



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

D7.1 Exploitation Plan V1

Grant Agreement No	861635	Acronym	5D-AeroSafe
Full Title	5 services of Drones for increased airports and waterways safety and security		
Start Date	01/06/20	Duration	36 months
Project URL	https://5d-aerosafe.eu/		
Deliverable	D7.1 – Exploitation Plan (Iteration One)		
Work Package	WP7 – Innovation Management and Exploitation Activities		
Contractual due date	28/02/2021	Actual submission date	28/02/2021
Nature	Report (R)	Dissemination Level	Public (PU)
Lead Beneficiary	ADS		
Responsible Author	FERRO		
Contributions from	ADS/FINT/ENAC/ITWL/GWA/AIRMAP/ECTL		

Revision history (including peer reviewing & quality control)

Version	Issue Date	Stage	Changes	Contributor(s)	Comments
1.0	24/02/21		First Version	FERRO	
1.5	25/02/2021		Changes in chapter's text	George Bogdos (FINT)	
1.5	26/02/2021		Changes in chapter's text, Quality check by QAM	Anna Nikodym-Bilska (ITWL)	



This project has received funding from the European Union's Horizon 2020 innovation programme under the Grant Agreement No 861635.

Executive Summary

The document presented here on the 5D-Aerosafe project's exploitation plan will contain information related to the commercialisation and business development of the platform and the services resulting from the project's results.

After a brief descriptive summary of the 5D-Aerosafe project, the current market situation in the drone sector for uses similar to the five axes of the project has been analysed at high level. This analysis has led the Consortium to develop an initial business model proposal for the results of the project using the Lean Canvas model and taking up the forecast of future income after the end of the project.

With this model, the common strategy of the Consortium is established to carry out the exploitation plan according to the tangible results to be obtained from the development of the technical solution and the activities to be carried out for a successful commercialisation and new business opportunities. Furthermore, it has been considered relevant to expose the individual strategy of each partner for the exploitation according to their own experience that they bring to the project and according to their own business models and sector.

The document reviews the initial exploitation strategy considering that it is in a phase of definition of use cases, tests and trials from which no results have yet been obtained to adapt the strategy presented here.

This first iteration of the Exploitation Plan will be followed by a more refined second iteration in March 2023, when project results will be much clearer.

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Table of Contents

1	Introduction and positioning in the project	5
2	Market situation summary	7
3	Planned foreground.....	9
4	Business model	10
5	Preliminary Consortium exploitation axes	12
6	Preliminary individual exploitation plans	13
6.1	Airbus Defence & Space	13
6.2	Future Intelligence Ltd.....	14
6.3	Ecole Nationale de l'Aviation Civile	15
6.4	Air Force Institute of Technology	16
6.5	Fundación Centro de Tecnologías de Interacción Visual y Comunicaciones Vicomtech.....	17
6.6	Hellenic Mediterranean University.....	18
	FERROVIAL CORPORACIÓN, S.A.....	19
6.7	Greek Water Airports	20
6.8	AIRMAP.....	21
6.9	EUROCONTROL.....	22
7	Conclusion	23

List of Figures

Figure 1 Schematic Representation of the main concept of 5D-AeroSafe	5
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List of Tables

Table 1 Business Model Lean Canvas	10
Table 2 Estimated maximum market share after 5 years.....	11
Table 3 Projected revenues for first 5 years period	11

Glossary of terms and abbreviations used

Abbreviation / Term	Description
CNS	Communication, Navigation and Surveillance
UAS	Unmanned Aircraft Systems
GNSS	Global Navigation Satellite System
GGCS	Generic Ground Control Station
UTM	Unmanned Traffic Management
ATM	Air Traffic Management
TRL	Technology Readiness Level
SWIM	System Wide Information Management
ICAO	International Civil Aviation Organization
EASA	European Aviation Safety Agency
RPAS	Remotely Piloted Aircraft Systems
DME	Distance Measurement Equipment
NDB	Non-Directional Beacon
ILS	Instrument Landing System
VHF	Very high frequency
VOR	Omni-directional Radio-range
PAPI	Precision Approach Path Indicator
ALS	Approach Lighting Systems

1 Introduction and positioning in the project

5D-AeroSafe will develop a set of drone-based services to increase the safety and security of airports and waterways, while reducing operational costs through the offering of five services, namely: CNS/GNSS equipment inspection and calibration, security checks in the airport perimeter and approaches, runways and taxiways inspections, aircraft inspections, waterways operation and inspections.

The challenge is to integrate the flight of drones in restricted areas where they will co-exist with numerous commercial flights without increasing risks. The integration UTM/ATM is thus studied in detail in the project to propose these efficient solutions. The services are based on the use of several drones (fixed wings for large area monitoring, and VTOLs for detailed inspections and calibrations) integrated in a generic ground station equipped with innovative ITC capabilities, connected to the airport legacy systems.

The 5D-AeroSafe modules will be connected, via SWIM, to airport maintenance systems for infrastructure inspection and calibration aspects, operations systems for the aircraft inspections, and finally with the local ATM for the ATM/UTM integration aspects.

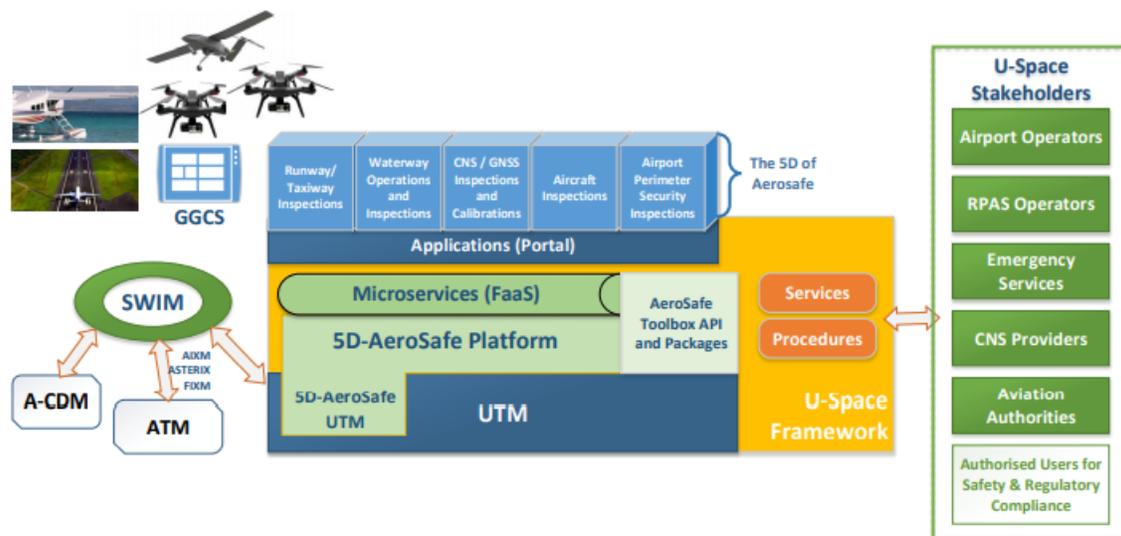


Figure 1 Schematic Representation of the main concept of 5D-AeroSafe

The project will be implemented under the control of relevant end-users' stakeholders (airport and water airport operators), and authorities (Civil Aviation Authorities). The tests and validation of the system will be performed through three operational test pilots at different stages of the project as the implementation will be incremental and will take place in real locations and in as much as possible real conditions.

The overall solution will target TRL 6 to 7 and will envisage all applicable ICAO and EASA applied standards, while providing the appropriate APIs in order to be integrated to legacy systems. The main target is to take advantage of inherent UAS capabilities to provide information to users, which currently is quite difficult (or expensive) to acquire and at the same time to build new and accurate inspection and calibration methods and procedures.

Several of the Consortium Members are involved in the definition and the implementation of RPAS activities in Europe. They are playing a key role to define the way the RPAS are and will be used in the various contexts. EUROCONTROL, EASA, Civil Aviation Authorities, Airports, etc. are key actors for the concept evolution and the operation definition in Europe. The concept of operations, the regulation are evolving quickly in order to face the important demand of new type of operations of the RPAS. Focusing on the use cases that will be defined in 5D-Aerosafe, a critical survey will be performed by the 5D-Aerosafe team, to provide the needed current situation and the perspective of evolution of the concepts and rules of operations. The rules could be at the European level but also at the national level. In the Consortium, ENAC and

The 5D-AeroSafe Consortium includes:

- **Industrial partners:** Airbus (coordinator – FR) responsible for the provision of the GGCS, appropriate fixed wings RPAS for area monitoring and for nav aids calibration and VTOL for detailed inspections.
- **Research/academic partners:** ITWL (PL) responsible for the provision and adaptation of UAS; ENAC (FR) will support and enforce the regulatory framework in the project, and provide flight procedures simulators for the first pilot; VICOM (ES) will provide expertise in video analytics; TEIC (GR) will support the development of the nav aids specialised module, the development of the 5D-AeroSafe applications and the overall software platform implementation.
- **SMEs:** FINT (GR) will build the RF hardware transceiver, will provide the FINoT platform, and contribute to the development of the core platform, while supporting U-Space services integration; AirMap (DE) will be the UTM platform provider and leading U-Space service integrator.
- **End Users:** FERROVIAL (ES) in collaboration with Greek Water Airports (GR), will be responsible for the use cases and scenario definitions, and the testing of 5D-AeroSafe in real conditions.
- **Advisory Board:** Managed by FERROVIAL (ES) with the assistance of EUROCONTROL (BE), the User Advisory Board, will provide support to the 5D-AeroSafe during the project lifetime by the organisations (Letter of Intent signed and received by the coordinator): Polish CAA, Heathrow airport, Glasgow Airport, Municipality of Rhodes, EuroECS, Technosky, SESAR JU, IABG, Hellenic CAA, and Glasgow Airport.

2 Market situation summary

The aviation domain is the 2nd largest industry in the world after Oil and Gas holding \$650B in revenues. The flight inspection market as part of the aviation industry is rising steadily due to increased airport expansions. In 2018 the flight inspection market had a share of \$1,5B and is expected to rise over \$1,8B by 2025 (over 3% CAGR) according to a 2019 Global Market Insights. It is expected that rising prominence of pilot assistance and aircraft control systems will drive the flight inspection market growth. Improved air flight operations in lower visibility conditions while maintaining standard safety levels fosters the need for airport visual aids. The execution of inspection activities in shorter timeframes and lower costs will escalate the industry growth. Moreover, growing use of drone technology for inspections will also boost the flight inspection market growth. The usage of RPAS (key part of UTM) for flight inspection purposes will offer accurate results providing real time data of critical parameters and will provide the confidence to operators to operate both manned and unmanned aviation in a flexible, efficient and safe manner.

Currently, inspections are executed using small to medium aircraft such as the Beechcraft BE-300, Challenger 601/604, Lear 60, and Hawker Bae-125 or ground platforms. National civil aviation authorities are in charge of either executing the inspection or subcontracting it to external companies.

The major players that hold the current share of the flight inspection market includes Safran, Textron Inc, Norwegian Special Mission, Airfield Technology, Inc., Bombardier, Aerodata, Cobham PLC, ENAV and Saab AB. However, the drone era has brought new start-ups and SMEs that are using them for some flight inspection purposes. Companies like Canard, AltiGator, AirSpection, Colibrex, Aviontek and AirSight are providing commercial inspection solutions for PAPIs inspection, ILS and runway without however offering a unified solution for all the aforementioned needs. The main target is to reduce the cost per-hour of flight inspection tasks in order to provide significant savings to airport operators, removing their decency on manned aircraft services. Some of the offering of those companies are described in the following paragraphs.

CANARD is a Madrid, Spain-based company that has developed and markets state-of-the-art air navigation aid (NAVAID) and airport facilities inspection and calibration technologies, as well as PCI (Pavement Condition Index) devices for the identification of runway defects and objects. They provide a full solution kit which is incorporated into normal airport work, without the need to close or minimize activities. CANARD depends on the world's leading maker of drones, DJI. They claim to use the best quality UAS and the newest technologies, but also strong security measures that ensure careful execution of operations. Their solution includes a Calibration tool App that has an integrated, smart and user-friendly interface that allows anyone to perform automatically any operation while also displaying real-time data. The whole system has been designed according to ICAO (International Civil Aviation Organization) and FAA (Federal Aviation Administration) standards and have been validated by civil aviation authorities across the globe. They also offer a Web Platform that helps with mission planning, asset management and data & reports generation.

Altigator company is a UAV manufacturer and based in Waterloo, Belgium. They developed a partnership with Skyguide that resulted in a solution for airport and flight inspections. The solution relies on an OnyxStar® ATLAS drone with high lifting power, efficiency and reliability that can perform inspections in the far field. Elevation profiles and mini approaches are conducted by the Instrument Landing Systems (ILS) inspection UAV in order to analyze the ILS signal (course alignment, slope angle, alarms, displacement sensitivity, etc.) and complete the ground and manned flight measurements. The development of the ILS-check UAV solution involving is currently used by Skyguide in Geneva and Zurich airports.

Colibrex is a German company with its headquarters in Rheinmünster. They have developed the NavAidDrone system that offers runway, airport perimeter and GNSS inspections. It also has an interface for integration into any UTM system. Their solution has many features:

- ILS periodical measurements as specified by ICAO, to reduce ground-based inspection cost.
- Correlation with flight inspection data for overall optimization of ILS/VOR installations and preparation for the extension of flight inspection periods with the corresponding savings

- Special measurements to detect degradation of ILS/VOR signals coming from change in the surrounding infrastructure or moving structures (cranes, temporary buildings, etc)
- Support of ILS commissioning during installation of new systems or replacement of antennas, potentially enabling a reduction of flight inspection efforts.
- Special measurements to facilitate maintenance and problem detection, possibility of extensive offline data analysis.

Airsight is also German and specifically from Berlin. It is an experienced and well-established company providing airports, air navigation service providers and civil aviation authorities and organizations with consulting, engineering and aerial services, software and training. Their system performs a complete airport inspection but cannot give quick results. Their approach is different, and their system follows a certain path:

- Definition of the area to be inspected: An initial plan for the inspections is prepared.
- On-site UAV inspections: Their UAVs, equipped with GPS and high-resolution photography equipment and remotely controlled by trained operators, fly over the relevant segments of the airfield to inspect, and acquire high-resolution images in a minimum time.
- Image post-processing: The photos are post-processed to produce a single and complete orthoimage, which is geo-referenced and delivered in several digital formats and can be provided as an online service via the company's servers.
- Analysis and documentation: After the inspections, off-site, they identify and document all deteriorations (or abnormalities), based on the reconstructed aerial image of the airfield in CAD and using predefined categories. In addition to the image, the inspection results contain a complete and structured record of all findings.

Aerium operates across the Atlantic and is based on Calgary, Canada. They excel in many sectors: operations support, infrastructure analysis, obstacle limitations surveying, but also in wildlife management.

- Wildlife control: AERIUM integrates conventional methods of bird hazing with Robird[®] Ornithopter to provide airports with the next level of wildlife management. When this is combined with the collection of habitat data and hazing system analysis, a highly efficient SMART wildlife management approach is developed.
- Operations support: Data obtained from surface scans of runways and taxiways can be used to provide operating personnel with timely information on Runway Markings and Signage, PAPI and Lighting variances and Airport Obstacle Identification.
- Infrastructure and maintenance analysis: UAS allows for both LiDAR and imagery data to be collected simultaneously for all surfaces in and around airports. This data is then combined to perform Pavement Condition Indexing, Runway Displacement Analysis, Surface drainage analysis (both airport wide and on specific surfaces) and Perimeter Fence/Rooftop Inspections to allow for a comprehensive report to plan for major infrastructure operations.
- Obstacle limitations surface surveying: AERIUM depends on expertise in geospatial data analysis to identify successful and reliable solutions to common challenges that their customers may encounter. This is why they use LiDAR data at international airports to perform Obstacle Limitation Surface (OLS) surveys.

The partners of 5D-AeroSafe are following closely the market evolution and the proposed solutions especially where drones are used for flight inspection purposes. The idea is not to duplicate things that are already in the market but to try to provide an ecosystem where various independent solutions can easily be integrated on a unified and widely accepted system. The overall solution of 5D-AerSafe while also the individual components/solutions/products that will be developed during the project span should bridge the chasm between the market of early adopters (technology visionaries), who will take on new technologies and the early majority, who are business actors driven by realistic marketing plans based on established trends and data and comprise a crucial market segment.

3 Planned foreground

The envisaged outcome of the project is a complete business offering that has a wide target group including but not limited to airports, water airports, aviation authorities and operators. The aim of the business model of 5D-AeroSafe is to slash current costs and time needed for calibration and inspection operations. Based on industry feedback, the 5D-AeroSafe solution will improve or in some cases even will replace the state-of-the-art solutions that are at moment applied for the same purposes. The users (customers) of the 5D-AeroSafe platform will be provided with a, tailored for their individual use, RPAS accompanied by an appropriate GCS station fully integrated with UTM and U-Space. A possible 5D-AeroSafe venture will be able to provide managed and unmanaged services to its clients. After specialised and adapted training, the customer (e.g. airport operator) will be able to autonomously execute the operations, while an option for offering “Calibration & Inspection” as a service will be also available. Moreover, the same integrated solution will be able to support more added-value applications e.g. aircraft inspections and security checks, something that will offer to the solution owner a quick Return On Investment (ROI), and will maximise of the investment. Based on the frequency that each airport/waterway operator is obliged to execute these operations, we expect that a single RPAS offering will reach a ROI during the first two years of operation comparing to current available services.

5D-AeroSafe envisages to bring a complete end-to-end solution for navAids inspection and calibration by the usage of sophisticated RPAS platforms, as part of a unified ATC (ATM + UTM) ecosystem, while respecting all international regulations in order to perform effective flight inspections. A number of different ground facilities, like Distance Measurement Equipment (DME), Non-Directional Beacon (NDB), Instrument Landing System (ILS), very high frequency (VHF) omnidirectional range (VOR), while also PAPI lights, Approach Lighting Systems (ALS) and runway & airport inspection are major part of instrument navigation. The International Civil Aviation Organization (ICAO) specifies the required navAids availability, quality, accuracy, and integrity for installations on service. Within these specifications, ICAO includes the flight inspection operations. Flight inspection is the task of validating the radio signal emitted by navAids.

On the side of the 5D-AeroSafe venture, we expect that due to the emerging remote tower concept, the continuously increasing costs of inspection flights and related calibration procedures, as well as operational cost reduction that most airport/waterway operators wish to achieve, the 5D-AeroSafe solution will have a very high demand both within the EU and beyond, utilising in the best manner the EU financial contribution, while rendering air transport even safer.

In particular 5D-AeroSafe Consortium aims to disrupt the domain of flight inspection market by providing a low cost, 0% emissions procedure and highly accurate inspection solution for the above-mentioned facilities under a unified platform.

4 Business model

A preliminary business model for commercialization of 5D-Aerosafe results based in Lean Canvas is presented in following figure. Lean Canvas is an approach focused on the identification of elements to be considered for introducing new products in the industry and market, and provides differentiated aspects related to the products from the project and the target market.

Table 1 Business Model Lean Canvas

CANVAS model				
Key Partners	Key Activities	Value proposition	Customer Relationship	Customer Segments
Industrial partners End user partners Research partners Civil Aviation Authorities Air Navigation Service Providers (ANSPs)	CNS and GNSS inspections and calibration Security Checks/patrolling of critical airport infrastructure Runway and Taxiway Inspections Aircraft Inspections Waterway Operations and Inspections	A complete end-to-end solution for navAids inspection and calibration, airport runways/taxiways and waterways inspection by the usage of sophisticated RPAS platforms, as part of a unified ATC (ATM + UTM) ecosystem, while respecting all international regulations in order to perform effective flight inspections.	Pilot demonstrations User Advisory Board User toolkit and app	Airports Water Airports Emergency services UAS providers CNS providers
	Key Resources EU Funding IT Architectures FINoT Platform UTM Cloud infrastructure API Toolbox and Applications Generic Ground Control Station (GGCS) UAS operators UAS pilots Airport TWR Air Traffic Controllers Data collected (monetisation opportunities)		Channels User workshop and trainings Newsletter and press release Website Videos Social media Conference presentation Articles and scientific publications	
Cost Structure FINoT platform maintenance UTM platform maintenance Generic Ground Control Station (GGCS) maintenance Development cost for updates		Revenue Streams Service for a fee: <ul style="list-style-type: none"> inspection-as-a-service calibration services airport and aircraft inspections waterway inspection 		

Revenue Streams

The 5D-AeroSafe solution targets recurring revenues for providing a service for a fee. This offering can be a service that will be provided by the joint venture that the Consortium will form after the completion of the project as an inspection-as-a-service provision and/or a wholesale of a platform including the appropriate RPAS, software and training. Moreover, this service can also be enhanced with an offering for calibration services on a per location basis. The main model with respect to clients will be B2B and B2G. Today's inspection services are provided on a rate is approximately 3.000 USD per hour. 5DAeroSafe wants to provide this service in a fraction of that cost, estimating it at €400 per hour. Based on the demand, multiple drone platforms can be exploited simultaneously allowing the business scaling.

In addition, when the user base will reach a critical mass level (above 100 customers), 5D-AeroSafe will have the opportunity for additional revenues through the development of new offerings related to airport and aircraft inspections. The targeted market share and the expected penetration is estimated as shown in Table below, where we assume that maximum penetration will be achieved on the 5th year from the solution launch. Revenues are calculated for a period of five years. Forecast is based on the assumptions that the revenues arrive from service on a fee basis and not a wholesale, and the initial targeted market consists the EU 28 members states. For calculation reasons each inspection is assumed to last 2 hours including the actual inspection and the post process service where each hour is priced at €400. For PAPI inspection alone for an airport with 1 runway, 6 inspections per year per runway will be needed. For ILS for the same airport, 3 inspection per year per airport will be needed (9 inspections in total per year per airport).

Table 2 Estimated maximum market share after 5 years

Number of Inspections	Number of Airports	Year 5 max expected penetration
1800	Circa 10.000	8%

Table 3 Projected revenues for first 5 years period

YR1 (8% x 5%)	YR2 (8% x 20%)	YR3 (8% x 50%)	YR4 (8% x 80%)	YR5 (8% x 100%)
€288.000	€1.152.000	€2.880.000	€4.608.000	€5.760.000

Key Metrics

Indicators that can be of importance for assessing the market uptake capabilities of the project's results are the following:

- Requests for information/proposals from potential users or collaborators (such as stakeholders, or hardware/sensors providers).
- Number of pre-commercial agreements signed with potential users.
- Number of press publications or conference presentations that have been performed and potential reach of this and other dissemination activities.

5 Preliminary Consortium exploitation axes

As the exploitation of the 5D-AeroSafe project results are to our benefit as participating Consortium members, we expect that the exploitation activities of the project will be to convert our vision and results into tangible business opportunities and sustainable business models for the Consortium members. No project partner will be exempt for potential exploitation activities, which for the industrial/end user organisation partners will revolve around business exploitation, and for the research/academic partners will be scientific exploitation. The outcomes of 5D-AeroSafe that are scheduled to be exploited are:

- The whole system (RPAS connected to the UTM platforms and the capability to interface it with existing airport systems). This exploitation would be preferably done through a Joint Venture as all the competences are needed to commercialise it. The preferred business model is service for a fee.
- All or part of the RPAS: it can be used for airport applications as demonstrated during the project, but also in other domains such as monitoring of (critical) infrastructures, including transport networks, energy networks, etc., maritime surveillance, border control to name just the major possible usages.
- “AeroSafe” Toolbox and Applications Portal: offers the opportunity for independent software houses and developers to offer 3rd party applications that will make full use of the platform capabilities.

Business Exploitation

Business exploitation entails the commercial exploitation of the technological solutions that will be developed (exploitable results) throughout the course of the project, either as a whole solution, as components and/or individually where feasible. In case of Consortium exploitation, the conditions of use of the foreground (and background if necessary) will be defined according to the type of organisation (joint venture, spin-off, MOU, etc.). In case of individual exploitation, the industrial partners of the Consortium will make use of their own foreground in the form of technological solutions in order to enhance and advance their own personal product portfolio. The IPR of the foreground developed will remain with the corresponding beneficiary (please see Section 0 for details on IPR management).

Scientific Exploitation

There are two main domains where the 5D-AeroSafe will bring significant progress: RPAS safety and RPAS swarms. The safety of RPAS is still a major barrier for the operational use of drones in open airspace and in populated area. The safety can relate to the safety of the RPAS itself or the safety when faced to other vehicles. The systems can never be 100% safe but the specificity of the RPAS is that the responsibility is difficult to define precisely. E.g. If an accident occurs when the RPAS is not under control (loss of data link for instance), the pilot is not at fault. So, higher reliability is requested from unmanned platforms than for manned ones. Technical solutions have to be found to reach this reliability and it is part of the outcome expected from the project.

Swarms are still of research interest as they are essentially used at the moment for shows and not for combined operational tasks (or at a low TRL with a low level of automation). 5D-Aerosafe will make an important progress in the domain of collaborative search by a small fleet of RPAS.

Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 of the Grant Agreement— take measures aiming to ensure ‘exploitation’ of its results (either directly or indirectly, in particular through transfer or licensing) by:

- (a) using them in further research activities (outside the action);
- (b) developing, creating or marketing a product or process;
- (c) creating and providing a service, or
- (d) using them in standardisation activities.

6 Preliminary individual exploitation plans

6.1 Airbus Defence & Space

The Generic Ground Control Station GGCS is already within ADS portfolio. 5D-AeroSafe will provide extended capabilities to pilot multiple heterogeneous drones, especially drones procured externally off the shelf.

ADS are putting a strong emphasis on the development of services supported by UAVs in the civilian domain, and a specific subsidiary was created 2 years ago for this purpose (Airbus UAS). The exploitation of 5D-AeroSafe outputs are multiple:

- Continue the development of small UAV platforms in new domains and with new type of sensors. The airport domain is very important in general for Airbus and the insertion of drones in this demanding environment complex. The project will be the opportunity to study the domain through technological, legal and business aspects. 5D-AeroSafe will open the market to develop drone-based applications in airports (project applications but also aircraft inspections).
- Continue the development of drone-based systems that can manage in a maximized autonomous way fleets/swarms of heterogeneous flight.
- Build a long-time collaboration with the project partners on all aspects: UTM (Airmap and FINT), UAVs providers, sensor providers and application developers.
- Continue to participate actively on the evolutions of the legal framework,
- Integrate in our portfolio the services that will be developed in 5D-AeroSafe.

Summary of background	Identification of foreground	Planned roadmap for exploitation
<p>Use of unmanned vehicles for Search and Rescue operations. The first version of the Generic Ground Station that will be used in 5D-AeroSafe.</p> <p>Maritime surveillance integrating manned and unmanned aircraft. The system, like 5D-AeroSafe, integrated several heterogeneous networks, in a non-segregated airspace.</p> <p>Monitoring of Road Infrastructures supported, inter alia, by UAVs that are used in non-segregated airspace</p>	<p>Generic Ground Control Station</p>	<p>Critical infrastructure monitoring, maritime surveillance, border control. Support to airlines, quick pre-flights and post flights inspections.</p>

6.2 Future Intelligence Ltd.

Currently, the Core FINT Platform – which will be the foundation upon which the 5DAeroSafe platform will be built – is commercially used in the domains of smart cities and smart infrastructures. Through the expansion and enhancement of the platform to satisfy the needs of the 5D-AeroSafe project, FINT will be in an advantageous position of being able to bring this innovative technology into the aviation domain, a market which the company have strategically aimed to penetrate.

The developed miniaturised transceiver will also expand the company’s know-how and expertise in the hardware domain, as the already market available FINT wireless IoT nodes are also currently being used in the Smart Cities and Smart Infrastructure domains.

Summary of background	Identification of foreground	Planned roadmap for exploitation
<p>Provision of middleware platform for interconnecting all the heterogeneous data sources from devices and platforms along with the microclimate smart and cost-effective stations.</p> <p>Knowledge of applying security techniques for land border’s monitoring, a very security-oriented application/domain, provides the insights for applying similar approach for implementation and validation of the cybersecurity of 5D-AeroSafe system infrastructure.</p> <p>Development of embedded systems and FPGA enabled edge devices that can support acceleration of algorithms and can be served as payloads to the RPAS.</p>	<p>5D-AeroSafe Platform, Miniaturised Transceiver</p>	<p>Aviation, Smart Cities, Smart Infrastructures.</p>

6.3 Ecole Nationale de l'Aviation Civile

ENAC is one of the top universities in the world devoted to the aviation industry. ENAC research is active in the field of Air traffic management since 1959. It is a public institution under the supervision of the French Ministry of transport. ENAC International involvement will be a good relay to the results and achievement of 5D-Aerosafe. The presence of ENAC in ACARE groups, ASDA, EUROCAE, its partnership with EASA, the various international groups relevant to the UAS operations will make the results and perspectives of the 5DAerosafe well known. ENAC has also an activity in the training of technicians for the maintenance of the NAVAIDS, and ENAC has also in its portfolio an advance master in Airport management, in which some modules could take benefits from the use cases of 5DAerosafe.

Summary of background	Identification of foreground	Planned roadmap for exploitation
<p>Development of an OpenSource RPA System named Paparazzi (http://paparazzi.enac.fr), RPAS integration in the airspace and civil applications for small RPAS.</p> <p>In CLASS project a surveillance of drones by using ground equipment have been set, some trials have been done for drone detection and data fusion. The results of this project will provide a good background for the preparation of the 5D-Aerosafe use cases.</p> <p>The insertion of drones through SESAR projects with other operations and their result will provide elements to tune the usecases in 5D-Aerosafe.</p>	5D-AeroSafe Platform	Aeronautics training

6.4 Air Force Institute of Technology

The Institute manufactures advanced unmanned aerial vehicles whose strategic subsystems are developed on its premises, which increases the safety and precision of the performed tasks. UAVs are intended for conducting observations and inspections of critical infrastructure as well as precise engaging of a target with the use of armament.

The primary task of ITWL's Team involved in the project is to develop unmanned aircraft systems with aircraft support systems, designing, constructing of new aircraft structures and developing, producing and testing composites.

The Team works in the field of designing the aircraft structural elements (manned and unmanned) and on-ground equipment, developing mechatronic systems, including autonomous unmanned platforms, developing and implementing composite technologies in aviation of the Armed Forces of the Republic of Poland, developing and implementing composite technologies in aviation of the Armed Forces of the Republic of Poland. The Team also focuses on security and airworthiness issues of unmanned aerial vehicles and also has competences to conduct training in the field of service of unmanned aerial vehicles.

As a research organisation, ITWL will disseminate the results of the 5DAeroSafe project through will contribute to the dissemination of project results via participation in referenced conferences, workshops and trade fairs in the aviation and transport related events both locally and internationally (e.g LE BURGET, MSPO-LOGISTICS, REGIONAL AIR SHOWS IN POLAND). ITWL will also facilitate the contacts with stakeholders and potential end-users from industry based in Poland for providing them information on the project objectives and results produced. ITWL will organize in Poland one pilot demo, one workshop and disseminate project outcomes during conferences and trade fairs.

Summary of background	Identification of foreground	Planned roadmap for exploitation
RPAS construction and development (Aerodynamic computing, Strength computing, Development of manufacturing technology, Solid modelling, Designing of electronic systems, Modelling and simulation of RPAS dynamics, Development of control systems operating, Development of image processing algorithms, Development of software for unmanned systems operations and managing; On-ground and in-flight tests of unmanned aerial vehicles (UAV); Developing procedures, research methodologies and technical documentation of unmanned aerial systems; Certification of unmanned aerial systems intended for the civilian and military market. ATM/UTM integration (development, implementation and sustainment of IT systems for technics (esp. Aeronautical systems) Planning Management.	Integrated and tested 5D-AeroSafe system	Polish security and defence sector, stakeholders as Polish Aviation Agency, MOD, Ministry of Interior Affairs (Police, Border Guard) EDA, ASD, EREA, Airports.

6.5 Fundación Centro de Tecnologías de Interacción Visual y Comunicaciones Vicomtech

Vicomtech as non-profit organization the main exploitation strategy lays on the technology transfer to the industry and the technical positioning that the project offers to access new research opportunities.

Transfer technology to the Basque ICT industry, to improve their competitiveness.

Extend Vicomtech expertise with leading-edge technological and scientific developments in a European framework.

Maintain an active position as reference agent in Spain in research and development activities related with visual communication technologies.

Summary of background	Identification of foreground	Planned roadmap for exploitation
<p>Algorithms for static object detection will be used as basis and will be adapted to the new application domain (aircraft/airports). Road sensing and signal detection and classification efforts when developing the new algorithms will be reduced thanks to the work done in this project.</p> <p>Cloud-LSVA platform will be used in this project to generate the required dataset for training and validating the Deep learning algorithms for object detection and classification.</p>	<p>Viulib[®] - Proprietary Computer vision SDK, multiplatform, to rapid prototyping in a large variety of sectors, including Air Planned roadmap for exploitation</p>	<p>Aviation, Road</p>

6.6 Hellenic Mediterranean University

HMU as a non-profit university cannot directly exploit in the business sector the result of 5D-AeroSafe but is able to be part of Spin-off or start-up companies that may rise from the Consortium it can provide support and human resources for exploiting these applications. Following the results obtained via 5D- AeroSafe will be exploited by HMU for exposing its graduate engineers and researchers in state-of-the-art areas of 5G-Micro Cell, Communication and the User Experience, by offering them theoretical knowhow as well as practical and in-hands experimentation tools to be developed within the framework of 5DAeroSafe. MSc courses will be enhanced with tutoring on the specific concepts, and extensions on the related aspects will be offered for PhDs. HMU also puts extreme value in its collaboration via 5D-AeroSafe with other research, civil-sector and industrial partners, since this is the only way to be promptly acquainted with upcoming standards and major imminent technical and scientific breakthroughs.

Summary of background	Identification of foreground	Planned roadmap for exploitation
Front-End modules, interactive GUIs and secure/trustworthy private communications Developer of a Vulnerability Assessment as a Service Tool Experience with large pilots in a asset	The 5D-AeroSafe Applications	Critical infrastructure monitoring, maritime surveillance, border control

6.7 FERROVIAL CORPORACIÓN, S.A.

Ferrovial is one of the world's leading infrastructure operators and municipal services companies, committed to developing sustainable solutions.

Ferrovial's strategy is based on four pillars:

1. Profitable growth, through a combination of organic growth and selective acquisitions. Strategy of complementing organic growth with selective acquisitions to strengthen the company's competitive position and add capacity.
2. Internationalization, has led Ferrovial to consolidate a significant and stable presence in five geographical areas: Spain, the United States, the United Kingdom, Canada and Poland. The aim is to continue to drive activity in these countries, while developing new markets with appropriate risk management, leveraged by current capacity and establishing alliances with local partners.
3. Operational excellence and innovation are fundamental levers for the management of complex operations and the search for outstanding solutions for its clients. Promotion of employee talent and centers of excellence and innovation improve its competitive position in the different markets, governed by best practices in project management and personal safety. Its commitment to the environment, society and its employees are key for the development of operational excellence and innovation, which are Ferrovial's distinguishing features.
4. Ferrovial's financial discipline, through diversification of its sources of finance and liquidity management, has improved its credit risk ratings and strengthened the company's solvency. Ferrovial aims to maintain a low level of debt in terms of debt excluding projects, allowing it to maintain an "investment grade" rating level.

If the project solution delivers its expected impacts and reaches the market, Ferrovial will assess the possibility of implementing it in its current operations. It is expected to have a beneficial commercial agreement, thanks to its contribution as an end-user at 5D-AeroSafe.

Summary of background	Identification of foreground	Planned roadmap for exploitation
Use of drones for asset maintenance at airport Carry out a proof of concept with drones to test their feasibility Pavements inspections, perimeter fence inspections and building inspections with drones Use of drones for bird hazard at airport	The 5D-AeroSafe Solution	Airports Management

6.8 Greek Water Airports

Greek Water Airports specialises in waterdromes (otherwise known as waterairports or seadromes) study, design, construction, licensing and management services and holds the market leader position in Greece. The company is staffed by industry professionals, experienced in seaplane operations, waterdrome development and airline management.

Greek Water Airports are currently in the process of finalising a long-standing agreement with the Greek Government with respect to the operations of water airports, thus rendering us as the number one water airports operator in the country. The participation of GWA in the project will provide a 2-way benefit, and the timeline of the project will enable GWA to adopt the solution in time for water airports management and operations.

Summary of background	Identification of foreground	Planned roadmap for exploitation
Undertake licence services for waterdrones Training and certificate the security staff	The 5D-AeroSafe Solution	Water Airports Management

6.9 AIRMAP

AirMap is the world’s leading airspace safety and management platform for unmanned aircraft systems (UAS). Industry developers, UAS operators, and airspace managers rely on AirMap’s airspace intelligence and services to fly safely and communicate in low-altitude airspace. AirMap unlocks safe, efficient, and scalable operations by connecting the world’s UAS to airspace authorities through an open platform of Application Program Interfaces (APIs) and Software Development Kits, with integrations by leading UAS manufacturers and application developers. AirMap operates a worldwide UAS Traffic Management (UTM) service and leads the industry in implementing technology solutions to automate safe access to airspace in partnership with authorities including technical integrations with airspace authorities in the United States, the Czech Republic, Japan, Switzerland, and beyond.

If this project proves to be successful, we will be able to state that our tool will have the ability to initiate task orders and requests for missions to the drone operators that are involved in the CTR internal processes. We will also have a data interface link with the FINoT platform adding to our overall capability to show the results of a finished drone mission.

Summary of background	Identification of foreground	Planned roadmap for exploitation
<p>Demonstrating state of the art Geofencing capabilities supported by UTM</p> <p>U-Space demonstration projects</p> <p>Deliver instant airspace authorization for UAS operators</p> <p>UTM service provider</p>	<p>Customization tasks will include: Task order functionality in the UTM Center (the ability to initiate a mission request from the tool); Ability to display the flight mission results stored in the FINoT platform after completion of the flight.</p> <p>We will facilitate the integration to our system by Airbus GGCS and FINoT data interface.</p> <p>The maturity of our solution will be TRL8. The maturity of the overall 5D solution will need to be addressed further in the project</p>	<p>We do not have this step yet. We need to see the maturity of the solution at the end of the project</p>

6.10 EUROCONTROL

EUROCONTROL, the European Organisation for the Safety of Air Navigation, is an intergovernmental Organisation with 41 Member States, committed to building, together with its partners, a Single European Sky that will deliver the ATM performance required for the 21st century. EUROCONTROL employs more than 1,900 highly qualified professionals spread over four European countries..

EUROCONTROL has more than 50 years of experience in ATM concept development and validation, on its own and at the core of a pan European network of collaborators. EUROCONTROL has researched countless concepts and has enabled the implementation of many, from Short Term Conflict Alert to Reduced Vertical Separation Minima.

The role that EUROCONTROL has as a pan-European organization financed through our stakeholders' contributions makes it impossible and undesirable to exploit the results of 5D-Aerosafe in any other way than publishing and disseminating the project results as largely as possible.

Summary of background	Identification of foreground	Planned roadmap for exploitation
The Concept of Operation for UTM The U-Space services, procedures and technologies U-Spaces demonstrations RPAS Real Time Validation Exercises	N/A	Dissemination

7 Conclusion

In this first version of the project business plan, the information in the proposal has been updated due to the fact that only nine months have passed since the start of the project.

The project is in an initial development phase in which the use cases, the Concept of Operation and other documents are being defined prior to the test phase in the pilots that have been considered.

After discussion with the Consortium partners, it has been considered that it is too early to provide data on the exploitation of the project's results, as it is still at an early stage. Therefore, in the next version of this same document planned for the last stage of the project, more concrete data and activities will be provided in order to carry out an optimal business development with the support of the Advisory Board.

During the development of the project, the partners will review their strategy and activities for the commercialisation of the technology and the forecast of fee-based services to be offered to potential customers as results are obtained and adapted to the situation in each country.