5 services of Drones for increased airports and waterways safety and security

DATA MANAGEMENT PLAN V2

Document Summary Information

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Executive Summary

The 5D-Aerosafe Data management Plan (DMP) has been set up for ensuring that 1) the data are always accessible, even for further research projects and é) that the projects are adequately protected. This document is the second version of the DMP.

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Glossary of terms and abbreviations used

Abbreviation / Term	Description
BMS	Business Management System
DMP	Data Management Plan
DOA	Description of Action
EC	European Commission
GA	Grant Agreement
PMB	Project Management Board
PRMP	Project and Risk Management Plan
TC	Technical Committee
Overall project risk rating	The highest risk priority of risks in the Risk Register.
Process	A systematic series of actions directed to some end. Sequence of interdependent steps for converting inputs into outputs.

1 Data Summary

The project is built on three main pillars, namely:

- The UAV sub-system that performs the inspections,
- The 5D-AeroSafe platform that handles all the data, manages the missions (task orders and reports and manages the use of the airspace (deconfliction between UAVs and commercial flights),
- Monitoring of the airport status (control towaer and ATM).

The data that will be collected and generated after processing fall in these domains.

An important aspect of 5D-AEROSAFE is the monitoring over the time of the events and their effects on the airport/waterport availability. So, both for deep learning method and for statistics, the data have to be kept for several years. Typically, we need data from the last 5 years and data over the whole duration of the project (3 years) to optimize the inspection of the infrastructure.

The origin of the data are the sensors and processing systems that can provide a description of the environment and detect events that can threaten the safety or the security. Among these sensors and processing systems, there are:

- UAVs: In 5D-AEROSAFE, the UAVs are equipped with various types of cameras depending on the defects that need to be detected. In the project, the sensors are mainly cameras and a calibration sensor. The size of the data base collected for the project will be quite huge because it will be thousands of high resolution pictures taken during the project and additionally pictures from external data bases to train the detection algorithms.
- Vulnerability data: these data will combine the descriptive data for the airport and supporting infrastructure (taxiways, runways, parking places, etc.). On the 3D map, the defects will be super-imposed (results of inspections and status assessment). The volume of data is once again dependent on the size of airports and waterports.

The project will create data through:

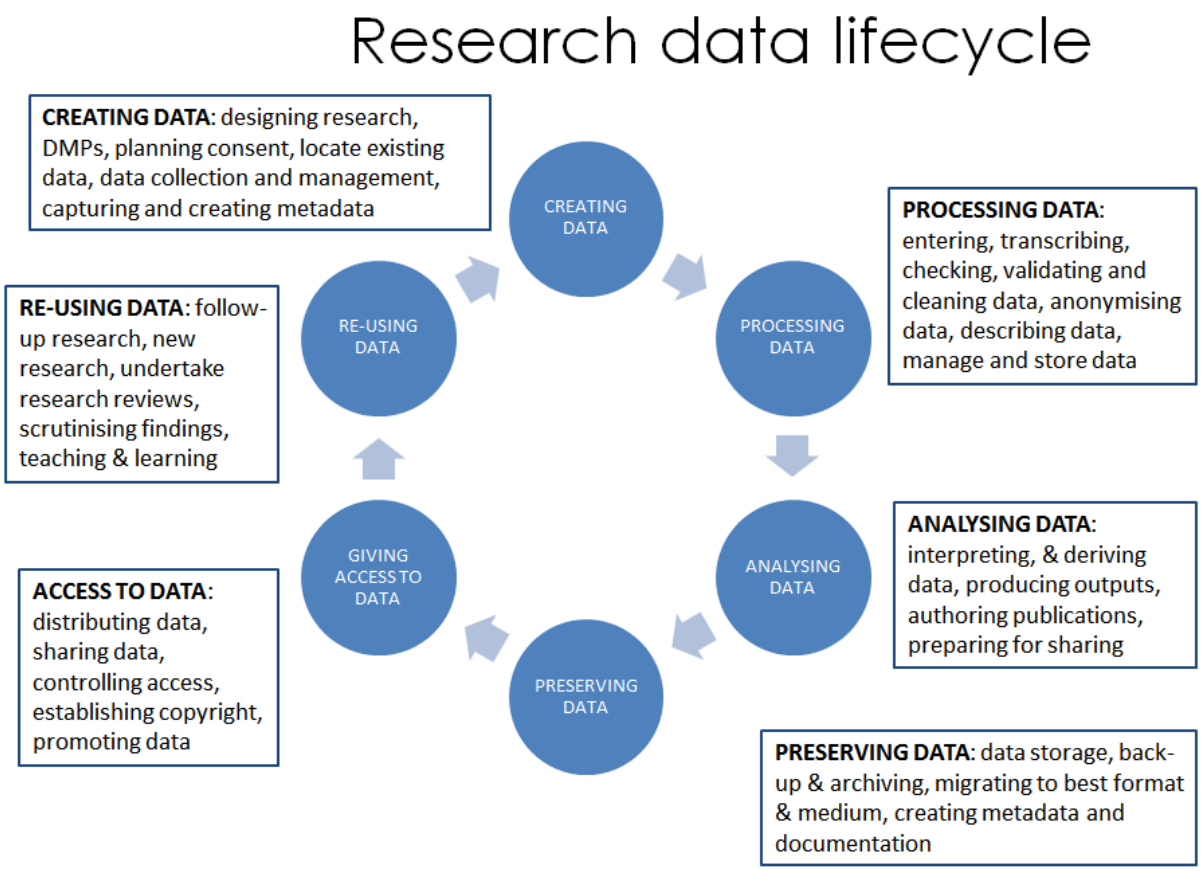
- WP4 that gathers airport data (pictures, calibration data and respective exploitations).
- WP5 will manage the missions of the UAVs and their reports
- WP6 will integrate all the data to ultimately update the infrastructure management system.

As the system capabilities are optimized with the data and statistics from previous events, the data have to stay in the archives for a very long period of time (at least during the whole life of the components).

The data related to the airports/waterports belong to the agencies that own or manages the infrastructure, namely FERROVIAL or Greek Water Airports in our case. Any additional use that could be done of these data has to be approved by them.

The data collected and processed from external services (e.g. maps, weather conditions) will be protected as per the respective contracts clauses with this external services.

The data cycle is the following one (defined by EUDAT – OpenAIRE):



At each step of the cycle, the IPRs and contractual clauses need to be respected. In particular: who owns these data, is the process applied to these data allowed, where will the data be stored and during how much time, who can have access to these data, to do what?

2 FAIR data

2.1 Making data findable, including provisions for metadata

The data produced in the project will be discoverable with metadata. The majority of the data used and produced by the project will be time-stamped, geo-referenced and classified (generally type of defects).

The detailed list of the data used and processed in 5D-AEROSAFE is the following one:

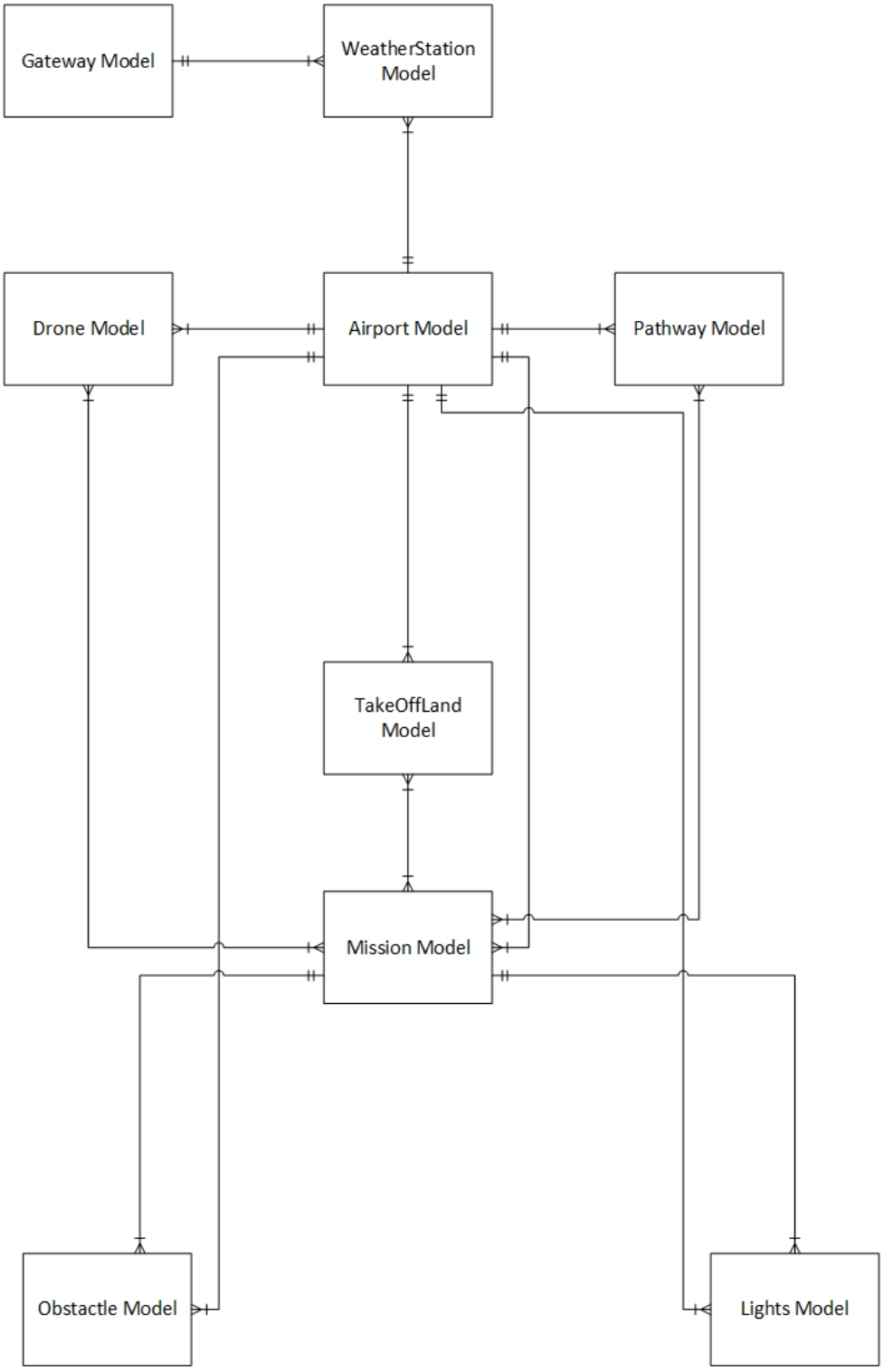


Figure 1 : Relation diagram of 5D-AeroSafe data Models

2.2 Airport Model

The airport model is conceptualized as a digital twin, mirroring a real-life airport situated within the physical world. This digital twin is a virtual representation of the actual airport, encompassing a wealth of information such as the airport's name, the official code, etc.

Name	NGSI Type	Description
category	Text	The category of the airport. It could be of two types: A) an aerodrome and B) a hydrodrome.
code	Text	The official code of the airport.
dateCreated	DateTime	A value automatically generated when the entity was created.
mapSettings	StructuredValue	A map of information for the maps module. The data inside the map are: A) zoomSize, B) bearing and C) pitch.
name	Text	The name of the airport.
location	geo:json	The location of the airport.

2.3 Pathway Model

The pathway model refers to the actual route or trajectory the objects follow within the airport's physical infrastructure.

Name	NGSI Type	Description
category	Text	The category of the pathway. It could be of two types: A) Runway and B) Waterway

dateCreated	DateTime	A value automatically generated when the entity was created.
name	Text	The name of the pathway.
refAirport	Text	The official code of the airport that the pathway belongs to.
location	geo:json	The location of the pathway.

2.4 TakeOffLand Model

The TakeOffLand model refers to the actions of taking off and landing. It is connected to the Airport by the field refAirport.

Name	NGSI Type	Description
category	Text	The category of the take off land. It could be of three types: A) TAKEOFF, B) LANDING and C) EMERGENCY-LANDING
dateCreated	DateTime	A value automatically generated when the entity was created.
name	Text	The name of the take off land.
refAirport	Text	The official code of the airport that the pathway belongs to.
location	geo:json	The location of the takeoffland.

2.5 Drone Model

The drone model refers to the twin of an unmanned aerial vehicle (UAV) that is either remotely operated by a human or autonomously by onboard computer systems. Inside the model, it is stored about the dimensions of the physical object and the current rotation the drone has and the reference ID of the airport it belongs to.

Name	NGSI Type	Description
dateCreated	DateTime	A value automatically generated when the entity was created.
dimensions	StructuredValue	A map of the dimensions of the drone. The values are: A) width, B) height and C) length.
name	Text	The name of the drone.
refAirport	Text	The official code of the airport that the pathway belongs to.
rotation	StructuredValue	A map of the rotation of the drone. The values are: A) x, B) y and Z) z.
serialNumber	Text	The serial number of the drone.
location	geo:json	The location of the drone.

2.6 Mission Model

The Mission model is the digital twin of a mission that is scheduled to happen, is happening or has ended. It helps the users to plan it, monitor it, conduct simulations and make informed decisions real time. Each mission happens on one airport and can have multiple drones operated and multiple pathways used.

Name	NGSI Type	Description
archived	Boolean	A flag to determine if the mission is archived.
dateCreated	DateTime	A value automatically generated when the entity was created.
dateEnded	DateTime	The date that the mission ended.
dateStarted	DateTime	The date that the mission started.
emergencyLandingPoints	Array	A list of reference IDs for emergency landing points.
executionMode	Text	The mode of the execution. It can be of two types: A) manual and B) automatic.
flightNumber	Text	The official code for the flight.
inspector	StructuredValue	A map with the inspector's information.
landingPoints	Array	A list of reference IDs for landing points.
mapSettings	StructuredValue	A map of information for the maps module. The data inside the map are: A) zoomSize, B) bearing, C) pitch and D) center.
maxMissionAltitude	Number	A number that indicates the maximum altitude of the mission.
missionType	Text	The type of the mission.
operationAltitude	Number	The altitude of the operation
operationSpeed	Number	The speed of the operation.
refAirport	Text	The official code of the airport that the mission takes place.
refDrones	Array	A list containing the IDs of the

		drones used in the mission
refPathways	Array	A list containing the IDs of the pathways used in the mission.
status	Text	The status of the mission. Its types are: A) PENDING, B) ARRIVAL and C) REJECTED.
takeoffPoints	Array	A list of reference IDs for take off points.
travelSpeed	Number	The actual travel speed of the drone.
location	geo:json	The location of the mission.

2.7 MissionTemplate Model

The MissionTemplate model is a similar model to the Mission Model, with two extra fields.

Name	NGSI Type	Description
archived	Boolean	A flag to determine if the mission is archived.
dateCreated	DateTime	A value automatically generated when the entity was created.
dateEnded	DateTime	The date that the mission ended.
dateStarted	DateTime	The date that the mission started.
emergencyLandingPoints	Array	A list of reference IDs for emergency landing points.
executionMode	Text	The mode of the execution. It can be of two types: A) manual and B) automatic.

flightNumber	Text	The official code for the flight.
inspector	StructuredValue	A map with the inspector's information.
landingPoints	Array	A list of reference IDs for landing points.
manned_flight_from	None	
manned_flight_to	None	
mapSettings	StructuredValue	A map of information for the maps module. The data inside the map are: A) zoomSize, B) bearing, C) pitch and D) center.
maxMissionAltitude	Number	A number that indicates the maximum altitude of the mission.
missionType	Text	The type of the mission.
operationAltitude	Number	The altitude of the operation
operationSpeed	Number	The speed of the operation.
refAirport	Text	The official code of the airport that the mission takes place.
refDrones	Array	A list containing the IDs of the drones used in the mission
refPathways	Array	A list containing the IDs of the pathways used in the mission.
status	Text	The status of the mission. Its types are: A) PENDING, B) ARRIVAL and C) REJECTED.

takeoffPoints	Array	A list of reference IDs for take off points.
travelSpeed	Number	The actual travel speed of the drone.
location	geo:json	The location of the mission.

2.8 WeatherStation Model

The WeatherStation model refers to a physical Weather Station deployed at the location of the airport. It helps the users to monitor the weather conditions and make decisions on the missions based on that. It is linked with the airport based at the field of refAirport.

Name	NGSI Type	Description
airRelativeHumidity	Number	The humidity's percentage in the air.
airTemperature	Number	The temperature in the air. It is stored in Celcius.
averageWindSpeed	Number	The speed of the wind. It is stored in m/s.
dailyRain	Number	The amount of the rain daily.
gustWindSpeed	Number	The sudden increase of the wind. It is stored in m/s.

locationName	Text	The name of the location that the weather station is stored at.
manufacturerName	Text	The name of the manufacturer.
name	Text	The name of the weather station.
productId	Text	The ID of the weather station as a product.
rainRate	Number	The rate of the rain. It is stored in mm/h.
refAirport	Text	The official code of the airport that the pathway belongs to.
serialNumber	Text	The serial number of the weather station.
solarRadiation	Number	The solar radiation in the atmosphere. It is stored in Watt/Square Meter.
windDirection	Integer	The direction of the wind.
location	geo:json	The location of the weather station.

2.9 InternetWeatherStation Model

The InternetWeatherStation Model refers to a Weather Station provided by an internet provider such as WeatherBit. It is mostly used to provide extra information that the physical Weather Station deployed at the location cannot sense.

Name	NGSI Type	Description
dateCreated	DateTime	A value automatically generated when the entity was created.

dewPoint	Number	The point of the body of air which the water vapor.
forecast	Array	A list containing data for forecasts.
humidity	Number	The percentage of the humidity.
name	Text	The name of the weather station.
precipitation	Number	The point of the water that becomes frozen.
precipitationType	Text	The type of the precipitation. There can be three: A) snow, B) rain and C) none.
pressure	Number	The pressure of the atmosphere in Hectopascal.
provider	Text	The provider of the weather station.
refAirport	Text	The official code of the airport that the pathway belongs to.
solarRadiation	Number	The solar radiation in the atmosphere. It is stored in Watt/Square Meter.
stationId	Text	The ID of the weather station.
temperature	Number	The temperature of the atmosphere.
weatherCode	Text	The code of the weather.
weatherDescription	Text	The description of the weather.

weatherIcon	Text	The ID of the icon for the weather.
windDirection	Number	The direction of the weather in degrees.
windSpeed	Number	The speed of the wind in meters/seconds.
location	geo:json	The location of the weather station.

2.10 Gateway Model

The Gateway Model refers to a Virtual Machine that hosts the Gateway API. Inside the model, the user can monitor information about the Virtual Machine such as the CPU Usage and the Interfaces used.

Name	NGSI Type	Description
cpuUsage	Integer	The CPU's usage in percentage.
diskUsage	Integer	The Disk's usage in percentage.
ifaces	Array	A list of a map of each interface. The interface has an IP, the name of the interface, what has been sent from it and what it has received.
manufacturerName	Text	The name of the manufacturer.
memoryUsage	Integer	The memory's usage in percentage.
name	Text	The name of the gateway.

productId	Text	The ID of the gateway as a product.
serialNumber	Text	The serial number of the gateway.
systemUptime	Integer	The uptime of the gateway.
location	geo:json	The location of the gateway.

2.11 Obstacle Model

The Obstacle Model refers to the digital twins of the obstacles found during the run of the mission. It stores an image and a video that the user can see and is connected to the Airport and the mission through the refAirport and refMission respectively. The inspector can also write a note and see the severity of the condition.

Name	NGSI Type	Description
acknowledged	Boolean	A flag that checks if the obstacle is acknowledged.
bbox	Array	It is a box that is rendered on top of the image. It is an alternative to the image overlay.
category	Text	The category of the obstacle.
dateCreated	DateTime	A value automatically generated when the entity was created.
dateDetected	DateTime	The date that the obstacle was detected.
description	Text	A description of where the obstacle was found at.
image	Text	The filename of the image taken of the obstacle.
inspectorNotes	Text	The notes of the inspector.

refAirport	Text	The official code of the airport that the obstacle was found at.
refMission	Text	The reference of the mission that the obstacle was found at.
severity	Text	The importance of the obstacle for the mission.
video	Text	The filename of the video that showcases the obstacle.
location	geo:json	The location of the obstacle.

2.12 Lights Model

The Obstacle Model refers to the digital twins of the lights found during the run of the mission. It stores an image and a video that the user can see and is connected to the Airport and the mission through the refAirport and refMission respectively. The inspector can also write a note and see if the lights are damaged.

Name	NGSI Type	Description
acknowledged	Boolean	A flag that checks if the lights are acknowledged.
bbox	Array	It is a box that is rendered on top of the image. It is an alternative to the image overlay.
colors	Array	A list of the colors featured on the image.
damaged	Boolean	A flag that checks if the lights are damaged.
dateCreated	DateTime	A value automatically generated when the entity was created.
dateDetected	DateTime	The date that the lights were detected.
image	Text	The filename of the image

		taken of the lights.
imageOverlay	Text	The filename of the image overlay taken of the lights.
inspectorNotes	Text	The notes of the inspector.
refAirport	Text	The official code of the airport that the obstacle was found at.
refMission	Text	The reference of the mission that the obstacle was found at.
video	Text	The filename of the video that showcases the obstacle.
location	geo:json	The location of the lights.

2.13 Making data openly accessible

At this time of the project, we can make the hypotheses that the data will be stored:

- In the project web site repository.
- At the end-user premises/maintenance systems,
- In the integration platform (system repository),
- At the partners premises.

Some of the data will be collected from external data bases (open) so as to develop system capabilities. It is especially true for images of defects on airports and roads or images of foreign objects that need to be detected. These images will be used to calibrate the detection/analysis algorithms as several modules will use deep-learning techniques. So, the more images will be available, the more accurate the results should be.

In the other way round, some data collected and processed in the project should be made accessible to researchers outside the consortium so they can use them for similar purposes. The WP leaders will therefore decide after the trials which data should be made accessible from outside the consortium in respect of the IPRs and of the data owners decisions.

The repository that will be used for the open data will be accessible through the project website hosted by ITWL.

2.14 Making data interoperable

5D-AEROSAFE is dealing with data that describe an environment which is the same all over Europe (and over the world). The type of data is in general standardised but the interpretation that is done from them to produce alerts can vary. The approach in 5D-AEROSAFE is to use as much as possible

existing standards and propose standardization efforts in the domain where the standards are not widely used or not yet existing.

For the airport/waterport risks, although not completely standardized, there are very similar approaches in Europe to define them and to define the risk thresholds. s. The taxonomy and the ontology of the airports will be produced in 5D-AEROSAFE.

For the infrastructure management system, the objects displayed in the situation will be exchanged using pre-standardised or widely spread formats: XML documents collection. Using these formats, the situation elaborated in 5D-AEROSAFE can easily be exchanged with other parties ivolved in the safety/security of the airports/waterports.

2.15 Increase data re-use (through clarifying licences)

The data will start to be available when the first version of the system is integrated and validated (From month 24).

From all the data collected and processed by the system, the data related to the Airport Infrastructure can be confidential. They belong to the owner/operators (respectively FERROVIAL and GWA), so if any third party outside the consortium wants to use them, a case by case authorization is needed from the operators.

The data should be accessible after the end of the project;

The web site of the project will be maintained one year after the project,

Academic and Research partners of the project will continue to use it after the project.

3 Allocation of resources

The costs for making data FAIR in 5D-AEROSAFE are related to WP1 (all data) and WP4 (sensors data), managed by ADS and VICOM, with the support of the other partners and the end-users.

The maintenance of these data after the project life-time will be decided within WP1 after the system architecture (especially data models) completion.

4 Data security

The data security will be assured by:

- The project data repository (controlled access);
- The partners secured accesses to their data bases.

5D-AEROSAFE data are sensitive, especially for the security aspects. The infrastructure data owners (FERROVIAL and GWA) want to control the use of their data and be sure that they are not used in improper ways.

5 Ethical aspects

5D-AEROSAFE data mainly concern physical infrastructures No part of 5D-AEROSAFE system manipulates personal data.

However, during the tests, trials or dissemination events, pictures of persons can be taken, either by the system sensors (UAV cameras) to illustrate reports or to put in the project galleries. In addition, persons from or outside the consortium can be interviewed.

Any time there will be a collection of personal data (images, CVs, etc.), the persons will sign a consent form under which they accept the use of these data in the context of the project and provided that their use cannot go beyond what is specified in the consent form.