



# AIDA study case

---



Architecture model in Capella

System version : V4.4

# Table of content



<b>0</b>	<b>Before opening the Capella model</b>
1	Capella model overview
2	OA : Operational Analysis
3	SA : System Analysis
4	LA : Logical Architecture
5	PA : Physical Architecture

# Copyright



Copyright (c) 2016-2021 IRT AESE (IRT Saint Exupéry).

All rights reserved. This program and the accompanying materials are made available under the terms of the

**Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)**

which accompanies this distribution, and is available at

<https://creativecommons.org/licenses/by-sa/4.0/>

Contributors:

Pierre Virelizier, Tatiana Prosvirnova, Estelle Saez – Initial contribution

Romaric Demachy – System version V4.4

# 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/>

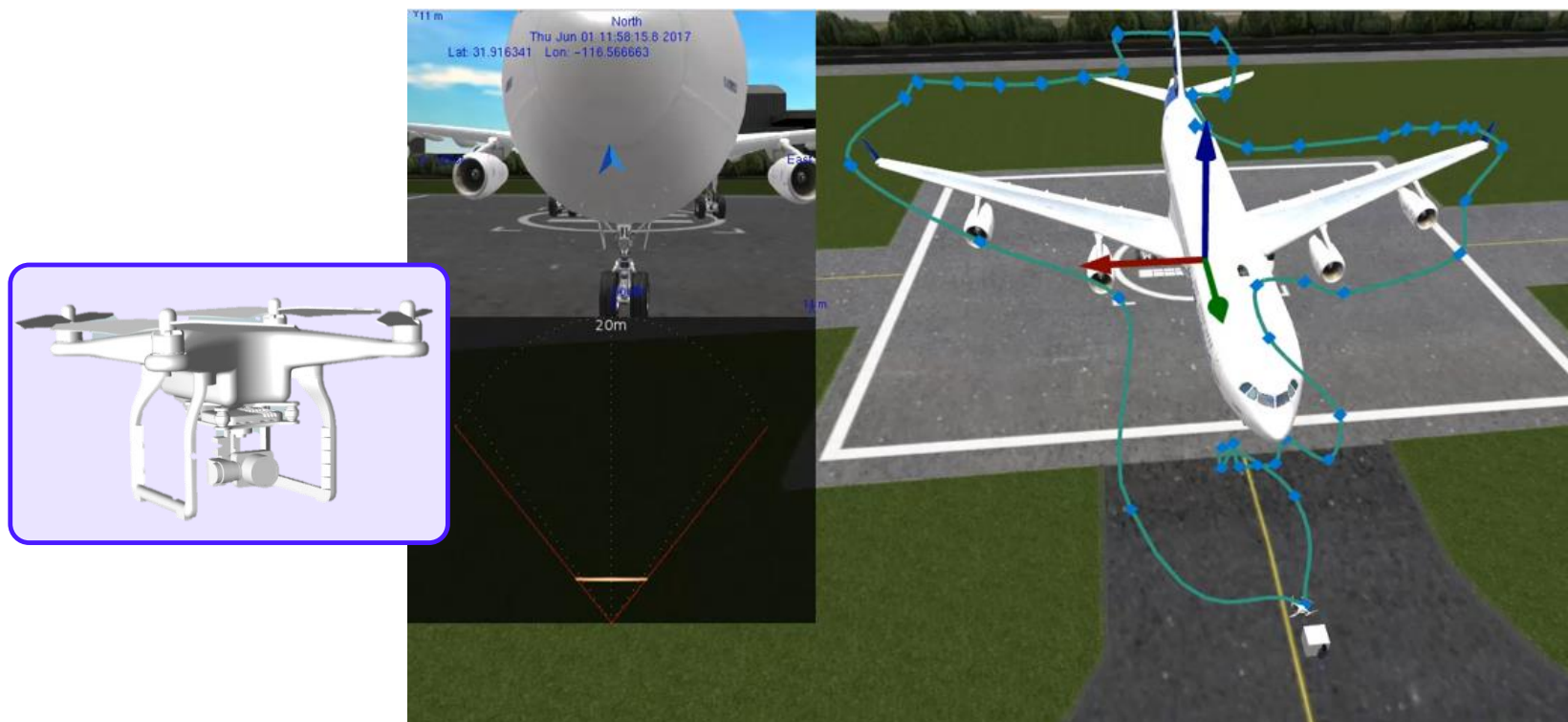
The AIDA architecture system version V4.4 is modelled with the version V1.4.0 of Capella.

A migration of the model under Capella V5.0 is foreseen in 2021

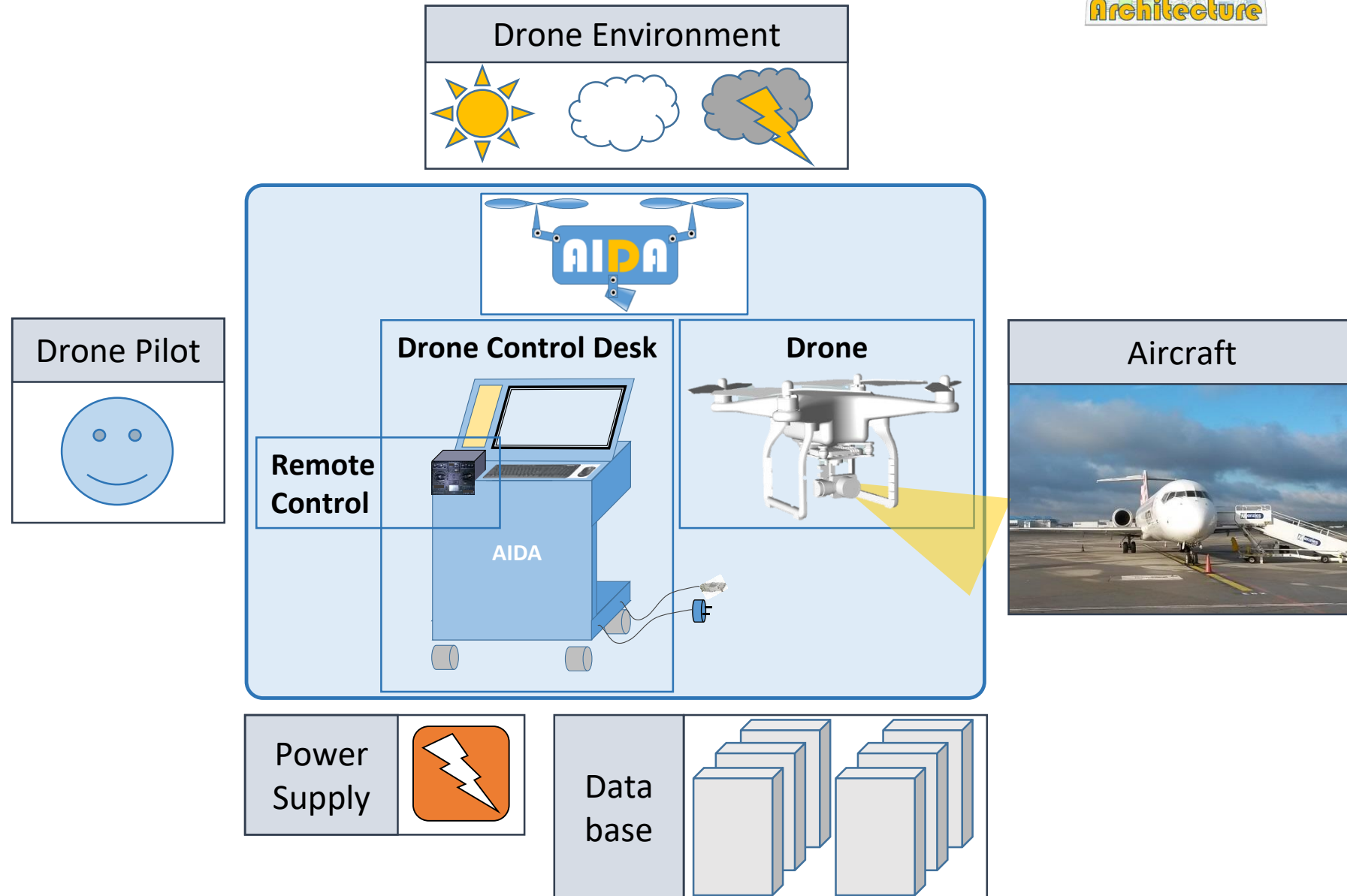
# AIDA system introduction



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 Exupéry, 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



0	Before opening the Capella model
<b>1</b>	<b>Capella model overview</b>
2	OA : Operational Analysis
3	SA : System Analysis
4	LA : Logical Architecture
5	PA : Physical Architecture



# 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.

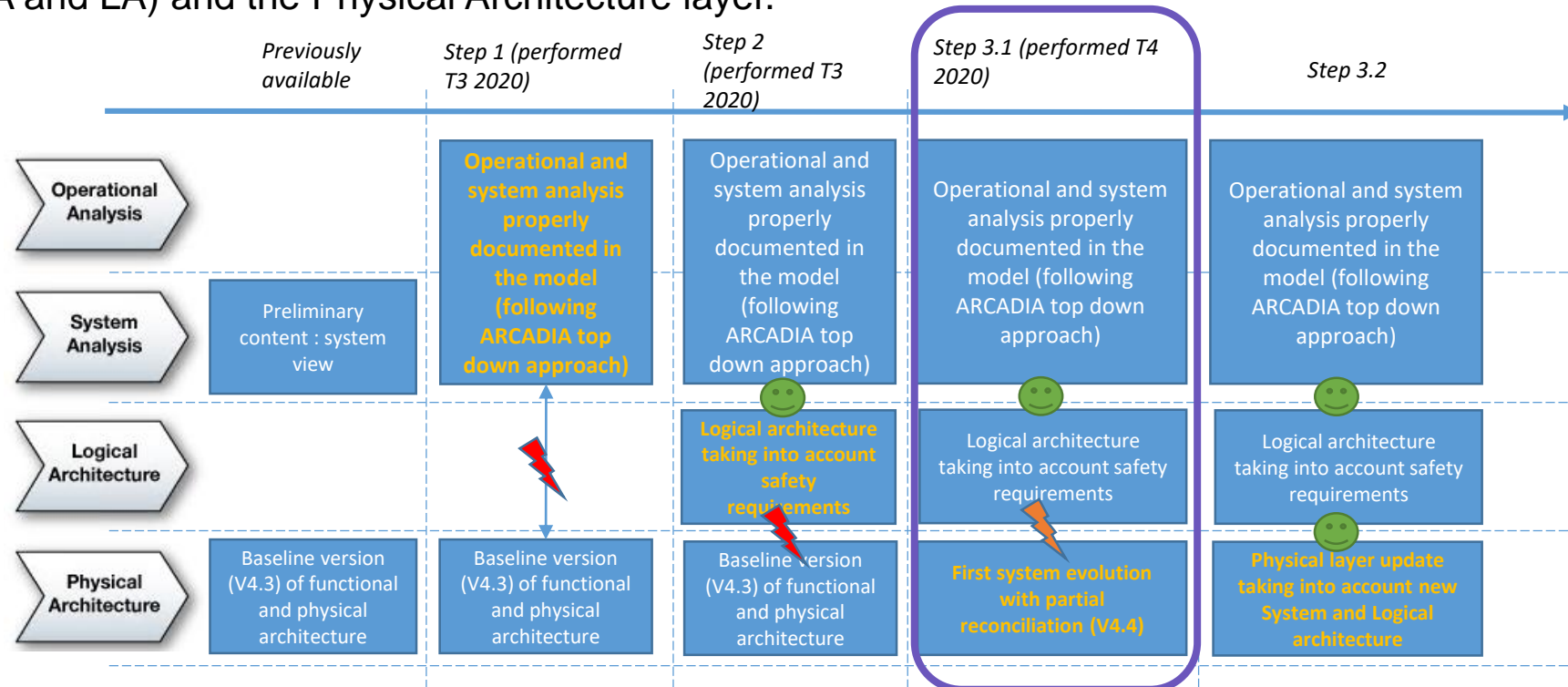
Capella layers/visions		AIDA model description	
Activity explorer		Content	Comments
<b>Arcadia note:</b> Visions for environment description and need analysis.	Operational Analysis	Description of Walk-Around process – identification of high level capabilities and activities	<i>The system does not appear in this layer</i>
	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
<b>Arcadia note:</b> 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 <b>solution</b> of the system supplier (with functions of physical objects)	System supplier proposal taking into account technological choices

# Capella model overview



A full documentation of the model has been created, see the document “AIDA Architecture synthesis V4.4”.

**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.



Current state

⚡ : Consistency not ensured    ⚡ : Consistency not ensured    😊 : Consistency ensured

# Table of content



<b>0</b>	<b>Before opening the Capella model</b>
<b>1</b>	<b>Capella model overview</b>
<b>2</b>	<b>OA : Operational Analysis</b>
<b>3</b>	<b>SA : System Analysis</b>
<b>4</b>	<b>LA : Logical Architecture</b>
<b>5</b>	<b>PA : Physical Architecture</b>

# 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

# Table of content



<b>0</b>	<b>Before opening the Capella model</b>
<b>1</b>	<b>Capella model overview</b>
<b>2</b>	<b>OA : Operational Analysis</b>
<b>3</b>	<b>SA : System Analysis</b>
<b>4</b>	<b>LA : Logical Architecture</b>
<b>5</b>	<b>PA : Physical Architecture</b>

# 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

# Table of content



<b>0</b>	<b>Before opening the Capella model</b>
<b>1</b>	<b>Capella model overview</b>
<b>2</b>	<b>OA : Operational Analysis</b>
<b>3</b>	<b>SA : System Analysis</b>
<b>4</b>	<b>LA : Logical Architecture</b>
<b>5</b>	<b>PA : Physical Architecture</b>

# 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



# Table of content



<b>0</b>	<b>Before opening the Capella model</b>
<b>1</b>	<b>Capella model overview</b>
<b>2</b>	<b>OA : Operational Analysis</b>
<b>3</b>	<b>SA : System Analysis</b>
<b>4</b>	<b>LA : Logical Architecture</b>
<b>5</b>	<b>PA : Physical Architecture</b>

# 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)