AIDERS

Deliverable 2.1
End User Requirements

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Executive Summary

The aim of the project is to develop a management tool able to handle and analyse operational data during emergency response and rescue operations. Their quantity and variety do not always foster a quick and global understanding of the crisis situation. The deployment of a data processing platform, collecting data from different sensors, in real time and simultaneously, could facilitate the interpretation of this data and potentially speed up decision-making.

In order to identify these types of data, CEREN as the leader of the respective task, with the contribution of the other end-user partners of AIDERS, gathered and analyse the user needs requirements in order to build the decision process and operational choices that will be taken by incident commanders, regarding the deployment and integration of RPAS within emergency response. An enquiry among many National rescue centres and European civil protection services was conducted to enable the global and common understanding of the needs. The needs were built on the feedback gathered through surveys with project and external stakeholders, consolidated and finalized through CEREN (SECOAS) expertise, which a) provides expertise for the Directorate of the French Civil Protection, b) has built the training program, and c) trains all French civil protection pilots. The enquire was circulated by the end-users of this project to their first-responder communities in France, Italy, Greece and Cyprus and was answered by 74 first responders in total.

Data type is sometimes initially difficult to link with drone activity but eventual sensor development and most of all, artificial intelligence contribution, can upgrade raw data into valuable information, especially for decision makers. It is therefore advisable not to be restrictive regarding data type and to be as extensive as possible.

This deliverable documents the needs and requirements that have been identified through the aforementioned actions, in order to ensure that a common understanding is obtained on the operations that the end user of the consortium and the civil protection authorities in general, seeks to achieve and that a consensus is reached on the most important operations that RPAS need to perform.

This work enables project partners to focus their deliverables on genuine user needs mainly originating from rescue services and emergency response.
This deliverable will act as the axis which enables the link with the following project tasks, a sort of guidelines, which will be combined with the related threats and hazards, and the respective indicators to measure them. All these findings will provide, the initial and concrete input for the next WPs, guiding the technical partners on the design and development of each one of the components.

1 Introduction

According to (Newsome, 2014) , a hazard is a potential, dormant, absent or contained threat. Hazard and threat are different states of the same situation: The hazard is in a harmless state, the threat Drones in the area of civil protection is still a sector requiring further development. Their use needs no longer to be demonstrated, but methods and tools that are related to them, still need to be improved. Image and video from the field, appears to be the first use, that services have started with, when exploring and using RPAS.
The use of traditional aerial means during emergency response is crucial, but the increasing needs and frequency of use, have led to availability issues in some territories. Based on this emerging need, one of the main ideas of Emergency Response Organisations, was to replace or combine the traditional aerial means with RPAS and further extend the spectrum of their uses.
Finally, European countries do not necessarily use the same tools or have the same level of equipment, but perhaps if all possibilities are considered, the variety of capabilities that RPAS offer could help the consortium to define a common approach as well as to facilitate the work, especially for those that have just started to use RPAS to their operations. The idea is to have a comprehensive approach but common.

2 Existing Legislation

We provide a short description of the legislation related to the usage of PRAS and Unmanned Aerial Systems (UAs) in emergency response, in the participating countries.

2.1.1. French Legislation

The drone legislation in France in order to remotely operate an aircraft flying with no one on board, in other words a drone for which the main outlines are provided here
The four main legislation and regulations for drone use are:
Decree of 17 December 2015 regarding the design of civil aircraft which circulate with no pilot on board, the conditions of their use and the capacities required of the people who use them
Decree of 17 December 2015 regarding the use of airspace by aircraft which circulate without anyone on board, modified on 30 March 2017.
Law n ° 2016-1428 of 24 October 2016 regarding the reinforcement of the security of civil drone use.
Decree No. 2018-67 of 2 February 2018 regarding the training required for drone pilots using civil aircrafts operating without anyone on board for purposes other than leisure.

The use of a drone for other cases than for leisure or competition falls within the specific activity category and is tightly regulated according to weight, distance, height and areas overflown and identified according to 4 scenarios, S1-S2-S3-S4 providing the different possibilities to fly a drone whether it is for aerial photography or for other aerial tasks.

S1 – visual flight, maximum horizontal distance of 200 meters
S2 – instrumental flight, uninhabited area, maximum one-kilometer range in a horizontal volume, height under 50 meters from ground, artificial obstacles, no person in the area, up to 150 m if flying weight under 2 kg.
S3 – visual flight in urban area or near people or animals at a maximum horizontal distance of 100 meters, flying weight of 8kg at most.
S4- specific activity (survey, pictures, aerial surveillance and observation), instrumental flight, uninhabited area and not meeting the criteria of S2.

In order to be able to practice a drone pilot profession, the person must declare the activity to the general directorate of civil aviation, have a theoretical diploma of ULM pilot, a competency declaration (DNC) recognized by the DGAC, a professional insurance and a drone equipped with the required safety equipment.

N° scenario	Height	Distance from operator	Weight	Flight type	Flight area	Additional info	Security perimeter
1	150 m	200m	25 kg	Visual flight	uninhabited		yes
2	Under 50 m	1000 m	25 kg	Instrument flight	uninhabited	Artificial obstacles	yes
3	150 m	100m	8 kg	Visual flight	populated		yes
4	50m	----	2kg	Instrument flight	uninhabited	Special activity (observation, surveillance, picture)	possible third-party overflight

French Legislation related to data collection

The legislation regarding image or data recording above national territory is provided by article D133-10 of the Civil Aviation Code and by the decree of 27 July 2005 implementing its application.
In brief, when a physical or moral person wants to record images or data in the visual spectrum above the national territory, a declaration must be made the latest 15 days before the beginning of the period planned for the operation.
Furthermore, a list of forbidden areas has been established by an inter-ministerial decree.
Derogations are possible. They are provided by a state representative competent in the corresponding territory.
Article 8 of the European Convention for the Protection of Human Rights and fundamental freedoms and article 9 of the Civil Code ensure the rights of any individual to privacy. In this context, any person can object to the use, storage of disclosure of their image.
However, according to article L251-2 of the Homeland Security Code: “the transmission and recording of images taken on public roads through video protection means can be processed by relevant public authorities to ensure the prevention of natural or technological risks, use of persons and for the defense against forest fires.

Law n° 78-17 of 6 January 1978 regarding data processing and fundamental rights provides the legal framework for the protection of recorded data. However, regulation N°2016/679 of the European Parliament and of the Council of 27 April 2016 regarding the “protection of individuals related to the processing of their personal data and on the free movement of such data” makes it mandatory to implement "appropriate technical and operational measures” in order to protect individual rights and also to implement actions regarding data protection (collection and processing registers, rules of conduct, procedures for data security, training programs and awareness raising, etc..).
This regulation has entered into force on 24 May 2018.

2.1.2. Greek Legislation

In Greece, the Civil Aviation Authority (CAA) is a Civil Service under the Ministry for Infrastructure, Transport and Networks, that is responsible for the organization, development and control of the country`s air transport infrastructure, as well as the study and laying of respective polices, including those related to UAVs. There are three Government gazettes related to UAVs:
Government gazette 3152, issue B, 30-09-2016[1] -available also in English-
Government gazette 4527, issue B, 30-12-2016
Government gazette 1607, issue B, 10-05-2017

These regulations define the aircraft that is operating or is designed to operate without an operator (unmanned). This aircraft and operation may be categorized on one of the three categories: a) Open, b) Specific, and c) Certified, based on the following criteria:

- MTOM (maximum mass of the aircraft at take-off)
- Type of use (commercial, scientific or recreational purposes)
- Flight height
- Flight area (Prohibited, Segregated, Restricted area)
- Technical Opportunities of UAVs
- Risk Assessment

These criteria for the aforementioned categories, among further details and prerequisites are depicted in the following table.

Table 1: Categorisation of UAV operation

OPEN CATEGORY
Direct visual contact of the remote pilot of small unmanned aircraft Flight distance is less than 500 meters away Maximum flight altitude 400 ft (AGL ή MSL) MTOM under 25Kg CAT A0: MTOM < 1 kg CAT A1: MTOM 1=< kg <4

[1] https://dagr.hcaa.gr/docs/HCAA%20UAS%20Regulation.pdf

CAT A2: MTOM 4=< kg <25 Flights under Temporary Segregated Area must comply with applicable restrictions Within a safe distance from persons on the ground * * Except UAV operators with certification including the option to fly above people
SPECIFIC CATEGORY
Category for UAS operation, which is likely to pose significant risks on persons, over whom the operation is conducted. They are used for commercial, scientific purposes as well as for performing aerial works flights. Registration in the Special Registry of UAS Obtaining an Operation Authorization by HCAA Operate a UAV requires submission of the Operator of a certified completion of a relevant training course, by a certified UAS training centre.
CERTIFIED CATEGORY
classified by a decision of HCAA / Flight Standards Division after the submission of an application for registration and the subsequent elaboration similar obligation with manned aircraft certificate (CofA) issued by the HCAA airworthiness of the specific UAS Special Registry of UAS Operate a UAV requires submission from the Certificate Officer of the successful completion of a relevant certified training program by a licensed Training Centre of UAVs or UAV owner

To conduct flights of UAVs, several conditions are evaluated, in combination to the three categories above. These conditions are briefly described below:

Recording in a Registry, they are recorded according to their Category, the UAVs that are used for flights conducted at distances greater than 50 m. from their remote pilot and all UAV used for business purposes.
Airworthiness, proved by the following:

- Certificate of manufacturer under current European Union Legislation on general product safety for UAS "Open Class"
- Operational License by the HCAA / Flight Standards Division for UAS of “Specific” Category
- Special Certificate of Airworthiness (special Certificate of Airworthiness - CofA) from HCAA/ Flight Standards Division for the UAS "Certified" Category.
- Route data submission in a special flight plan for UAS. For each UAS flight of “Open” Category, which is conducted at more than 50 m. from the point where the remote pilot stands, and for “Specific” or “Certified” Categories, Route Data shall be submitted by the UAS operator / remote pilot in a special flight plan for UAS, through a special electronic form in the HCAA website.
- Permission to use airspace for UAS flights, for airspace:
- Less than 8 km. from the airport or landing field
- In areas where flights of unmanned or manned aircraft are restricted.
- In any class of airspace in height over 400 feet (FT) from the ground surface or the mean sea level.

UAS remote pilot License.

In order to be a certified pilot, a candidate must follow a theoretical program from a certified UAV Training Center, and afterwards pass theoretical examinations conducted by the Hellenic CAA. The same procedure is followed then for the practical program and examination Licenses for UAV operators are issued for the following categories and according to UAV's Maximum Take Off Mass, as follows:

Table 2: Categorisation of pilot licences according to MTOM

MTOM UAV	CATEGORY
Up to 1 kg (<1)	UAS Pilot A
From 1 kg (=/>1kg) to 4 kgs (<4)	UAS Pilot B
From 4kgs (=/>4kgs) to 25 kgs (<25)	UAS Pilot C
From 25 kgs (=/>25kgs) to 150 kgs (< 150)	UAS Pilot D
Over 150 kgs (=/>150 (EASA regulation)	UAS Pilot E

In addition to the above training and examinations, the following must be acquired under Special and Certified category:
Class 3 Medical Certificate (equivalent level to an air traffic controller).
English language at level ICAO 4 or higher.

Insurance coverage.

The operator / owner / remote pilot of UAV in the following categories

- the UAS A2 "Open " Category and for all the "Open " Category subcategories in case of professional use
- the UAS of the “Specific” Category
- the UAS of “Certified “Category

shall insure the UAS for third party liability and especially in respect of damages to property of third party up to 150.000€ and in respect to bodily injuries up to 1.000.000€.

Registering of license and security mechanisms integration for UAS flights above gatherings of persons. For flights over gatherings of people a special license extension/endorsement of UAS license is required and an embodiment of security mechanisms (parachutes, small body weight, foam material, etc.) in the aircraft.

Further to the aforementioned categories and conditions, UAS flights, are classified according to the visual contact kept by the remote pilot of the aircraft, as follows:

- **Flight with visual contact (Visual Line Of Sight-VLOS),** during which the system operator can keep direct visual contact with the unmanned aircraft without aids(except corrective lenses-glasses) to monitor the progress of the flight in relation to other aircraft, people, vehicles, boats and structures to avoid conflicts. UAS Flights with VLOS are

permitted at a maximum distance of 500 meters horizontally and 400 feet (FT) vertically from the remote pilot.

- **Flight with Extended visual contact (Extended Visual Line Of Sight - EVLOS)**, during which UAS fly at a distance within the range of the system by the operator and 400 feet (FT) from the ground or water surface, thus at a distance where the system operator is able to comply with the collision avoidance procedures. On these flights the requirement for the operator to keep direct visual contact of the operation of Unmanned Aircraft is achieved via the "visual observation" method, namely by monitoring the flight progress through its camera, by the transmission of the relevant image. The operator must submit a safety assessment plan, including risk assessment for flight operation.
- **Flight Beyond Visual contact (Beyond Visual Line Of Sight - BVLOS),** during which a UAS flight beyond visual contact, the remote pilot is not able to respond or avoid other airspace users by visual means. For a UAS intended for operation beyond system operator's visual contact, the definition of a restricted (segregated) airspace to avoid a collision is required, or to follow in full compliance, the relevant special instructions of the authorization given by the competent Air Traffic Control Service Unit of HCAA. The UAS conducting flights in BVLOS conditions are required to submit a safety assessment plan, including risk assessment for the operation.

All these types of flights are not always and everywhere allowed. There are prohibited areas that must be respected.

In order to conduct a UAS flight within the areas listed below, a special permission from the HCAA / Air Navigation Services Regulatory Division is required, along with any competent Civil Service Entity (e.g. Ministry of Culture for archaeological sites, the Ministry of Defence for military facilities etc.):

- In prohibited, restricted, dangerous and reserved areas as defined in every form of aeronautical publications of HCAA.
- At a height of more than four hundred feet from the surface of the ground or water.
- Within Aerodrome Traffic Zone (ATZ), meaning less than eight kilometres - five nautical miles (8km -5nm) from a controlled aerodrome, airfield and heliport.
- Above, close to or within any kind of military areas / Installations and vital infrastructures.
- Within military or civil airports and heliports
- Above or near schools, hospitals, establishments, detention facilities
- Above or near constructions of common utilities
- Above or close to archaeological sites
- Environmental protection areas

Finally, within the Greek legislation, also penalties and enforcement jurisdiction are foreseen. In case an operator (owner, lessee) and / or remote pilot of UAS who either:

- Commits a breach of Rules for the operation, exploitation, security, air traffic rules and the provisions of other Laws and Regulations of civil aviation,
- Refuses check (inspection) by the HCAA,
- Violates the terms of use of radio frequencies used for communication between the control station and the UAS.

- the following justified penalties are imposed on the offender:
- Administrative Fine
- In particularly serious or even repeat offenses
- Suspend for a limited time or revoke licenses - certificates.

Greek Legislation related to data collection

In Greece, as in all EU member states, the General Data Protection Regulation has come to force. This has been achieved through the Greek Law 4624/2019, GG 137- 29.08.2019, and refers to the protection of natural persons with regard to the processing of personal data and on the free movement of such data. This is further analysed in the respective section below.

2.1.3. Cyprus Data Collection Legislation

Cyprus RPAS regulation is in line with the new regulations of the European Aviation Safety Agency regarding Unmanned Aircraft Systems that will partially get into force for all EU Member states as of 1st July 2020. There are two regulations, the first aims at regulating the requirements and specifications of UASs and the second regulates the use of UAS by operators and pilots of drones, whether recreational or professional.

1. *COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems*
2. *COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft*

The new regulations of EU are mainly focused in the level of risk each flight/operation has with respect to the equipment specifications. Under the EASA rules there are three categories of UAS:

1. Open Category
    - A1 (Fly **over** people)
        - Privately build (<250g)
        - C0 (<250g)
        - C1 (<900g)
    - A2 (Fly **near** to people 5-30 meters)
        - C2 (4kg)
    - A3 (Fly **far** from people minimum of 150 meters)
        - C3 (<25kg)
        - C4 (<25kg)
        - Privately built (<25kg)
2. Specific Category
3. Certified Category

Open Category

Open Category is divided into three subcategories A1, A2 and A3 each of those has an allowance to fly over, near or far from people. UAS are then divided into 5 classes (C0 – C4) depending on flight characteristics, for example weight, energy produced in case of an impact at maximum velocity ($E_{impact} = \frac{1}{2}mU^2$) or physical dimensions of the UAS. Each class is categorized in one of the 3 subcategories as previously mentioned.

It is important to note that all UAS that have been released after 1st July 2019, are CE marked in one of 5 classes C0-C4.

Basic characteristics of Open Category:

- Low or no risk to third parties.
- Basic, predefined operational characteristics.
- No authorisation required.
- Basic level of training.
- Line of Sight operations.
- MTOW (Maximum Take-Off Weight) of 25Kg.
- Maximum altitude of 120m above take-off point (except where flying over a fixed obstacle).

Subcategory A1

1. Class C0:
    - For a drone weighing up to 250g (MTOW) not going beyond 19m/s.
    - The drone pilot can fly over people not participating in the operation but can not fly over people's gatherings.
2. Class C1:
    - For a drone weighing up to 900g (MTOW) not going beyond 19m/s.
    - The drone pilot does not fly over people's gatherings and can reasonably estimate that no person not participating in the operation will be overflown.
3. Low or no risk to people.
4. Drone registration for C0 is required if camera is equipped in the drone and it is not considered as a toy.
5. Pilot Training: Online training and online theory test is required organized by the competent authority or by an entity recognized by the competent authority of the operator's Member State. The examination consists of 40 multiple-choice questions into the following subjects:
    - Aviation safety
    - Airspace restrictions
    - Air regulations
    - Limits of human performance
    - Operational procedures
    - General knowledge of UAS
    - Data protection and privacy
    - Insurance
    - Security
6. If the drone is considered as a toy, online training and test is not required as well as drone registration.

Subcategory A2

1. Class C2:
    - For a drone weighing up to 4Kg (MTOW)
2. The flight is carried out in such a way that the drone does not fly over people and takes place at a safe horizontal distance from people:
    - At least 30m horizontal distance from the people.

- At least 5m horizontal distance from the people is permitted when using a drone equipped with an active low-speed mode function (<3m/s) and after assessing the situation with respect to:
    - Weather conditions
    - The performance of the drone
    - The isolation of the area overflown

3. Pilot Training:
    - Have completed online training and passed the online theory test from Subcategory A1.
    - Pass a complementary theoretical examination organized by the competent authority or by an entity recognized by the competent authority of the Member State. The examination will include at least thirty multiple-choice questions into the following subjects:
        - Meteorology
        - flight performance of UAS
        - technical and operational mitigation measures for ground risks
4. Drone registration required.

Subcategory A3

1. Class 3 and Class 4:
    - For a drone weighted up to 25Kg (MTOW).
    - Class 3 has a maximum characteristic dimensions of 3 meters.
2. No uninvolved people in the area of the flight.
3. Must be 150m horizontally from residential, commercial, industrial or recreational areas.
4. Registration required.
5. Read user manual.
6. Online training and theoretical examination required as defined in Subcategory A1.

Specific Category

1. Too complex or risky to be carried out in the open category, for example:
    - BVLOS (Beyond Visual Line of Sight) flights.
    - Operations over 120 meters high.
    - Drones over 25 kg.
    - Urban flights with drones over 4 kg or without CE certification.
    - Material dumping.
    - Flight over crowds of people.
2. If one of the requirements of the open category is not fulfilled, the operation will be placed into the Specific Category.
3. Operational authorisation **is required** from the local competent authority.
4. Drone registration required.
5. This has variable training requirements ranging from the basic foundation test all the way up to a potential Remote Pilot Licence (RPL). The level of training will be dictated by risk.
6. ‘Standard Scenarios’ with known risk profiles will be written over the next few years. The required training will be built into the Standard Scenario requirements.
7. If the operation is not covered by the ‘Standard Scenarios’ that will be published by EASA, then the operator should conduct a safety assessment study using the Specific Operations Risk Assessment (SORA) approach for both Ground Risk Class (GRC) and Air Risk Class (ARC). Then it is required to form the Specific Assurance and Integrity Levels (SAIL) for both risk

classes to determine the level of confidence that the UAS operation will stay under control within the boundaries of the intended operation. The safety study will then be submitted to the Competent Authority for authorization.

Certified Category

- Risk equivalent to manned aviation.
- Certification of aircraft and operator required.
- High level of training and licensing.
- Drones with dimensions of more than 3 meters, or if it transports dangerous goods or people.

Summary:

Operation		UAS					Area of Operation	Remote Pilot Competency	
Category	Sub Category	Class	Max Weight (MTOW) or Kinetic Energy	Main Technical requirements (CE marking)	Electronic ID / Geo Awareness	Registration		Training	Minimum Age
Open	A1	Privately Built	< 250 g	N/A	No	No	-Allowed Airspace -Can fly over uninvolved people (Not over crowds) -Maximum altitude from take-off point 120m AGL	No	No
		C0		Consumer information < 19 m/s, no sharp edges, selectable height limit				No	
		C1	< 900 g or < 80 J	Consumer information < 19 m/s, kinetic energy, mechanical strength, lost-link management, no sharp edges, selectable height limit	Yes & unique SN for identification	Yes		Yes, 40 multiple choice questions	16*
	A2	C2	< 4 Kg	Consumer information, mechanical strength, lost-link management, no sharp edges, selectable height limit, frangibility, low-speed mode			-Allowed Airspace -Can fly at a safe distance from uninvolved people (> 30 m or > 5 m in low speed mode) -Maximum altitude from take-off point 120m AGL	Yes, 70 multiple choice questions & theoretical test	
	A3	C3	< 25 kg	Consumer information, lost-link management, selectable height limit, frangibility			-Allowed Airspace -Fly far from uninvolved people and buildings (> 150 m) -Maximum altitude from take-off point 120m AGL	Yes, 40 multiple choice questions	
		C4		Consumer information, no automatic flight	If required by zone of operations				
		Privately Built		N/A			Usually model airfields		
Specific	N/A	N/A		Feature the technical capabilities set out in the operational authorisation issued by the competent authority or in the standard scenario	Depending on permission	Yes	Depending on permission	Depending on permission	16*
Certified	N/A	N/A	N/A	Comply with the applicable requirements set out in Commission Regulations (EU) No 748/2012, (EU) 2015/640 and (EU) No 1321/2014.	Depending on permission		Depending on permission	Depending on permission	Depending on permission

2.1.4. Italian Legislation

In 2017, the **Italian Civil Aviation Authority (ICAA)** introduced a regulation regarding the safety rules and flight conditions for UAVS. The regulation enabled the usage of UAVs in urban areas given their respect on a set of rules, such as the presence of a primary command and control system compliant with UROCAE ED-12B (RTCA DO-178B) corresponding to a minimum of level D. The different levels and their description are presented below.

Table 3 Levels of RTCA DO-178B software

Failure Conditions	Software Level	Description
Catastrophic	A	Software that can cause or contribute to the failure of the system resulting in the loss of ability to continue safe flight and landing
Hazardous	B	Software that can cause or contribute to the failure of the system resulting in a hazardous or severe failure condition
Major	C	Software that can cause or contribute to the failure of the system resulting in a major failure condition
Minor	D	Software that can cause or contribute to the failure of the system resulting in minor failure condition
No Effect	E	Software that can cause or contribute to the failure of the system resulting in no effect on the System

On the 11th of September 2019, the EU regulation 2018/1139 was entered into force and defined the rules and principles of airspace by examining the various aspects of drones. The regulation was applied to all drones at the European level regardless of their weight, including those with a weight of less than 150 kg. Before the EU regulation 2018/1139 , it was the responsibility of the nation to regulate smaller drones. It was also the responsibility of the nation to cover aspects such as the protection of personal data, operator training, design, production, maintenance, and the obligation to register, as well as establishing the essential requirements for unmanned aircraft.

The current regulations define the essential requirements of unmanned aircraft, with the provision, as already mentioned, of intervention by the implementation of specific acts by the commission. The legislation also draws the attention of operators to the question of the protection of personal data with provisions that limit the activity of drones in compliance with the rights guaranteed by the Union, relating to privacy and family life, as outlined in *Article 7 of the Charter of Fundamental Rights of the European Union* and those relating to the protection of personal data, referred to in *Article 8 of the Charter and from Article 16 TFEU*, and from *Regulation (EU) 2016/679* of the Parliament and of the European Council.

The requirements relating to the registration of unmanned aircraft and those of their operators have also been established, always in consideration of the risks that unmanned aircraft can represent for the safety, confidentiality, and protection of personal data and the environment, for which reasons they need to be identifiable. Thus, harmonized and interoperable national digital registration systems have been introduced on the D-Flight website, in which all information relating to drones and their operators has converged and been stored, in accordance with the provisions of the regulation and of the acts implemented based on the same.

The information stored in the registration systems must be easily accessible and drone operators must be registered in specific national lists if they use:

- Unmanned aircraft, which in the event of an impact can transfer kinetic energy greater than 80 joules to the human body; and
- Unmanned aircraft whose use involves risks to confidentiality, protection of personal data, security, or the environment.

The regulation shows a risk analysis related to the weight of the drone, the operations carried out, and the contexts of its use, and therefore a series of preventive, organizational, and technical measures are indicated, including protection from electronic interference, those relating to communication and anti-collision (“detect and avoid function”).

The new rules confirm the need to adopt an adequate management system to ensure compliance with the requirements in order to monitor and predict security risks, with the aim of constantly improving the system. Furthermore, the importance of operator training has been emphasized, which represents a challenge for public entities, businesses, and citizens at this time.

Flight Licenses and Certificates Professionally piloting an RPA involves the following requirements:

- Over 18 years of age;
- Psychophysical fitness;
- Basic aeronautical knowledge;
- The ability to fly an RPA; and
- Obtaining a certification that establishes the obligations and limits of the activity, which is of two types: The certificate or the RPA pilot license.

The RPA remote pilot certificate is issued by an authorized ICAA center and authorizes the holder to pilot drones of different categories with a mass of less than 25 kg in VLOS (visual line of sight) conditions, e.g., flight operations with visible controls in the absence of additional supports. For psychophysical fitness, a LAPL (light aircraft pilot license) medical certification is required, issued by an aero medical examiner (AME), which is valid for 60 months if the pilot is under 40 years of age, but if the pilot was certified shortly before he turned 40, his certificate validity ceases at 42; after 40, the certificate must be renewed every 24 months. The certification of aeronautical skills is issued upon passing a theoretical-practical exam to be taken at ICAA authorized centers.

There are three possible levels of flight certificates for the use of RPAS based on their weight:

- **VL** Very Light from 0.3 kg to 4 kg;
- **L** Light from 4 kg to 25 kg; and
- **H** Heavy over 25 kg.

These certificates allow the holder to fly drones of different categories also based on their structures:

- **Ap** Fixed wing;
- **Hc** Helicopters;
- **Mc** Multi-cop

Piloting in BVLOS (beyond visual line of sight) is not allowed in Italy, because it has not been regulated yet.

To secure psychophysical fitness certification, it is necessary to pass a class-three medical examination and obtain the relative certificate issued by the ICAA Regulation, which will be valid for 24 months for pilots under 40 years of age. Over the age of 40, the certificate must be renewed annually. The certification of aeronautical skills, also for the pilot license, is entrusted to the centers recognized by ICAA, after passing theoretical and practical exams. It is valid for 5 years.

The regulation on drones was passed by the European Union in July 2019 and entered into force, replacing national regulations with simplified rules and higher safety standards for those who want to operate RPAS (remotely piloted aircraft systems).

Following approval of the new basic regulation in June 2018 by the European Parliament, the EASA (European Union Aviation Safety Agency) voted in favor in July 2019—after the representatives of the Member States had examined the acts to be implemented, at the EASA Committee of the European Commission—and allowed passage of the regulation .

The rules contained therein will become applicable in July 2020 in all Member States, exactly one year after their approval. The use of UAS placed in the market before the new regulations, which had not been classified according to the new codes, will be permitted until July 2022 for low-risk operations (so-called open category), provided that certain criteria are met based on the weight range. Starting from July 2022, those who want to operate a drone in Italy will have to comply fully with the new European laws.

Regulation for the use of RPAS by the Italian fire and rescue service.

The Italian regulation in question does not apply to State drones, such as those owned by the Italian fire service (CNVVF), and it refers to emergency operations through a simple and specific article:

"Remote pilots and SAPR operators must not fly near or within areas where interventions are taking place in response to an emergency".

As for the above, the CNVVF's drones, being State drones and being excluded from the scope of the Italian regulation, as required by the Italian navigation code, are operated according to the specific regulations issued by the administration.

Therefore the CNVVF issued a specific regulation for the use of drones during rescue operations, which wherever possible takes as a reference the national ENAC regulation, aiming for a level of safety at least equivalent to it, while taking into account the specific mission objectives; as mentioned above require an in-depth risk analysis, based on the scenario and on the rescue operation to be carried out, and which also includes a series of mitigation actions aimed at ensuring the safety of flight operations.

Since operations with drones, even in emergency conditions, presuppose the commitment of the common airspace, it is necessary that operations take place with procedures linked to the reference legislation.

The operations of the firefighters are carried out with the drone on sight, by the responsible pilot or by an observer, provides for a crew composed of at least two SAPR pilots, provides for constant listening on the aeronautical frequency in use and where deemed it is also possible to request the airspace segregation through the issue of a specific NOTAM (e.g. collapse of the Polcevera viaduct, Sisma Centro italia 2016).

The implementation of the risk assessment procedure is currently being implemented through the application of the SORA methodology, in order to structurally support the chosen mitigations and possibly remodel them in relation to the results of this analysis.

2.1.5. European Aviation Safety Agency (EASA) regulation

In 2015, the European Commission has assigned to EASA to setting up a set of European Rules. Common rules would help foster investment, innovation and growth in this promising sector, while helping to protect the safety and the privacy of EU citizens. In this direction EASA rules released in June 2019 and came into force on 1st of July 2019. EASA's regulation acts, consists of COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft

EASA has created three risk-based categories for flying UAVs:

1) **The open category.** This is a category of operational activities (commercial enterprises), which, taking account of the relevant risks does not require prior approval of the civil aviation authority before the flight is made.
2) **The specific category.** This requires a permit from the competent authority before it takes place and takes into account the mitigation measures identified in an operational risk assessment.
3) **The certified category.** This covers operations that do not meet the open class characteristics, where a specific risk should be mitigated by additional operational constraints or higher capabilities of the equipment and personnel involved. This requires the certification of the UA, an authorized remote operator and the competent authority to ensure an adequate level of security.

In general, the most important regulations are the follow:

Table 4: EASA rules for UAV's flights

	C O	C 1	C 2	C 3	C 4
Height	**< 50**	**< 120**	**< 120**	**< 120**	
Age		> 14 + supervisor	> 16 +Supervisor +registered drone	> 16 +Supervisor +registered drone	> 16 +Supervisor +registered drone
Comply with the limitations of the area, zone or airspace, defined by your National Authority.	✓	✓	✓	✓	✓
Do not make changes to the drone.	✓	✓	✓	✓	✓
Do not fly over large crowds or groups of people.	✓	✓	✓	✓	✓
Supervisor needs to be registered and pass an online test.		✓			
When flying over others people property do not fly below 20 m without their permission.			✓	✓	✓
Always VLOS			✓	✓	✓
Adequately insured				✓	
Electronic identification		✓ (If equipped, upload the registration information)		✓	✓

Plan your flight				✓	

3 Privacy and Data Security

There are several challenges to expanding the use of UAVs. The biggest of them are the following:

- **Legal issues.** In the OECD, most countries are just developing legal guidance for the commercial or civilian use of UAVs. In general, small systems that fly at altitudes below commercial aircraft are much more lightly regulated and may be used freely if they are for "recreational" purposes. Use is generally more restricted in urban areas. The main concern of regulators is safety and liability, if a UAV crashes could cause injury or property damage.
- **Ethical procurement and partnerships.** The military remains the largest user of UAVs, while the manufacturers are primarily military contractors. This situation raises ethical and operational considerations for humanitarian organizations, who may not wish to be associated even indirectly with military actors
- **Privacy & data protection**. Regulators are wrestling with how to deal with UAVs' capacity to observe, even not in purpose, private property and capture sensitive personal information.
- **Transparency, informed consent & community engagement**. Communities or local authorities would be informed of the timing of flights, the purpose of the mission and the type of data being collected, with the aim of having some kind of informed consent, whether formal or informal.

More specifically the third challenge mentioned above, within EU is covered by the General Data Protection Regulation (**GDPR**), if at least one of the following is applicable:

- As long as the drone operating carries any payload / equipment / sensor that is used to collect and/or analyze and/or process any kind of personal data
- Whether the data collected by drones unequivocally identifies a person, or if such may be the case subsequently (identification is possible thanks to crossed information from different sources)
- Regardless whether the operation of the drone takes place in the professional or recreational sphere (exception for purely personal/household activity)
- Ensure the protection of individuals' civil rights and reasonable expectations of privacy before deploying

For example, GDPR is applicable, if through a drone's video/image a person's face is clearly visible, or if a person can be identified in another way (e.g. from the location, visible address numbers, car plate numbers, time of day, specific clothing, etc.), or if details are shown about the person's bodily characteristics, behavior, private life or his or her professional activities.

Based on the content and articles of GDPR, the following guidelines should be followed in order to ensure data protection, when operating a drone with payload/sensors that can gather personal data (e.g. a camera):

- **Lawfulness:** operation applies with national aviation legislation [not be operated near or over military installations (military bases, airstrips, ships, etc.), intelligence and security-

related installations, or over critical infrastructure]. Legal basis for processing (consent where appropriate and feasible, contract, legal obligation, legitimate interest, etc.).

- **Transparency:** before deployment, a plan must be established regarding the management of the data that will collected (who will be responsible, where the data will be stored, etc.).
- **Fairness:** The data will be collected and analyzed in a manner that is impartial to avoid discrimination
- **Purpose limitation:** data collected are necessary and proportionate given the need(s) of the mission

Integrity and confidentiality: technical measures to reduce resolution of images that contain personal (blurring and/or down sampling the data), any of imagery will not be released to the media without the permission of the organization. A plan for storing, sharing and discarding the data collected must be established, ensuring the security of storage and transmission of data. Before deployment, a risk assessment will be conducted covering the data that will be collected and the tools that will be used. Before collecting, sharing or storing data that is particularly sensitive, an assessment should be conducted to mitigate the risk and benefit

- **Storage limitation:** Any data collected using UAS shall not be retained for more than one hundred eighty (180) days unless deemed absolutely necessary. Any data collected must be secured and safeguarded.

During an emergency operation, depending on EU Member State local laws, some provisions of GDPR may not apply. Article 23 of the GDPR gives the right to Member States to introduce certain derogations from data protection law in certain situations:

- national security;
- defense;
- public security;
- the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, including the safeguarding against and the prevention of threats to public security;
- other important objectives of general public interest of the Union or of a Member State, in particular an important economic or financial interest of the Union or of a Member State, including monetary, budgetary and taxation a matters, public health and social security;
- the protection of judicial independence and judicial proceedings;
- the prevention, investigation, detection and prosecution of breaches of ethics for regulated professions;
- a monitoring, inspection or regulatory function connected, even occasionally, to the exercise of official authority in the cases referred to in points (a) to (e) and (g);
- the protection of the data subject or the rights and freedoms of others;
- the enforcement of civil law claims.

Based on the above, if Search and Rescue during an emergency is conducted, compliance with GDPR is not needed, however in a training or an exercise this is not applicable. So, depending, on the mission type certain provisions of GDPR may apply or not, however, First Responders must always do their best to secure any data collected.

Standard Operating Procedures (SOPs) for data protection, that may be followed are depicted below:

- Encrypt downstream video from drone.

- After moving from SD-card to computer extract and keep only images/video from area of interest.
- Use registered and secured media, media devices and data storage.
- Identify any GDPR sensitive information, manually or by software.
- Delete all data not relevant to the task.
- Anonymize personal data on images/videos in the information concerning the main task. Separate location data from images or video if needed.
- Document/log all steps (art. 30: Records of processing activities).
- Maintain Personal Data Register.
- Do regular training on GDPR and data security activities.
- On Drone crash and security breach, where unauthorized access or capture of this personal data has taken place a “breach” may have occurred and steps to secure the data, inform those involved and perhaps contact the data protection authority may be needed. Operators and data controllers should have policies, procedures and training in place, so that staff can take the appropriate action should a data breach occur.

In a nutshell, SOPs for data protection are very important to ensure the protection of privacy of the individuals. Although emergency response may be a derogation under Article 23, however, Emergency Response Agencies need to know GDPR well and comply with it to avoid sanctions. The safest and most legal option is to collect, process and store only the absolutely necessary data.

4 UAV Types

The term Unmanned Aircraft System covers the flying vehicle itself (UAV) and all the components necessary to accomplish the mission objectives.

According to the International Civil Aviation Organization (ICAO), Unmanned Aircraft (UA) is defined as any powered or unpowered aircraft that is flown without a pilot onboard, including:

- Remotely Piloted Aircraft (RPA);
- Autonomous Aircraft;
- Small Unmanned Aircraft (sUA or sUAS);
- Model Aircraft.

UAVs may be classified, based on the following criteria

- Size (micro, mini, small, etc)
- Altitude (low, medium, long, etc)
- Weight
- Range (close, short, medium, etc)
- Take off (VTOL, HTOL)
- Type

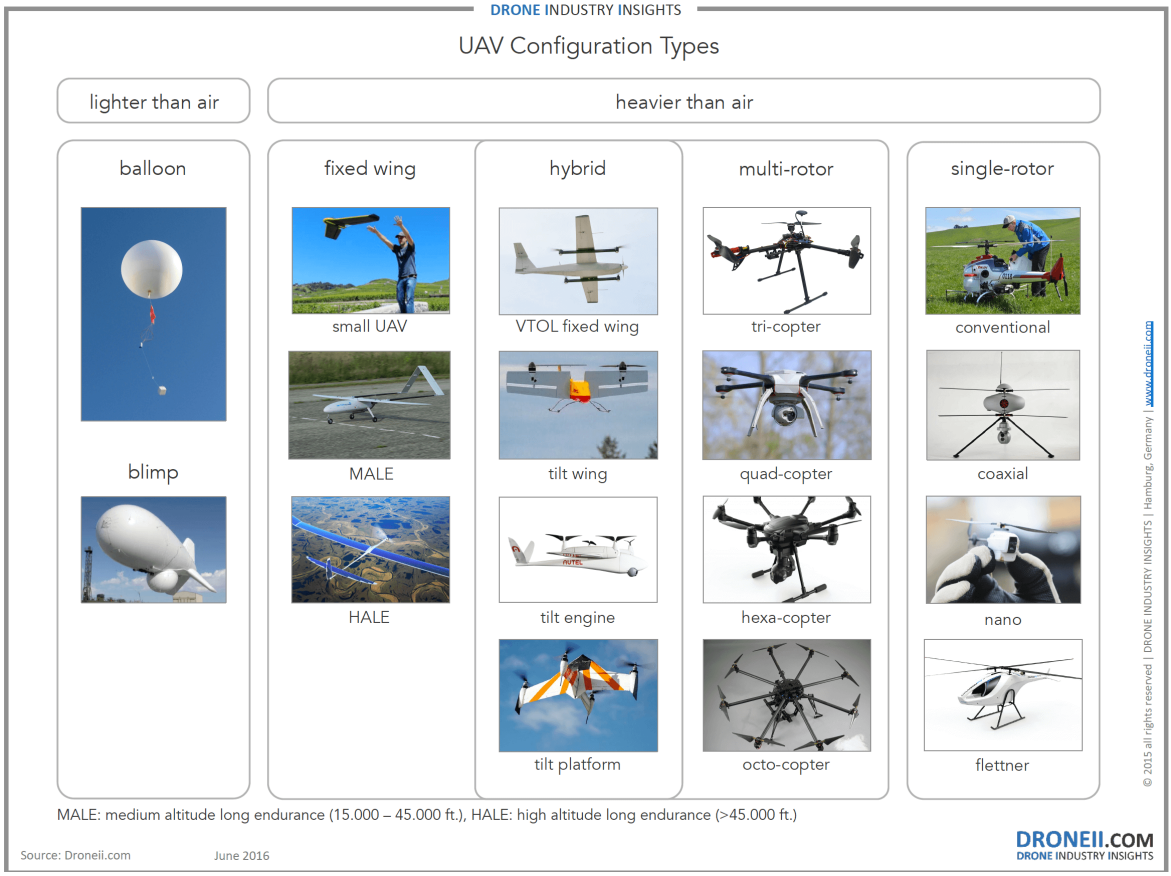


Figure 1: UAV configuration type

Rotary-wing

Rotary-wing UAS have the following general characteristics:

- Use a spinning rotor or propellers to generate lift, independent of airframe movement
- Have the ability to hover – remain motionless – over a target area
- Hovering requires more power than fixed-wing flight, so rotary-wing platforms will have shorter flight-times, lower top speed, and lower altitude limits than equivalently-sized fixed wing airframes
- Platforms may be of the familiar mainand-tail-rotor configuration or the increasingly common multi-copter configuration
- Multi-copters, with three, four, six, eight, or more powered rotors, benefit from mechanical simplicity and redundancy in higher-number configurations
- Have the ability to launch from, manoeuvre in, and recover to very restricted terrain; and
- Can provide a steady video picture from a stationary, top-down perspective

Fixed-wing

Fixed-wing UAS have the following general characteristics:

- Fixed-wing UAS have solid air foils and will depend on moving through the air to generate the required lift to remain airborne;

- Require a means of propulsion, which may be an electric or internal combustion engine driving a propeller, or a jet engine;
- Range in size from tiny, hand-held electrics to 737-size jets
- Will generally have longer range, higher speed, and greater payload capability than a similarly sized rotary-wing UAS
- Will usually be able to fly at a higher altitude
- Most are limited by the need to take-off and land laterally, so terrain will affect launch and recovery sites
- Cannot be used in restricted or congested areas because of their requirement to move through the air to generate lift; and
- Without a stabilized camera, video imagery from a fixed-wing UAS can be difficult to interpret due to the constant airframe motion.

Balloon

Stationary, they are easy to use and do not require a piloting process

Linked systems

More recent, they are limited in their movement but their autonomy is unlimited.

5 Embedded Devices

Type of sensor	Array	Applications	Cost	Resolution/observations
Optical	Many …	MNT /MNS Topography Monitoring: - coast - Landslide - River sediment transport - Erosion	Starting at 1K€	Centimetric
Thermal	NIR (0,75 to 1µm) SWIR close to infrared (1 to 2,5µm) MWIR (3 to 5µm)	Biology Fire (enables to identify the source through smog or smoke) High temperature, extended range	from 5k€ to 30 K€	

	LWIR (8 to 14µm)	High humidity, smog detection gas leak		
Lidar	Yellowscan/Geodetics/PhoenixLidar..	Archeology Civil engineering Mining Environmental research	20k€	Millimeter accuracy
Multispectral	CMS4, Tetracam, Sequoia	Agriculture Viticulture	4 to 15k€	Normalized Difference Vegetation Index NDVI, MCARI, MSR, SAVI, TV
Hyperspectral	(0,4 to 1 µm) Rosonon, Headwall , HySpec (complete system)	Morphological monitoring (ground and vegetation) Bathymetry Pollution of the water column Reflectivity Biomass assessment	➢ 30K€	
Chemical	DJI, MGGA, pMGGA	Gas detection	20k€	Under development; « general public » DJI sensors have insufficient detection thresholds for scientific research, but are enough for security purposes
Radioactivity	Uranium Thorium or Potassium Minitrace Gamma and X ray (Bertin technology), IMS, Rium …	Nuclear power plant Sensitive site Radioactive leak	From several hundred Euros to 8 /10K€ for high end sensors	Very accurate but caution regarding the amount of atmosphere between the source and the sensor
Sonic /acoustic	Long-range ; micro directional	Optronic sensor guidance, (intrusion) Monitoring Security	<1k€	Under development
Other	RFID chip	River sediment transport	2k€	Under development

6 Enquiry Results

An enquiry was used to elicit the end-user requirements for identifying what operations they undertake, what data they would consider useful for emergency response, what equipment they would like to use, their opinion on the usage of UAVs, the current legislation and any accountability on the usage of UAVs. The questioner was circulated to all end-users and their communities in France, Greece, Cyprus and Italy and was filled by 74 first responders. The Enquiry is available as appendix. This section presents the aggregated responses for this enquiry.

6.1 Responses for each question

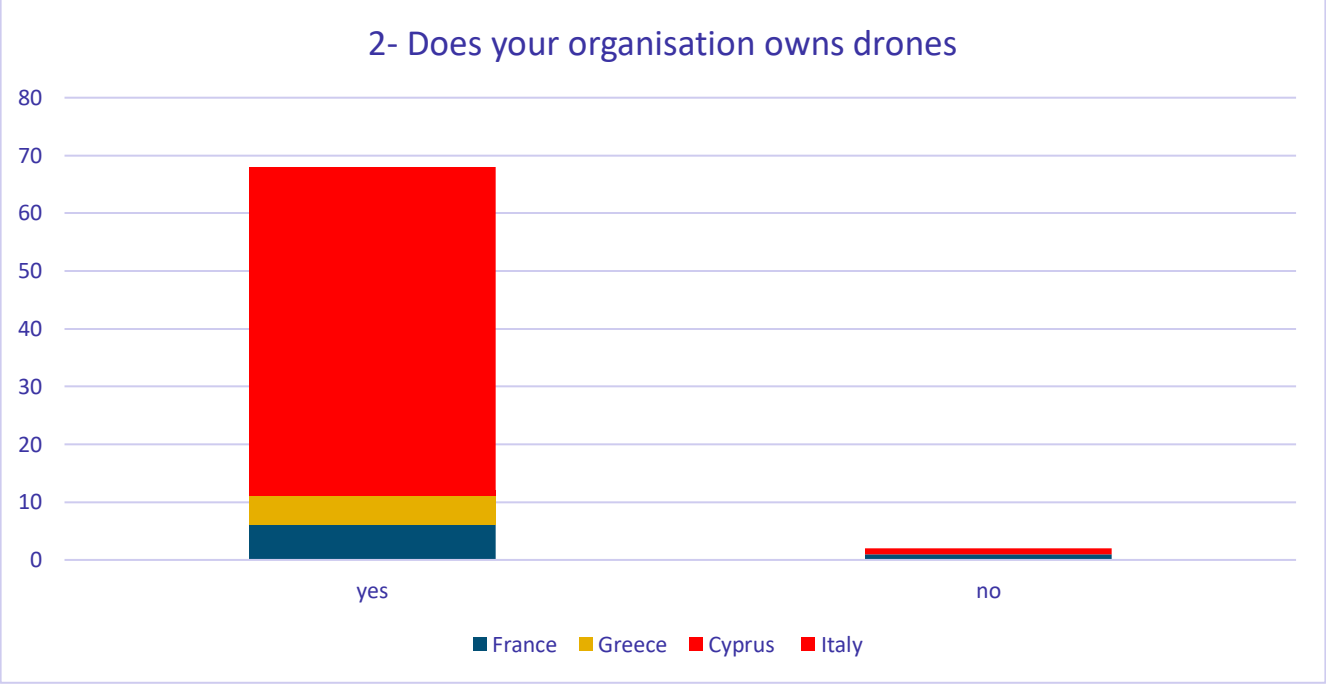
1. *Type of disaster*

*"What are the types of disasters that your organization deals with**?"***

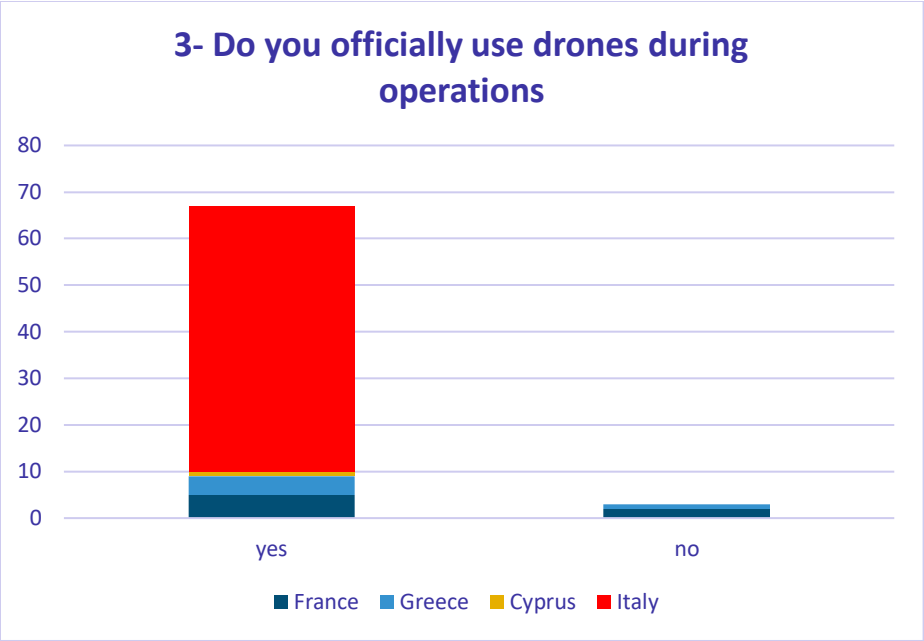
Generally speaking, excluding specific cases for avalanches, river accidents and rescue at sea, it is the operational spectrum that is being actually considered for each service without any genuine priority.
Territory induced differences appear, mountain presence, water courses or seafront presence will influence risks to be covered.
Missions are generally and mainly common.
Differences can surge between partners when their National organization is different and thus operational mission spectrum can vary. For example, in England, firefighters do not carry out « emergency services », whereas in France this activity represents 75% of their missions.

2. *Usage of drone in the organisation*

*"Does your organisation owns drones**?"***



*3- "Do you officially use drones during operations**?"***



DJ Phantom, Inspire and MAVIC types of drone constitute the majority of drones used on a daily basi. These inexpensive yet effective drones are useful in 80% of missions, as denoted by the first responders.

First responders, reported that such drones are insufficient for more technical and precise operations and have important limitations regarding their speed, their weight, their effectiveness in varying weather conditions and their carrying capacity.

First responders who are experienced in using drones and want to increase the scope of drone operations, whether in operational missions or in prevention or preparation missions, they move into acquiring larger, more expensive drones that have more capabilities such as the DJI M210 and fixed wings drones.

4- Usage of drone in the emergency response

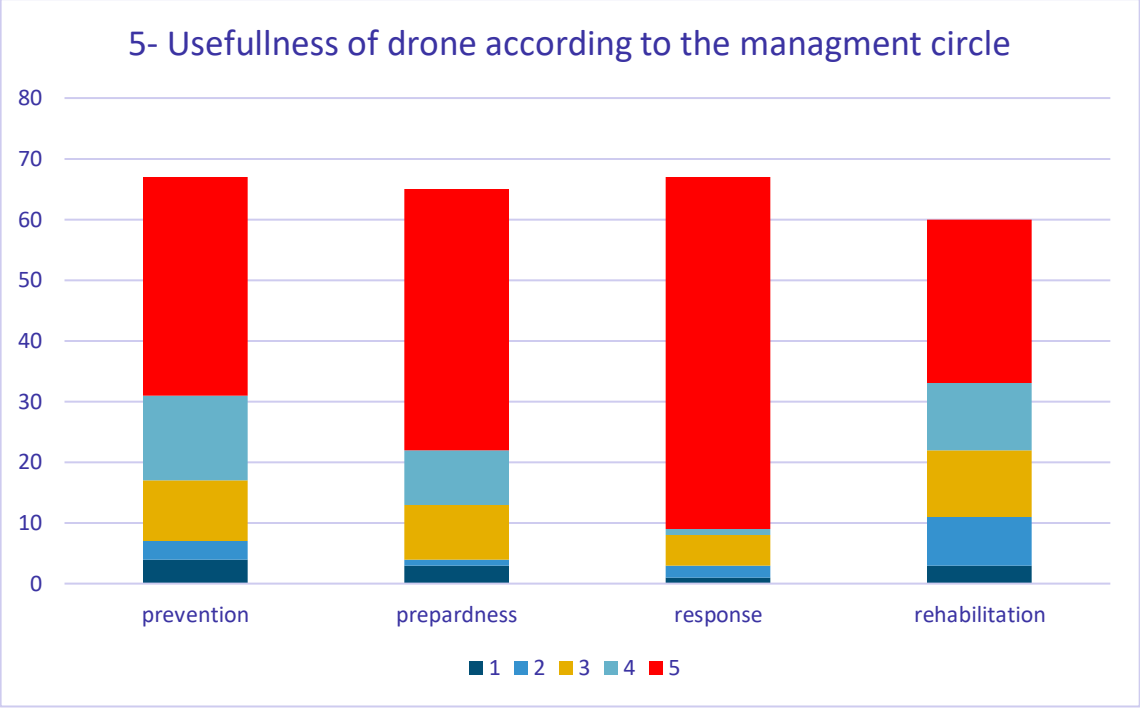
"If yes, at which stage of the disaster cycle do you use drones (prevention, preparedness, response, recovery)? You may choose more than one option."

☐Prevention ☐Preparedness ☐Response ☐Recovery

All phases of the crisis are well represented in the responses received, showing the wide applicability of drones in all phases of emergency response. The Response phase is considered as the most important, followed by preparedness one which is for sure strongly linked to operational activity. Recovery although mentioned seems less important, as it is not the main mission of the interviewed organizations.

5- *Perceived usefulness of drone in each stage of disaster management cycle*

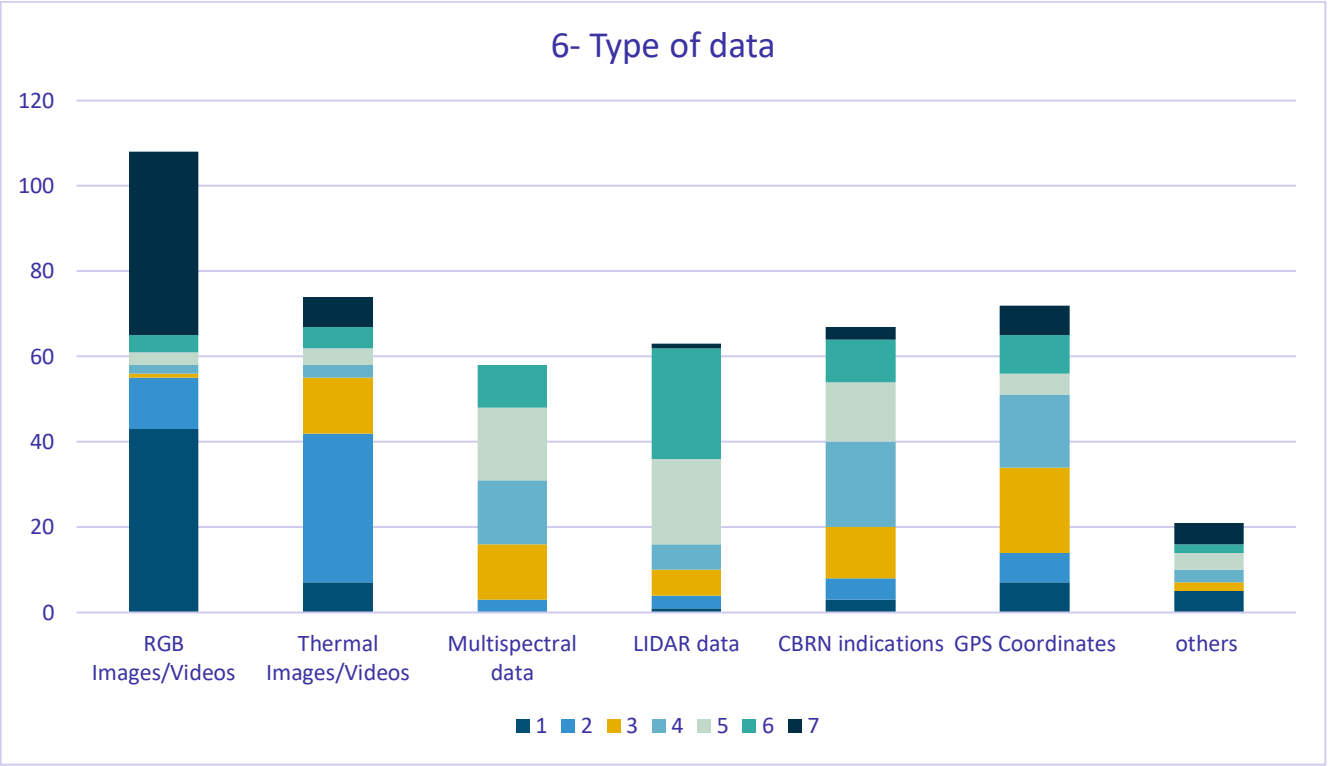
"Please score by checking the respective box (scale 1 to 5, with 5 being the most useful) the usefulness of drones' utilization regarding each stage of the disaster management cycle"



First responders have evaluated almost equality the potential usefulness of drone in all stages of the emergency management. First responders identify the response stage as the stage where drones will more usable, followed by prevention and then preparedness and rehabilitation.

6- *Perceived usefulness of data gathered by drones*

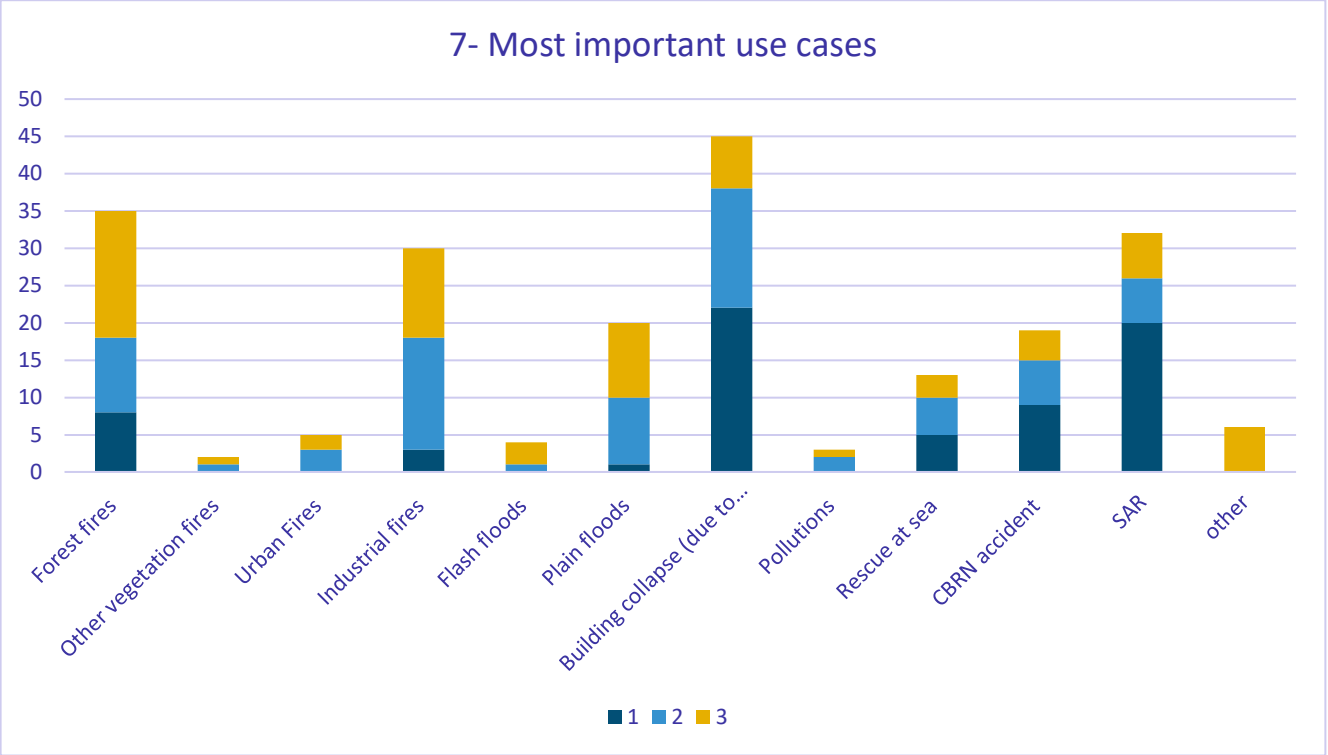
"What type of data gathered by drones you consider most useful (rank the options from 1 as most useful to 7)?"



The video and the images come are without surprise in the lead as the most important type of data that can be gathered by drones , followed by the thermal images and the elements of GPS coordinates. Data related to CBRN seems to be of less interest among the participants of the enquiry.
These results were expected, since first responders in all countries follow the principle of recognition and evaluation in emergency response scenario. Imagery from drones, can be utilized to gain situational awareness, recognize the risks, and then proceed into making decisions. The thermal elements correspond well to the will of the services to want to configure the fires against which they are fighting.

7- *Usage of drones in operations*

"In which cases will you use drones operationally (please check as many boxes as you want)? Also indicate within the brackets only the three most important use cases (from 1 to 3)"

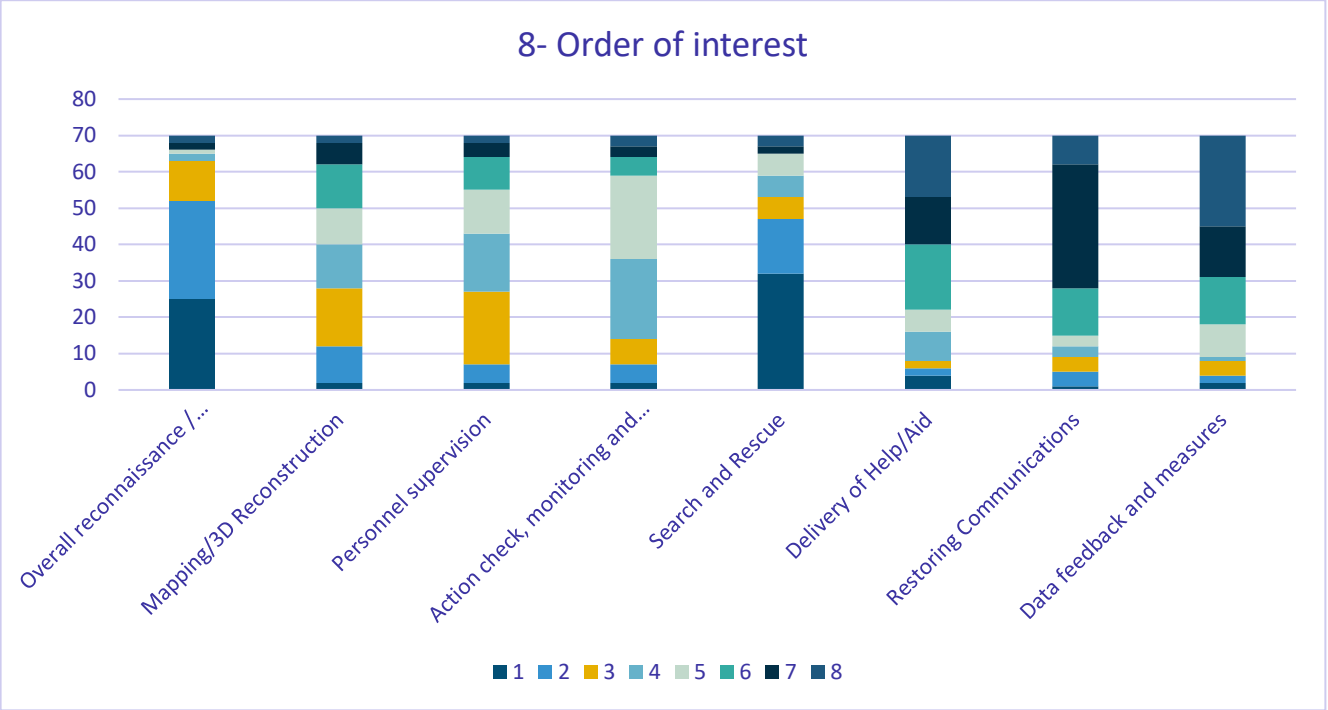


This citation and ratio-based approach enables to conclude that we mainly have similar needs but that the intensity of the need varies according to territories and countries. We identify three main use cases which the AIDERS project should focus upon: a) Building collapse, b) forest fires and Industrial fires. and c) Search and rescue. Thus, this result leads us to cross-reference important ratios (priority needs) with needs more widely shared by all the actors even if ratios are lower.

8- Usage of drones in operational tasks

"Please rank (1-8) the use of drones to support the following operational tasks, by order of interest"

According to the responses received, first responders are interested in using drones mostly in search and rescue and overall reconnaissance, delivery of help (such as first aid kit) and mapping / 3D reconstruction



The complete classification is as follows:

1/ Search and rescue

2 / Overall reconnaissance / assessment

3/ Delivery of Help/Aid (Secours)

4/ Mapping /3D reconstruction

5/ Personnel supervision

6/ Action check, monitoring and adjustment

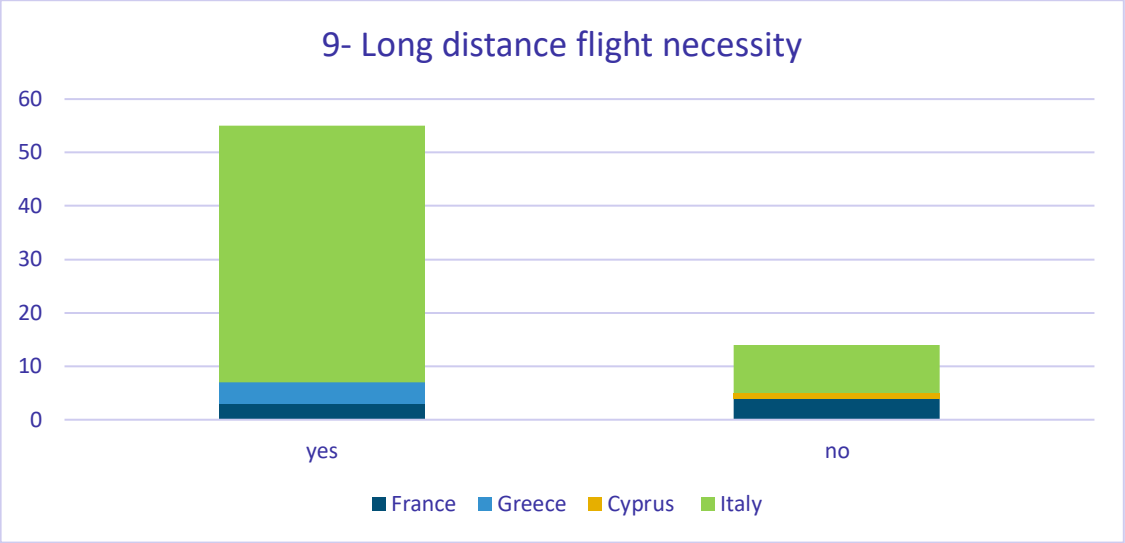
7/ Data feedback and measures

8/ restoring communication

9- Importance of long-distance autonomous flights

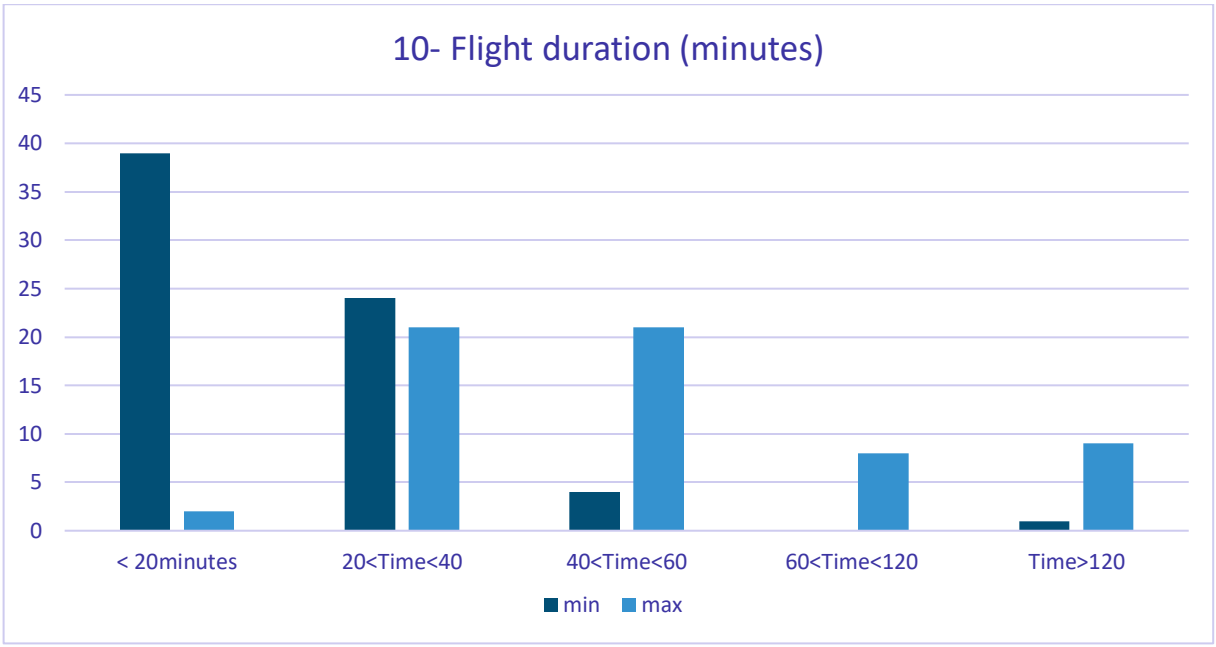
"Do you consider long distance or long duration autonomous flights necessary?"

The results of this enquiry denote that long-distance flights are important for first responders from Greece and the majority of Italian responders, while this is not the case for first responders from Cyprus, Greece and France.



10- Ideal duration of a single flight

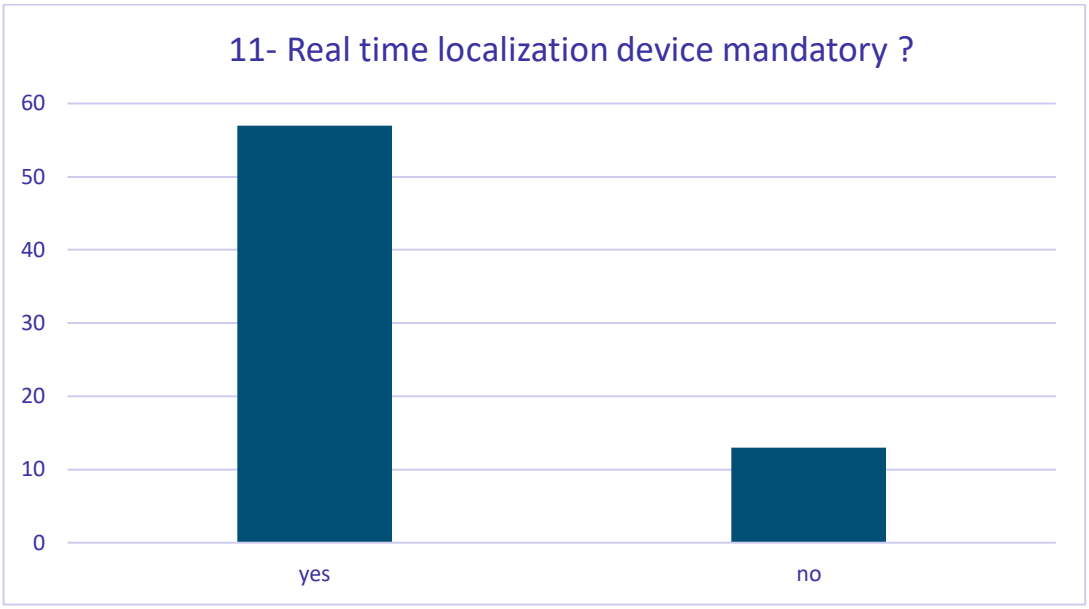
"What is a single flight's duration for a drone mission of your interest?"



According to responses of the enquiry demonstrated above, the flight duration of a drone mission should range between 20 minutes and 60 minutes.

11- Usage of a real time localization device

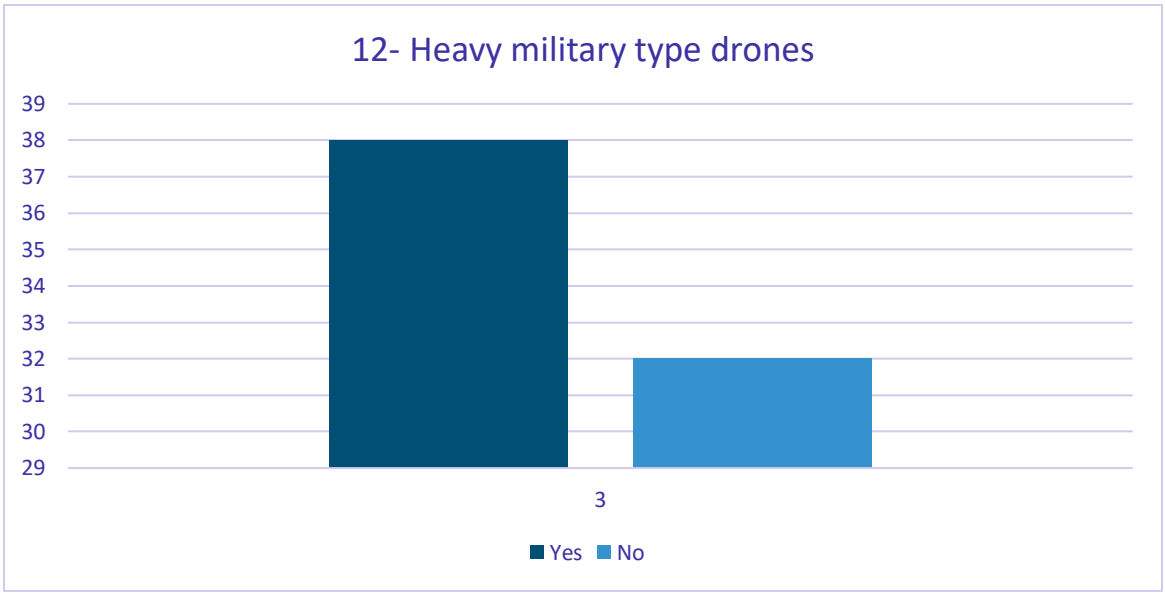
"Should a real time localization device (transponder type) be mandatory during operations?"



It is important that the drone is located in space by other aerial means and control towers. Currently, their location remains the main criticisms from many organizations.

12- Usage of heavy military type drones

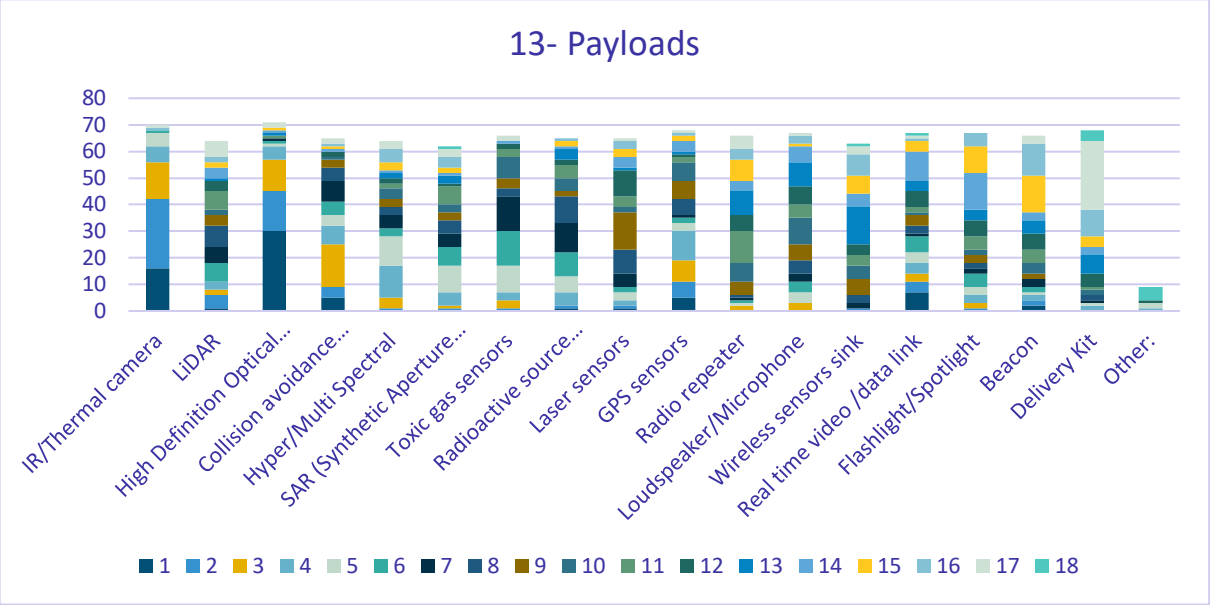
"Do you think that heavy military type drones with pilot in shelters could be used for civil protection operations?"



As shown in the chart, 38 responders of the enquiry replied that heavy military type drones with pilot in shelters could be used for civil protection operation while 32 replied that such drones are not applicable.

13- Priority of drone onboard payloads

"Please rank (starting from 1 as the most important) the following drone onboard payloads by order of priority: "



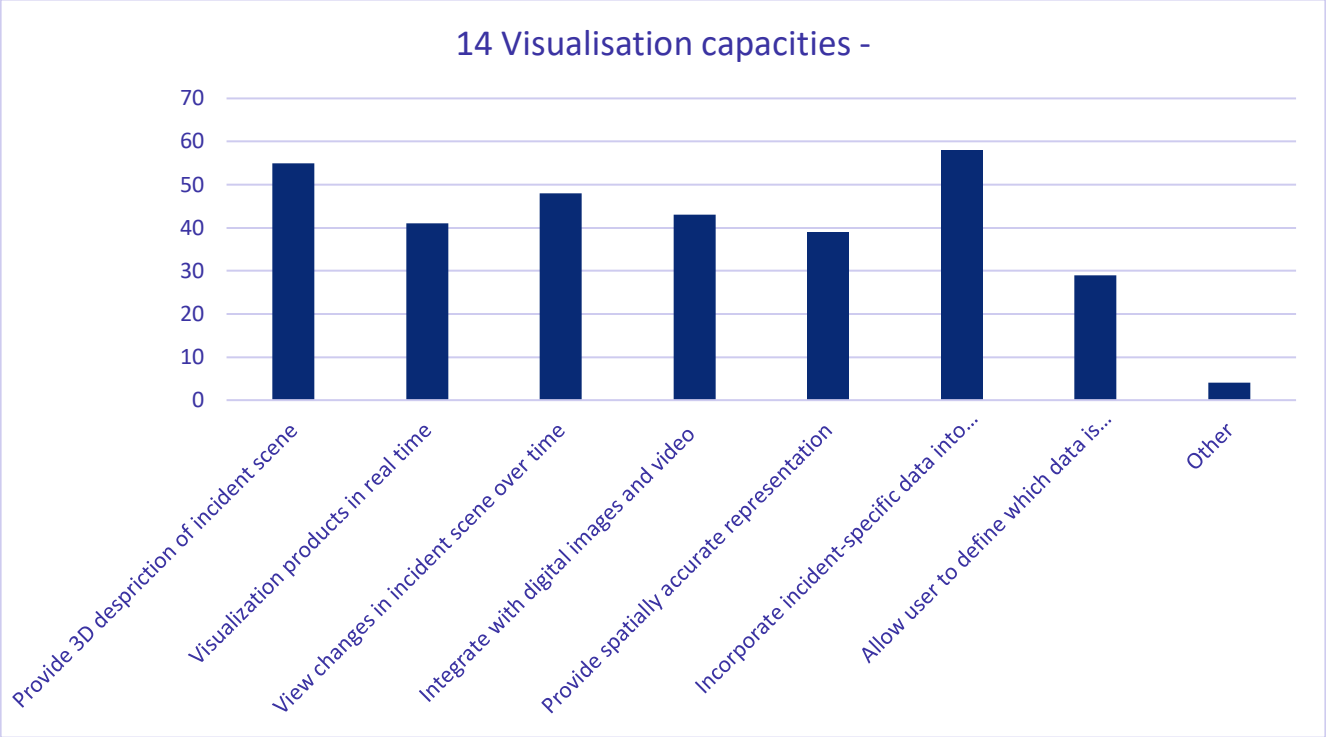
According to the responses regarding the importance of onboard payloads, the High Definition Optical camera, the thermal camera, the real time video and GPS sensors are the most important, followed by collision avoidance systems, beacon, lidar and radioactive source detector sensors.
The complete ranking is as follows:

1/ High Definition Optical camera (RGB)
2/ IR_Thermal camera
3/ Real time video /data link
4/ GPS sensors
5/ Collision avoidance systems
6/ Beacon
7/ LIDAR
8/ Radioactive source detector sensors
9/Laser sensors
10/Hyper/Multi Spectral Images
11/Toxic gaz sensors
12/ Flashlight/Spotlight
13/ SAR (Synthetic Aperture Radar)
14/ Wireless sensor
15/ Loudspeaker
16/Radiorepetater
17/ Delivery Kit
18/Other

14- Importance of visualization capabilities

"Please indicate the visualization capabilities that are important to you (please check as many boxes as you want):"

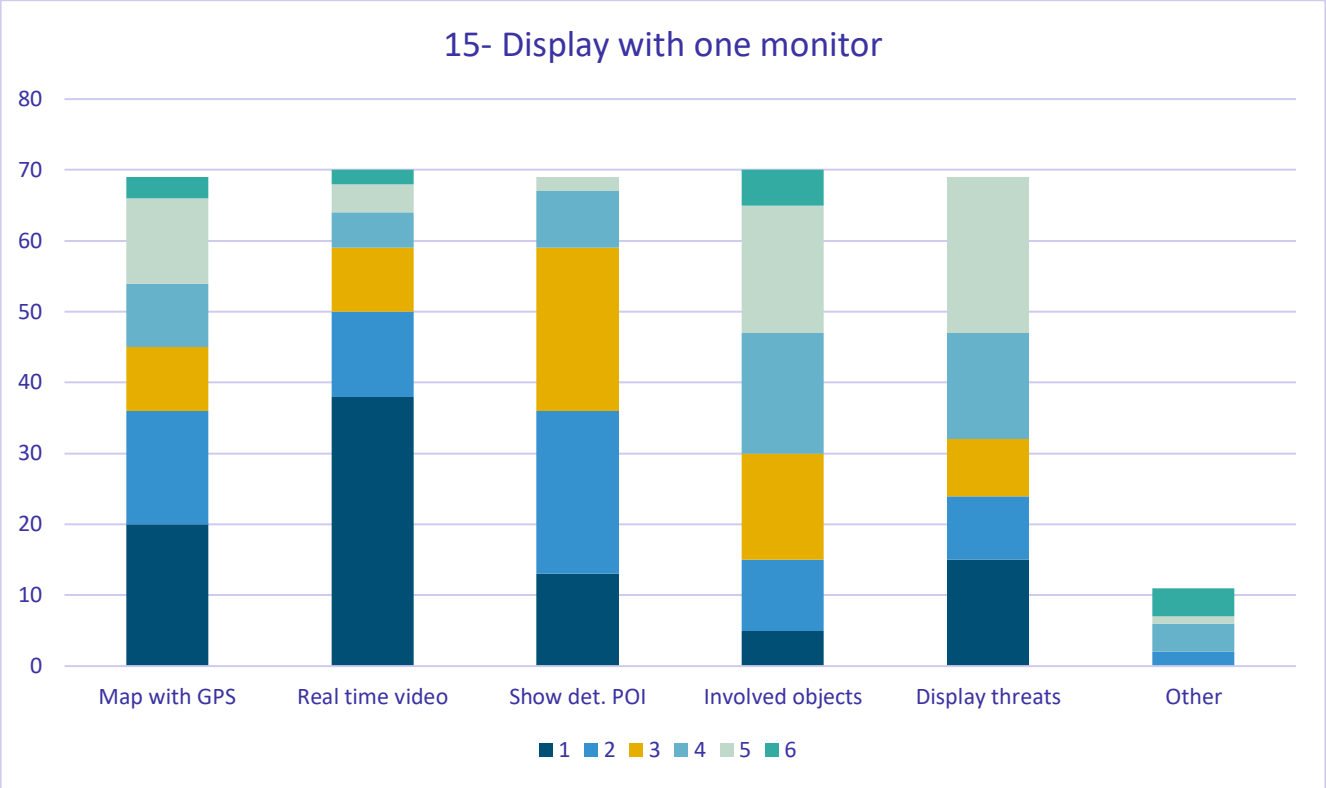
3D and spatialized graphical representation with an integration of useful infrastructure elements, intervener geo-tracking and real time selection of data to be displayed on the platform.
The detection of the developments on the field is an approach driven by many crisis professionals.



15- Usefulness of displayed information

"Assuming that you have only one monitor, please rank by order of importance the most useful information to be displayed"

The first responders identify as most important information to be shown on a screen the real-time video of the drone and a map with GPS coordinates and attributes of the drone. Other important information is the display of threads and hazards data, the image or video of detected points of interests (e.g., detected human) and their number estimation.



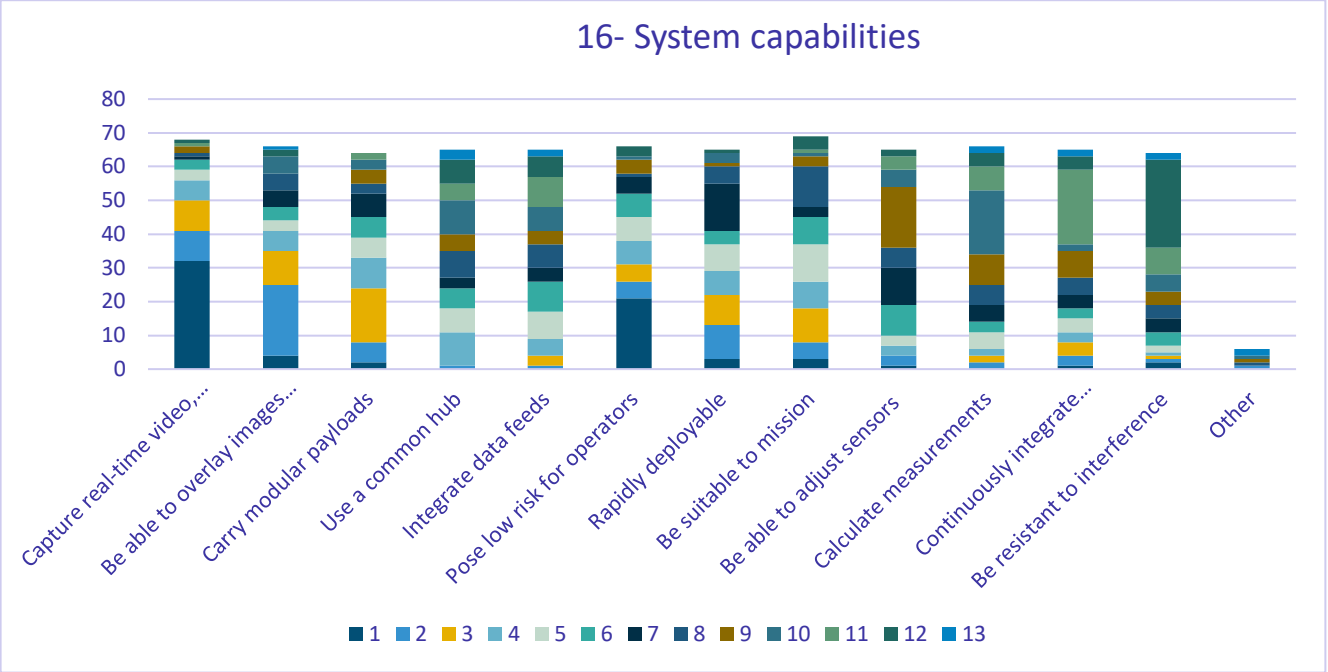
In particular, the first responders rank the importance of information as follows:

1- Real time video, transmitted by the drone
2- Map with GPS coordinates and other attributes of the drone
3- Display threat and hazard data on a geographic displa
4- Image or video with detected points of interest (e.g. detected human)
5- Estimation of the number of involved objects (humans, cars, etc.)

16- Importance of system capabilities

"Please rank (starting from 1 as the most important) the system capabilities by order of priority"

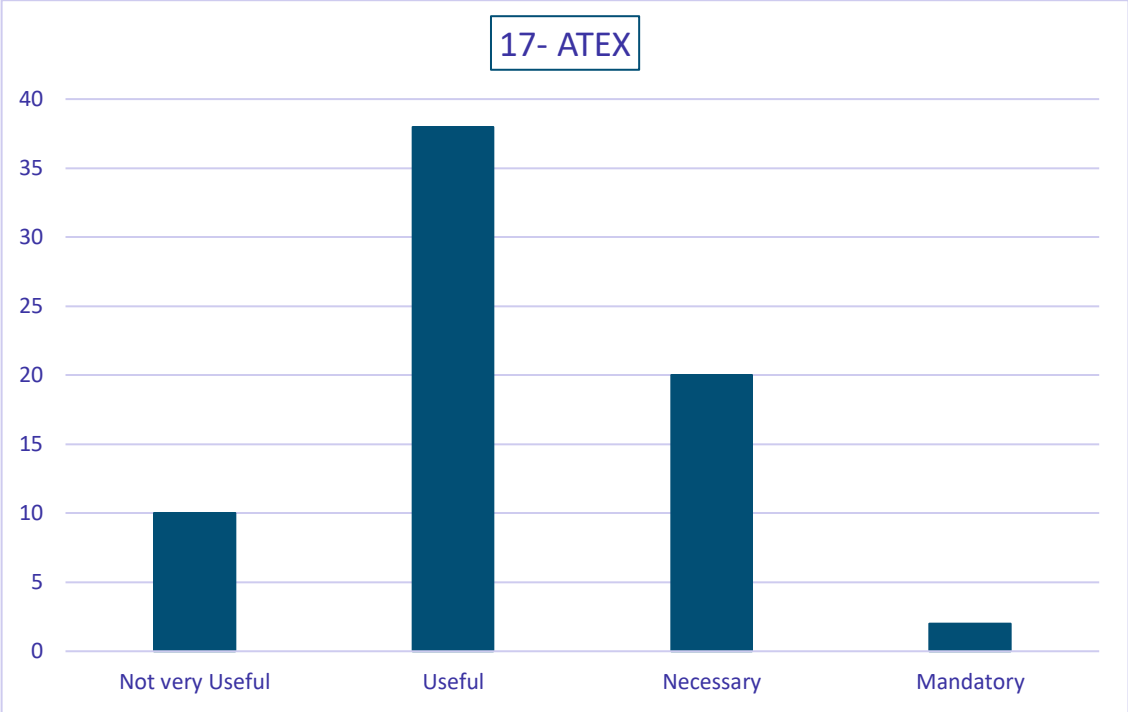
According to the responses regarding the importance of system capabilities, the most important one is the possibility of capturing real-time video, images and audio, while representing a low risk for operators, responders and civilians.



The complete ranking is as follows:
1) Capture real-time video, images, and audio (high-definition, zoomable, remote camera control, infrared, multispectral, etc.)
2) Pose low risk for operators, responders and civilians
3) Be able to overlay images from different sensors (e.g. thermal over video)
4) Rapidly deployable
5) Be suitable to mission in a several conditions (e.g. harsh weather conditions, confined spaces, smoke, humidity, etc.)
6) Carry modular payloads, including threat, hazard and biometric sensors, lighting, and communications equipment
7) Be resistant to interference with functionality
8) Continuously integrate location data, captured with geographic information systems (GIS), in the system
9) Be able to adjust or tune sensors for different environments (e.g., smoke, steam)
10) Calculate measurements between objects using video and image data (photogrammetry)
11) Integrate data feeds when a new system is rotated into operation to maintain a continuous picture of the scene for as long as needed
12) Use a common hub or interface for sensors and imagers

17- Importance of ATEX drone

"Is an ATEX (ATmospheres EXplosive) drone necessary in your operations"



For the most part, ATEX capacity is considered as useful and necessary.

18- Adequate Legislation in your country

"Do you consider the current legislation (both national and European) adequate for using drones in civil protection operations (please elaborate)?"

1. The existing legislation provided flexibility for civil protection missions as it makes waivers possible. Only the S4 scenario, which is only accessible to PPL holders, should evolve to authorize drone pilots to fly at least up to 4000m.

2. Yes, as long as legislation authorizes civil protection actors to waive rules established for everyday life. However, these waivers require further details and specific rules to maintain a high security level.

3. National legislation is not meant for rescue services, even if it provides a derogatory framework requiring a National standardization (and not per department).

4. The European legislation does not integrate the "rescue" component, which will necessarily cause problems for SC operators.

5. SC pilots should be exempted from distance limitations only (ex: reconnaissance or surveillance of wide areas such as forest fires or flooded areas).

6. A genuine certification is missing for drones that can be used for civil protection missions as well as a European standardization to enable true operability.

7. Yes, in agreement with waivers very useful in operational context.
8. With the final Commission Delegated Regulation (EU) 2019/945 and Commission Implementing Regulation (EU) 2019/947 the landscape of drone operations has become clearer and leads to a path of a comprehensive set of rules ensuring safe, secure and sustainable operations of drones, for commercial and leisure activities.

9. When it comes to civil protection operations, it is up to European agencies of civil protection and the corresponding national agencies to collaborate and build a concrete set of rules that will allow such operations to be implemented in a context of safety, security and personal data protection and at the same time ensure reliable and successful outcomes.
10. Can be improved
11. The use of drones for law enforcement is potentially controversial and must be managed carefully. Since the use of drones by police forces is regulated by Member States, not at a European level, consultation and research is required at a national level. However, the success of a European civil drone sector rests upon widespread public acceptance.
12. No, the procedure to engaging on rescue scenarios, as regards the provisions, must be faster.
13. I believe so, compliance with the rules imposed, allow us to operate safely.
14. Yes. For the Fire service's needs is adequate.
15. Regulation needs improvements.
16. Yes, because our RPAS are "State" aircrafts, with our own specificity.
17. I believe that professional first responders have a number of limitations in carrying out the activities and current legislation leaves more freedom to the operations carried out by private subjects.
18. I believe that too much freedom and range of action has been granted to voluntary and civil protection associations
19. I consider as adequate.
20. It is not easy to regulate such a wide field. There are restrictions that limit our work a lot, but the situation is evolving well.
21. I believe legislation is adequate for my organization (CNVVF) that operates with "state" RPAS, respecting rules and communications with all the relevant bodies (ENAC - ENAV – Air Force), in order to avoid risky situations (Flight safety violations especially with regard to manned aircrafts involved in the same scenario). Since we are responsible for the rescue during small interventions and major disasters, and knowing in real time (as regards CNVVF aircrafts) who is flying, I believe that a more fair and restrictive regulation regarding other organizations that use RPAS in emergency would be appropriate. Too many times in complex scenarios we found unknown RPASs of private individuals belonging to newspapers and sometimes to the Civil Protection without informations about NOTAM in force, omitting to communicate their mission, compromising the safety. We need clear regulations and rules to respect, for all.
22. Even if anyone who owns it can fly an RPAS, in the emergency area we must be the firefighters, and not others, in charge of managing the operations with drones.
23. Yes
24. I think that for first responders agencies could be implemented the BLOS flight.
25. I believe that issue of operational use with multiple air vehicles present in a scenario must be developed in terms of safety to allow it to co-exist
26. CNVVF RPAS have status of "State Aircraft" and are operated according to Special Rules issued and adopted by CNVVF. In any case, recent emergencies have shown that the number of operators who use the drone is continuously increasing and also private individuals are engaging; for this reason I think that the EASA regulation must become more precise in this regard, also taking into account the possibility of the international use of RPAS within the EU civil protection Mechanism (EU modules).
27. Continuous correction and updating are undergoing. Personally, I believe that the functions of the Civil Protection voluntary system must be very limited in order to limit chaos and, in the other hand, to proceed with massive integration between state administrations. This in all emergency scenarios.
28. A bit of confusion and not perfectly clear rules for non-professional operators.
29. I believe that, at the moment, it does not impose major restrictions, but it would be necessary to enhance it.
30. Yes
31. I think that now is too much interpretable.
32. It could be interesting to cooperate between different "States" to improve the rules.
33. I think we need more specific and clear rules, especially on complex scenarios.
34. More specific and strict regulation is needed for voluntary organizations which must certainly be for security and efficiency reasons coordinated and subordinated to administrative ones.
35. Yes
36. Legislation is adequate; it is mandatory to keep high level on controls to avoid violations.

37. As for CNVVF, considering the “derogations” for rescue operations, it is not easy to give a judgment on the matter.
38. Yes, but it is possible to improve it.
39. Good, but improvable.
40. Legislation is correct.
41. CNVVF’s aircrafts, including RPAS, State Aircraft and, therefore, are registered in the CNVVF’s Aircraft Register.
42. Yes
43. Rules are sufficient, but we need more detailed prescriptions about the employ of RPAS for the private subjects.
44. I think that more significant restrictions on the use of airspace for private operators would be required, with a legislation less tied to commercial interests.
45. The situation is rapidly changing, I prefer to wait to see news.
46. The use of drones within the CNVVF is based on internal and non-national legislation. The current national legislation has given free field to non-institutional bodies and associations; rules are indispensable to have clear roles and avoid problems during rescue operations.
47. Currently too much freedom for voluntary associations
48. I think is adequate
49. Yes. Responsibility, in my opinion, is mainly linked to a correct 360 ° risk assessment and maximum reduction of the same, so that the SAPR operations are concluded without accidents.
50. Yes, absolutely.
51. Yes
52. I believe that the criteria for the use of RPAS in emergency situations should be better defined by better defining the skills and creating coordination or in any case directives that better regulate the use of airspace in the event of emergency events, also going to punish stronger offenders.
53. No
54. Yes
55. No, because according to my point of view, the real problem is not perceived; that is the interference with "manned" aircraft in the intervention scenarios.
56. Yes, Italian legislation classifies the APRs of our organization I work for as State Aircraft, assigning it one of the highest priorities and employment opportunities.
57. NOT COMPLETELY ADEQUATE. COULD BE USEFUL MORE FREEDOM OF SURVEY IN VIRTUE EVEN OF THE HIGH TRAINING OF THE PILOTS
58. The current national civil drone legislation is not applicable to the organization (state drones) but nevertheless does not adequately preserve the operational scenarios from the presence of civil drones. European legislation is not equally applicable to the organization. However, it was chosen to pursue the safety objectives of the European regulation by taking it as a reference. In general, national and EU civil regulations, addressing civilians, cannot take into account the specificities of state drones in terms of mission objectives, while ensuring uniformity in the procedures for engaging the common airspace.
59. No, too chaotic.

A majority (34) consider that the legislation is suitable, while some consider that it is protective. A third consider it unsuitable or to be improved; among them half complain about the possibility that associations or the press can enter the airspace of a crisis. 10 do not respond to this question.

19- Accountability issues

“*Are accountability issues a constraint for using drones in your operations? if yes, please explain”*

1. In the context of our operations, there is no constraint other than the application of flight safety rules

2. Yes. In the absence of specific rules related to civil protection operations, the compliance with regulations intended for “classic” activities is required in order to not engage operator responsibility which adversely impacts the use of drones for civil protection operations. This is the case, for example, with respecting horizontal distances of the drone from the remote pilot which are not always adapted to the size and needs of a civil protection operation.

3. Responsibility stakes are always present for rescue missions.
4. Drone use causes an additional 3D component which makes operations more complex and requires some level of expertise regarding the technical and legal environment.

5. Responsibilities are indeed a constraint according to intervention types and scenarios to be respected (population or not). Operators identified by prefectural order should be free to work only “operational” flights for prevention, preparation, and rehabilitation phases and must respect DSAC rules in force.

6. Responsibility stakes are not a constraint if legislation is respected, especially the doctrine note from the Civil Protection Directorate (DGSCGC).

7. SDIS05 tried to develop this approach with private drones belonging to firefighters but had to stop due to an over restrictive legislation for piloting. SDIS 05 is however closely monitoring drone use and if necessary, will have some in the future (under agreement or internal development)

8. Mainly linked to piloting authorizations

9. The use of drones will also be examined with an insurance focus in case of damage, this aspect is at this time not included in our contracts.

10. YES, IT IS BECAUSE WE ARE VOLUNTEERS

11. NO

12. In my organization (Hellenic Police) before each UAV flight we submit an ORM (Operation Risk Management) document which defines the decision-making person (Chief of Police, deputy Commander, Mission Commander, etc) for the specific UAV mission. In this context, we do not face accountability issues.

13. Sure. Each operation, even the emergency ones, must be assessed to minimize the risk of possible accidents to obtain the best result

14. No.

15. Using a drone certainly implies a responsibility for those who lead it, especially in an emergency scenario; and they are certainly a constraint but I think it is right. I think the the risk is bigger with private subjects who interfere with their RPAS in rescue operations and scenarios.
16. No
17. Primary liability is the the work in a safe way; therefore after have planned the mission respecting this basic parameter, problems are declined.
18. No
19. Knowing and applying rules and procedures, accountability is not a constraint.

20. No
21. A more adequate regulation to differentiate rescue operations, and to allow such operations only to the responsible bodies, in order to avoid dangerous safety situations.
22. No.
23. I don't think that accountability generates constraints.
24. The legislative status of First response agency, operating in restricted areas, having an organized structure and defined operating procedures greatly limits individual responsibility.
25. Once the rules of engagement have been well defined, I do not think that the accountability could limit the operations.
26. Currently the liability to whom is conducting RPAS is absolutely not adequate to the recognized qualification; another aspect for RPAS operators with certificate from the public administration is to have the adequate economic treatment to balance the responsibility.
27. No
28. No
29. No
30. The sector is enormously evolving/growing, therefore more flexible regulations are needed to keep up with technological evolution; I think could be important to give first responders administrations, such us Fire service, the opportunity to actively participate in the drafting of the rules that specifically regulate our sector.
31. No
32. No
33. No
34. No
35. No
36. No
37. Yes, because in many intervention scenarios, with all restrictions and respecting safety standards, interventions should not be done many times, except with the help of the police.
38. Risk assessment is the key: assessing the scenario before each mission, in order to minimize any problems, reduce consequently responsibility.
39. I do not believe. operational capacity and training, however, accompanied by a service provided with more time continuity allow a safe service.
40. No
41. Yes, and it's good that they are. The use of a drone must be bound and the operator must take responsibility for what he is doing. The employ during rescue operations is extremely useful but, without the constraints that place limits on use, rescue would lack professionalism.
42. It is sufficient to stick to the rules
43. No
44. For sure, the technology will improve the RPAS used for rescue and defense (military), but an improvement that I hope is a longer battery life and resistance to humidity. Very very useful questionnaire
45. During any operation, responsibility is the certain awareness of whether or not you can operate on a scenario, provided that all the security conditions allow it.
46. No.
47. No
48. No, if all the safety procedures are adopted.
49. No
50. Yes, due to current legislation which considers unnecessary official communication of operations to the "Manned" world.
51. No

52. IN SOME EMERGENCY SCENARIOS THE RESPONSIBILITIES ARE HIGH
53. Within a structured organization such as ours, the responsibility for employment is divided on various levels.
54. No.

A large majority (35) consider that there is no problem of responsibilities, and that this is all the more true if one respects the rules. A minority believes that there is a need for adequate regulations for civil protection.

6.2 Summary of results

These enquiry results allowed us to define the main topics on which AIDERS consortium will concentrate its efforts, concerning either the civil protection missions, either the payloads and the results that should be displayed on the ground station. Based on the results of this enquiry, it was decided among the AIDERS partners to focus the project in three emergency situations and provide solutions in scenarios for: **a) building collapse, b) Search and rescue, c) forest fires and Industrial fires.**

According to the enquiry, RGB and Thermal images and real-time video feed from the UAVs are very important for first responders since they can provide situational awareness. In addition, first responders would be interested in using technologies for 3D and spatialized graphical representation with an integration of useful infrastructure elements, intervener geo-tracking. They would be interested in a software platform that would enable the real time selection of data to be displayed, and in particular the real-time overlay of images from different sensors (e.g. thermal over video).

In addition, through this enquiry they requested that the AIDERS developed solution should be rapidly deployable and suitable for sever conditions (e.g. harsh weather conditions, confined spaces, smoke, humidity, etc.)

7 Needs according to the different civil protection missions

This section presents expert knowledge of the end-users of the AIDERS project in the operational management emergency situations and crisis events. In particular, it provides the expertise of end-users in handling the emergency missions the AIDERS project will focus on, as identified the previous section being forest fires, floods, earthquakes, explosions, urban fires and industrial fires.
The information is extremely important for the development of the AI toolkit that will assist first responders in their operations. The AI toolkit will aim to infuse the end-user's expert knowledge into its processes to be an effective tool in the first-responders' operations.

7.1. Forest fires

- **Fire temperature** will mainly indicate the thermal power of the fire. It will determine the needs for additional ground means and for aerial reinforcements.
- **Fire surface** is important for the distribution and quantification of ground means, especially for the boundaries accessible by forest fire protection paths.
- **Flame height** will indicate the possible ground means position depending on the fire front but most of all their approach possibilities.
- **Smoke color** shows the combustion evolution of flammable materials; shrubs and trees; a black smoke often indicates that water is lacking and thus a fire not covered by aerial means.
- **Vegetation type** correlates, resource commitment, spread rate and probable danger.
- **Spread rate** brings us back to the issue of anticipation of means and actions to be timely distributed on the event.
    - It enables at T plus 2 or 3 hours to find the proper attack area by concentrating resources and generating a major attack.
    - The main spread axis is the course of the fire, the one enabling to measure the future stakes requiring protection or evacuation.
- The presence of **dwellings** triggers an accurate assessment of required evacuations.
- The presence of **population inside the fire area**; here as well requires a very early commitment of evacuation means and anticipation of emergency shelter.
- The presence **of public buildings or parcs** is also the same idea but with more population and foreseeable domino effects.
- The presence of **roads** and their **identification**; here as well it is the access roads to forests, they thus need to be cut as early as possible.
- **Fire mapping,** it informs the command post on fire evolution on a map, it enables to complete fire images and also informs on topography and thus on the spread model in relation to real time weather. The tactic situation is pretty much linked to cartography. It identifies the means on spot, actions carried out and actions planned. It is an operational and strategic commandment tool.
- The **position of teams and means** on the event scene is intended to guarantee a global coverage of the fire by aerial or ground means.
- **Real time weather conditions and forecasts:** It is the key information for a good anticipation of actions to be done.

7.2. Floods

- **Water height** of the flooded area in cm and m.
    - It identifies the level of exposure of resident populations on the territory and the types of means to be committed on the area such as the types of units to be sent, divers, lifeguards
    - It also enables to divide the area into sectors for ground, nautical or aerial means.
- **Water speed in m/s**

    - It enables here again to measure the level of risk for responders and for the population and to choose the type of means that should be involved. (helicopter, jet ski)
    - It eventually enables to extrapolate a flow
- **Altimetry** of the **submerged** area. The knowledge of these values enables to anticipate an area that can be flooded with its level of exposure but also to estimate the required pumping equipment to be committed.
- **Altimetry of protection works.** It is the estimation of the overflow level and is correlated to the flood forecast at the time of overflow.
- Altimetry of the **water line**. It enables to compare it to the altimetry of the territory to detect flood risk areas.
- **Flooded surface.** It is the surface of the affected area and thus the measurement of human and material means which need to be implemented.
- **Hydrographic network.** It is the analysis area of the different water intakes to integrate all the different possible water intakes.
- **Topographic drainage basin.** It is the rain collection basin, which irrigates the drainage basin
- **Actual drainage basin.** It can be bigger than the topographic drainage basin and integrates the underground water courses feeding the topographic drainage basin.
- **Presence of a spring in the high water and low water channels.** It is to make sure the flow of a course is impacted or not by the presence of springs or groundwater seepage.
- Presence of **water courses** with their **average flow** and **real time flood discharge.** It is the global vision of the instantaneous intakes of all involved flows as well as the forecasts for the next hours.
- **Overflow areas**: These are air or ground identified overflow areas. It is eventually possible to calculate an empirical overflow rate or a leakage rate to plan pump capacities. But most of all historical breaches (flood memory). An empirical overflow rate or leak flow can eventually be calculated to anticipate pump capacity.
- **Type and location of hydraulic structures.** It is to properly integrate the role and influence of these structures on the considered flood, especially when they are dikes or dams.
- **Soil type and runoff capacity.** Presence of karstic zones . They significantly impact flood kinetic (absorption and restitution).
- **Presence of jams.** Important monitoring points to avoid breaches often destructive or deadly.
- Presence of **landslides.** It is a soil liquefaction indicator which causes building, bank and hydraulic structure destruction. It should be monitored.
- **Real time weather conditions and forecasts.** A key data for both crisis management and stake and action anticipation.
- **Value of water runoff / rainfall and radar.** It is the refining of the water runoff value correlated to the water runoff radar and water runoff rainfall.
- **Associated runoff-rainfall model.** It is the transformation of a rain into an expected flow on a drainage basin.
- **Presence of isolated dwellings i**n the area. The point is their surveillance and potential evacuation.

- **Position of urban areas.** It is there that rescues, or evacuations are the most performed, where damage and associated costs are highest.
- **Presence and location of roads.** It is essential for rescue transport to the disaster area and also it is required to cut them off if they are flooded or at risk of being flooded.
- **Presence of industrial areas** and activity type. Beyond the potential victims for evacuation, the pollution risk and domino effect in case of water on site
- **Existence and location of sensitive sites.** Electricity production areas, military areas, dumps, dams…
- **Area mapping and object heights.** It is the part that is needed for the analysis of the intervention area, stakes and exposure risk.

7.3. Earthquakes

- **Existence and location of sensitive sites**
- **Detect surface victims**: It is the priority of the first rescuers on spot; assistance to victims.
- **Detect buried victims**: It is the extension of rescue actions in a more complex manner.
- **Analysis of collapse types**: This enables to assess potential voids for survival, small voids and big voids
- **Structure evaluation**: It means measuring future collapse risks and anticipating evacuations or securing the entire disaster area
- **Detect eventual gas leaks**: It is to avoid explosion risks and thus pile-up accidents.
- **Detect vibrations on the collapse site**: It is to prevent a replica or a movement of the collapsed area.
- Delineate all impacted or destroyed areas: It is the intervention area and therefore the assessment and quantification of resources.
- **Measure the altimetric variation at T time or minute ground movements**: It is to prevent possible aftershocks and to prevent a landslide or additional collapse.
- **Check for noises or sounds**
- **Detect life presence**, but also ground movement.
- Measure **local radioactivity and electromagnetic field** variations: It is also to prevent a replica risk.

7.4. Explosions

The procedure for handling explosion is similar to earthquakes, with some differences.

- **Detect origin**
- Type of product and eventual hazards for population and responders.
- Analysis of **explosion shape**, its **intensity**
- Measure their **range**, in order to identify sectors and a map of the observed effects.
- Detect possible **domino effects**
- **Limit the risk of additional accidents** such as broken pipes, and impacts on nearby structures (blast effect and missile effect)
- **Detect surface victims and buried victims**

- First aid is always the priority, it is necessary to **ensure quick victim assistance**: emergency care and evacuation.
- Evaluate **building resistance**: Always to avoid additional accidents.
- **Stabilize** the collapse or the collapse.
- **Safety of possible buried victims and of rescue teams**.

7.5. Urban fires

- **Cut all energies**: This is to avoid electrical or explosion risk.
- Find a good **route for rescuers**: It is to save as much time as possible for rescue arrival.
- **Fire temperature**: It is to measure the intensity and assess extension risk.
- Ensure **volumetric recognition**: It is to ensure a complete and global vision of the fire (vertical and horizontal propagation).
- Have an architectural **vision of the building**: It is understanding the structure of the building.
- Determine **fire spread axes, vertical and horizontal**, it is knowing the path of the smoke.
- **Detect victims and those threatening to leap into the void**: It is about saving as many people as possible.
- Find a **good location for vehicles and aerial ladders** *: Here it is favor fight and rescue efficiency.
- **Evacuate buildings or ensure safety**: This is also to avoid an increase of victims.
- Have a **global vision of the disaster area**: It is the immediate environment of the intervention area with possible impacts on the functioning of this peripheral zone.
- **Spray water or extinguishing agents**: It is the actual fight and chosen methods.
- Measurement of the **thermal effects on nearby or adjacent buildings**: This is the issue of spread to nearby or adjacent buildings.
- **Detect other hot spots** out of the hearth: It is identifying the elements which through conduction or convection will participate to fire spread.
- **Measure flash-over risks**: Smoke and unburnt gases concentrations may appear in areas near the hearth and, without sufficient ventilation, will ignite the whole atmosphere.
- **Measure smoke explosion risks** (back draft) : It is similar to flash-overs but with a more pronounced oxygen intake: window opening.
- **Monitor personnel safety**
- Make sure operational conditions, building entries, intervener position is respected and monitor all elements that can lead to accidents, falling objects, floor or roof collapse…
- **Detect onlookers**
- Make sure **no public is in the marked area.**

7.6. Industrial fires

In addition to what must be done for urban fires,

- It is necessary to check combustion toxicity

    - Check products integrated into the combustion process, their possible toxicity and **physio**-chemical changes induced by the combustion.
- **Heavy response means with strong extinguishing flows**
    - Test extinguishing efficiency (foams) and conditions of foam carpet.
    - Implement thermal or visual measurements to contain or vacuum fire extinguishing waters.
    - Check nearby water courses.
- **Establish a security perimeter and a permanent surveillance of the area**
    - Have a precise site plan and permanently maintain reconnaissance actions.
- **Smoke direction and concentration of toxic particles**
    - Set up perimeter reconnaissance, map propagation cloud, and measure smoke concentrations and opacity**.**
- **Population information**
    - Inform the population, especially within the smoke propagation cone.
    - Make sure nearby traffic lanes are cut off.
- **Maintain a permanent weather monitoring**
    - This is to monitor the evolution of the smoke cloud as well as the changes in wind direction and speed. Anticipate thermal inversion effects.
- The exhaustive list of the different **gases and liquids stored on site** or circulating within the industrial process
    - Respiratory protection for all personnel and uses of ATEX materials in areas where flammable or explosive products are stored.
- **The product pipe scheme**
    - This is to monitor possible toxic product leaks and measure explosion risk.

7.7. Search and Rescue

SAR or Search and Rescue will be approached here as a multi-risk approach whereas this term is often linked to sea rescue, like the Hamburg SAR convention of 1979, which concerns maritime rescue.
It is therefore a question of dealing with situations where the victims have disappeared either because they are lost, or because an event has isolated, trapped them, or even buried them. In any event, the support by technological solutions is interesting: images, thermal camera, geolocation of phones. Motion detection systems, thermal camera (Even if the thermal trace does not exist until shortly after the death of the victims) and deep images deep learning and artificial intelligence.

- The simple disappearance is often linked to walkers who get lost either in the forest or in the mountains, the searches are carried out either by rescuers on the ground or by helicopters. If it is **an Alzheimer's situation**, then the research action is often more uncertain, except by using facial recognition.
- This research can be carried out at sea while trying to locate a shape, a body or a victim on a very large surface. Analysis of carrier winds and currents is necessary. In the same way finding victims in a flood is the same methods,
- The case of **victims missing from an earthquake** was discussed previously

- The **avalanches** that generate many disappearances in the mountains or the fall in the seracs can find research applications with GPS, sounds, hyperspectral, thermal and images
- Concerning **chasm or caves** The image and the thermals can be applied but it is advisable to use mini drones subject or wired drone

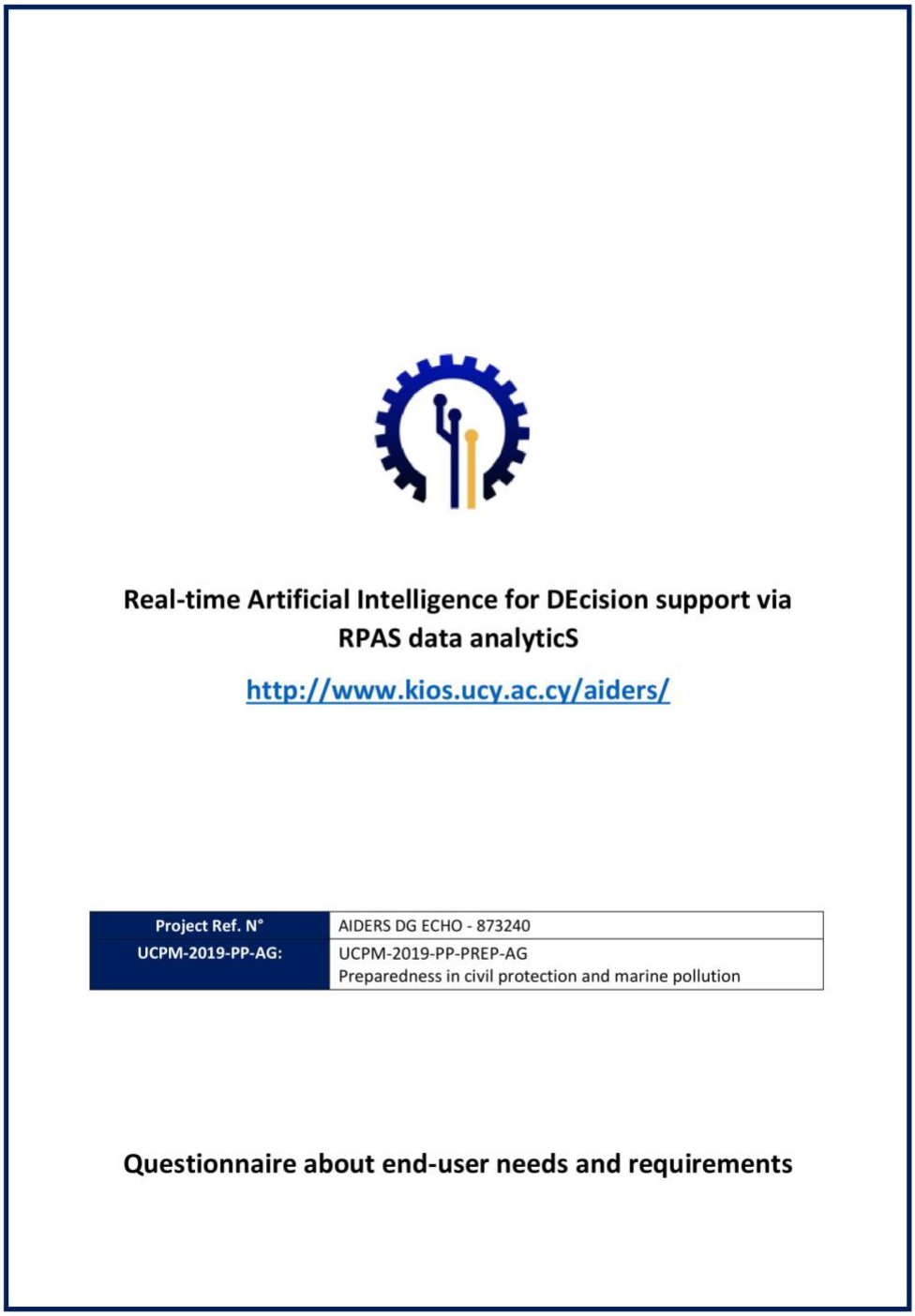
8 Conclusions

The elicitation of the first responders' needs and requirements are of particular importance and instrumental to the development of a usable, useful and applicable AI toolkit for emergency response.

Operational applications in the field of drones will continue to grow. The range of possibilities will widen. What a rescue service did not imagine envisioned ten years ago is now in the realm of reality. Technology has opened applications that will optimize and facilitate work. The enrichment of operational data will facilitate analyzes and decisions. The use of air assets will be less stressed for reconnaissance operations. The question of images, as we have seen, remains the priority of civil security. There is therefore a need to pose the question of ethics and individual freedoms as a guiding principle. We have to convince possible detractors of our maturity on the subject; These questions should therefore be the subject in the units of a specific process of taking into account in conjunction with the heads of the GDPR.
In France, the Council of State has suspended the use of drones by the police in the context of monitoring COVID-19 barrier measures in the city of Paris.
Technological developments must be part of a watch principle with all of our European partners.
Our training process must integrate technological developments in real time and report on the evolution of our needs.
The European knowledge center and centers of excellence could be the place for these exchanges and sharing.
If This survey showed some differences of appreciation, it mainly demonstrated a unity of thought in methods and expectations. It is a pledge of credibility for future work.
The ambition of this deliverable was also to clarify the needs rather than to engage in a raw enumeration of the elements, so we tried to make them more understandable.

9 APPENDIX

We provide the enquiry which was used to elicit the end-user requirements for identifying what operations they undertake, what data they would consider useful for emergency response, what equipment they would like to use, their opinion on the usage of UAVs, the current legislation and any accountability on the usage of UAVs. The questioner was circulated to all end-users and their communities in France, Greece, Cyprus and Italy and was filled by 74 first responders.



Real-time Artificial Intelligence for DEcision support via RPAS data analyticS

http://www.kios.ucy.ac.cy/aiders/

Project Ref. N°	AIDERS DG ECHO - 873240
UCPM-2019-PP-AG:	UCPM-2019-PP-PREP-AG Preparedness in civil protection and marine pollution

Questionnaire about end-user needs and requirements

Introduction

This Questionnaire has been developed in the framework of AIDERS project funded by DG ECHO, aiming to collect and analyse the common needs in the deployment of RPAS for emergency response, and the necessary operations that they need to perform.
To ensure that you have a proper understanding of the aim of our project and this survey, your involvement in this survey, and your rights as a participant to this survey, please read carefully through this introduction.
This questionnaire will take approximately 10-15 minutes to complete.

What is AIDERS about, what is the aim of the project?
The AIDERS project aims at developing application-specific algorithms and novel mapping platform that will harness the large volume of data that first responders are now able to collect through heterogeneous sensors (including visual, thermal and multispectral cameras, LIDAR, CBRN sensors, etc.) on-board RPAS units, and converting that data into actionable decisions for improved emergency response. To address this challenge, this project will capitalize on:

1) the long-lasting collaboration of the first responder and technical partners in the consortium to identify which information needs to be extracted from the collected data,
2) design online machine learning algorithms to process and analyse the received data in real-time in order to build situational maps, and
3) implement novel visualizations that higher-command can use to take intelligent decisions.

The AIDERS project activities will result in 4 main outputs, namely:

1) knowledge on potential use of AI techniques and algorithms for acquiring valuable information of the incident,
2) a novel AI toolkit will be developed to provide relevant, reliable, and timely information from the available aerial sensor data,
3) field exercises will be conducted to evaluate the integration and performance of the AI toolkit, and
4) conduct a number of training activities to first responder experts.

These outputs will be the drivers of the project to achieve its objects. All the project outputs have an international outreach and are applicable to civil protection as well as other first responder agencies which will have the chance to access and integrate in their own mission cycle.

Please return this questionnaire (or ask for further clarifications) to m.sudre@valabre.com before 25th of March.

Please tick (check) this box to indicate that you consent to taking part in this questionnaire:

☐ **I consent to taking part in this questionnaire**

☐ **I do not consent to taking part in this questionnaire and wish to leave the questionnaire.**

Responders' profile

Name (optional, for additional exchanges only):

Organization:

Country:

Command level / rank (if applicable):

Position in the organisation:

Years of experience:

Can you share your last experiences/interventions related to drones?

How familiar are you with all the integrated sensors and payloads?

Questionnaire

1. What are the types of disasters that your Organization deals with?

☐Earthquake ☐Fire
☐Flood ☐Chemical Accident
☐Landslide ☐Explosion
☐Avalanche ☐Other: _____

2. Does your organization own drones?

☐Yes ☐No

If yes, which type/model?

……

3. Do you officially use drones during operations?

☐Yes ☐No

4. **If yes, at which stage of the disaster cycle do you use drones (prevention, preparedness, response, recovery)? You may choose more than one option.**

☐Prevention ☐Preparedness ☐Response ☐Recovery

5. **Please score by checking the respective box (scale 1 to 5, with 5 being the most useful) the usefulness of drones' utilization regarding each stage of the disaster management cycle:**

	1	2	3	4	5
Prevention					
Preparedness					
Response					
Recovery					

6. **What type of data gathered by drones you consider most useful (rank the options from 1 as most useful to 7)?**

__ RGB Images/Videos
__ Thermal Images/Videos
__ Multispectral data
__ LIDAR data
__ CBRN indications
__ GPS Coordinates
__ Other sensor data (please indicate): _____

7. **In which cases will you use drones operationally (please check as many boxes as you want)? Also indicate within the brackets only the three most important use cases (from 1 to 3)**

☐ Forest fires (__)
☐ Other vegetation fires (__)
☐ Urban Fires (__)
☐ Industrial fires (__)
☐ Flash floods (__)
☐ Plain floods (__)
☐ Building collapse (due to earthquake, landslide, explosion, etc) (__)
☐ Pollutions (__)
☐ Rescue at sea (__)
☐ CBRN accident (__)
☐ Other (__) .....

8. **Please rank (1-8) the use of drones to support the following operational tasks, by order of interest:**

__ Overall reconnaissance / assessment
__ Mapping/3D Reconstruction
__ Personnel supervision
__ Action check, monitoring and adjustment
__ Search and Rescue
__ Delivery of Help/Aid
__ Restoring Communications
__ Data feedback and measures

(*Example "1: Personnel supervision"*)

9. Do you consider long distance or long duration autonomous flights necessary?

☐Yes ☐No

10. What is a single flight's duration for a drone mission of your interest?

Minimum (in minutes)	Maximum (in minutes)

11. Should a real time localization device (transponder type) be mandatory during operations?

☐Yes ☐No

12. Do you think that heavy military type drones with pilot in shelters could be used for civil protection operations ?

☐Yes ☐No

If yes, in which operational situation?

……

If yes, can you explain the expected operational benefits?

……

13. Please rank (starting from 1 as the most important) the following drone onboard payloads by order of priority:

__ IR/Thermal camera
__ LiDAR
__ High Definition Optical camera (RGB)
__ Collision avoidance systems
__ Hyper/Multi Spectral Images
__ SAR (Synthetic Aperture Radar)
__ Toxic gas sensors
__ Radioactive source detection sensors
__ Laser sensors
__ GPS sensors
__ Radio repeater
__ Loudspeaker/Microphone
__ Wireless sensors sink
__ Real time video /data link
__ Flashlight/Spotlight
__ Beacon
__ Delivery Kit
__ Other (please specify): _____

(*Example "1: Laser sensors"*)

14. Please indicate the visualization capabilities that are important to you (please check as many boxes as you want):

☐ Provide 3D or other appropriate graphical depiction of incident scene
☐ Create and update visualization products in real time
☐ Allow user to view changes in incident scene over time; both historical and within the incident

☐ Integrate with digital images and video of the incident scene
☐ Provide spatially accurate representation
☐ Incorporate incident-specific data into visualization, such as: Critical infrastructure data, Responder geolocation, Maps, etc.
☐ Allow user to define which data is displayed
☐ Other (please specify): _____

15. Assuming that you have only one monitor, please rank by order of importance the most useful information to be displayed:
__ Map with GPS coordinates and other attributes of the drone
__ Real time video, transmitted by the drone
__ Image or video with detected points of interest (e.g. detected human)
__ Estimation of the number of involved objects (humans, cars, etc.)
__ Display threat and hazard data on a geographic display
__ Other (please specify): _____

16. Please rank (starting from 1 as the most important) the system capabilities by order of priority:
__ Capture real-time video, images, and audio (high-definition, zoomable, remote camera control, infrared, multispectral, etc.)
__ Be able to overlay images from different sensors (e.g. thermal over video)
__ Carry modular payloads, including threat, hazard and biometric sensors, lighting, and communications equipment
__ Use a common hub or interface for sensors and imagers
__ Integrate data feeds when a new system is rotated into operation to maintain a continuous picture of the scene for as long as needed
__ Pose low risk for operators, responders and civilians
__ Rapidly deployable
__ Be suitable to mission in a several conditions (e.g. harsh weather conditions, confined spaces, smoke, humidity, etc.)
__ Be able to adjust or tune sensors for different environments (e.g., smoke, steam)
__ Calculate measurements between objects using video and image data (photogrammetry)
__ Continuously integrate location data, captured with geographic information systems (GIS), in the system
__ Be resistant to interference with functionality
__ Other (please specify): _____

(*Example "1: Rapidly deployable"*)

17. Is an ATEX (ATmospheres EXplosive) drone necessary in your operations:

☐ Not very useful ☐ Useful ☐ Necessary ☐ Mandatory

18. Do you consider the current legislation (both national and European) adequate for using drones in civil protection operations (please elaborate)?

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19.Are accountability issues a constraint for using drones in your operations? if yes, please explain.

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