EENA Operations Document

Remote Piloted Airborne Systems (RPAS) and the Emergency Services

Title	RPAS and the Emergency Services		
Version	Final		
Revision date	20-11-2015		
Status of the document	Draft	For comments	**Approved**

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

Contributors to this document

This document was written by the following individuals and compiled and edited by EENA. EENA is grateful to all concerned for their time and efforts. Tony O'Brien (EENA) can be contacted by email tob@eena.org.

Contributors	Country / Organisation
Tony O Brien	EENA / Belgium
Håkon Bjorheim Abrahamsen	Norway / The Norwegian Air Ambulance Foundation, the University of Stavanger and Stavanger University Hospital
Alfonso Zamarro	Spain / DEA Drones
Marc Valls	Spain / DEA Drones
Oriol Badia	Spain / DEA RPASs
Jordi Guasch	Spain / DEA Drones
Dimosthenis Ioannidis	Greece / CERTH
Kostantinos Votis	Greece / CERTH
Christos Palaskas	Greece / CERTH
Savvas Rogotis	Greece / CERTH
Adrian Brookes	UK / Avaya
Eleni Vlahogianni	Greece / NTUA
Emmanouil Barmpounakis	Greece / NTUA
Fernando Pessoa Sousa	Portugal / Intergraph
Banerjee Sanchito	Germany / IABG
Hans Tönskötter	Germany / IABG
Josef Mendler	Germany / IABG
Helmut Wittmann	Germany / IABG
Li Guohui	China / Huawei
Andy Rooke	UK / Shadowfocus Ltd
Norman Woollons	Croatia/ International policing and aviation consultant
Kenneth Kronohage	Denmark / Falck Emergency Medical Services
Jiří Němčík	Czech Republic / FRB of Moravian-Silesian Region
Vlček Vladimír	Czech Republic / FRB of Moravian-Silesian Region
Vachta Jonáš	Czech Republic / FRB of Moravian-Silesian Region
Jalůvka Zdeněk	Czech Republic / FRB of Moravian-Silesian Region
Radim Kuchař	Czech Republic / FRB of Moravian-Silesian Region
Panayiotis Kolios	Cyprus / KIOS Research Center, University of Cyprus
Mark Mangham	UK / Vedette Consulting
Mark Townend	UK / Vedette Consulting (Associate Consultant)
Peter Sanders	Netherlands / one2many
Thomas Reimann	Qatar / Ambulance Service of Qatar

Eleni Mangina	Ireland / University College Dublin

Legal Disclaimer

This document is authored by EENA staff members with contributions from individual members of EENA and other contributors and represents the views of EENA. This document does not represent the views of individual members of EENA, or any other parties.

This document is published for information purposes only and it does not declare to be a statement or interpretation of EU law or the national law of EU Member States. This document is entirely without prejudice to the views of relevant national statutory authorities and their legal functions and powers, whether under EU law or the national law of their Member State. Accordingly, under no circumstances may reliance be placed upon this document by any parties in compliance or otherwise with any applicable laws. Neither may reliance be placed upon this document in relation to the suitability or functionality of any technical specifications, or any other matters discussed in it. Legal advice, technical advice and other advice as relevant, may be sought as necessary.

Table of contents

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

1 Executive Summary

The use of RPAS (also known as Drones) by the emergency services has been an emerging concept in recent times, although the use of RPAS by hobbyists and professionals such as photographers, surveyors and safety inspectors has been around for some considerable time.

Using RPAS has many benefits for the emergency services and humanitarian agencies and without doubt, they are a welcome addition to emergency services' toolkit. RPAS will provide both informant support (providing situational awareness information) and helper support (dropping life saving equipment) in a flexible, effective and efficient manner but only if the framework to do so is created.

The permitting of RPAS to fly in certain areas, under certain conditions with certain specific types of equipment is not harmonised in Europe with many Member States adopting different approaches. The tendency might be to heavily regulate this market but to do so would be a mistake. The EU framework is being drawn up right now and it is EENA's view, and those who contributed to this document and EENA's Working Group on RPAS, that the emergency services should be granted special exemptions to operate RPAS whilst carrying out their duties.

This does not mean that the emergency services should be absolved of any safety obligations; on the contrary, the emergency services should ensure that all identified risks have been mitigated and that the public are not placed in any danger whilst the emergency services are operating RPAS. The risks associated with operating RPAS are well known and there have been several well-documented incidences. A system of reporting accidents and "near misses" would go a long way to creating the much needed transparency and safety ethos as well as a system to identify each registered RPAS and its pilot.

A robust programme for the training (and re-training) of pilots is extremely important especially so for the emergency services and this is a crucial element to the use of RPAS. Current and future RPAS technology (both hardware and software) will provide the emergency services with more and more capabilities and those capabilities should be matched with the requirements of the emergency services. To that end RPAS suppliers should be more in tune with the emergency services so as to produce equipment that is fit for their needs.

Finally, the emergency services also need to be afforded adequate protection from RPAS flown by members of the public whilst they are performing their duties and the appropriate provisions in European and National legislation should be drawn up. This includes mandatory training for RPAS pilots and a flexible but robust registration scheme for all RPAS sold in each EU member state. Existing privacy legislation should be adapted (if needed) to ensure that RPAS are not compromising individual citizen's rights.

RPAS will undoubtedly continue to save lives and protect our citizens property and their use is widely welcomed by many emergency services. Harnessing their capabilities is the key to their success whilst protecting the safety and privacy of our citizens.

1.1 List of Abbreviations

Abbreviation	Short Description
ANPR	Automatic Number Plate Recognition
ATM	Air Traffic Management
BVLOS	Beyond Visual Line of Sight
CAA	Civil Aviation Authority
CCTV	Closed Circuit Television
EASA	European Aviation Safety Agency
EMS	Emergency Medical Services
EU	European Union
ES	Emergency Services
EVLOS	Extended Visual Line of Sight
FLIR	Forward Looking Infrared
FPV	First Person View

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

FP7	Framework Programme 7
IFF	Identification Friend or Foe
JARUS	The Joint Authorities for Rulemaking on Unmanned Systems
MAC	Mid-Air Collision
MS	Member States
RPAS	Remotely Piloted Airborne System
SMS	Safety Management System
SSP	State Safety Program
UAV/UAS	Unmanned Aerial Vehicle/Unmanned Aerial System

2 Introduction

RPAS (or more commonly known as Drones) are in our media almost constantly over the past number of months. The overall outlook and likely impact of this relatively new tool is very significant, especially for the emergency services. But the use of RPAS has also been viewed negatively with many incidences ending up in the media. Whilst these may be standalone events and the overall number may be low, the potential reputational impact is significant.

Companies that develop and supply RPAS hardware and software have also seen demand for their services and the presence of RPAS in our skies is only going to get more and more. Companies specialising in the manufacture and operations of RPAS have seen significant investments indicating that the market for their products and services is very strong. Approximately 1 million RPAS have been sold to the consumer market indicating their level of interest and use. RPAS are considered by the European Commission as a promising technology for both environmental and infrastructure monitoring with broad applicability to a plethora of governmental applications[1]. As such, there is currently a strong effort along local, regional, national and international levels to shape the landscape of the RPAS operation[2]. It is also anticipated by the European Commission that the use of RPAS technology can foster the creation of jobs and accelerate innovation in the activities of governmental authorities and interested stakeholders in the domain of disaster prevention[3].

But it's not just about the machine itself. The availability of spectrum is fundamental to the success of RPAS. Two main international institutions have a role in regulating this at international level: the International Telecommunication Union (ITU) and International Civil Aviation Organization (ICAO). The continuation of the active coordination of MSs already existing in the European Aeronautical Spectrum Frequency Consultation Group (ASFCG) is strongly recommended so that Europe speaks with a single voice and the necessary spectrum is allocated to RPAS operations.

In terms of the scope of this document it will look at the use of RPAS from the perspective of the emergency services and how RPAS can be potentially used whilst being aware of all of the safety, privacy, operational and technical considerations that prevail. But let's start off by understanding what is in fact an RPAS. The document will not look at the use of RPAS for commercial or private use as this would distract from the primary purpose of the document.

[1] Commission Staff Working Document (SWD(2012)259)
[2] http://europa.eu/rapid/press-release_IP-14-384_en.htm
[3] European Commission, Communication From the Commission to the European Parliament and the Council, A new era for aviation
Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner, Brussels, 8.4.2014
COM(2014) 207 final

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

3 Use of RPAS by the Emergency Services

An RPAS is a subset from the wider term known as Unmanned Aircraft Systems (UAS). RPAS vary greatly in size, flying capability, capacity and methods of control. We see RPAS being used in many parts of Europe to monitor roads, railway systems and infrastructure, to support the agriculture industry and commercial photography and mapping industries and to check on wind turbines, electricity pylons, dams and other critical infrastructures. Basic national safety rules apply to their use, but these rules differ across the EU and a number of key safeguards are not addressed in a coherent or harmonised way.

Some of the questions that need to be answered regarding RPAS usage are the following:

- What is an 'equivalent' level of safety to manned aircraft, and how can RPAS be protected against security threats?
- How can the emergency services use RPAS as part of their everyday resources?
- How will data protection rules apply to RPAS and their usage?
- Does the current framework for liability and insurance for manned aircraft need to be amended to take into account the specifics of RPAS?
- What is considered to be an emergency operation versus non-emergency operations? Are humanitarian operations also considered to be an emergency operation?

The emergency services can and will use RPAS potentially in different ways and how they use it will depend on the phase of the disaster (Mitigation, Preparedness, Response Recovery, see figure below), the situational awareness level at that time, the level of risk and the type of RPAS being used.

Figure 1 – Different phases of disaster management

RPAS could potentially carry high definition cameras using wireless communication protocols, sensors, microphones and speakers, specialist medical equipment etc. Of course RPAS per se on their own are not enough to allow for smart decisions. The emergency services may need to have different views from different sites aggregated into one application solution, which can provide a 360-degree view to cover all decisions and scenarios.

3.1 Types of RPAS and possible use cases by the emergency services

There are different RPAS for a wide range of applications with many different sizes. They can also be classified in many ways: Use (civilian/military), Lift (fixed-wing/multi-rotors), MTOW (maximum take-off weight), etc. For a conceptual approach, a good way is to look at their performance, so it becomes easier to understand the capabilities.

For a quick understanding of the performance and specifications of current commercial RPASs in the market, see the table below:

Agility
Fault tolerance

Endurance
Payload

	MULTIROTORS	FIXED-WING
POWER SOURCE	**Electric**	**Electric** / **Combustion**
ENDURANCE	**10’** to **50’**	**45’** to **10+ h**
PAYLOAD	up to **15 Kg**	**0,5 Kg** to **50+ Kg**
GROUND SPEED	0 (hovering) to **75 km/h**	**45 km/h** to **200+ km/h**
ALTITUDE (ceiling)	Up to **3000 m**	Up to **5000+ m**
SIZE	**6 cm** to **1,6 m** (frame diameter)	**1 m** to **20+ m** (wingspan)

Table 1. Average commercial RPAS Specs & Performance

Examples of where RPAS could be used by the emergency services/disaster management agencies:

1. Record and transfer video and/or audio information from the place of an incident. The most impact will be mainly where there is a large geographic area to cover or where the intervention team will have to cope with local risks;
2. Import or export technical devices and equipment, spare parts, etc., to/from the place of an accident which is either inaccessible or accessible only with a considerable delay;
3. Movement of humanitarian aid, medical drugs, emergency blankets, emergency flotation devices in areas difficult to reach by human response teams;
4. Installation of loud speakers which are capable of warning citizens in an affected area (e.g. toxic cloud);
5. Place a detection device into the place of an incident in order to find people or animals during an earthquake or avalanche;
6. Place a sensor to detect hazardous materials in an specific area;
7. Be the “eye in the sky” covering large distances in short timeframes such as the reduction in potential crowd trouble by monitoring large crowds;
8. Monitoring large fields and forests during dry spells to reduce the risk of wildfires.

Deployment of micro RPAS is considered as an appropriate supplement to standard RPAS, which could be used mainly in the interior of buildings or in the inner perimeter of technological units. Micro RPAS could also be used in the recording and transfer of video and/or audio information from the place of an accident or incident. It can be used in tactical/operational or strategic level when assessing and responding to the emergency situation.

In terms of general RPAS application, it can be broken down into certain categories. The figure below outlines the different applications-categories of RPAS.

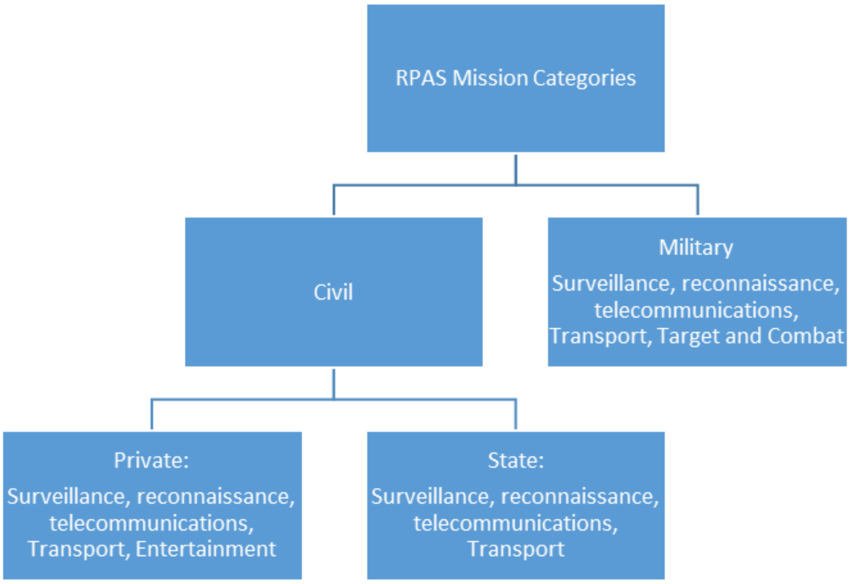


Figure 2 – Application categories for RPAS

3.2 Police and use of RPAS

Each emergency service will have specific needs and requirements but their objective is all the same; to bring help to those in need as effectively and efficiently as possible and to ensure the lives of those responding are as safe as possible.

Within the police services; RPAS could be used to:

- Support the policing of remote areas on an ad hoc basis;
- Rapid deployment capability;
- Incident control:
    - Increasing and improving situational awareness;
- Crowd observation;
- Aviation security;
- Generic surveillance for drug related offences and public order maintenance;
- Anti-terrorism surveillance;
- Stolen vehicle searches.

RPAS are also being used for surveillance purposes like the example of London airport[4] by the National Counter Terrorism Policing Headquarters, as counter-terrorism to better protect people. The Hellenic Police (National Police Service of Greece) acquired 6 RPAS in 2015. Test flights took place in August 2015 to test the pilots' skills and RPAS capabilities. The RPAS are intended to be used for forest monitoring and wildfire prevention, while further applications will be examined in the future[5].

In the UK a number of the 43 police forces use RPAS. The public debate and use of RPAS has been predominantly focused around their use for surveillance purposes and the associated civil liberty issues. This has included several Parliamentary committees reports all of which are viewing the problem from the surveillance perspective so there is little focus or evidence of their use for emergency response – and a lack of best practice or innovation in that area. There is more evidence of the use of RPAS for agricultural than flood prevention information gathering. It is regrettable that as the commercial and recreational sector use of RPAS proliferate; a more positive and proactive approach to using RPAS to enhance police and emergency response is not seen. Perhaps this may change with clearer guidelines and legislation on their use.

[4] *http://www.bbc.com/news/uk-england-london-32431630*
[5] *http://www.kathimerini.gr/827352/gallery/epikairothta/ellada/se-dokimastikes-apostoles-tria--RPASs-ths-elas [in Greek]*

3.3 Emergency Medical Services and the use of RPAS

There are many examples of manned helicopters being used by the Emergency Medical Services (EMS) known as Helicopter Emergency Medical Services (or HEMS) in Norway (Norwegian Air Ambulance) and in London (London HEMS) where the overview from the air is used to improve situational awareness in major incidents before landing. It is obvious that an RPAS equipped with video camera and wireless transmission could provide the same data. Current practice reflects a need for aerial view of major incidents[6].

A rapid response RPAS has been developed by an engineering graduate at Delft University of Technology that increases the chances of recovery for a heart attack victim. The RPAS is carrying a defibrillator and is equipped with features that could reduce the time before first aid or professional medical help arrives at the point[7]. A video[8] outlining this technology is available also. Within the EMS, RPAS could be used to:

- Deliver much needed first aid or resources to the affected area.
- Provide specialist equipment such as defibrillators to the first responders to the incident.
- The correlation between the package that is to be delivered and the RPAS that will be used to deliver
- Provide situational awareness data to the HEMS pilot in advance of landing in a specific area

3.4 Fire and Rescue and the use of RPAS

Fire and Rescue operations are equally as complex and many innovative solutions are already being used by the Fire and Rescue Services (FRS), and many other emergency services also. The control and activities of the RPAS devices over the fire sometimes can help, other times are obstacles to the correct firefighting (sometimes an RPAS device without the proper control can impact negatively other activities done in other ways, like airplanes). Under the proper and correct control, RPAS device can help on some type of actions like the fire detection, fire recognition even if it is a marsh fire, forest fire, or even a building fire. For example in the United States[9] there are companies providing such services.

One of the applications of COMETS Project was fire monitoring. Involving cooperation between several RPAS would determine the fire front position, geometric characteristics of the fire, transmit images from the point of interest and provide assistance to fire-fighters[10].

A team at the University of Melbourne is working on using RPAS to deliver new data combined with satellite or airborne information, to help them make more accurate predictions of bushfire risk[11].

The Andalusian authority for the management of wildfires in Spain uses a RPAS with a large payload to track wildfires during night time using equipment that can perform missions of 1.5 hours with a radio control of up to 45 kilometres. The RPAS can fly above the point of interest, for example the fire line, record video including thermal images that are then geo-tagged and sent to command centres[12].

[6] *See Abrahamsen HB. A remotely piloted aircraft system in major incident management: concept and pilot, feasibility study. BMC Emerg Med 2015:15:12 doi:10.1186/s12873-015-0036-3 on the feasibility of using an RPAS to support remote sensing in simulated major incidents*

[7] *M. Starr, "Ambulance RPAS unveiled in Netherlands," www.cnet.com, 2014. http://www.cnet.com/news/ambulance-RPAS-delivers-help-to-heart-attack-victims.*

[8] *http://www.tudelft.nl/en/current/latest-news/article/detail/ambulance-RPAS-tu-delft-vergroot-overlevingskans-bij-hartstilstand-drastisch/*

[9] *http://www.wisconsinRPASfootage.com/services/fire-fighting-RPAS).*

[10] *L. Merino, F. Caballero, J. R. M. Dios, and a. Ollero, "Cooperative Fire Detection using Unmanned Aerial Vehicles," Proc. 2005 IEEE Int. Conf. Robot. Autom., no. April, pp. 1896–1901, 2005.*

[11] *Palmer, C., 2013. RPASs to forecast future bushfir http://www.itnews.com.au/News/328040,RPASs-to-forecast-future-bushfires.aspx*

[12] *M. R. Roberts, "5 RPAS technologies for firefighting," www.firechief.com, 2014. http://www.firechief.com/2014/03/20/5-RPAS-technologies-firefighting/*

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

Micro RPAS[13] are used for post-disaster search and rescue missions, including real-time map stitching, indoor navigation and roof-top perching.

For FRS, RPAS could be used to:

- *Obtain situational awareness information using IR cameras and sensor equipment to assess potential fire risk areas;*
- *Inspect buildings and risk related infrastructures in advance of any fire crews being deployed;*
- *Detect and report hot spots during an intervention to assist and support fire management;*
- *Detect critical points post fire suppression by observing cinder remains;*
- *Manage hot spots allowing firefighters to leave the risk area*
- *Assess potentially dangerous incidents, including where hazardous materials may be present*

3.4.1 Project FERMIS; an example of an RPAS for the Fire and Rescue services

FERMIS (Fire Event Remote Monitoring Management Information System) is a Greek-Israeli joint effort to develop an intelligent system for fire prediction and prevention, early fire detection, monitoring and fire-fighting, by the use of an advanced and integrated aerial sensing system coupled with innovative sensors and cloud-based architecture software. The official web-page is http://www.fermis-project.eu/fermis, where more info about the participating parties (ALTUS-LSA (coordinator), CERTH/ITI, KEMEA from Greece and BLUEBIRD from Israel) can be found. The project was co-funded by the European Commission within the Seventh Framework Programme (2007-2013) (GSRT ISR_2898).

Due to the lack of such an auxiliary system to the fire-fighting authorities, which assistance is done currently only by experts analysing data presented to them with significant time delay, this system aspires to fill in the gap, and provide them with a useful ally. The system consists of an RPAS, which is controlled by a Ground Control Station (GCS), and to which the data is sent. This in turn is coupled with a remote Ground Fire Analysis Station (GFAS) that receives the data, processes it, and sends back commands, alerts and decision support data. All firefighting personnel and vehicles are equipped with GPS locators that inform the GCS of their location (Figure 3).

Within the project FERMIS, a new RPAS will be implemented, based on the requirements collected by the respective agency involved in the project (partner KEMEA). Until its completion, a tetra-copter was obtained and equipped with a 12Mpixel RGB camera, shooting 1080p HD video at up to 60fps and stabilized by a 3-axis gimbal, in order to test and validate the algorithms developed.

The RPAS will be equipped with high-tech sensors that monitor its exact position, direction etc. which is usually known as Inertial Measurement Unit (IMU). These measurements along with the image it receives will be sent back to the GFAS via the GCS. The first process run by the system is the orthorectification of the image, using all the data from the IMU, such as GPS location of RPAS, yaw, pitch and roll of the camera, height of flight and also some Digital Elevation Models of the area.

3.4.2 Driver Project and RPAS in the Marseille region

The DRIVER Project also has evaluated the use of RPAS by the Fire and Rescue Services in the Marseille Region in France. The lessons learned [14] from the air surveillance and use of RPAS is available and is a valuable resource tool.

[13] *Cui, J.Q., Phang, S.K., Ang, K.Z.Y., Wang, F., Dong, X., Ke, Y., Lai, S., Li, K., Li, X., Lin, F., Lin, J., Liu, P., Pang, T., Wang, B., Wang, K., Yang, Z., Chen, B.M., 2015. RPASs for Cooperative Search and Rescue in Post-Disaster Situation. 2015 IEEE 7th International Conference on CIS & RAM 167–174*

[14] http://driver-project.eu/sites/default/files/driver/files/content-files/articles/Présentation%20workshop%20driver%20ANG_0.pdf

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

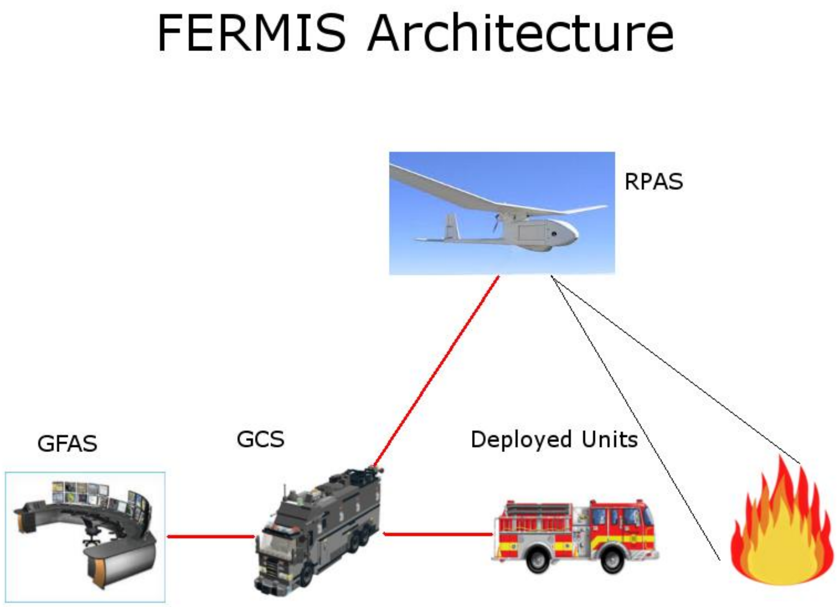


Figure 3 - The FERMIS architectural components

3.5 Coastguard and the use of RPAS

In the context of the current refugee crisis in the Mediterranean, RPAS could be and are being used to support the work of the Coastguard services. An example of such is the work being done by the Migrant Offshore Aid Station (MOAS), who in cooperation with Médecins Sans Frontières (MSF) operate for 6 months each year locating and rescuing migrants in the Mediterranean[15]. MOAS use two RPAS along with boats to carry out their work.

The U.S. Coast Guard uses fixed-wing RPAS to MAVs in marine SAR missions[16]. The RPAS are able to track helicopter manoeuvres with specially-designed algorithms, while increasing the search area with minimal cost.

In Belgium, project ICARUS (Integrated Components for Assisted Rescue and Unmanned Search) provides robotic support for marine SAR operations. Crucial objectives included heterogeneous robot collaboration between Unmanned Search and Rescue devices between RPAS and Unmanned Surface Vehicle (USV) and the development of a light sensor being able to detect human beings[17]. On 7 May 2015, a rotorcraft developed within the ICARUS FP7 research project performed the first-ever legally approved Remotely Piloted Aircraft (RPAS) flight in Brussels, less than one kilometre away from the Berlaymont building, the iconic headquarters of the European Commission, as confirmed by the Belgian Civil Aviation Authorities (CAA)[18].

---

[15] *http://mashable.com/2015/08/21/RPASs-help-find-migrants-in-the-mediterranean-sea/*

[16] *Ryan, A., Hedrick, J.K., 2005. A mode-switching path planner for UAV-assisted search and rescue. Proceedings of the 44th IEEE Conference on Decision and Control, and the European Control Conference, CDC-ECC '05 2005, 1471–1476.*

[17] *De Cubber, G., Dorofteri, D., Baudoin, Y., Serrano, D., Chintamani, K., Sabino, R., Ourevitch, S., 2012. ICARUS: An EU-FP7 project Providing Unmanned Search and Rescue Tools. IROS2012 Workshop on Robots and Sensors integration in future rescue INformation system (ROSIN'12)*

[18] *http://www.fp7-icarus.eu/news/icarus-makes-first-ever-legal-RPAS-flight-brussels*

A hybrid control system was developed to assist a US coast guard search and rescue mission with two fixed wings UAVs. The two UAVs assist with their equipped cameras, swap positions to improve tracking and ground coverage[19].

A recommendation from the Norwegian Board of Technology[20] is that RPAS should form part of a national public resource in climate monitoring, oil spill preparedness and in search and rescue operations. The same organisation has also called for the use of RPAS in monitoring the environmental situation in the arctic regions.

3.6 Other Services and the use of RPAS

RPAS have other potential uses that may not fall into the category of an emergency but nonetheless are related in terms of humanitarian aid, disaster management and such like.

The long-term objective of the WITAS Unmanned Aerial Vehicle Project[21] was to operate over road and traffic networks, plan for mission goals for example locating, identifying, tracking and monitoring different vehicle types etc. Such functionalities could assist several police missions, such as stolen vehicles or tracking specific vehicles of interest.

A company that started as a start-up in the US named Matternet, tested delivering medicines and other supplies to remote areas in Haiti and the Dominican Republic with three RPAS conducting missions[22].

After the derailment of 13 cars of a 39-car freight train in Kentucky, the onsite teams launched a RPAS a safe distance from the accident site and provided real time images and video to the teams on the ground. Various agencies used the same information to collaborate with each other for situational briefings and important decisions. Moreover, the system was able to fly at low altitudes and record the code information on the derailed cars. This enabled the response teams to know which cars contained the hazardous materials[23].

A long-range RPAS is used by NASA, the National Oceanic and Atmospheric Administration (NOAA) and Northrop Grumman to improve predictive capability for weather and extreme weather events, by understanding how tropical storms form and develop into major hurricanes[24].

The Royal Canadian Mounted Police in the province of Saskatchewan have successfully used a small RPAS to locate and treat a man who was injured when his car flipped over in a remote area. The man managed to call 911 but he couldn't inform the authorities about his location. The RPAS was deployed with an infrared camera (after a manned helicopter with a night vision failed to locate him) and the missing driver was then rescued by the fire department[25].

---

[19] *A. D. Ryan, D. L. Nguyen, and J. K. Hedrick, "Hybrid Control for UAV-Assisted Search and Rescue," Dyn. Syst. Control. Parts A B, vol. 2005, no. 1 PART A, pp. 187–195, 2005.*

[20] *http://teknologiradet.no/english*

[21] *P. Doherty, G. Granlund, and K. Kuchcinski, "The WITAS unmanned aerial vehicle project," ECAI, 2000.*

[22] *Guardian, "Flying aid RPASs tested in Haiti and Dominican Republic." [Online]. Available: http://www.theguardian.com/global-development/2013/jan/09/flying-aid-RPASs-haiti-dominican-republic.*

[23] *Aeryon.com, "Aeryon Scout streams high-resolution images to help assess train derailment site," 2013. http://aeryon.com/casestudies/RPAS-systems-case-study.*

[24] *A. C. Watts, V. G. Ambrosia, and E. a. Hinkley, "Unmanned aircraft systems in remote sensing and scientific research: Classification and considerations of use," Remote Sens., vol. 4, no. 6, pp. 1671–1692, 2012.*

[25] *C. Franzen, "Canadian mounties claim first person's life saved by a police RPAS," The Verge, 2013. http://www.theverge.com/2013/5/10/4318770/canada-draganflyer-RPAS-claims-first-life-saved-search-rescue*

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

In summary, RPAS devices can have a critical role in terms of mountain rescue by locating natural disaster victims, preventing avalanches, helping on health support, delivering medication and keep people on mountain on safe side.

4 Legislation

Contemporary experience tells us that the current, most significant risks for RPAS usage in today's world lies in the general mass availability of uncertified technology to an untrained, unaware and unregulated general public in an environment shared with manned aviation.

This leads to an overall increase in the likelihood of a mid-air collision (MAC) between manned platform and RPAS alongside the increase in "worst case" consequence realisation (a mass casualty event resulting from a catastrophic collision between RPAS and passenger carrying aircraft). Underlying the future and current use of RPAS is the European legislation is crucial and is currently in the early phase of development. Some Member States (MS) in Europe have developed guidelines or in some cases have set national legislation but there is no current harmonised approach.

There are 18 EU MS who have adopted or are about to adopt regulations on RPAS. Most of the regulations are for RPAS that weigh less than 20KG or in some cases 25KG.

The national aeronautical authority of the EU country concerned has formulated the regulations in most cases. The limitations, with slight variations are generally:

- Not to fly closer than 50 metres to persons, property, buildings or vehicles.
- Always within the line of sight of the pilot.
- Daylight only flights.
- No further than 500 metres from the pilot and at no greater altitude than 120 metres.

It is in this context that the European Aviation Safety Agency (EASA) has recently published a notice[26] about how it plans to set legislation and it will have a substantial effect on how the ES will use RPAS going forward.

A full description and report regarding the EASA proposals is in Annex B; a summary table is outlined below containing the 3 proposed risk-based categories:

- An "Open" category for low risk operations
- A "Specific" category for specific risk operations
- A "Certified" category for higher risk operations

Category name	Risk - level	Size of RPAS	Authorisation	Altitude permitted	Flying over crowds (>12 persons)	Line of Sight	Pilot Licence	Other
'Open'	Low	Below 25kg	No prior permission to fly is needed.	No higher than 150m	Not permitted	Must be in direct visual line of sight		Enforcement is likely to be by the Police.
'Specific'	Med	Below 25kg	Permission is required from the National Aviation Authority		Permitted	Expectation is that Beyond Visual Line of sight may be permitted		Each risk is to be analysed and mitigated through a risk analysis process

[26] *http://easa.europa.eu/newsroom-and-events/news/easa-launches-public-consultation-new-rules-RPASs-europe*

'Certified'	High	Below 25kg	NAA has oversight for licences, approvals, training, air traffic management	Permitted	Expectation is that Beyond Visual Line of sight may be permitted	Pilot must be licensed and the operator shall hold an operators certificate	Type Certificate (or Restricted Type Certificate) is required. Also a Certificate of Airworthiness is needed.

4.1 National legislation examples

Legislation in European countries does not specifically contemplate the use of State RPASs for public services. Their laws are oriented towards the commercial and recreational use of RPASs. There are no defined exemptions for the use of RPASs in emergencies, but there may be scope to analyse this on a case-by-case basis leading to the issuing of the required certifications and permit.

The UK has long established laws on the use of model aircrafts and those rules also apply to RPASs as well. Nevertheless, the national Civil Aviation Authority has recently published the "DroneCode[27]" to clarify the aviation laws while privacy issues are looked at in a more general framework by the government as a whole. The "DroneCode" simply states that pilots must be in the line of sight with their RPASs at all times and that they do not fly higher than 400ft. It also states that RPASs should not come close to airports, aircrafts or helicopters while safety should always come first. Moreover, RPASs fitted with cameras must not be flown within 50 meters of human, vehicles, buildings, structures (such as power cables), or in the close vicinity of congested areas such as large gatherings (including concerts and sports events).

The UK House of Lords while urging support of NASA's attempts at tracking RPAS recommended that an idea like an on-line database might be a pragmatic measure. They stayed: *'In the absence of a global system which could track all RPAS (including small RPAS flying below 500ft), we were impressed by industry suggestions for the creation of an online database through which commercial operators could log their flight plans and data protection policies.'*

An example of a working database that logs flight plans for hand gliders and helicopters in the UK is CADS. This deployed airspace management capability allows a secure, and collaborative, advisory web-based flight planning service that reduces the risk of collision with other aircraft in uncontrolled airspace. Designed as a way of notifying lower level airspace users of temporary hazards like cranes and wires, it may be an excellent practical example of RPA safety mitigation that might merit EU attention and replication[28].

In Cyprus (the eastern Mediterranean county in the EU) there are no RPAS laws established. The Civil Aviation department of Cyprus considers that everything that flies over 30 metres is an aircraft and as such is obligated to follow the relevant aviation laws. For instance, and in accordance with EU directives, remotely piloted aircrafts should keep a safety distance of 6km from airports. Also manufacturers of popular RPAS brands have already coded into the RPASs the no-fly zones in Cyprus. A shortfall of the current law, however, is that it does not forbid children under the age of 18 of operating such RPASs. In practice, Cyprus follows EU directions for the use of RPASs and police will intervene when there is a violation of privacy, there has been third-party damage, or the no-flight zone restriction over sensitive areas has been breached. Those who need to fly over sensitive areas such as military installations need to fill in a form requesting permission from the civil aviation department. Insurance coverage is also needed when flying over populated areas.

[27] http://www.caa.co.uk/default.aspx??catid=1995&pagetype=90&pageid=17054
[28] *http://www.baesystems.com/product/BAES_019757/cads;baeSessionId=EmDhY7qCsdUz3fl_9xvjNXS-J-lUUOXaWN1ZttEvwpOyb-QMiBZU!201291115?_adf.ctrl-state=3nnh5i0z2_4&_afrLoop=2435835422736000&_afrWindowMode=0&_afrWindowId=null_-!%40%40%3F_afrWindowId=null%26_afrLoo*

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

The situation in European countries is listed in Annex A. Annex 6 of the EASA draft document, which lists a sample of rules from Austria, Denmark, France, Germany, Spain, Italy, Sweden and the UK is also a useful resource.

4.2 Legislative Requirements from the Emergency Services

To maximise the benefit and minimise the risk of using RPAS, the ES require a special set of legislative requirements. This should be done in accordance with other existing legislation, such as the relevant data privacy and similar frameworks.

In brief (non-exhaustive list) the emergency services need legislation that:

- Reflects their statutory mission and their overall protection of our citizens and property;
- Protects their existing resources from interference from private RPAS owners;
- Provides them with the flexibility to use an RPAS when the situation requires and where no advance permission is required during their operations. This means either RPAS used by the ES itself or where it is a third-party agency using the RPAS on behalf of the ES;
- Provides them to fly over crowds if necessary and beyond visual line of sight;
- Helps them to identify and distinguish non-emergency RPAS and if needed, provide them with their own recognisable call signs or airspace;
- Provides them with the capability to fly inside any restricted flying zones such as airports, critical infrastructures etc;
- Allows them to operate the RPAS at any time of the day or night;
- Allows them to prevent jamming frequencies and set secure protocols for data transmission
- Allows them to use the RPAS to drop specialised equipment if and when it is needed;

In response to all of these requirements it is apparent that the framework that will govern and harmonise the EU regulation on the use of RPAS should include these provisions. RPAS will be a critical support resource for the emergency services and disaster relief community and as such the legislation needs to reflect these requirements.

The aforementioned EASA consultation also proposes that industry bodies and such should come together and it is proposed that industry and standardisation bodies be requested to provide standard solutions to address the safety risks, e.g. for airworthiness aspects.

4.3 Legislative Recommendations

It should be noted that neither the basic EASA Regulation nor the proposed rules apply to aircraft used for military, customs, police, search and rescue, fire-fighting, coastguard or similar activities or services (State aircraft). There is no specific mention of medical services and EASA regulations do apply to aircraft registered in the commercial category, even when carrying out these functions.

It is justified to think that EU Member States must ensure that such services have due regard as far as practicable to the objectives of the EASA Regulation. EASA has recommended and that emergency services using RPAS should probably comply with the “Specific” category recommendations of the EASA proposal and should seek to have easements included in their approved manuals, which will then allow them to fly with lower minimum limits than commercial operators in the same category.

Therefore, all emergency services should be able to obtain permission or exemptions to fly in the following circumstances:

1. Overfly congested areas such as cities or events (concerts, demonstrations etc.). Police surveillance, firefighting or EMS support for example.

2. Fly BVLOS therefore allowing emergency services to act in long distances and in a faster way and permit SAR or EMS intervention in cities or rural areas for example.

European Emergency Number Association – EENA 112
Avenue de la Toison d’Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

3. Fly at night. For example, surveillance in rural areas, coast guard operations and SAR missions using RPAS. Such missions are often carried out during the hours of darkness. Of course, the RPAS Pilot would need to be correctly certified to carry out such missions.

4. Share airspace with other users, like helicopters from HEMS or the Police, particularly in urban areas.

The legal framework should have a flexible and simple system for emergency systems to permit exemptions to use RPAS. It could be for example either with an "Exemption Norm" applied to the regular law for State RPAS, just like emergency helicopters. This would permit the emergency services to operate freely after a risk evaluation and mitigation measures implemented. The responsibility for any damage would be for the Government. The other option is to have a flexible system in the "Regular Norm" for emergency RPAS to operate and is similar to the system proposed by EASA and the one working in Switzerland. Again risk evaluation and mitigation measures would be required. With time, a database of measures to mitigate risk could be created, allowing a faster evaluation of risks. The definition of an emergency is also something that may require closer examination, especially when humanitarian agencies are using RPAS for their operations.

Such exemptions mentioned above should be allowed, but always with measures to ensure safety in the operation. Examples would be:

- Fully trained pilots with regular testing
- Duplicate on-board systems to ensure functionality
- Parachutes and propeller protectors
- Geo-fencing

In summary, in the face of this issue, the temptation may be to significantly over-regulate RPAS usage across the board, without effectively identifying the key risk groups in play. Early and consistent engagement with EASA and National Air Authorities is key to enabling the technology's required degree of operational freedom and benefit exploitation whilst also efficiently targeting key risk groups with well thought out and suitably balanced legislation.

5 Technical considerations

After hearing about what the examples of where RPAS are used, the objective here is to outline what the technical considerations are towards the deployment of RPAS by the emergency services.

In all scenarios the element of security must be first and foremost. The definition of the micro RPAS would mean that consideration must be given to its ability to maintain safe flight in agreed conditions, that observations regarding fuel level and positioning and piloting criteria must be adhered to.

Micro RPAS are fast and flexible and can become a real enabler of change when it comes to emergency services. Current micro RPAS technologies usually offers range up to 2 km and short flight times. Moreover, most current systems do not offer rain immunity and are vulnerable to high wind speeds (~20 knots). To that end, Micro RPAS may not be suitable for emergency services response but in time the micro RPAS industry may be able to surpass such obstacles.

5.1 On Board Equipment and Technology

Today the small RPAS (<5kg) are mainly electrically driven with batteries on board. Bigger RPAS feature combustion engines (reciprocating engines and gas turbines). Due to the rapid progress in engine and battery technology development in the recent years, electric propulsion systems will also be used for bigger RPAS in the category of up to 1000kg take-off weight. The advantage of electric propulsion systems with lithium-ion batteries - and may be supported by solar cells - are low noise, no emissions and low operating and maintenance cost. Due to these features electric RPAS provide advantages for operations, where low noise is very important.

The following technologies are important in the operation of RPAS:

- Datalink (uplink and downlink of data in real-time) – needs to be secure, encrypted and protected against jamming.
- "Sense and Avoid" (Aircraft proximity warning systerms)
- Camera
- Navigation equipment (Inertial/GPS)
- Weather sensors (depending on the weight category of the RPAS)
- Approved automatic detection and avoidance equipment should be implemented and mandatory as a mitigation means in case the RPAS-pilot cannot avoid due C2-linkloss during Extended Visual Line of Sight (EVLOS) and Beyond Visual Line of Sight (BVLOS) concept operations
- Automatic Flight Control System and Guidance
- Redundancy in critical location tracking systems such as GPS and location reporting systems like IFF

Primarily the unit must be modular in approach so that cameras and where deemed necessary payloads can be interchanged without the need to replace the unit.

Security must be built in from day one and not bolted on after the RPAS has been constructed. Irrespective of how such technologies such as facial recognition, Automatic Number Plate Recognition (ANPR) or speech analytics are handled, the equipment that is used to control the RPAS must be secure (no short cuts) and the devices that capture the information should be subject to the various legislative powers that already exist. This would in effect ensure that the RPAS is seen as an extension to those services already defined. This should in fact deliver a faster time to service for RPAS as new legislation will not have to be drafted to control the use of the RPAS but security technology is of paramount importance.

Impact Avoidance (IA) and Anti Collision (AC) technologies are being developed in the commercial space and this technology should be considered for the RPAS device as well as the ability to "fly and retrieve". The security of any data that is held by the RPAS should also be maintained.

Anti-jamming and anti-hacking technology are of primary importance that will allow less strict legislation, especially when it comes to flying above sensitive areas or transmitting privileged information. Although no-fly zones can also be a solution, such facilities and areas should offer alternatives to RPAS in operational requirements. In addition, anti-collision sensors or software that will allow cooperation between a swarm of RPAS is crucial in an environment in which various aircrafts will operate close one to the other.

As far as the cameras are concerned, the quality of live images and video feed that can be transmitted is at a very adequate level for most cases, especially if someone takes into account how little such high-quality cameras can weigh. However, improving zooming and stabilisation capabilities would greatly improve operational and safety issues in RPAS missions. As seen in previous sections, the operational capabilities of RPAS could greatly increase by improving Forward Looking Infrared (FLIR) camera capabilities, while at the same time reduce their weight (especially advantageous for micro-RPAS).

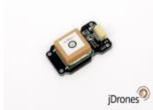
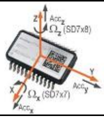
The design and development of airborne WiFi networks has also been proposed[29] where RPASs carry the infrastructure of a self-organized WiFi network that can be easily deployed, for use in emergency situations. Two hexacopters were used for long distance WiFi transmission[30] that could be applied in the areas of emergency response, monitoring public events and public safety order restoration. To support the introduction of wifi networks to remote areas of the globe, the social media network Facebook is building and will soon be testing its RPAS infrastructure. It is proposed that Project Aquila[31] will circle in the stratosphere, above the weather, wirelessly beaming Internet signals to base stations in underdeveloped countries.

RPASs are versatile platforms for a wide variety of airborne systems. As processors and sensors reduce in size, more and more can be installed and used for all kinds of purposes. The RPAS itself consists of a frame with engine(s) and propeller(s), processors and sensors to allow stable flight and some other systems for specific purposes other than just flying. It is also equipped with a radio receiver and transmitter to receive flight commands and send back various kinds of data.

---

[29] *Rosati, Stefano, et al. "Testbed for Fast-Deployable Flying WiFi Networks." FOURTH NORDIC WORKSHOP ON SYSTEM AND NETWORK OPTIMIZATION FOR WIRELESS. No. EPFL-CONF-187170. 2013.*
[30] *Gu, Y., Zhou, M., Fu, S., Wan, Y., 2015. Airborne WiFi networks through directional antennae: An experimental study. Wireless Communications and Networking Conference (WCNC), 2015 IEEE 1314 – 1319*
[31] http://www.wired.com/2015/07/facebook-poses-test-737-sized-solar-powered-drone/

Apart from the frame/fuselage, motors, propellers and batteries, and through the perspective of the functionality, the on board equipment can be classified into the following categories:

	Equipment	Use	Picture
Flight Control	Antennas	The receiver antenna is needed to receive the commands from the ground station, while a transmitter antenna may be used to send telemetry and other data from the systems on board (video).	
	ESC	The Electronic Speed Controller regulates the electrical power supplied to the motors, which is managed by the Flight Controller.	
	Flight Controller	Controls the power of each motor and other systems depending on the data received from the sensors and the commands from the ground station. It can be a commercial standard device with open software or developed for a specific solution.	
Navigation	GPS	To establish the geographic position of the RPAS.	
	Altimeter	Determines the distance from the ground (Laser or by ultrasounds) or Sea Level (barometric).	
	3D Accelerometer	Determines the magnitude of the acceleration in 3 axes for stability purposes and data processing.	
	Gyroscope	Determines the rotation around 3 axes for stability purposes and data processing.	
	Magnetic compass	Determines the direction of the RPAS in relation to the magnetic North of the Earth.	
	Airspeed sensor	Widely used in fixed-wings and in some multi-rotors, determines the relative speed between the air and the RPAS.	
	Positioning camera	Installed pointing towards the ground, it is used by the RPAS to keep its position over a specific area over the ground. It can also be used as a camera to record or take pictures.	
	Obstacle sensors	They are installed towards a specific direction to range and detect static/moving obstacles (Ultrasounds or IR).	
	FPV Camera	Camera installed in the front side of the RPAS used to give to the pilot a first person view of the flight. Also used to take pictures or record.	
Specific mission equipm	HD Camera	High definition camera, usually stabilized with a Gimbal device, used for professional quality recording and to take pictures.	

	Thermographic camera	Camera with thermal vision used commonly for infrastructure inspections.	
	Laser Sensors	Laser Imaging Detection and Ranging (LIDAR), used to perform surface inspections and determine the distance between an object and the RPAS.	
	Chemical sensors	Some specific sensors are used to detect chemical substances in the air such as CO2 concentration.	
	Temperature sensors	Used to determine the temperature of the environment around the RPAS.	
	Radioactivity sensors	Used to measure radioactivity in areas that might be dangerous for humans.	
	Other	Many other systems (physical and electronic) and sensors can be easily integrated with this technology.	

5.2 Future technologies

RPAS technology offers many possibilities in the mid-long term, most of them will actually benefit and improve our lives. Also the growing number of flying RPASs with different capabilities brings up the need to implement technologies in order to ensure safety and privacy. The following list is an example of promising areas in terms of technology development:

- Collision avoidance / warning: Within a short time, RPASs will be equipped with fast collision avoidance sensors to warn pilots or to act automatically in order to avoid obstacles.
- "Sense and avoid": This technology will provide RPASs and other aircrafts the necessary information to know where other unmanned vehicles are flying.
- RPAS delivery service: Although it is still under development mainly due to legal issues and safety concerns, a lot of efforts are put into making this new way of delivering things a reality in the next few years. This would also allow the emergency service to use RPAS to deliver specialised equipment to the scene of an incident or accident.
- Provide internet/phone coverage: Some companies have already demonstrated that RPASs can be strategic temporary antennas to create or improve connectivity.
- Fully autonomous RPASs: Completely automated operations will be a reality once the technology of "sense and avoid" for both aircrafts and RPASs is tested and ready, although it could be allowed before under some circumstances.
- Automatic charging stations: For automated or permanently functional RPAS, the charging and/or replacement of the batteries will be as simple as landing and remaining on a deck.
- Hybrid RPAS: Emerging hybrid RPAS concepts (both fixed and rotary wings) where reduced time-to-arrival, increased maximum distance and combined with hovering capabilities are slowly becoming available.
- Internet connection: A way to keep track of RPAS and manage the traffic is to have them connected to the internet, so useful services can be provided while using similar infrastructure as the mobile

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

phone network. 3G/LTE (Long Term Evolution) technology is used to transmit video from RPAS to ground station or contact centre right now. Emerging LTE technology has more advantage than 3G as it can provide 100 Mbit/s downlink and 50 Mbit/s uplink capabilities and can accommodate real-time 1080pHD video data transmission.

- "Geo fencing": Efforts are being made to develop a way to physically keep RPAS traffic from entering in to certain areas. Technology that creates RPAS-free zones/no fly zones seems reasonable near airports and approach routes for manned aircrafts. However, in case of major incidents/ plane crashes etc within these RPAS-free zones, there must be a possibility to deactivate the signals that create no-fly zones so that EMS can use RPAS for medical support.

- Image recognition: This is an existing capability on military RPAS that could be integrated into civilian RPASs used by the police or rescue systems to identify people or objects in many situations.

- More precise geo-location: The GNSS-based devices make use of all the satellite navigation networks, what makes them much more precise than the common GPS. This can make operations safer in the scale in which RPAS move. The utilisation of the EU satellite system Galileo with its technologies and services for navigation and location could be maximised for the benefit of European emergency services.

5.3 Technical Requirements from the Emergency Services

What are the needs of the Emergency Services when it comes to the technical equipment onboard the RPAS? What requirements should they expect to see to match their needs?

A suggested (non-exhaustive) list of technical equipment that could be useful for emergency services is:

- High definition video camera
- Mechanical gripper arm/release hook for transporting goods
- Wireless transmission
- Infrared camera to see in the dark
- Search light to illuminate dark areas
- Strobe light for visibility
- Two way audio communication equipment
- Speaker
- GPS
- Option for search grid patterns

In addition to the above there may specific equipment that the emergency service needs to carry that are related to its mission. For example, in an Emergency Medical Services perspective, first aid kit, including basic airway management is key equipment. Auto-injectors caring for instance epinephrine, naloxone or other essential drugs that could be administrated by an auto-injector is favourable. Tourniquets to control or block venous and arterial circulation are mandatory. Floating devices to drowning victims could be lifesaving. The Fire and Rescue services may also have special requirements to for instance carry hazardous-material detection sensors or even emergency breathing apparatus, emergency blankets etc.

Other examples of useful equipment are:

- Avalanche transceiver
- Gas sensors (NOX, CO, CO2, H2S etc)
- Thermographic camera (for triage of patients)
- Sample collection e.g. liquid or solid samples to be taken from a risk object.

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

5.4 Technical recommendations

RPASs are, and have to be, a better solution to current processes or problems. In that sense, this technology has to adapt to the environment by following some recommendations such as:

- Aircraft awareness of nearby RPASs: The actual capabilities of RPASs are beyond the current legal framework and as a result, they could potentially interfere with piloted aircraft. There should be a way for aircraft to detect RPAS and avoid them during the aircraft's flight in a similar way to the current collision avoidance technology that exists today. Equally the emergency services should have the ability to detect RPAS in their vicinity in order to deploy any counter measures.

- RPAS Tracking System: There will be a need to identify and track RPASs in order to manage air traffic or enforce the law, which is very critical in the case of autonomous flights. This should also include the registration of all RPAS by a recognised entity like the national aviation authority.

- RPAS interconnection: A possible way to deal with congested airspace is that the RPAS itself could send and receive basic information from other RPASs. A "smart" network of interconnected RPASs could manage itself and gather real time information.

- Security: It is critical to keep RPASs from being hijacked and operated with bad intentions. Special efforts must be carried out to make RPASs reliable and build trust at all levels of society.

- Batteries: More research should be done on batteries to improve their capacity and charging time to make them more reliable.

- Sensors for navigation and communication should be standardised, and easily upgraded or replaced to avoid problems due to obsolete

6 Operational use of RPAS

RPAS presents an attractive proposition for all of the emergency services to be able to deliver an airborne capability. This can be for a number of roles that in some cases are currently prohibitive due to cost, and in other cases have now become possible due to the size, capability and flexibility of RPAS.

However in looking toward RPAS for possible solution provision, it should be the responsibility of the emergency services themselves to evaluate and define the role of a RPAS, as opposed to a commercially driven solution. It makes perfect sense therefore to suggest that the emergency services would be able to ascertain when and where a RPAS could be of benefit. To that end, the emergency services should be able to clearly articulate their user requirements and select a RPAS that meets these needs. Such an RPAS could be an "off the shelf" solution modified accordingly or a bespoke RPAS custom built to the specifications needed.

As with emergency service aviation today the service is defined by the responsible body, it can choose to deploy the technology itself or it can choose to tender externally for a 3rd party commercial organisation to provide defined service.

Any RPAS deployment must form an integral part of operational strategies, not just a "nice to have". RPAS will become an important tool to be used by an emergency service, however this must be controlled by a robust tasking regime, where each use is critically assessed, the tasking must be appropriate for the RPAS. If this strategy is not followed then the use of the RPAS will fall into disrepute. Coupled with this must be a clear understanding from each service deploying a RPAS regarding the characteristics and capabilities of the device and the pilot along with the risk analysis.

RPAS devices will definitely contribute to a new generation of 112 systems. But this key contribution to the 112 system will be much more effective if it is fully integrated in the management of 112 software solution.

The RPAS devices will create a new type of action, which can contribute to a smart and better decision making process:

- **Informers:** It is a RPAS device, which can get more information from the incident and allows a better smart decision to support the incident. It can be a fixed wing RPAS which for example may get more information from a boat with problems on the river or sea or it can be copter which can "evaluate" a fire in its earlier phases or it can be a micro RPAS (an indoor device) which can see from inside a collapsed building and allows smart decisions about the damage degree and possible victims inside;

- **Helpers:** It is a RPAS device, which can help and deliver some type of product/device, like medicine, defibrillator or other type of equipment that can help in the incident resolution. A Helper device can be also a RPAS with a full video connection to the central command centre to establish a video connection and some type of elementary sensors to measure for example, blood pressure meter;

The operational considerations concerning RPAS will occur at a number of levels.

- Government/Policy level.
  - This is the strategic decision for the deployment of RPAS;
  - Which service should operate them?
  - What are there operating parameters?
  - How will they be funded from capital or revenue budget?
  - How will national aviation legislation be applied?
  - Who will oversee privacy concerns?

- Emergency Services.
  - What tasks will the RPAS fulfil?
  - What times should they be deployed 24/7 or daylight only or as the task demands?
  - When can and should they be deployed?
  - When should they NOT be deployed?
  - Who will verify the tasking?
  - Who will decide to end the tasking is it a fiscal or operational decision?
  - Who could I share my RPAS with?
  - Where are there common activities and payloads that could reduce cost?
  - Will the emergency service operate the RPAS or will it be under contract?
  - What will be your limit of liability?
  - How will ground units communicate with the RPAS and vice versa?
  - Who will be the Champion for your emergency service?
    - There is a requirement for champions at all levels of an emergency service from strategic to tactical and then specialist teams.

- Service providers,
  - What type of RPAS will be offered and to whom?
  - What are the needs of the emergency services community?
  - Where will trained pilots be sourced?
  - Where will they be located?
  - What is the level of service, 24/7?
  - When will the RPAS be updated?

- Industry
  - How will it understand the operational needs of the emergency services?
  - How can Use Cases be specifically captured and made known?
  - How can the emergency services influence future research and development
  - Will the industry build RPAS specifically for the emergency service community, recognising that some needs are very close to military requirements?

6.1 Operational Work Flow

How will the emergency services bring RPAS into their everyday workflow? What are the best practices for achieving the maximum impact with the RPAS. Should the emergency service own and operate its own RPAS or should it ask a specialised 3rd party to operate it on their behalf?

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

Quite simply it will differ from country to country, from service to service with varying degrees of complexity. The operational work flow for a RPAS[32], will differ depending on the emergency service that is operating the device, broadly this can be divided into a number of categories:

- Enforcement/Police Services
- Medical
- Fire and rescue
- Coastguard

It should be the responsibility of each service in the MS where it is being operated to define the operational limitations. However the following factors need to be considered:

6.1.1 Operational Tasking

The experience of the aviation wing of the emergency services provides an excellent template to ensure effective deployment of a RPAS. A decision to task must be critically assessed by a central point (usually the Air Support Unit with the appropriate manager/supervisor/dispatcher making the decision). Once the initial approval is given, considering the following:

- What is the nature of the request?
- What is the exact reason for the RPAS (What explicitly will the RPAS provide that normal resources are unable to do)?
- Time to tasking and deployment?
- Duration of the tasking?
- Expected outcome?
- Does the RPAS have the capability to meet the requirements?
- Is it desirable to use RPAS? In specific relation to the various legislative instruments that would need to be complied to.

In terms of the question should an emergency service own and deploy RPAS or should it use a specialist organisation is a matter entirely for each emergency service.

The question of ownership has a number of facets; if you own the RPAS you have direct control over the RPAS, you decide where the RPAS is located, who pilots and maintains the device, when the device is off line etc However this comes with some risk. The purchase, maintenance and service of RPAS is not cheap, coupled with the regulatory requirements that accompany the device.

If the RPAS is leased, this will not commit significant amounts of capital budget and the use of the RPAS remains flexible (within the constraints of the contract). All of the requirements concerning the location of the RPAS base, the purchase and maintenance of the RPAS and the provision of pilots is not a concern for the emergency service per se but of course the emergency service needs to satisfy itself that the 3rd party service provider has the necessary regulatory approval to operate.

6.2 Training and Certification of Pilots

Training and certification of RPAS Pilots is a crucial element to ensuring that the RPAS is used safely and the relevant risks are mitigated.

The role of certifying the pilot is to ensure that only trained and competent persons are allowed to operate RPAS for emergency services, and that such competency is recognised by being granted an approval to fly an RPAS.

The issuing of a competency document, under the authority of a national aeronautical authority, would make it recognised in other countries and across borders. This would be a key element in mutual aid operations at

[32] *See Abrahamsen HB. A remotely piloted aircraft system in major incident management: concept and pilot, feasibility study. BMC Emerg Med 2015:15:12 doi:10.1186/s12873-015-0036-3*

large natural disasters where several countries provide resources. Such a competency document would include the number of completed flights, take offs, landings etc in the last number of months..

Things will go wrong from time to time, and where it can be shown that the pilot of the RPAS was trained, experienced, competent and current, has the appropriate certificate or licence to fly the RPAS in question, it will go a long way to negate civil claims against the operator for damage caused or injury suffered. Using staff who are insufficiently trained and experienced, or who do not have the appropriate certificate or licence, would not be acceptable and would result in litigation that could be very costly.

There are a number of issues, which will dictate the licencing, and role of a RPAS pilot; much of this will be derived from civil aviation rules that will be applied to RPAS used in a commercial environment. Though just as with fixed wing and rotary platforms that are used for the emergency services now, dispensations should be granted to RPAS pilots and it is sensible to think that these should be in line with those already granted for police and HEMS aircraft now. It should be remembered that in some MS the operation of RPAS might come within the remit of the military. In those MS the operation of the RPAS presents less of a problem.

One of the key questions that remain to be answered is the location of the pilot. In a military context, the pilot can be remote or in line of sight. In a commercial environment, currently the pilot has to be in line of sight, but there is strong commercial pressure from organisations such as Amazon[33] for the pilot to be remote, and not in the line of sight. It is clear that in terms of RPAS deployment for the emergency service, this very much depends on the operational requirement, and the size of the RPAS in use.

The assumption is that the operator will be a Police/Fire/Medical officer however in reality this type of duty could be allocated to a civilian control room staff member. However we must also take into consideration the ability of autonomous flight using GPS and other technologies which would automate the use of RPAS, potentially remove some of the issues that could be voiced from a civil rights perspective, and also allow multi tasking from an inter-agency perspective.

As the capabilities of RPAS and the role equipment becomes ever greater, there is a need potentially for a fully trained two-person crew. (e.g. the pilot/camera operator, and the safety lookout or "spotter"). With devices that can transmit live video to the pilot available now, the tendency is to fly by using what you see on the screen or goggles. Without a second person who maintains the situational awareness, it is very easy to fly into danger. Consequently, both crew members should ideally be trained as RPAS pilots.

There is currently no such thing as an RPAS licence. For example, in the UK, the Civil Aviation Authority approves third party organisations to train and test potential RPAS pilots for Commercial (paid) work. The pilot certificates are not recognised outside the UK, and in many countries, they are not even needed.

The national aeronautical authority should be the organisation that covers both training and licensing of pilots. This will be through approved and designated local training providers, often referred to as a Qualified Entity.

There are a minimum number of core subjects in which training should be given such as:

- Air Law
- Human Performance
    - Height, depth and distance perception
    - Fitness to fly
    - Health and Safety
- Principles of Flight
- Navigation
- Aviation radio communications
- Meteorology
- RPAS knowledge and systems
- Operations Manual Design
- Flight Operations
    - Operational Procedures
    - Mission planning

[33] *http://www.theguardian.com/technology/2015/jul/28/amazon-autonomous-drones-only-airspace-package-delivery*

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

    - Operational Site Assessment
    - Risk Assessment & Management
    - Go-No go decisions
    - Crew coordination
- Pre flight checks
- Emergencies
- Performing set manoeuvres
- Post flight checks and actions
- Pilot log book and record keeping
- Evidence handling

In the Czech Republic, for example, there are private flying schools, which provide training in order to obtain the necessary flying permission for aerial works. The theoretical and practical examinations before the CAA Commissioner is a requirement for flying the pilotless devices. All permits in the Czech Republic are granted by CAA. Whilst some Member States and emergency services may consider using a specialised service provider or contractor to train pilots, some emergencies are partnering with other emergencies to train their RPAS pilots. For example, the training centre of Fire Rescue Service of the Czech Republic and Air Service of the Police of the Czech Republic will be used in the future.

Of course one of the key components of the training programme is the size of the RPAS involved as clearly the piloting skills for a LASE (Low Altitude Short Endurance) RPAS is different to a MALE (Medium Altitude Long Endurance) or HALE (High Altitude Long Endurance) RPAS; the core skills are there but from that point forward the skill requirement changes.

Special training should be followed for pilots that control other equipment while flying or cooperate with other equipment operators, since some missions may require the use of sensors or cameras to complete. Therefore, the pilot should either be controlling both the flight parameters and the extra equipment, or be focusing exclusively on flying the RPAS while the other operator is controlling extra sensors or cameras. In also considering the training of the pilot, we should consider also the training of the support team for the RPAS such as the maintenance engineers, ground crew teams and other similar supports.

In Spain and France, the RPAS devices require a brevet pilot. The experience of the military services could form a good point of reference across the range of RPAS. It is known that the military have achieved considerable success with LASE RPAS deployed on the ground with operators with minimal training; much experience has been gained through operators who are also proficient in "Gaming" applications. These applications now offer an excellent training/aptitude assessment and could be considered as a training resource remembering that the ability to coordinate hand-eye-cognitive reasoning is essential for flying of RPAS.

According to Spanish legislation, only pilots that have been qualified as RPAS pilot can operate RPASs. To be qualified you must demonstrate the knowledge of general aeronautical rules and the specific abilities to pilot a specific model of RPAS. The content is quite similar to obtain the licence of an ULM Pilot. Courses also include the completion of 10 hours flying time. The content of RPAS Pilot exams is:

- Aerial Legislation
- RPAS General Knowledge
- Performance and Flight Planning
- Meteorology
- Navigation
- Procedures and Operations
- Communications
- Human Factors
- Technical flight knowledge

In Australia the length of the training program comprises of an 11-step process. It is outlined in the figure below. This figure along with the instructions can be found on this link:
http://www.RPAStraining.com.au/remote-pilot

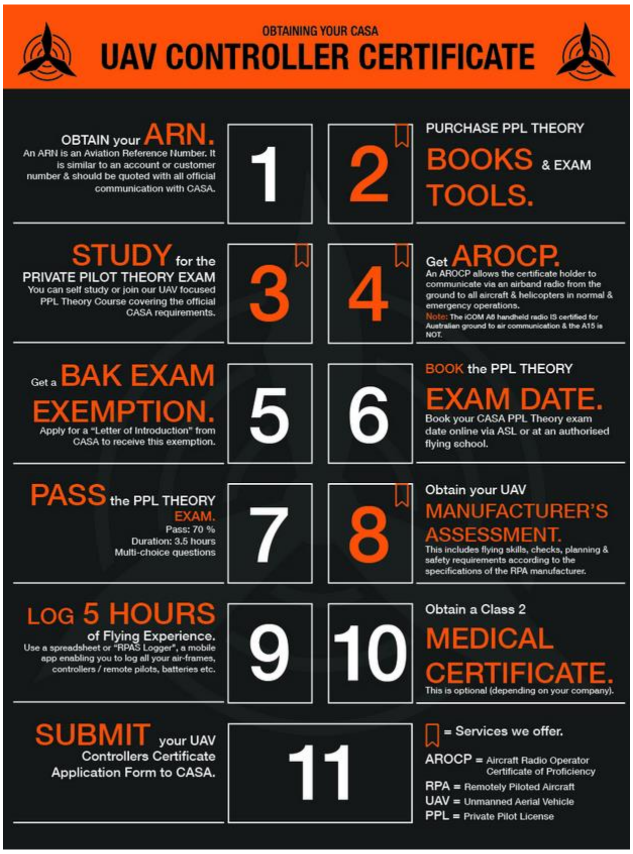


Figure 5 – 11 Step process for training RPAS Controller (Australia)

The steps that must be taken in Australia for obtaining the remote pilot certificate could form the basis here in Europe are outlined in the figure below. And the RPAS controller page with all the requirements is placed under this link:
http://www.RPAStraining.com.au/remote-pilot/uav-controller

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

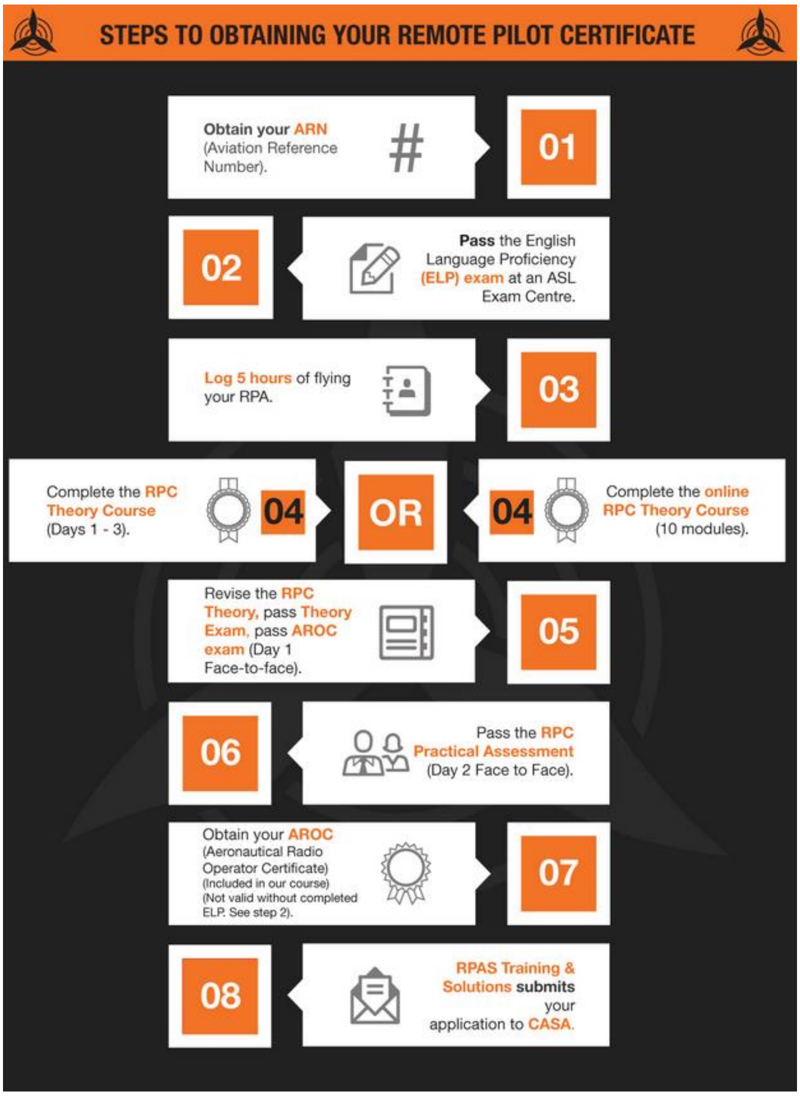


Figure 6 – Obtaining the remote Pilot Certificate (Australia)

7 Privacy and Safety

When dealing with RPAS, a number of privacy, ethical and data protection and safety risks arise. The European Commission has identified and documented the possible risks in order to better regulate their use[34]. These risks could restrict the potentials of the technology to achieve the desired outcomes. To mitigate these risks, strict guidelines are offered, including:

a) restriction of flight to only non-segregated airspace (meaning, not in the same airspace used by 'manned' air traffic), and obey of no flying zones (e.g., near airports and military camps);
b) restrict operation to regions where there are no members of the public and if the need arises to operate the RPAS in modes which do not allow for the identification of individuals in order to preserve privacy;
c) collect and store data that contains no personal information, such as weather data;
d) collect only data that is necessary for the particular purpose for which prior permission has been given by competent authorities, and delete that data when no longer deemed necessary.

RPAS pilots and emergency service organisations that use them should therefore observe and adhere to this legislation. By way of comparative example, CCTV cameras are being used by many emergency services (most Police services) in Europe and the therefore the same rules should apply.

The issue of citizen's privacy when RPAS are being used is a serious matter but is one that should be dealt with a degree of common sense. To that end, as there already exists extensive data privacy legislation in Europe, there is no requirement for any new specialised legislation.

7.1 Privacy

7.1.1 Current controls and obligations regarding privacy and personal data

EU MSs have adopted the protection of personal data regulations under Directive 95/46/EC principles and have created Data Protection Authorities. Its stated aim is to: 'The Directive aims to protect the rights and freedoms of persons with respect to the processing of personal data by laying down the key criteria for making processing lawful and the principles of data quality'.

'Data processing is only lawful if:

- the data subject has unambiguously given his consent; or
- processing is necessary for the performance of a contract to which the data subject is party; or
- processing is necessary for compliance with a legal obligation to which the controller is subject; or
- processing is necessary to protect the vital interests of the data subject; or
- processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller or in a third party; or
- processing is necessary for the purposes of the legitimate interest pursued by the controller or by the third party, except where such interests are overridden by the interests for fundamental rights and freedoms of the data subject which require protection'.

[34] http://ec.europa.eu/enterprise/sectors/aerospace/uas/ and the references therein.

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

'The principles of data quality, which must be implemented for all lawful data processing activities, are the following:

- Personal data must be processed fairly and lawfully, and collected for specified, explicit and legitimate purposes. They must also be adequate, relevant and not excessive, accurate and, where necessary, kept up to date, must not be stored for longer than necessary and solely for the purposes for which they were collected;

- Special categories of processing: it is forbidden to process personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, and the processing of data concerning health or other personal information. This provision comes with certain qualifications concerning, for example, cases where processing is necessary to protect the vital interests of the data subject or for the purposes of preventive medicine and medical diagnosis'.

Notwithstanding the current EU legislation on data privacy, the emergency services while using RPAS will follow the existing national legislation and would be obliged to do so under their current operations.

In some countries, the national legislation is very strict whilst in some member states it is less so. But it is not just still images that require careful consideration. All video and voice picked up by a RPAS and wirelessly transmitted need to be encrypted. There are substantial challenges regarding the protection of privacy and confidentiality for both patients and bystanders. Obtaining informed consent from patients or bystanders will at best be difficult but in most cases not possible and for example, children, unconscious and heavily injured adult patients lack the capacity to provide their consent.

It is not clear who will have the ownership of aerial recordings of patients and rescue workers in major incidents and who should have access to them but the respective national legislation should prevail.

There are current systems in road management that allow vehicle plate recognition or identifying hazardous materials. Similar technology and legislation can be used for RPAS in terms of privacy. In some cases, predefined routes can be created with specific field of view to overcome privacy issues that may occur.

Citizen's will probably expect to know if the RPAS belongs to the emergency services and this should be clearly made known, unless there are special circumstances that allow for this not to be revealed. Equally the communication with the command centre must be encrypted, protected and correctly stored.

7.1.2 Data ethics

When dealing with RPAS, data ethics issues arise. All information gathered from RPAS has to be based on best practice and to maintain ethical standards of practice; protect human subjects from harm; ensure that the practice of fully informed consent is observed; preserve the subjects' right and provide reassurance to the public and outside bodies that all the above are being done. The 2014 European Commission Report[35] on Privacy, data protection and ethical risks in civil UAV applications provides guidance for mitigating these risks by following best practices consistent human research requirements, including informed consent, minimising the amount of data collected, making the data anonymous, using data only for original purpose, and properly securing collected data.

Following also the Humanitarian UAV Network guidelines on data ethics (http://www.uaviators.org) certain principles have to be followed in terms of collection, usage, management and storage of data:

- Determine the needs of the data collection to identify appropriate data collection platform (RPAS data might be used in conjunction with other data sources)
- Collect and analyse data that is impartial and always with informed consent

[35] *Finn R. L., Wright D. and Donovan A., "Privacy, data protection and ethical risks in civil RPAS operations: D3.3: Final report for the European Commission", Trilateral Research & Consulting, LLP, Laura Jacques and Paul De Hert, Vrije Universiteit Brussel, 07 November 2014.* http://ec.europa.eu/DocsRoom/documents/7662

- Avoid collection, storage and sharing information that might be sensitive
- Identify who will own and store the data and the standards that are being used
- Plan for responsible storage, sharing and discarding the data collected ensuring security of transmission and storage
- Conduct a risk assessment before deploying taking into account the data to be collected and the tools to be used
- The potential of loss of data needs to be managed responsibly: collect, store, share and discard data ethically using a needs-based approach, applying informed consent
- The potential for information to put individuals or communities at risk if shared or lost must be assessed and measures taken to mitigate that risk (e.g. limit or cease collection or sharing).
- Ask representatives/stakeholders for guidance on data privacy/protection preferences and use best judgment. Schedule public meetings sharing the results of the mission, any incidents/accidents and imagery collected. Explain the process for data removal

7.2 Safety

Safety concerns are in particular expressed by pilots of manned aircraft (commercial, general aviation and military) who highlight that flying very low does not mean that the risk of collision with other manned aircraft is zero. They argue that there is a quite significant traffic below an altitude of about 150 m: military, police, emergency helicopters, recreational aviation. Their concerns are acknowledged and the following measures can alleviate them: RPASs give the right of way to all other aircraft, minimum level of competence for the RPAS pilot, awareness campaigns for pilots and operators, operations in Visual Line of Sight (VLOS). The objective of safety regulations for RPASs should be to minimize the frequency of occurrence of mid-air collision with manned aircraft; harm to people; and damage to property, in particular to critical and sensitive infrastructure.

A series of important pre-conditions still need to be addressed and met in order to ensure that RPASs do not pose serious risks for citizens' fundamental rights, and notably for privacy and data protection, security and safety. These issues could be resolved through a clear and complete regulatory framework, addressing the whole "RPAS chain" and guaranteeing safety, security, privacy and data protection, environmental protection, responsibility and liability, law enforcement action, insurance, identification and transparency. The technological developments and a clear plan for regulatory and legislative action that could allow the safe and secure integration of RPAS into the civil aviation system still seem to be lacking.

In order to fully gather the views of all interest stakeholders when it comes to safety issues should be taken into account. This includes for example industry, the Commission, working groups and other aviation-related agencies authorities, citizens representatives, civil society, NGOs, as well as the Fundamental Rights Agency, the European Data Protection Supervisor, the Working Party Article 29, and Data Protection Authorities. Such discussion would allow legislators, such as the European Parliament and national parliaments, to gather further information and opinions and elaborate its position, including on the future proposals on RPASs.

Aircraft, both manned and unmanned, will always be at risk of collisions with air obstacles like high voltage cables, high-rise buildings, other aircraft and telephone masts, especially when operating at low altitude and in confined areas. If an unmanned vehicle comes into conflict with a manned aircraft there is a considerable risk that both will crash. To avoid these kinds of accidents RPAS need to be equipped with a transponder, strobe lights or traffic collision avoidance systems as a minimum. The RPAS pilot should also be able to communicate with other aircrafts and traffic control although such an infrastructure may take some time to implement.

Turbulent winds can make it difficult to manoeuvre small RPAS. Operations at low altitudes and in confined areas in turbulent winds may result in collisions and crashes and the falling RPAS may hit people on the ground. In addition, the fast rotating rotor blades can cause injuries if they come into contact with bare skin.

A common solution to avoid the issue of falling RPAS is the installation of safety parachutes to the RPAS that could ensure a smooth landing and prevent further accidents in case of emergency.

Due to the characteristics and limitations of RPAS, all risks shall be mitigated to achieve at least an equivalent level of safety to the one in place before integration of RPAS with manned aircraft in low-level operations. Where necessary, the rules should be amended, and should be proportional to the classification and place of RPAS operation. As the minimum level of safety for airworthiness is based on the safety risk assessment, the utilization of certified components compliant with aviation industry standard should be considered.

When integrating RPAS in common airspace, the new rules should not put additional burden on manned flight operations. As a general rule, the operation of RPAS should neither deny airspace nor require additional procedures or equipment for manned aviation.

The emergency services are also concerned about the possibility that their RPAS could be jammed or hijacked and what steps they could take to reduce this risk. There are solutions on the market that provide such service and therefore such a risk should be a big issue to overcome.

7.3 Recommendations

On Safety:

- Ensure that RPAS device must have frame for rotor protection to ensure that the rotors does not hurt people. There are even RPAS devices that can normally react to soft hand touch in the frame for rotor protection. This requires the input of the RPAS manufacturers and designers.
- Ensure that RPAS device has a proper identification which can let anyone understand the RPAS purpose;
- Ensure that RPAS device has a proper encrypted connection between the device and its central control and that such connections are jam-proof and hack-proof;
- A proper video connection with the central connector ensure a better control of the RPAS device;

On Privacy:

- Legislation already exists regarding this area. The only consideration here is that RPASs represent a new risk (easier to break the law). Enforcement authorities should have tools to make sure every activity respects the law.

8 Overall EENA recommendations

Stakeholders	Actions
European Authorities	Ensure that the use of RPAS by the emergency services are permitted and that the EU legislation in place is flexible, easy to implement and robust. The emergency services should be given exemptions to use RPAS whilst carrying out their statutory duties. A database of reporting accidents or "near-miss" incidences should be established and managed by a European authority, as well as a process to identify each RPAS and the registered pilot. A registration system linked to mandatory training and licensing of pilots should be implemented.
National Governments	Nominate the national organisation, which can certify the RPAS devices and how they can be used and integrated in the National emergency system. The national legislation should also be flexible and easy to implement, including the necessary privacy and safety requirements. Such safety requirements must include provisions to protect the emergency services and citizens alike.
National / Regional Authorities	Should ensure that the emergency services receive the level of investment needed to acquire and operate their RPAS fleet and that they are supported in full.
Emergency services	Should ensure that all the necessary safety steps, including the training of pilots, are taken and any risks identified are mitigated. Emergency services should also reach out to their national authority responsible for RPAS and communicate their requirements. For the security of the data created during the RPAS operation, the emergency services should ensure that it is secure and treated in accordance with the respective privacy legislation. Furthermore, an operations manual for using RPAS by the emergency services may be needed; EENA in conjunction with other stakeholders will evaluate taking the lead in this item. In addition an inventory of Use Cases where the emergency services are using RPAS should be compiled. EENA will take the lead in this item.

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

RPAS Manufacturers and Software Providers	Should ensure that the requirements of the emergency services are taken into account when designing the RPAS and the functionality, security, safety and capabilities are in line with those requirements. RPAS hardware and software providers should therefore engage in proactive studies to understand the emergency services users requirements.

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

Annex A – Country examples of RPAS rules

	Governing body	Regulations	RPAS Types	Registration	Permission	Pilot qualification	Overfly congested areas	Line of sight
United Kingdom	Civil Aviation Authority UK (CAA)	Air Navigation: the Order and the Regulations	20 kg and less, more than 20 kg up to and including 150 kg	No 20 kg and less Yes more than 20 kg yes	No if not overfly people or properties	Yes	Prohibited	VLOS always
Ireland	Irish Aviation Authority (IAA)	Irish Aviation Authority (Rockets and Small Aircraft) Order, 2000. Aeronautical Notice O.63	Less than 20 kg	No	Yes	Yes	Prohibited, except with the written permission of the Authority	VLOS always
Denmark	Civil Aviation Authority Denmark (CAA)	Danish Air Navigation Act, cf. Consolidation Act no. 543 BL 9-4. Regulations on unmanned aircraft not weighing more than 25	General regulation: until 25 kg Special regulation: over 7 kg and under 25 kg	_	_	_	Prohibited	_
Sweden	Swedish Transport Agency	Article 131 of the aviation ordinance (1986:171) The STA´s regulations on unmanned aircraft systems (UAS)	Category 1A: less or equal to 1,5 kg Category 1B:from 1,5 kg to 7 kg Category 2: more than 7kg Category 3:	Category 1 and 2 yes	Yes	Yes	Prohibited	Category 1A, 1B and 2: VLOS Category 3: BVLOS

			unmanned aircraft which is certified to fly and be controlled					
Spain	Agencia Española de Seguridad Aérea (AESA)	Ley 48/1960 Ley 18/2014	Less than 2 kg Until 25 kg More than 25 kg	From 25 kg to 150 kg	Yes	Yes	Prohibited	VLOS always, except UAV less than 2 kg that needs a NOTAM to fly BVLOS
Italy	Italian Civil Aviation Authority (ENAC)	Art. 743 of the Italian Navigation Code Regulation Remotely Piloted Aerial Vehicles	Equal or less than 25 kg More than 25 kg	From 25 kg to 150 kg	Yes	Yes	Prohibited	VLOS always
Austria	Austro Control	Luftfahrtgesetz (LFG)	Under 25 kg From 25 kg to 150 kg	Yes	Yes	Yes	Prohibited	VLOS always
Netherlands	Inspectie Leefomgeving en Transport	Informatiebulletin lichte onbemande luchtvaartuigen UAS – unmanned	Equal	Yes	Yes	Yes	Prohibited	VLOS always

		aircraft systems	or less than 150 kg					
Switzerland	Federal Office of Civil Aviation (FOCA)	Verordnung des UVEK über Luftfahrzeuge besonderer Kategorien	Less than 30 kg More than 30 kg	_	No if less than 30 kg	_	Prohibited, however, FOCA grant exemptions	VLOS always, however, FOCA grant exemptions
Norway	Civil Aviation Authority Norway (CAA)	Aeronautical Information Circular (AIC) 14/13 20 June	_	_	Yes	Yes	_	VLOS and BVLOS

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org

Annex B - Summary report on the EASA Proposed Amendment

The following report is drafted according to the Advanced Notice of Proposed Amendment 2015-10 (A-NPA 2015-10):

Although safety is ensured through dedicated legislation in many EASA MSs, the current situation is not fully satisfactory for two reasons:

1. EASA MSs' legislation is not harmonized and there is no obligation on mutual recognition of certificates. This means that a RPAS operator authorized in one Member State must obtain another authorization in another Member State if wishing to operate there.
2. The current legislation in EU is based on the assumption that small RPASs operating locally, which is largely true today. However, there are small RPAS that can fly very high or can operate at long distances from their base. Operation of such RPAS would affect several EASA MSs and, therefore, would need multiple authorizations. In addition, such RPAS are likely to be complex as they possess a significant level of autonomy and some EASA MSs may not have the competence to address this complexity and the cross border impact.

The European Commission, the European Parliament and the Council of the European Union are calling for the safe, secure and environmentally friendly development of the RPAS industry as it will bring about employment, growth and technological development, while respecting at the same time the public concerns about privacy and data protection. This support has been expressed in the Declaration which was adopted following a Summit organized during the Latvian Presidency in Riga in early March 2015.

The following principles were identified as the main drivers for a European regulatory framework :

- RPASs need to be treated as new types of aircraft with proportionate rules based on the risk of each operation.
- EU rules for the safe provision of RPAS services need to be developed now.
- Technologies and standards need to be developed fort the full integration of RPASs in the EU airspace.
- Public acceptance is key to the growth of RPAS services.
- The operator of a RPAS is responsible for its use.

To ensure a safe, secure and environmentally friendly development, and to respect the citizens' legitimate concerns for privacy and data protection, EASA has been tasked by the European Commission – following the Riga Conference and its associated Declaration – to develop a regulatory framework for RPAS operations as well as concrete proposals for the regulation of low-risk RPAS operations. Both aspects are included in this consultation document together with a chapter containing background information. Following this consultation, which ended on 25 September 2015, the Agency will submit a technical opinion to the European Commission by the end of 2015.

EASA developed the Advanced Notice of Proposed Amendment 2015-10 (A-NPA 2015-10) in line with Regulation (EC) No 216/2008 and the Rulemaking Procedure. The text of this A-NPA has been developed by the Agency based on the inputs of the Joint Authorities for Regulation of Unmanned Systems (JARUS), and numerous meetings and workshops with the EASA MSs, RPAS industry and operators as well as 'manned aviation' stakeholders.

The A-NPA reflects the principles laid down in the Riga Declaration. It introduces three categories of operations as already proposed in the published EASA Concept of Operations for RPASs:

1. **'Open' category (low risk):** is low-risk and simple-RPAS operation, where the risk to third parties on the ground and to other airspace users is mitigated through operational limitations, compliance with industry standards, requirements on certain functionalities, and a minimum set of operational rules. Enforcement shall be ensured by the police. The main features are:
    - Not require an authorization by a NAA for the flight.
    - Upper limit of 25 kg for the mass of RPASs. In theory, depending on the density of population, heavier RPASs would not significantly increase the risk, but a practical limit need to be established.
    - Always Visual Line of Sight (VLOS), maximum altitude and minimum distance with respect to uninvolved persons on the ground.

- Subcategories to allow for a more flexible adaptation to the risk. CAT A0: 0 to 999g; CAT A1: 1 to 3,99 kg; CAT A2: 4 to 25 kg.

2. **'Specific' category (defined risk):** as soon as an operation starts posing more significant aviation risks to persons overflown or involves sharing the airspace with manned aviation, the operation is placed in the 'specific' category. This category will require an authorization by National Aviation Authorities (NAAs), possibly assisted by a Qualified Entity (QE) following a risk assessment performed by the operator. A manual of operations shall list the risk mitigation measures. The main features are:
    - Require an authorization by a NAA for the flight.
    - Expect operations of RPASs Beyond the Visual Line Of Sight (BVLOS).
    - Fly above densely populated areas, like city centres.

3. **'Certified' category** (higher, non defined risk): when unmanned aviation risks rise to a level similar to normal, manned aviation, the operation would be placed in the 'certified' category of operations. This means your operation will be risky, but you don't know exactly where and how. Therefore, you need to be prepared for any possible incident. Requirements are comparable to manned aviation ones (less restrictive since there is no one onboard). Oversight by NAAs (issue of licenses and approval of maintenance, operations, training, Air Traffic Management (ATM)/Air Navigation Services (ANS) and aerodrome organizations) and by EASA (design and approval of foreign organizations).

*The delimitation between 'specific' and 'certified' category may not be easily expressed in terms of weight as it is related to the applicability of the safety risk assessment process so there is a critical line between the two categories. The main difference is that "Specific" category has defined risks that can be evaluated and mitigated with extra measures. "Certified" is meant for operations with uncertain destinations or without specific flight plans. Here the risk of encountering any kind of unexpected incident is higher and operators need to be ready to ensure safety.

This regulatory framework:

- Will encompass European rules for all RPASs in all weights classes so proposes that all RPASs be regulated at EU level. Therefore, the arbitrary limit of 150 kg would disappear. The reason for this scope is that operators have asked for such harmonisation.
- Is based on the risk posed by RPAS operations. The following safety risks must be addressed: mid-air collision with manned aircraft; harm to people; and damage to property, in particular to critical and sensitive infrastructure. The level of risk depends on: the energy and the complexity of the RPAS (kinetic and potential energy); the population density of the overflown area; and the design of the airspace and density of traffic. The requirements associated with each category are tailored to the risk associated to each category.
- Applies to both commercial and non-commercial operations as the identical RPAS might be used for both commercial and non-commercial activities with the same risk to uninvolved parties. This approach affects mostly model aircraft practitioners and the 'open' category RPASs. The intention is to develop rules for the 'open' category that will not affect model aircraft flying.
- And its categories have been established with the idea that a company would start to operate in the 'open' category with small and simple RPASs in operating conditions that pose very low risk and as its experience increases to move more progressively to the 'specific' and 'certified' category with more complex operations.

European Emergency Number Association – EENA 112
Avenue de la Toison d'Or 79, Brussels, Belgium
+32/2.534.97.89 | info@eena.org