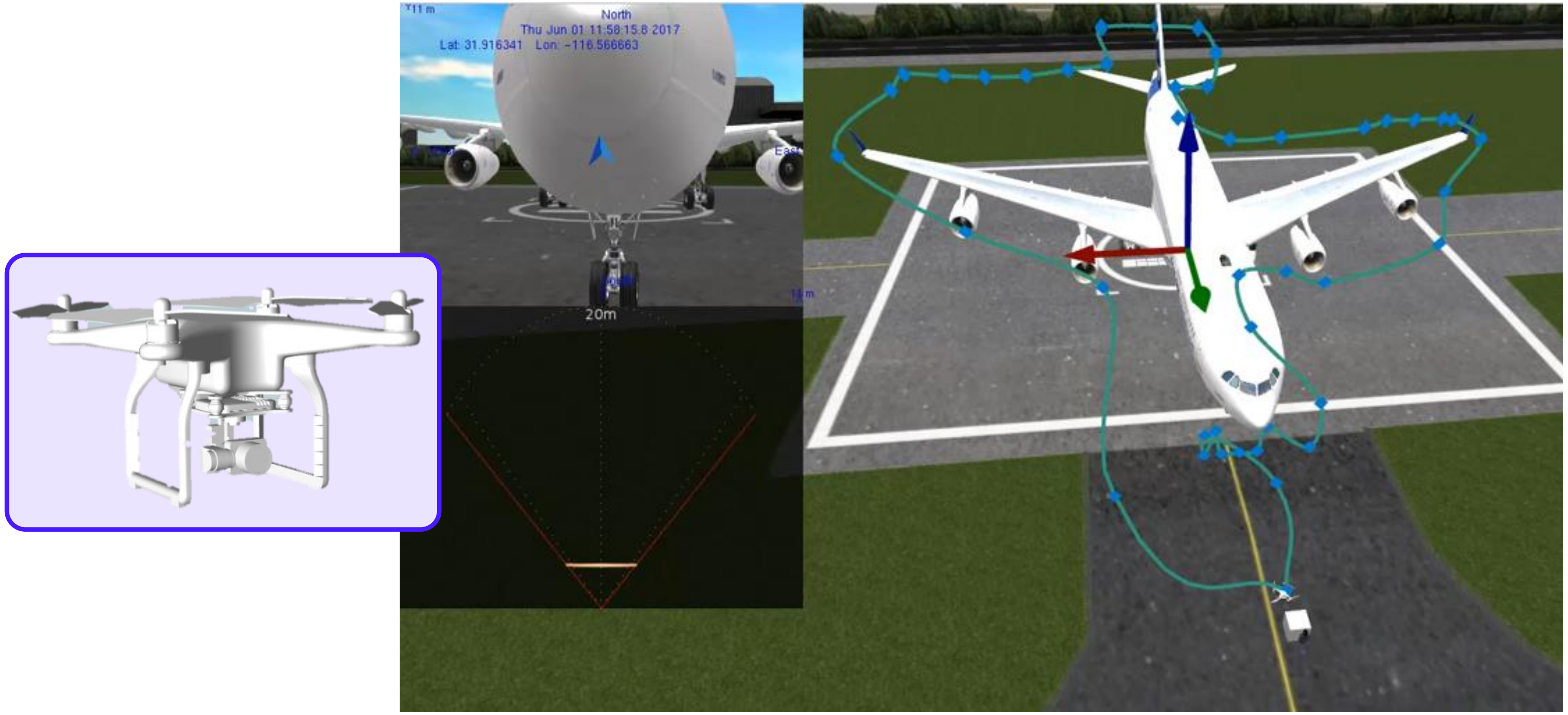
The AIDA architecture system version V4.5 is modelled with the version V5.1 of Capella.

FRENCH INSTITUTES OF TECHNOLOGY

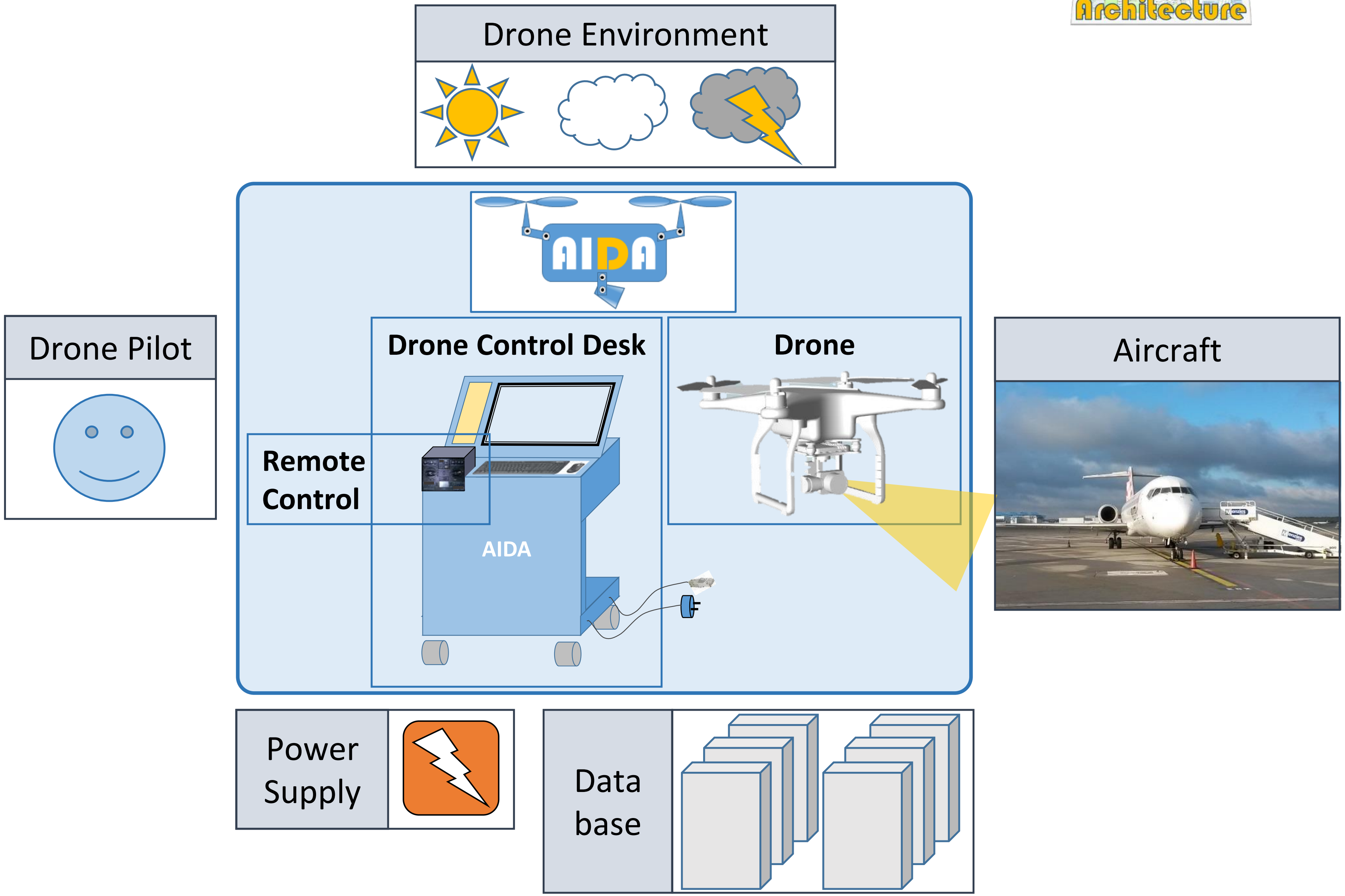
AIDA system introduction

AIDA : Aircraft Inspection by Drone Assistant

Assistance during walk around. AIDA seeks Aircraft defects



AIDA system description



AIDA experimentation

- AIDA system was first designed and modelled by the MOISE project (IRT Saint Exupery, Toulouse, France). The S2C project, a MOISE sequel, also uses AIDA and continues the development of the use case.
- This system is a full study case, covering several fields of system design assisted by models.

Topics: system architecture, MBSE
Tool: Capella

Topics: system safety analysis, MBSA, Altarica
Tool: Cecilia Ocas, SimfiaNeo

Topics: system simulation, control law, cosimulation
Tools: simulationX, OpenModelica, ProSivic, Cosimate

- This document describes the model of the **AIDA Architecture** package.

Table of content

FRENCH INSTITUTES OF TECHNOLOGY

Capella model overview

The AIDA model follows the Arcadia method. All the modelling layers proposed by this method are exploited, except for the EPBS layer.

Capella layers/visions	Activity explorer	AIDA model description: Content	AIDA model description: Comments
Arcadia note: Visions for environment description and need analysis.	Operational Analysis	Description of Walk-Around process – identification of high level capabilities and activities	*The system does not appear in this layer*
	System Analysis	Vision with need analysis and system context analysis (high level scenarios and functional architecture, external interfaces)	Gathers technical exchanges between system supplier and customer
Arcadia note: Visions for solution description	Logical Architecture	Vision for classification and traceability between need analysis and solution	Architecture breakdown taking into account non-functional considerations (safety,…)
	Physical Architecture	Vision with the **solution** of the system supplier (with functions of physical objects)	System supplier proposal taking into account technological choices

FRENCH INSTITUTES OF TECHNOLOGY

Capella model overview

A full documentation of the model has been created, see the document “AIDA Architecture synthesis V4.5”.

Important remark : amongst other evolutions, the V4.4 system version aimed at completing Capella layers that were not, or only partially populated in previous versions. Currently, all the layers (except for EPBS) are populated, but inconsistencies remain between the upper level layers (OA, SA and LA) and the Physical Architecture layer. V4.5 provides minor additional modelling improvements.

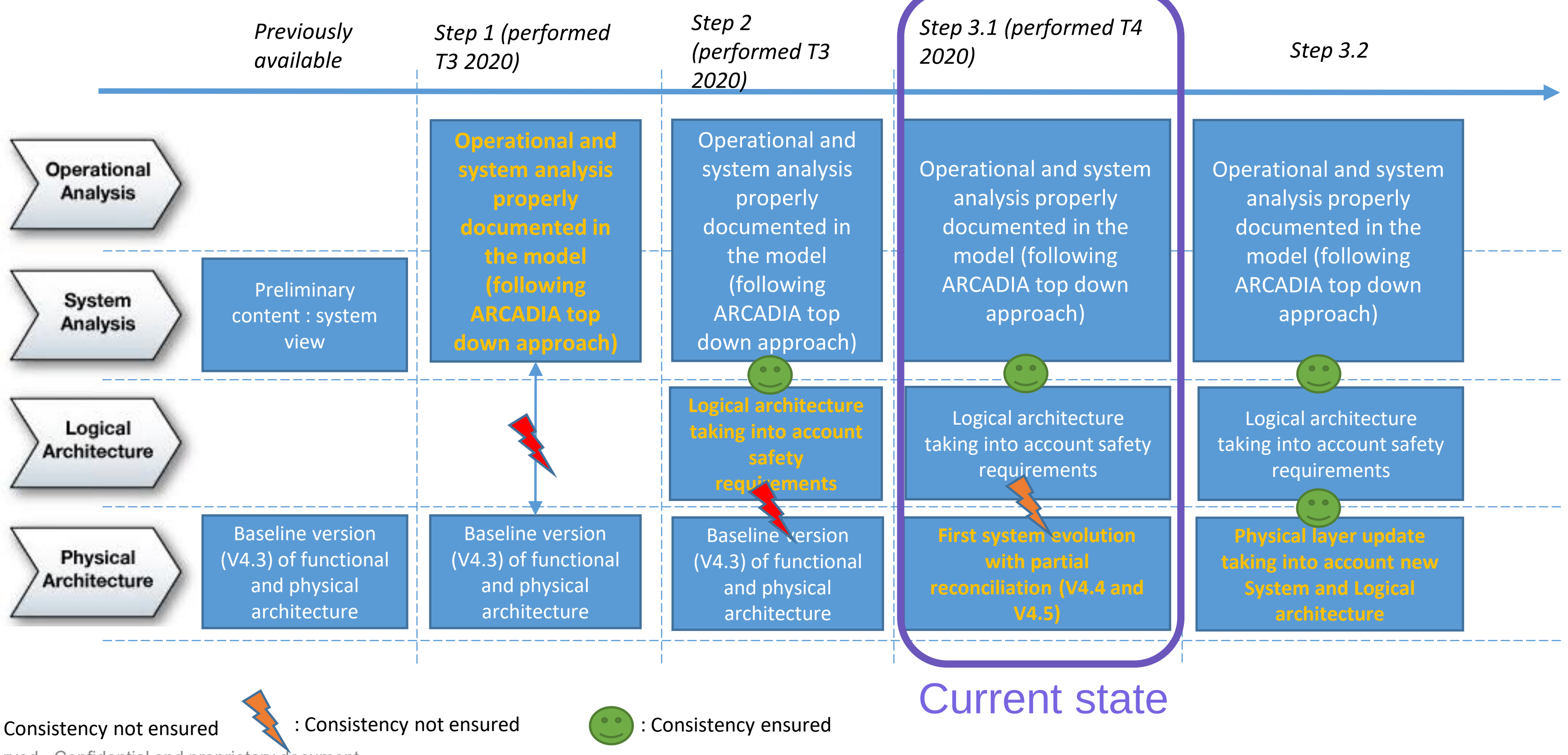


Table of content

FRENCH INSTITUTES OF TECHNOLOGY

OA : Operational Analysis layer description

The Operational Analysis layer aims at identifying the users needs and objectives. It describes the missions, activities and involved capabilities from the user and stakeholders point of view, without focusing on the system itself.

The objects and diagrams used for AIDA are described in the table below.

Point of view	Capella Diagrams	Capella Objects
Stakeholders identification	[OAB]	Operational entities
Capabilities identification	[OCB]	Operational entities, operational capabilities
Operational activities and workflows	[OAIB], [OAB]	Operational entities, operational activities

FRENCH INSTITUTES OF TECHNOLOGY

Table of content

FRENCH INSTITUTES OF TECHNOLOGY

SA : System Analysis layer description

The System Analysis layer aims at identifying the system functions and associated requirements, and the system externals interfaces. It describes the missions and associated capabilities, the scenarios associated to each capability, the identified system level functions and the exchanges with external systems and actors

The objects and diagrams used for AIDA are described in the table below.

Point of view	Capella Diagrams	Capella Objects
Actors identification	[CSA]	Components/Actors
Mission and capabilities identification	[MB], [MCB]	Missions, capabilities, system components/actors
Lifecycle	[MSM]	States and transitions
System modes	[MSM]	Modes and transitions
Functional behavior and exchanges	[SDFB], [SFS]	System functions and functional exchanges, functional scenarios
External exchanges	[SAV], [SES]	System components and components exchanges, exchanges scenarios
System level requirements	*N/A*	Native Capella requirements

FRENCH INSTITUTES OF TECHNOLOGY

Table of content

FRENCH INSTITUTES OF TECHNOLOGY

LA : Logical Architecture layer description

The Logical Architecture layer aims at defining “how the system works”, without focusing on the technological choices. It describes the behavior of the various sub-systems and components and their functional interactions.

The objects and diagrams used for AIDA are described in the table below.

Point of view	Capella Diagrams	Capella Objects
System level functions breakdown	[LDFB], [LFBD]	Logical functions, functional exchanges
Modes allocation to sub-systems	[MSM]	Modes and transitions
Logical architecture	[LAB]	Logical components, components exchanges
Functional allocation to sub-systems	[LAB]	Logical components, components exchanges Logical functions, functional exchanges
Internal behavior	[LFS], [LES]	Functional and exchanges scenarios

fit | FRENCH INSTITUTES OF TECHNOLOGY

Table of content

PA : Physical Architecture layer description

The Physical Architecture layer aims at defining “how the system is built”, taking into account the constraints generated by the technological choices. It describes the real components that constitute the AIDA system, in two steps : allocation of functions to the behavior components, and deployment of the behavior components on the physical node components (see Arcadia documentation for more details).

The objects and diagrams used for AIDA are described in the table below.

Point of view	Capella Diagrams	Capella Objects
System level functions breakdown	[PDFB], [PFBD]	Physical functions, functional exchanges
Modes allocation to sub-systems	[MSM]	Modes and transitions
Functional allocation to behavior components	[LAB]	Physical functions, functional exchanges
Deployment on node components	[LAB]	Node components, physical links and paths Behavior components, components exchanges
Internal behavior	[PFS], [PES]	Functional and exchanges scenarios
Physical architecture	[PAB]	Node components, physical links and paths
Component level requirements	*N/A*	Native Capella requirements

PA : Physical Architecture layer features

Additionally to the main objects, the PA layer contains some features that complete the information contained in the model. They are described in the table below.

Features	Capella objects	Purpose
Main functional chains related to drone control and data transmission	Functional chains [PFCD]	Identify the functional chains related to the various control functionalities : control mode selection, automatic navigation control, attitude control, payload control,…
Communication buses and power supply wiring	Physical paths	Identify the implementation of the communication buses and the power supply principles
Physical links type	Property value + diagram styler (necessitate the PVMT add-on)	Identify the type of the physical links : electrical, wireless, mechanical, IHM,…
FDAL and IDAL	Property value + diagram styler (necessitate the PVMT add-on)	Identify the DAL level associated to functions and components (resulting from safety analysis)

FRENCH INSTITUTES OF TECHNOLOGY