Roadmap for the integration of **civil Remotely-Piloted Aircraft Systems** into the European Aviation System

Final report from the European RPAS Steering Group

ANNEX 3

A study on the societal impact of the integration of civil RPAS into the European Aviation System

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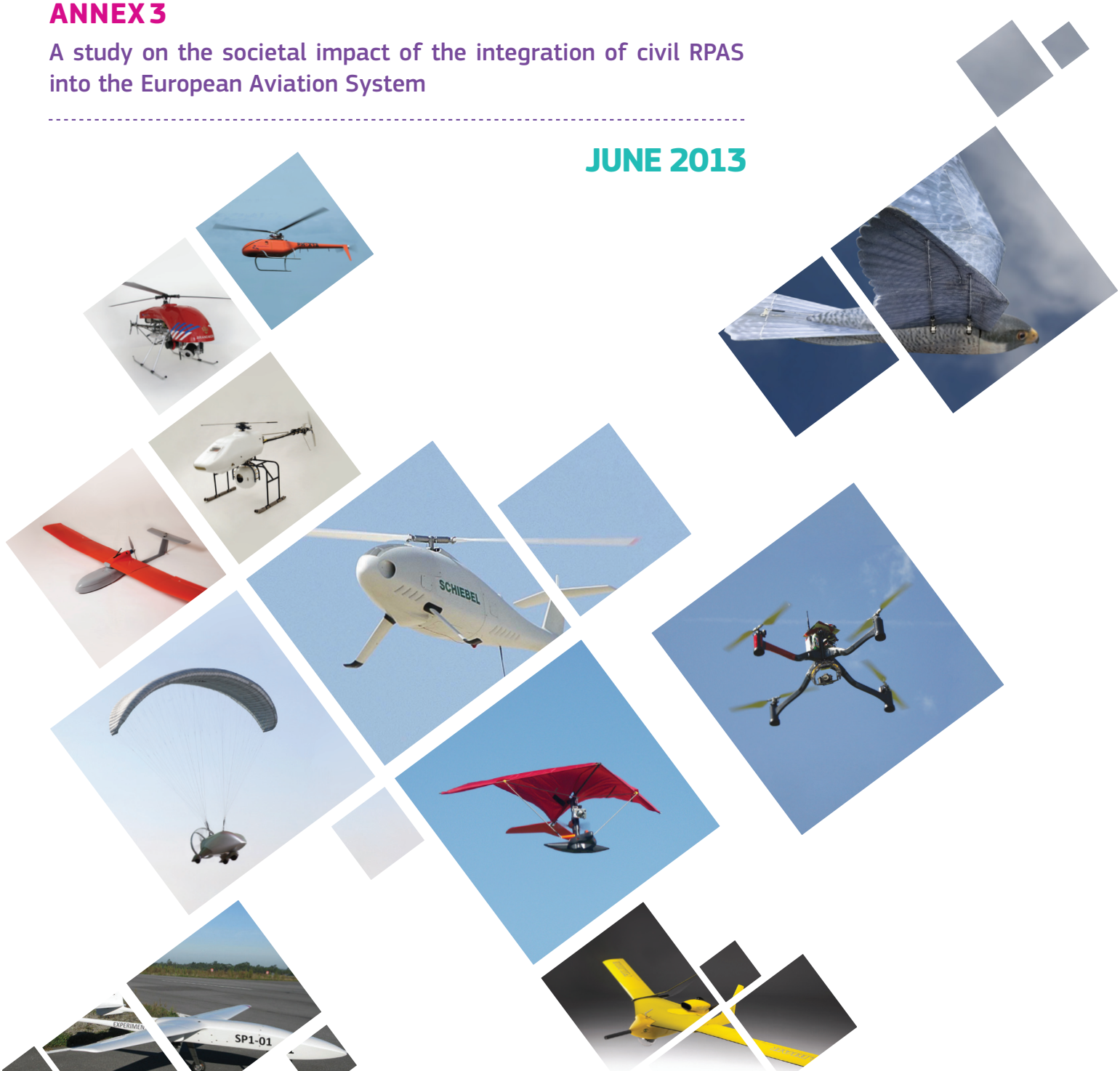

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Contents

1 EXECUTIVE SUMMARY

This third annex to the RPAS Roadamp provides a first analysis of the impact the development of RPAS aplications could have on the society. The main topics addressed include:

- In case of accident: liability (incl. issues like enforcement, impact of automation) and insurance;
- The protection against abusive use: privacy, data protection, security;
- Public acceptance of RPAS applications: benefits, acceptable risks/safety, end-user forum, demonstrations, etc.

It aims at providing the EC with preliminary views on some of the actions that might be required to address RPAS impact, allowing the society benefitting from this innovative technology, while minimizing potential threads.

The 1952 Rome Convention on damage caused by foreign aircraft to third parties on the surface may need to be amended in order to cover RPAS. This convention, signed by only 10 EU MS, establishes the liability of the aircraft operator and facilitates the resolution of international cases. However, although this study estimates that adaptation of the Rome convention could be a long-term objective, advice on how to do this would be certainly useful. This study investigates if liability issues exists in the case of purely national activities - in particular in countries not signatory of the Convention - and suggest ways forward.

Information is given on the overall legal framework defining responsibility/liability at national and international levels.

Insurance rates are very high at the moment due to the fact that insurance companies lack reliability data on RPAS. The study makes proposals on how to improve insurances' knowledge about RPAS related risks (safety data, accidents, reliability etc.) in order to help developing an adequate insurance offer. The study would define the problem related to the current Regulation (EC) No 785/2004 on insurance requirements for air carriers and aircraft operators and identified by the fitness check conducted by DG MOVE.

RPAS are covered by the Directive 95/46/EC on the protection of individuals with regard to the protection of personal data and on the free movement on such data ("data protection directive") and by two new Commission proposals in this area, COM (2012) 0010[1] and COM (2012) 0011[2]. The study analyses these proposals, identifies the practical consequences for RPAS, their added value compared to the current directive (in particular of the proposal for a directive on use by police, etc.) and possible gaps. It also studies more precisely how the privacy protection (right to collect the data) is covered by this new regulation and identifies possible complementary actions (if needed).

The discussion on the impact of automation on liability allowed clarifying that RPAS are never autonomous but deterministic (they never take a decision by themselves and no randomness is involved in the RPAS decision process). In some cases (in degraded mode) the flight might be automatic (following a decision tree embedded in a software designed by a human responsible for its conception). In consequence the relevance of this issue to RPAS is limited to the liability of manufacturers or software producer (problematic in case of open source software). The study clarifies if any specific action is required on this issue.

Benefits for citizens highlight the possible use of RPAS for civil protection and environmental monitoring. Industry insists on the need to develop specific rules allowing these applications to develop. The study also proposes ideas to increase public awareness on the benefits of RPAS.

2 LIABILITY

2.1 Liability provisions at international level

While the military RPAS market has been steadily growing, civil RPAS applications have developed quite slowly due, at least in part, to the lack of a regulatory framework. The civil use of RPAS could be significant and extensive: policing activities, traffic management and monitoring, fisheries protection, pipeline surveying, coverage of large public events, border patrol, agricultural management, power line surveying, aerial photography, global environmental monitoring and security related operations (GMES).

Liability for damage to persons or property that can occur as a result of an incident caused by a RPAS requires a number of issues to be resolved, such as identification of the ***applicable law(s)*** and of the ***liable party***. For this reason, it should be decided ***whether the Rome Convention of 7 October 1952 could be considered applicable to incidents involving RPAS.***

The Convention does not contain any reference to RPAS. Furthermore the Convention is not well supported with only 49 parties (out of 190 countries) having ratified it. Although several EU Member States have signed the Convention, many of these (including UK, France and The Netherlands) have not ratified it, and Germany has not signed it at all. Only 12 parties have ratified the 1978 protocol and these do not include any EU Member States or any of the other largest aviation markets, such the United States, China or Japan. ***However, in some cases, its regulations have been considered applicable to all kinds of vehicles, including spacecraft, provided they are 'usable for transport'.***

Whenever the notion of aircraft is interpreted broadly (as is the case with the 1944 Chicago Convention and Regulation 216/2008/EC), the set of regulations contained in

the *1952 Rome Convention* may apply taking into consideration the above-mentioned principles, which suggest the application of the existing rules duly, adapted to the RPAS applications. The Italian legislator, for example, has come to the same conclusion: the recently reformed air navigation code does not exclude the application of the regulations in question to RPAS.

Applying the same set of regulations on civil liability for damages caused to third parties to RPAS raises another question, which is the ***identification of the liable parties.*** The traditional approach to this involves *distributing liability between the pilot in command of the aircraft and its operator.* The pilot is usually liable under public law, as legal systems generally impose on the person in physical control of the aircraft responsibility for the observance of such obligations. In contrast, the liability for any other obligations, whether contractual or extra-contractual, is on the operator. ***In this perspective, the Rome Convention places the liability for damage to third parties on the operator.***

Therefore, considering the complexity of RPAS, it is vitally important to make a clear distinction between the person who has the authority to direct a flight (RPAS pilot in command) and is responsible for the operations of the aircraft in accordance with the rules of air, and the legal entity operating an RPAS (RPAS operator).

Nonetheless, it is generally accepted that an *RPA must be seen as a single entity.* In keeping with this concept, the roles of the RPAS operator and pilot in command must be defined in terms that make the application of the existing convention possible**.** The traditional approach to this involves distributing liability between the pilot in command of the aircraft and its operator. The pilot is usually liable under criminal law, as legal systems generally impose responsibility for the observance of such obligations on the person in physical control of the aircraft. In contrast, the operator is usually liable under civil law.

In fact, EU institutions have clearly suggested considering the RPAS as a single entity (RPA, control stations, RPA system elements such as communication links, launch and recovery equipment etc.) while creating a set of regulations for this kind of aircraft. As a consequence of this concept, the roles of the RPAS operator and pilot in command must be defined in relation to the system. The figure of the pilot can be identified as the subject to whom is entrusted the command of one or more aircraft owned or at the disposal of the operator. However, the matter is still debated and some RPAS experts have recently suggested considering the RPA and the ground station as two separate entity.

In this perspective, the liability for damages caused on the surface by an RPA crash should be attributed to the operator, that is, the person or entity that, on the basis of Article 2 of the Rome Convention, set up the RPA system, ensures its functioning and makes known his or its status as operator so that the aircraft's registered owner is not wrongly presumed to be its operator.

Determining the operator's liability is made regardless to personal responsibility (negligence or wilful misconduct). Therefore, it is strict liability based on the risk of a lawful activity. The regulation relating to the liability for damages to third parties on the surface is applicable any time an aircraft's fall causes damages to persons or property, even for reasons beyond the operator's control. In these cases the operator is liable on the basis of a ***strict liability regime*** (which is alleviated by some exceptions listed in the same Convention).

The application of the Rome Convention, based on the aircraft operator's *strict liability*, does include a *debt limitation scheme* for incidents. The Convention establishes the amount of financial compensation to be paid on the basis of the weight of the aircraft that caused the damage. This is another aspect that must be dealt with in any future legal framework as even a 'light' RPAS could cause a considerable amount of damage. ***Therefore the compensation mechanism based on the weight of the aircraft is not suitable for determining the debt limitation for damage caused by the RPAS operator and should be designed expressly for RPAS.***

The principle of applying to RPAS international regulations adopted for manned aircraft, especially those regarding safety, has been accepted within the EU and internationally. This approach implies that other international regulations may be applicable, such as the ***Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation*** signed in Montreal on 23 September 1971, the ***Montreal Convention of 28 May 1999 for the Unification of Certain Rules for International Carriage by Air*** and the more recent Cape ***Town Convention of 16 November 2001***. These conventions, however, do not apply to military, customs or police aircraft.

The 1999 Montreal Convention was the first international instrument with recognized general support (currently, 103 countries) to provide for compulsory insurance against the liability of an air carrier for damage sustained by passengers, baggage or cargo. However, the requirement was only to maintain "adequate insurance" with respect to liability under the Convention.

The Cape Town Convention aims at creating specific international protection, fully applicable in all Member States. The convention provides for the constitution and effects of an international interest in certain categories of mobile equipment and associated rights.

In the case in question, on the occasion of the approval of the Convention, an aircraft protocol was signed; as a result, those regulations created for conventional aircraft may now also be considered for application to RPAS. In the aftermath of 11 September 2001 and the activation by war risks insurers of the clause providing seven days notice before cancellation of the policies, ***ICAO undertook an initiative to reconsider the 1952 Rome Convention.*** The working groups understandably gave much attention to the introduction of a regime to deal with terrorism, ultimately producing two separate

Conventions: Convention on Compensation for Damage Caused by Aircraft to Third Parties and Convention on Compensation for Damage to Third Parties Resulting from Acts of Unlawful Interference Involving Aircraft, done in Montreal on 2 May 2009. The latter included a scheme to develop a permanent fund managed for the purpose of compensating loss caused by terrorist activity. However, these Conventions were opened for signature in 2009 and have not yet come into force on account of lack of sufficient support - and it seems unlikely that they ever will. No EU Member States, or any of the other countries with the largest aviation markets, have signed either Convention. These Conventions should be taken into consideration as RPAS could be used for terrorist activity.

2.2 Liability provisions in national law of Member States

Liability can be *strict* or based on *fault* of the operator. Under a *strict liability* regime, no negligence of the operator needs to be proven, whereas with *fault-based liability*, an operator will only be found liable if some form of negligence is established. In the first case of strict liability, it can be limited by a *cap* on the potential level of compensation, while in the case of fault-based liability there is no theoretical cap on the amount of damage for which defendants are potentially liable (although compensation will in practice be limited to the value of an airlines' insurance policy combined with its total liquidated assets).

The liability attributable to an aircraft operator according to the existing national provisions in the EU Member States is generally based on the principle of ***strict liability regime* with a limiting *cap*.**

The table below provides an overview of the different *third-party liability regimes* that exist in some Member States for aviation matters. There are some important differences between the regimes of the Member States surveyed and we would expect the same to be the case for the remaining EU Member States.

Member States	**Strict or fault based**	**Applicable limits**	**As defined in**
France	Strict	Unlimited	Civil Code
Germany	Strict	Limited except where the carrier is negligent	-
Italy	Strict	Limited except where the carrier is negligent	Italian Navigation Code, Article 971

Netherlands	No detail provided	No detail provided	Civil Code
Poland	Both	Unclear	-
Romania	Strict	Limited except where the carrier is negligent	Civil Code
Spain	Strict	Unclear	-
UK	Strict	Unlimited	Section 76(2) of the Civil Aviation Act 1982

Note: In the case of Poland, the CAA indicated that it is difficult to summarize the Polish third party liability regime in a one-word expression as the system is unique, complex and every case is individually investigated (among others it can be fault-based or risk-based liability). Similarly, whether the liability is limited or unlimited cannot be determined in general terms.

2.3 Applicability of space law to RPAS

2.3.1 *Space Law and RPAS*

The *corpus iuris spatialis* makes no reference to the use of data collected from space objects or to liability arising from the unlawful use of such data. Moreover, the existing legal framework is ill suited to regulate the use of RPAS controlled via satellites.

The absence of a comprehensive regulatory framework within the EU is another critical shortcoming, which might cause serious problems in future, especially in light of the discrepancies between the laws of Member States on limitation of liability and authorization.

Moreover, the Commission should take into consideration the implications of ***damage caused by a RPAS due to the malfunctioning of the satellite, which was controlling it***. In such a scenario, it would be in theory possible to invoke the absolute liability of the launching State (pursuant to Article II of the 1972 Liability Convention) to stave off a private liability action.

Such an occurrence would raise the issue of the possible competing liability between the satellite controller and the RPAS operator, complicated by the liability of the launching State pursuant to the Liability Convention.

Space Law may also have momentous implications for the data collection uses of RPAS, since international customary practice recognizes principles such as the freedom of access to outer space (without prior authorization) and the freedom of observation over any territory: principles which might potentially be at odds with national legislations and codes of conduct regulating the use of RPAS.

2.3.2 *Damage caused by failure of a space object or service*

A space sector that presents similar problems to RPAS is the GNSS (Global Navigation Satellite System).

Considering GNSS's potential global scope, the risk of damage caused by a malfunctioning of the satellite system is significant. The absence of an international uniform law causes a number of problems. Such problems include the risks of multiple applicable jurisdictions, the difficulty and costs of identifying the responsible party, uncertainty relating to the notion of reimbursable loss, the introduction of effective loss recovery mechanisms, and difficulties in coordinating with existing convention regimes.

Analysis of the convention scenario concerning uniform civil liability rules highlighted a set of well-consolidated approaches in practice on an international level. The European Commission has already examined the possibility of designing a specific regime for civil liability for loss deriving from GNSS services, collecting several opinions from Member States that will be useful for future regulations on this matter. The above mentioned regime should include: the strict liability rule; liability channelling; limit to liability; compulsory insurance for at least the limit of liability; the provision for supplementary compensation to guarantee satisfactory reimbursement of losses; and the criteria for identifying the applicable jurisdiction.

2.4 Automation and liability

The legal basis of liability for the design, construction and use of Remotely Piloted Aircraft (RPA) has still to be clearly defined. Although no lawyer doubts that strict liability rules apply to the field, today's debate on regulatory frameworks for RPAS should take into account previous debate (and case law) on automation and liability, much as sound methodological approaches suggested over the past years, *e.g.*, Herbert H. Simon's remarks in his classical text *The Sciences of Artificial*. Whilst different ways of dividing responsibilities and functional components of RPAS are at stake, focus should preliminarily be on different kinds of RPAS with their multiple uses, along with distinct types of responsibility that concern multiple potential defendants. On this basis, we should distinguish between:

a) Autonomous and semi-autonomous RPAS. For example, according to the UK Defence Standards definition, flight is autonomous when it is "independent of real time RPA-pilot control input" Here, the focus of the analysis is restricted so as to dwell on liability for the design, construction and use of semi-autonomous RPAS;
b) Responsibility for military and civilian use of RPAS, which includes responsibility for their use for domestic law enforcement. Consider immunity of military commanders, political authorities and liability of private contractors, *e.g.*, the US Federal Tort Claims Act, 28 U.S.C. §§ 2401 b and 2671, which bar lawsuits involving discretionary law enforcement functions and different types of intentional torts that, nevertheless, do not extend to US federal contractors. Here, attention is drawn to matters of liability in connection with traditional categories of the civilian use of RPAS covered by insurance policies such as "limited commercial," "business or pleasure," and "industrial aid";
c) Responsibility in the fields of criminal law, contracts, and torts. In this context, it is not necessary to dwell either on clauses and principles of criminal law in all its forms, such as international and national criminal laws, laws of war, international humanitarian law, or human rights law, or on contractual obligations that depend on the voluntary agreement between private individuals that a court will enforce. Rather, focus is on obligations between private persons imposed by the government so as to compensate damage done by wrongdoing, that is, what common lawyers call "torts";
d) A panoply of potential defendants that should be taken into account when dealing with issues of responsibility for the design, construction, and use of RPAS: software engineers, computer scientists, manufactures, maintenance and safety contractors, air traffic controllers, pilots, operators, further contracting parties, and so forth.

By restricting the attention upon the civilian (rather than the military and domestic law enforcement) use of RPAS, in connection with tortuous (rather than criminal or contractual) liability rules that concern designers/software engineers, manufacturers and operators of such semi-autonomous unmanned systems, what are then the legal challenges of RPAS?

A first lesson learned from case law on automation and liability suggests that evidence on "legally sufficient conditions" under strict liability rules does not exclude ***further kinds of responsibility for the design, construction, and use of RPAS.*** This means, on the one hand, that legal systems establish responsibility on the basis of evidence from which a rational finder of fact could find in his favour a "sufficient connection" between the problems with the system and the plaintiff's damages under the strict liability regime.

On the other hand, in addition to strict liability rules for RPAS operators, there are different types of liability for RPAS manufacturers, such a ***strict product and malfunctioning liability, as well as vicarious liability that involves further claims of***

negligence related to designers and engineers of RPAS. In light of a number of critical issues that are still open, *e.g.*, whether the higher malpractice standard for professional liability purposes is applicable to software engineering and RPAS design, let us follow the traditional distinction between valid law and the facts of the case, so as to address matters of liability and legal causation separately.

To start with, terms or conditions of the law should not contradict scientific evidence on natural events and, yet, the explanatory power of science is most of the time insufficient to clarify matters of legal responsibility. The same facts can obviously be harnessed by different legal systems in divergent ways and, moreover, multiple criteria for defining the notion of causation have been developed by different legal cultures. For example, German lawyers mostly refer to the theory of the adequate event, whereas French scholars follow the theory of the strict accountability of those events.

In the US, lawyers are *vice versa* divided between advocates of the but-for test and the necessary-condition test, namely, between those arguing that the action at issue in the circumstances must be necessary to the outcome, and those claiming that the action at issue instead must be a necessary part of a set of conditions sufficient for the outcome. Since ancient Roman law, legal responsibility has rested with the Aristotelian idea that we should take into account ***id quod plerumque accidit*** in the physical domain, that is, to consider that which generally happens as the most probable outcome of a given act, fact, event or cause. As a result, letting aside the hard cases of the law on matters of factual evidence, focus should be on the criteria for selecting from the entire chain of events the specific condition, or the set of conditions, that best explains a given outcome, such as ground damage, air-to-air collisions, communication interferences, or control loss.

So far, it is well known that civil aviation authorities have been reluctant to permit RPAS to share the same airspace as commercial traffic. The reluctance of civilian aviation authorities hinges on two main reasons, that is the limits of the current legal framework and safety concerns. Simply put, state of the art technology suggests that the risk for using RPAS is still unacceptable, because such systems should be deemed as an "ultra-hazardous activity," much as traditional aviation was conceived of in the 1930s. In the military field, some experts reckon that notwithstanding technological advancement, training or safer operations under peacetime conditions, RPAS security "needs to improve by one to two orders of magnitude to reach the equivalent level of safety of manned aircraft": this is what Peter Singer estimates in ***Wired for War*** (2009). Such poor figures certainly characterize the civilian use of RPAS as well. Remarkably, the American National Transportation Safety Board ("NTSB") examined some cases of domestic RPAS mishaps between 2006 and 2008, which "didn't help the industry's reputation," as Geoffrey Rapp's stresses in *Unmanned Aerial Exposure* (2009), quoting Stew Magnuson. From this state of affairs, it follows that today's legal framework, which applies to the civilian use of RPAS, hinges on strict liability rules, rather than negligence-related liability clauses, since strict liability rules traditionally represent the proper technique to

scale back such kind of risky activities. In light of the Rome Convention from 7 October 1952, for example, such a liability can analogously be attributed to RPAS operators.

Yet, cases on automation and liability indicate that matters of "causal link" under strict liability rules do not exclude further kinds of responsibility. Besides strict liability rules for RPAS operators, there are indeed different types of liability for RPAS manufacturers, *i.e.*, strict product liability, strict malfunctioning liability, and cases of vicarious liability that involve the negligence-based responsibility of designers and engineers of RPAS. For instance, in the phrasing of the § 402A of the Restatement (Second) of Torts in U.S., strict liability is imposed "not only for injuries caused by the defective manufacture of products, but also for injuries caused by defects in their design." Whereas, in cases of strict liability, the plaintiff has to show in most legal systems that a legally sufficient condition exists, the burden of proof varies in further cases of strict product and malfunctioning liability, or under hypotheses of vicarious responsibility. Aside from specific differences between legal systems, the complex set of notions and ways of determining on whom the burden of proof falls can be summed up in the following way:

First, in the case of strict product liability, the plaintiff has to prove that the product was defective; that the defect existed while the product was under the manufacturer's control; and, moreover, that such defect, according to the jargon of U.S. common lawyers, was the "proximate cause" of the injuries suffered by the plaintiff. Secondly, in the hypothesis of strict malfunction liability, responsibility can be imposed although the plaintiff is not able to produce direct evidence on the defective condition of the product or the precise nature of the product's defect (as it occurs with the strict liability rules mentioned above). In other words, rather than proving the specific defect of the product, the plaintiff shall demonstrate that defect through circumstantial evidence of the occurrence of a malfunction; or through evidence eliminating both abnormal use of the product and reasonably "secondary causes" for the accident. Thirdly, regarding claims of negligence and, thus, vicarious liability of the manufacturer, the plaintiff has to prove that the "reasonable person" failed to guard against "foreseeable harm." Namely, the defendants have a duty to conform to a certain standard of conduct and, yet, they breach that duty, thereby provoking an injury and an actual loss to the plaintiff.

Admittedly, cases of negligence-related responsibility represent the trickiest part of the picture on liability for automation, because of the complexity of the design project, software bugs, and matters of "foreseeability" when dealing with novel or experimental technology. Going back to Simon's remarks on *The Sciences of Artificial*, a first way for approaching such issues is illustrated by the Nobel laureate's "generator test-cycle." The test involves the decomposition of the complete design of the project into its functional components, so as to generate alternatives and check them against a set of requirements and constraints: "The test guarantees that important indirect consequences will be noticed and weighed. Alternative decompositions correspond to different ways of dividing the responsibilities for the final design between generators and tests" (Simon 1996). Besides, we may adopt the probability risk assessment-approach, so as to identify

the undesirable events to be covered by the analysis, much as the accident sequences that may lead to the occurrence of adverse events, the probability of each event in the sequence, etc. Furthermore, we may deepen a methodological tool such as the ALIAS's "Legal Case," built on the EUROCONTROL "Safety Case" and "Human Factors Case."

However, determining fault in complex design projects is often challenging, so that, due to the current state of art in the field of RPAS, legal systems endorse strict liability rules as the proper technique to govern such risky activities. Moreover, this strict liability regime often goes hand in hand with compulsory subscriptions to appropriate professional liability insurance as established by, say, art. 23(1) of D-2006/123/EC. In any event, the burden of proof ultimately falls on producers and manufacturers of such unmanned aircrafts that should preventively demonstrate "their capability and means of discharging the responsibilities associated with their privileges." In the wording of Article 8(2) of the EU Regulation 216/2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency ("EASA"), "these capabilities and means shall be recognized through the issuance of a certificate. The privileges granted to the operator and the scope of the operations shall be specified in the certificate."

Summing up the results of the analysis, evidence on "legally sufficient conditions" under strict liability rules does not exclude further kinds of responsibility for the design, construction, and use of RPAS. On one side, claims of negligence related to designers and engineers of RPAS may add to the vicarious liability of RPAS manufacturers. On the other side, strict product and malfunctioning liability of RPAS manufacturers are intertwined with the strict liability rules for RPAS operators. By focusing on a number of critical issues that are still open, *e.g.*, whether contracts of software developers that often establish clauses of strong liability limitations are applicable to our field, we should take such further cases of responsibility seriously. In the case of RPAS, it is not only a matter of strict liability after all.

2.5 Recommendations

Description of the Issue	Proposed solution
The correct interpretation of EU Regulation 216/08 leads to the conclusion that even RPAS are subject to the same airworthiness requirements as those for manned aircraft. Beyond the need of a legal framework relating to the airworthiness and operations of RPAS, special attention should be given to further legal implications deriving from the use of these aircraft, such as civil liability regulations for damage to persons or property caused by an incident involving an RPA. The	Study the main elements of a EU Regulation establishing responsibility and liability for damage to persons or property as a result of an incident caused by an RPA.

resolution of this problem would be a decisive contribution to increasing the use of RPAS for civil purposes outside segregated areas. Liability for damage to persons or property that can occur as a result of an incident caused by an RPA requires a number of issues to be resolved, such as identification of the applicable law(s). Considering the complexity of RPAS systems, it is vitally important to make a clear distinction between the commander, the pilot and the operator; that is, between the person who has the authority to direct a flight under his command (RPA commander), the person in direct control of the RPA (the RPA pilot), and the legal entity operating an RPA system (the RPAS operator). **In order to identify liability and a compensation system the air transport sector offers an experienced path initiated with the 1929 Warsaw Convention replaced by the 1999 Montreal Convention. It should also be examined whether the 1952 Rome Convention, based on the aircraft operator's strict liability should be applicable. Or the Aircraft Protocol annexed to the 2001 Cape Town Convention on International Interests in Mobile Equipment.** **The other important and related issue concerns the applicable law(s): international conventions, international customary law, EU regulations and national law systems.**	Study the applicability of International Conventions
An analysis of the existing legal framework with a view of solving the issue of competing liability between the satellite controller and the RPAS operator for damage caused by loss of signal from satellite.	Drafting a set of guidelines to be circulated among stakeholders and space and RPAS operators.
The integration of RPAS will imply the adoption of increasingly automated technologies. Advances in automation and technology may bring about drastic changes from the legal and regulatory perspective, questioning the allocation of liability to operators and enterprises.	To investigate how automation changes the tasks and responsibilities of human operators, organisations, and technology providers, i.e. manufacturers, system and software developers.

3 INSURANCE

The world of aerospace insurance contains distinctive characteristics from other conventional lines of business. First, aerospace insurance is highly internationally oriented and intertwined, just like the underlying industry itself. Second, significant insurance capacity is required to cover a small number of (homogenous) risks and their potential catastrophic loss exposures. The law of large numbers that allows a diversification and balance of risk is usually not satisfactorily given. Third, aerospace losses are usually adjusted within multiple jurisdictions, which often also result in a versatile technical, linguistic and cultural clash. Additionally, the majority of liability claims contain a long-term development (on average 5 – 8 years) until ultimate settlement therefore sustainable insurance security is required.

The commercial use of RPAS in civil (non-segregated) airspace creates new challenges for the aerospace insurance sector. Apart from the currently hardly regulated and supervised civil use of RPAS in Europe, insurers currently face a major challenge dealing with rather a small and very heterogeneous number of risks. Additionally there are limited structured and categorised flight safety data available to date that would allow a thorough analysis of the context. All such topics lead to uncertainty, cautiousness and risk-adversity within the aerospace insurance sector. This can be tractably seen in the number of questions asked by insurers confronted with requests for proposals as well as the pricing of such risks. There are some attributes of RPAS that may even justify such approach, as RPAS can complete missions that would either be too risky for human-piloted aircraft (search and rescue in bad weather, firefighting and inspection of hazardous-materials spills etc.) or remain too simplistic and repetitive (border line control or coastal stakeout).

Due to a not yet defined and available airworthiness and safety standard, it is thus to be expected that RPAS operating in civil airspace would pay significantly higher insurance premium rates compared to the conventional aviation segments. This may apply for the voluntary hull (physical damage to aircraft) cover as well as the mandatory (legally- imposed by Regulation EC 785/2004) third party liability insurance (TPL). Considering commercial applications in non-segregated airspace of RPAS it appears advisable that TPL insurance shall be mandatory for all commercially active RPAS operators. Supervised by the civil aviation authorities such minimum insurance requirements according to maximum take off mass (MTOM), already known pursuant to Article 7 of Regulation EC 785/2004, might be another aspect of obtaining the permit to fly.

Here, the basis for minimum insurance limits, currently the aircraft weight, would probably need to be adapted to accommodate possible damages that even smaller low-weighted RPAS operating at high velocity in populated regions could cause to third parties. Based on some initial analysis, major hazards that could trigger liability claims

(property damage and bodily injury) are seen in any mid-air collision with a passenger aircraft or any uncontrolled, discontinued flight into terrain (populated) or non-moving objects (buildings, power lines etc.). Although there seem myriad of causes (pilot or programming error, engine failure, structural fatigue, loss of transponder/radio link, weather conditions, act of unlawful interference etc.) that could to such occurrences, it is nonetheless fair to state that the outcome of any aircraft incident will technically and legally remain very comparable. Considering this statement, it appears to be crucial focusing more on the operational safety of such systems as for example on mishap rates of RPAS compared to operating conventional/piloted aircraft. In other words, the probability of an incident with RPAS may appear greater whereas the overall impact/severity is likely to remain unchanged.[1] However, as this is only a first hypothesis it seems elementary to test and comment this with respective data analysis and experience.

In respect of insurance there are two main drivers worthwhile to be further processed:

1. ***Reduce level of uncertainty within aerospace insurance sector or any other risk-sensitive stakeholders by providing a first solid attempt on assessing hazard risks around RPAS.*** Based on an exploratory study, RPAS could be classified in risk categories depending on complexity of operation such as capabilities of aircraft (propulsion, weight + payload, range, operating altitude etc.), navigation & communication as well as usage/activity of aircraft. At the moment all aviation industry stakeholders including civil aviation authorities of member states run a very static risk approach, which means that analysis is done retrospectively and information tends to exist in silos. Risk assessments are updated infrequently and reactively whereas controls are hardly monitored. Such exploratory study may launch a more holistic approach, considering the fact that key risks are usually interdependent. An example of interdependency is: consistently poor/hazardous flight operations tolerated would impact the societal and political acceptance of RPAS in general. Or in other words, the first few fatal or other loss-intensive incidents triggering civil lawsuits and media-hype interest will strongly influence the scope and the future of RPAS in civil airspace. Conclusions of such study to be shared amongst various stakeholders and aviation authorities and may even contribute to achieve increased acceptance within the society of member states. It is intended that the outcome of such study would create a basis for solving many further upcoming cross-sectional issues and eventually assists in unifying the risk terminology and making any discussion on underlying risks much more qualitative.

2. ***Revise recommendation in respect of Regulation EC 785/2004 and examine alternatives.*** It is worthwhile to note that the above-mentioned Regulation was

[1] With regard to a more qualitative (regression) analysis, the extent of loss severity would be regarded as dependent variable. Independent variables may then be developed from loss characteristics mentioned above

derived from the Montreal Convention, which is applicable in terms of commercial international air transport of persons, baggage and cargo. One could argue that extending the Regulation to also cover the broad, flexible and evolving world of RPAS appears inappropriate. ***A specific regulation on RPAS, including minimum insurance requirements, could facilitate the understanding and acceptance within the aviation industry as well as society of "commercially" operating RPAS in civil airspace.*** The Regulation is currently not applicable for model aircraft with aircraft weight below 20kg and/or foot-launched flying machines and/or non-commercial very light aircraft (below 500kg). For all other RPAS, a simple linear correlation with maximum take-off mass may not deem sufficient, particularly on lower MTOM categories up to 1,000kg. Recommendation may lead to increase minimum liability limits for light aircraft categories, depending on performance of the RPAS and its complexity as well as area of operation. However, any such alteration would still not have a major effect, as the majority of RPAS are "lightweights" below 500kg anyway. Therefore it seems worth considering examining alternative approaches outside EC 785/2004 based on the goal that every RPAS (e.g. with weights exceeding 20kg) preferably should have a minimum liability insurance cover.

To sum up, it is important to bear in mind that insurance provides a cross-sectional value added to the society. Insurance (no matter which line of business) provides supply upon specific demand; either legally imposed our following requirements of industries or societies. Therefore insurance may help developing the use of RPAS within civil airspace in Europe, but will not be the main driver for it. Additionally and in order to integrate the aerospace insurance sector into on-going discussions and development, it seems utmost crucial sharing or even involving it in the elaboration of the required regulations and technologies. Their view and assessment on airworthiness, operator licencing, safety etc. will assist reducing the number of known/unknown variables and to provide a qualitative reflection.

3.1 Recommendations

Description of the Issue	Proposed solution
RPAS operators need to be adequately ensured for the risk of damage to third parties resulting from their RPAS operations.	Assessing risks around RPAS
Today commercial applications of RPAS fall under the remit of Regulation EC 785/2004. A recent fitness check of the regulation revealed that the current regulation is not appropriate for RPAS.	Revise regulation EC 785/2004 in order to have RPAS properly covered.
In addition the market for RPAS operations	

insurance must develop in order to allow RPAS operators to be properly ensured at a non-prohibitive cost.	Support the development of an appropriate insurance offer

4 PRIVACY AND DATA PROTECTION

4.1 The existing regulatory framework.

The introduction of RPAS in the European civilian airspace has raised many legal questions that include, *inter alia*, the issues of right to privacy and data protection.

In Europe, respect for private life was established in 1950 with the adoption of the ***European Convention of Human Rights*** (ECHR) in the framework of the Council of Europe, reflecting the United **Nations *Universal Declaration on Human Rights*** of 10 December 1948. Concisely, the right to privacy may be described as a right, which prevents public authorities from measures that are privacy invasive, unless certain conditions have been met.

The right to data protection was introduced much later, in the 1980s, as a consequence of technological developments. In a nutshell, data protection legislation aims at setting down conditions under which it is legitimate and lawful to process personal data. Data protection legislation obliges those entrusted with handling data to respect a set of rules and empowers the people concerned by granting them rights and guarantees. Finally, it provides for supervision by independent authorities. Protection of personal data is a right that is separate but closely linked to the right to privacy.

Many international conventions or domestic laws protect privacy. We mentioned Article 12 of the *Universal Declaration on Human Rights* proclaimed by the General Assembly of the United Nations on 10 December 1948. The principle of Article 12 of said Declaration has been adopted by Article 17 of the *International Covenant on Civil and Political Rights (ICCPR)*, which "***obliges Member States to protect their citizens against interferences or attacks against the right to freedom due to arbitrary correspondence***". The right to privacy expressed by the ICCPR is reflected in supranational conventions such as the 1950 *European Convention on Human Rights (Article 8)* and the *American Convention on Human Rights (Article 11)*. To these international conventions we have to add, as far as the European Countries are concerned, EU Regulations or Directives and national laws to have a complete picture of the regulatory framework of privacy.

Despite such a consistent regulatory framework, privacy appears to be difficult to protect perhaps because it is an "***exoteric concept without precise objectively discernable***

boundaries" (in the words of Brendan Gogarty and Meredith Hagger). There is no universal definition for privacy and its features vary according to the context, culture and legal tradition.

Professor Arthur Miller of the Beckman Centre for Internet and Society, Harvard Law School, has described privacy as "***an intensely, perhaps, uniquely, personal value***". The word 'privacy' stems from a Latin root, *privare* which means 'to separate' or to deprive, i.e. to separate from others what belongs to an individual only. Therefore, as individuals we may have interests *to separate* our 'personal space' free from interference by other people and organizations.

Legal doctrine has identified four main facets of privacy:

1. *Bodily privacy* that relates to the protection of a person against invasive procedures such as genetic tests, drug tests and body searches,
2. *Information privacy*, also known as *data protection*, with reference to the rules governing the collection and handling of personal data such as medical records, Government records or financial records,
3. *Privacy of communication* that gives security and privacy of mail, telephones, electronic mail and other forms of communication,
4. *Location privacy* which sets limits on intrusion into domestic and other places such as at work or in public spaces; it includes searches, video surveillance and identity checks as well as one's geographical location and position in space.

This categorization suggests a continuum of zones of privacy and of personal, public and private space that can be imagined horizontal or vertical. The horizontal vision may distinguish what is private and what is public. It is difficult to draw a demarcation line between personal, private and public. We can take into consideration political interests, economic interests and even religious or cultural ones. From these considerations we can imagine a totally private area called *umbra* and an area characterized by a lesser degree of privacy called *penumbra*. Outside these areas there is the public area where there is no privacy at all.

The vertical vision introduces the third dimension in the vertical space that is strictly related to the use of RPAS. Roman law defined the ownership of a surface of land as extended *ex inferis usque ad sidera*, which means from the centre of the earth to the limit of the atmosphere. In theory, any intrusion of this space could be considered an intrusion to privacy. At first glance, this view could seem absurd and inapplicable; however, when we consider images taken from space that include identification of persons on the ground, in the privacy of their homes, this could be considered an invasion to privacy.

British Common Law is characterized by a tradition of protection of the private home (*a man's home is his castle*) against government intrusion. The same principle is contained in the US legal doctrine known as '*Castle law' or 'Defence of habitation law*'. It is interesting to remark the different vision of privacy in the US and Europe. In the US privacy is seen as

a protection from government intrusion into the private life. In Europe privacy is regarded as a human right to be protected from any kind of intrusion, governmental or not.

There are many opponents of an excessive defence of privacy claiming that privacy may prevent law enforcements or impede economic activities based on a free flow of information to be collected, stored and then sold. Privacy may also hinder law enforcement, national security operations and might even curtail freedom of information. As a matter of fact, privacy must be balanced against other rights like freedom of information, national security and law enforcement.

Several European provisions limit the right to privacy. The *Convention for the protection of individuals with regard to automatic processing of personal data* of 28 January 1981, ***"Recognizing that it is necessary to reconcile the fundamental values of the respect for privacy and the free flow of information between peoples"*** (preamble), in Article 9 allows derogations for: *a) protecting State security, public safety, the monetary interests of the State or the suppression of criminal offenses; b) protecting the data subject or the rights and freedoms of others*."

The same derogations are reiterated in Directive 46/1995/EC and in Regulation 45/2001/EC which fixes restrictions for:

(a) *The prevention, investigation, detection and prosecution of criminal offenses,*
(b) An important economic or financial interest of a Member State or of the European Communities, including monetary,
budgetary and taxation matters,
(c) The protection of the data subject or of the rights and freedoms of others,
(d) The national security, public security or defence of the Member States,
(e) A monitoring, inspection or regulatory task connected, even occasionally, with the exercise of official authority in the cases referred to in (a) and (b).

Until now RPAS have been used by State entities, civil or military, for security reasons, but technology to be installed on RPAS is becoming increasingly accessible to private sector organizations and individuals. Small RPAS can easily be constructed for less than €800 and equipped with ordinary videophones to provide live video. Besides continuous surveillance from the air (manned aircraft, satellites, RPAS) sanctioned by public authorities, a person cannot expect that himself or his property be immune from surveillance by other members of the community. Such a scenario has to be carefully monitored by the State authorities as it may entail many other infringements to privacy law.

American Courts have permitted aerial surveillance by police on the grounds that the owner should expect that any individual might view his property from a private plane. The wide use of aerial surveillance in the UK has led to litigation which has often been referred to the European Court of Human Rights (ECtHR); however, the ECtHR, while

determined to reduce State infringements of privacy in public spaces, the protection of citizens against the arbitrary invasion of their private life referred to the dissemination of personal information rather than to the collection *per se*. This orientation is reflected in all EU Directives or Regulations on the processing of personal data.

The ECtHR further requires that the State prove that surveillance was conducted in accordance with law, pursued with a legitimate aim, and necessary in a democratic society. However, the Court gives a relatively wide discretion to States in determining what aims are legitimate.

For example, the England and Wales Court of Appeal (EWCA) has interpreted Article 8 of the European Convention on Human Rights as protecting a '*reasonable expectation*' of privacy (Murray v. Express Newspapers plc. et al [2008] EWCA Civ 446) thereby raising the same problems as found under the US privacy model.

In Europe, the basic elements of privacy are set out by Article 8 of the European Convention on Human Rights of 1950, entered into force in 1953. Article 8 states that "***everyone has the right to respect for his private and family life, his home and his correspondence".***

There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and the needs of national security, public safety or the economic well being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others.

The EU Treaties

The place given to fundamental rights in the EU Treaties has changed considerably since the European Community was first launched. At the outset, fundamental rights were not a central concern of those who drafted the Paris and Rome Treaties. The Treaty of Paris, which established the European Coal and Steel Community (ECSC), is concerned solely with the coal and steel industries. This approach by sector gained strength after the failure, in 1954, of the European Defence Community (EDC) and the concomitant moves towards political union. It thus became a feature of the Rome Treaties establishing the European Atomic Energy Community (Euratom) and the European Economic Community (EEC). Although the EEC Treaty was wider in scope than the other two, all three Treaties covered well-defined economic spheres.

Unfortunately, this approach by sector sets the founding Treaties apart from any basic law of a constitutional nature incorporating a solemn declaration on fundamental rights. The situation changed rapidly as the Court of Justice, in the judgments it handed down, began to monitor the respect shown for fundamental rights by the Community institutions and the Member States whenever they took action within the areas covered by Community law. The Court recognized, for example, the right to property and the freedom to engage in economic activity, which are essential to the smooth operation of

the internal market. The Court held that fundamental rights ranked as general principles of Community law and that they were based on two pillars:

1. ***The constitutional traditions of the Member States,***
2. ***The international Treaties to which the Member States belonged (and the ECHR in particular).***

The EU Treaty states that "***the Union shall respect fundamental rights, as guaranteed by the European Convention for the Protection of Human Rights and Fundamental Freedoms signed in Rome on 4 November 1950 and as they result from the constitutional traditions common to the Member States, as general principles of Community law***" (Article 6(2), ex Article F.2).

The EU Charter of Fundamental Rights of December 2000 (which become binding in December 2009 when the Lisbon Treaty came into force) updates the right of privacy and embodies the new right of data protection. Article 7 of the Charter replaces the right of privacy of "*correspondence" with the right of privacy of "communications*". Article 8 of the Charter provides for the protection of personal data: "*1. **Everyone has the right to the protection of personal data concerning him or her; 2. Such data must be processed fairly for specified purposes and on the basis of the consent of the person concerned or some other legitimate basis lay down by law. Everyone has the right of access to data, which has been collected concerning him or her, and the right to have it rectified; 3. Compliance with these rules shall be subject to control by an independent authority.***"

This Article is based on Article 286 of the Treaty establishing the European Community and Directive 95/46/EC of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (OJ L 281, 23.11.1995, p. 31) as well as on Article 8 of the ECHR and on the Council of Europe Convention of 28 January 1981 for the Protection of Individuals with regard to Automatic Processing of Personal Data, which has been ratified by all the Member States. Article 286 of the EC Treaty is now replaced by Article 16b of the Treaty on the Functioning of the European Union.

Part I-51 of the Treaty establishing a Constitution for Europe incorporates the right to personal data protection in the first part of the Treaty, and provide for the first time a general legal base for European laws and framework laws on personal data protection. Part II-68 of the Treaty enshrines Article 8 of the Charter in the Constitution.

Article 286 TEC has been the legal basis for the Data Protection Regulation 45/2001/EC which complements the Directive 95/46/EC and lays down specific data protection rules with regard to the Community institutions and bodies. This Regulation contains provisions aiming to protect personal data processed by European Union (EU) institutions and bodies.
In particular, data must be:

- *Processed fairly and lawfully;*

- *Collected for specified, explicit and legitimate purposes and not further processed in a way incompatible with those purposes;*
- *Adequate, relevant and not excessive in relation to the purposes for which they are collected and/or further processed;*
- *Accurate and, where necessary, kept up to date (all reasonable steps should be taken to ensure that data which are inaccurate or incomplete in relation to the purposes for which they are collected or for which they are further processed, are erased or rectified);*
- *Kept in a form, which permits identification of data subjects for, no longer than is necessary for the purposes for which the data are collected or for which they are further processed.*

The Regulation also provides for the establishment of a "***European Data Protection Authority",*** an independent Community authority responsible for monitoring the correct application of the data protection rules by the EU institutions and bodies. This authority will be the equivalent of the data protection authorities established by Member States in accordance with Directive 95/46/EC on data protection.

Following the progress of European integration, the European Union has gradually widened its field of action, reflecting the determination of the Member States to act as one in areas which until then had been a strictly national preserve (e.g. internal security or the fight against racism and xenophobia) producing widely differing domestic law, although based on the basic principle of the Council of Europe Convention No. 108 "*Convention for the Protection of Individuals with regard to Automatic Processing of Personal data*" signed in Strasbourg on 28 January 1981 which followed the 1980 OECD Guidelines on automated processing data.

The purpose of the Convention was to strengthen data protection, i.e. the legal protection of individuals with regard to automatic processing of personal information relating to them. The Council of Europe recognized the need for legal rules in view of the increasing use of data made of computers for administrative purposes. Compared with manual files, automated files have a superior storage capability and offer possibilities for a much wider variety of transactions, which they can perform at high speed, while a further growth of automatic data processing in the administrative field was expected in the coming years as a result, *inter alia*, of the lowering of data processing costs, the availability of "intelligent" data processing devices and the establishment of new telecommunication facilities for data transmission.

The Council further stressed that "*Information power*" brings with it a corresponding social responsibility of the data users in the private and public sector: in modern society many decisions affecting individuals are based on information stored in computerized data files. This information should only relate to a precise given purpose and should be protected against physical hazard and unauthorized disclosure. Finally, the Council denounced the lack of general rules on the storage and use of personal information and in particular, on the question of how individuals can be enabled to exercise control over

information relating to them, which is collected and used by others.

Some Member States of the EU considered the Convention No. 108 a threat to free competition and consequently to the well functioning of Internal Market. We had to wait until 1995 to see Directive 95/46/EC that can be considered a central piece of legislation on the Protection of data in Europe. It provides that, *"Member States shall protect the fundamental rights and freedoms of natural persons, and in particular their right to privacy with respect to the processing of personal data"* (Article 1).
"Personal data' shall mean any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity" (Article 2).

The responsibility for compliance with the directive rests with the "*controller that is the natural or legal person, public authority, agency, or any other body that determines the purposes and means of processing personal data" (Article 2, d).* Articles 16 and 17 require data controllers to ensure confidentiality of processing and to implement security measures to protect personal data against abuse.

Article 3 provides that "***The Directive shall apply to the processing of personal data wholly or partly by automatic means, and to the processing otherwise than by automatic means of personal data which form part of a filing system or are intended to form part of a filing system" and shall not apply to the processing of personal data in the course of an activity [...] concerning public security, defence, State security (including the economic well-being of the State when the processing operation relates to State security matters) and the activities of the State in areas of criminal law".***

This concept is further reiterated and detailed in Article 13 of Directive, which includes also the freedom of information (as guaranteed in Article 10 of the 1950 European Convention for the Protection of Human Rights).

The Directive insist on secured technical processing measures saying: "*Member States …must implement appropriate technical and organizational measures to protect personal data against accidental or unlawful destruction or accidental loss, alteration, unauthorized disclosure or access, in particular where the processing involves the transmission of data over a network, and against all other unlawful forms of processing* " (Article 17) foreseeing the evolution of the information technology in the following years.

The Directive provides also for compensation in case of damage caused by unlawful processing operations.

Articles 25 and 26 provide for the transfer of personal data to third States. Article 25 lays down the principle that such transfers are prohibited unless a third state generally ensures an adequate level of data protection based on that state's constitutional and legal

provisions. Under Article 25(6) the Commission may adopt a decision (Adequacy Finding) that a third country ensures the requisite level of protection.

Finally, it is worth to note that the legislator has probably realized that the matter of privacy data protection appears to be an "*esoteric concept without precise objectively discernible boundaries*" and with Article 27 he suggested the adoption of a ***Code of Conduct*** to: "*contribute to the proper implementation of the national provisions adopted by the Member States pursuant to this Directive, taking account of the specific features of the various sectors*".

4.2 Regulation and Directive proposals – January 2012

In January 2012, the Commission proposed a revision of Directive 95/46, submitting to public scrutiny two draft instruments: the transformation of the Directive into a "General Data Protection Regulation" (which will apply to data processing by private or commercial RPAS operators) and a Directive regulating sensitive data processing by competent authorities for the purposes of law enforcement.
The proposals tabled by the Commission provide for tighter harmonization rules and are aimed at preventing fragmentation in the way personal data protection is implemented across the Union. Moreover, the General Data Protection Regulation seeks to address the threats to privacy posed by recent technological developments.

The General Regulation addresses several issues, largely neglected or insufficiently dealt with by the current legal framework, such as ***the need for special protection of health-related data, the need for clearer rules as regards data access and portability and the rules concerning data processing on grounds of public interest.***

The Commission's proposal seeks to strike a balance between the right of individuals to protect their personal data and the need to make data available to state officials for public interest or law enforcement purposes.

Finding a balance between the need to guarantee the right of individuals to "opt out" or delete their personal data (the so-called "***right to be forgotten***") and the need to provide access to the same data to public officials is especially difficult. An even bigger concern is raised by the possible use, which could be made of sensitive data by private subjects for commercial purposes.

After the reform, undertakings will have to deal with a single national data protection authority in the Member State where they have their head office. Likewise, private citizens will be able to refer to the data protection authority in their own country, even when their data is being processed in another Member State. Moreover, independent National Data Protection Authorities will be strengthened to improve enforcement of EU rules, and will be empowered to fine companies for violations of EU data protection

rules.

Following the EU-US conference on privacy and data protection in March 2012, the Civil Liberties, Justice and Home Affairs (LIBE) Committee of the European Parliament has started debating the proposals tabled by the Commission. The rapporteur, Mr Jan Albrecht MEP opened the debate by stating the ambitious goal to finalize the reform of the EU privacy and data protection rules by the end of the current Parliament's mandate.

4.3 Data protection, privacy and RPAS.

It has been more and more evident that the use of RPAS raises serious enforcement concerns, due to the difficulty of tracking and controlling them. Their low cost of operation and their small size, together with the difficulty of controlling their use through licensing or registration systems, could make it very difficult to ensure that they are used in a lawful and legitimate way.

The detailed analysis presented here above helps to understand the principles that stay at the basis of privacy and data protection. It also shows that existing regulations do not provide any provisions regarding RPAS. However, by analogy, part of the existing regulatory framework may be applicable to the use of RPAS and the existing case law on data collection and handling may provide guidance for the interpretation of existing norms in case of application to RPAS activities.

However, it should be remembered that, as far as the EU Member States are concerned, they have adopted the EU Regulations and Directives, although with some less or more stringent provisions. ***Therefore, the matter of protecting privacy and regulate data processing should remain a national competence of every EU Member State.***

4.4 Privacy by design

The concept was laid down in the first European directive on data protection, namely, in Art 17 of D-95/46/EC. According to Recital 46 of the directive, the aim is to embed "appropriate measures" in ICTs "both at the time of the design of the processing system and at the time of the processing itself, particularly in order to maintain security and thereby to prevent any unauthorized processing" of personal data. This objective has been facilitated by the capacities of computers to draw upon the tools of artificial intelligence (AI) and operations research. However, work on AI and the law entails crucial ethical issues concerning both values and modalities of design. On the one hand, design choices might result in conflicts of values and, vice versa, values may affect design features. On the other hand, the modalities of design cannot only limit the impact

of harm-generating behaviour but also prevent such behaviour from occurring via self-enforcement technologies.

4.5 Recommendations

Description of the Issue	Proposed solution
RPAS may present a threat to privacy. This concerns mainly applications involving video surveillance/monitoring activities. However a broad assessment of privacy threats should be developed in order to ensure any possible issue is identified and dealt with.	Collect opinion from relevant advisory bodies and broad public. Consultation with stakeholders and with law enforcement agencies is absolutely necessary to strike a balance between the need to regulate the use of RPAS for data collection and the citizens' right to privacy and data protection. These consultations should be guided by the understanding that the real problems arising from the use of RPAS concern the enforcement of EU Law (which is likely to be extremely difficult, in light of the extremely low cost of small RPAS and of the difficulty to track their operations).
Directive 95/46/EC sets out the principles for the processing of personal data and the rights of data subjects over their personal data. **MS have derived national legislative framework to transpose the directive. Some MS have adopted specific law on video surveillance.** **Video acquisition devices installed on RPAS may present specificities not adequately covered by the current national legal framework**	Analyse the issue of video surveillance using RPAS with National Data Protection Authorities and produce EC recommendations on the subject
The Commission has proposed a revision of the EU legal framework on the protection of personal data. Two draft legal instruments have presented: - **The transformation of the Directive into a 'General Data Protection Regulation' (COM (2012) 11)** - **And a proposal for a Police and Criminal Justice Data Protection Directive (COM (2012) 10)** **There is a need to ensure RPAS related issues are well covered in the revised regulation and that**	Monitor closely the revision of the legal framework

opportunities offered by the new regulation (ex in the area of police applications) are well exploited.	
'Privacy by design' techniques and standards applied to the relevant RPAS payloads may contribute to the compliance of RPAS applications with the data protection legal framework	Promote the use of RPAS payloads designed according to the 'privacy by design' standards developed for security technologies under the initiative of the Security unit of DG ENTR

5 BENEFITS FOR CITIZENS

5.1 Introduction

The benefits the RPAS could ensure to the European Citizens represents one important cornerstone for their acceptance by the European people.

Possible utilisations of RPAS were identified during the EC Panel Workshops, resumed in a quite large, despite non-exhaustive number of missions. Among these missions, citizens can see a number of them as having more direct benefits on their lives and we can classify them in three groups:

- Missions related to **Civil Protection**: RPAS could be used in monitoring, preventing and alert and post-crisis management system for natural disasters.
- Missions related to **Security**: RPAS could be used for coastal surveillance or sensitive sites (ports, airports, power plants) monitoring.
- Mission related to **Environment Protection / Preservation**: RPAS could be used in monitoring and protecting natural environment. RPAS could also ensure indirect benefits from the air vehicle platform by reducing carbon/noise footprint if compared with manned aviation.

Examining in more detail the above possible utilisations emerges a variety of specific tasks that are already perceived as important by EU Citizens, despite the possible different priorities among the Member States. Just recalling the results recently emerged from a number of statistical analysis and studies, it is possible to depict an almost exhaustive picture of what is actually recognised as "***important benefits***" by Citizens in the civil Protection, Security and Environment fields.

A number of coordinated action of leveraging on these arguments could help in building the public awareness about RPAS; as a consequence, will be facilitated the growth in

familiarity for their technologies, also considering that some of them are already available in different field of application like automotive and mobile phones.

These coordinated actions are deemed as necessary to ensure the success of the RPAS in Europe but need to be well prepared via an in deep analysis of the various aspects of RPAS utilisation. In particular ***is important to modify the vision of "killing machines" they have right now due to the actually military-specific utilisation and to some catastrophic movies.***

To maximise the success of information actions toward the Citizens, all the aspects of RPAS utilisation have to be addressed and analysed in advance by experts and institutions, in order to create a consistent foundations of knowledge to be used to adequately substantiate the information to be disseminated toward the population.

The entire process should then start from an as much as possible exhaustive analysis of the benefits deriving by the various areas of RPAS utilisation. In particular, it is necessary to well explain why RPAS are more efficient, under some hypothesis, than manned aircraft. In case certain tasks could be performed only by RPAS, this should be adequately justified and highlighted. Some of the RPAS utilisations that could give benefits for citizens are shortly exposed and discussed; they do not represent an exhaustive list and their analysis is necessarily incomplete.

5.2 Natural disasters and security

5.2.1 *Civil Protection*

Civil protection is involving thousands of workers in Europe and is typically perceived by citizens as an Institution able to intervene when a disaster occurs and sometime able to make prevention, alerting the people to abandon their places and/or organising active countermeasures to avoid or at least limit the effects of certain disasters.

It is actually known that, in the past years in Europe, various disasters provoked a high number of casualties and a much higher number of people involved or affected at various levels. The economical and social cost is very high as well, in the order of hundreds billions of Euro.

European population has a personal perceiving about the seriousness of disasters depending on their specific culture and the particular geographic area they live in. Despite an ad-hoc analysis is always possible, it is recommended, for the scope of this activity, to create a general common perception about disasters and consequently of the benefits that RPAS could give.

Typical disasters affecting Europe with a sensitive periodicity are specifically the following:

Floods: in relation to natural events like storms, they are characterised by heavy uninterrupted rain lasting for some days. At a certain moment, the terrain cannot more retain the excess of water (sometimes dams are also created locally by trees barriers) and the ground collapse in a fast river of water, mud and debris. Other possible causes of floods are recognised as dam beaks and fast snowmelt. A preliminary analysis of such phenomena shows some issues that should be adequately addressed under specific case studies:

- No way to avoid such phenomena once it starts,
- Pre-emptive alert could be raised based on the quantity of rain or other specific parameters, but an high probability of false alarm could prevent civil population from evacuation,
- Proper monitoring during the initial phases could help experts in understanding the level of risk, augmenting the probability to evacuate people on the basis of a correctly identified and real danger,
- After the flood, the bad weather usually remains for some days; the danger of a new flood is real, endangering the rescue teams,
- Collateral damages of the floods are very serious for the life of citizens as for instance loss of electrical power or communications. These damages remains for days or even weeks depending on the development and resources of the area affected.

Storms: the increasing relevance of storms danger is related to the increasing density of population and, consequently of valuable assets in the affected areas. In most cases, the principal consequence of a storm is a flood. The same high level considerations exposed for the floods are applicable.

Earthquakes: despite the extremely relevant importance in terms of human losses and damages they usually provoke, Europe does not have at the moment a specific policy. Mitigation measures are usually demanded to local authorities but, at the moment, prevention is mainly limited to specifications for building safe construction and to post-disaster intervention.

Forest fires: the range of damages induced by forest fires is usually not limited to the loss of human lives and to the cost of damaged properties but usually can last for years, ranging from a constant damage of the soil to water quality, tourism and also climate. It is already recognised that forest fire emergency can be raised in advance with proper monitoring. Adequate support can be offered to the fire fighters using sensors to monitor the scene, giving a mean to limit casualties and possibly reducing the amount of damages. Adequate prevention is anyway probably the better mean to fight such events, as it can give a clear benefit to the environment protection.

Nuclear accidents have as usual consequence the contamination of an area (terrain and water). The loss of human lives is typically limited during the initial emergency but

could continue in the following years due to pollution. These late casualties are usually associated with terrible diseases, having a relevant social impact. During such emergencies, humans are seriously endangered by nuclear pollution, and then prompt evacuation of the population is essential. The rescue teams have usually adequate protection but could be anyway safer to limit or eventually avoid their intervention into the polluted area. At the end of the main emergency, the polluted areas cannot be re-populated for years, inducing a total loss of properties.

Volcanic eruption: this natural disaster has typically a local impact, usually with casualties in the case of pyroclastic clouds and generally with damages to properties dependant by the extension of the phenomena.
On the contrary, the eruption of Eyjafjallajökull in 2010 created, together with problems to the civil population living close to the volcano, also big problems to airlines and passengers for several days, inducing very high losses in the business.
Consequently, in the International Civil Aviation Organization (ICAO) Volcanic Ash Contingency, three ash contamination levels have been defined:

1. Area of Low Contamination: an airspace of defined dimensions where volcanic ash may be encountered at concentrations equal to or less than 2x10-3 g/m3, but greater than 2x10-4 g/m3;
2. Area of Medium Contamination: an airspace of defined dimensions where volcanic ash may be encountered at concentrations greater than 2x10-3 g/m3, but less than 4x10-3 g/m3;
3. Area of High Contamination: airspace of defined dimensions where volcanic ash may be encountered at concentrations equal to or greater than 4x10-3 g/m3, or areas of contaminated airspace where no ash concentration guidance is available.

Radar Systems able to detect ash and its concentration are under development, (to be ideally embarked on a number of airlines).
Alternative means of detecting ash, like RPAS, should anyway be considered.

Communication relay: this is not a Civil Protection specific task, but it is indeed useful in a number of different situations following a disaster, to facilitate the work of the rescue teams.
Following a disaster, one major problem could be to ensure communications and maybe connectivity for the rescue teams and other assets present in the area. Continuous coverage for the entire mission duration is deemed as necessary and should be ensured H24, keeping active the line-of sight communications among users.

Disaster prevention and post disaster relief: disaster prevention is one of the most demanding issue for Civil Protection and, probably, one of the most sensitive arguments by the people point of view, but:

- Most disaster cannot be avoided (earthquakes, volcanic eruption, floods …);
- In most cases, the simple forecasting is almost impossible (earthquakes, volcanic eruptions).

Despite this, some disasters can be monitored BEFORE they happen:

- Proper monitoring could offer the opportunity to prevent or at least reduce the lost of human lives.

Post–disaster Relief is also a demanding task because the rescue teams need quick information dissemination, coordination, communication, and connection. Unfortunately, during the preceding and subsequent days, most of actual monitoring system could not work because of bad weather. Sometimes, this situation remains for some days after the disaster, endangering the rescue teams. After a disaster it is necessary to be aware of the current situation in order to update the vulnerability maps of the impacted zone. Due to difficulties in reaching the place, acquiring its current state (after the disaster), communicating this new data to the rescue teams RPAS could help in having a clear picture of the post crisis situation.

5.2.2 *Security and Environment*

Security is involving several thousands of workers at any level of the civilian and military institutions and means deemed to relief their work are constantly under assessment. The aerial component of the security is recognised, among others, as relevant for the type and frequency of the information introduced in the security networks for further analysis. Together with the Environment, it is recognised to have a constantly growing relevance in the Citizens perception and are demonstrated to have a growing impact on European economy.

Coastal monitoring: was initially created to respond to a monitoring need about the coastal environment and, subsequently, started to gain relevance also for the monitoring of irregular immigration. It is actually performed by processing of satellite data, with an increasing importance given to the air assets because of their operational flexibility and persistence.

Fisheries: represent a big market for Europe, with a relevant impact on employment along all the production, delivery and commerce chain. Actually no monitoring systems are implemented, and then are actually impossible to control the international fish quotas and consequently the illegal fishing is actually difficult to contrast and prosecute.

Sensitive sites monitoring: is assuming more relevance in the security perception of citizens because of the international situation of local limited scale conflict, having as a consequence the augmenting of terrorism danger in Europe and in the rest of world. In particular, ports, airports, power plants and water pipes are identified as relevant sites where to enhance the security, all these sites represent potential high-value targets for terrorists, because of their relevance in public opinion and because they can be highly damaged with limited effort from terrorists.

Monitoring and protecting natural environment is from decades a very sensitive issue for citizens. The impact on daily life of climate change, air and water pollution and other events endangering the natural environment has probably a psychological impact higher than the effective one. Despite this maybe debatable perspective, the natural environment represents formally the heritage for next generations and present generations are considered as morally responsible for its preservation.

5.3 The situation in Europe

Europe has an active way to manage the issues related to civil protection, security and environment, by issuing treaties and directives and consequently fielding people and systems to monitoring, supporting and enforcing. It is recognised the role of information acquisition, interpretation and analysis to support the people on duty, then the means to support the data acquisition are actually matter of research and development.

5.4 The assessment of RPAS capabilities

The various RPAS types represent one of these means and are candidate to form a part, maybe relevant, of the aerial component for Civil Protection, Security and Environmental Control in Europe. Unfortunately, the situation is actually negative for RPAS due to a number of limited but challenging issues:

1. They cannot fly in controlled airspace;
2. The specific missions and roles of RPAS in Civil Protection, Security and Environment protection are not yet addressed in a pragmatic and exhaustive way;
3. European citizens are not really aware of their capabilities and typically have a negative feeling of them.

It is in the scope of this part of the Roadmap to define how RPAS could be a mean of protection and security in Europe and to define how to inform the citizens about such benefits, to facilitate their acceptance. This is not a simple task and needs a **close coordination with other activities included in the RPAS Roadmap** to be successful in convincing the Citizens that RPAS could help, that sometimes they can perform better than other means and that, ***in certain cases, they are the only mean to perform some critical tasks.***

At the same time, it is necessary to contrast the negative feeling surrounding the RPAS, deriving from pure military utilisation, negative depicting from media and from catastrophic movies. Media address much more frequently the use of RPAS for their air to ground strike capability than for the pure ISTAR mission which in fact is much more common.

Work strands with **a civil/military strict coordination**, reflecting the specific needs of a civil end-user in the "civil-protection" domain need to be aligned to ensure targeted

results. Currently, there is limited availability of (military comparable) **civilian concept of operations and requirements**. Similar concept of operation and requirements has to be produced also for Security and Environment Protection entities. These activities should explore not only the RPAS utilisation but also the needs of the stakeholders and any possible implications on actual & future rules and laws. It is also essential the (at least preliminary) assessment of possible needs respect to the **integration into actual ATM and the future (SES) ATM**.

Once the concept of operations requirements are defined, an ***exhaustive analysis of all existing type of aircraft*** used for our scope has to be performed, posing specific attention to the small aircraft which will have an equivalent level of safety in terms of airworthiness than bigger platforms. Subsequently, should be performed a comparison with the RPAS types able to perform the same mission. The possibility to preserve human life from dangerous or dull flights has also to be considered.

After the requirements, it is time to address the ***possible missions*** the RPAS could perform and, as a consequence, the definition of the mission requirements and the harmonisation of requirements between civil and (State) military users taking into account the different consideration of state aircraft in the different European countries. In particular, Civil Protection and Security issues have to be specifically analysed.

RPAS should be considered as systems, and then ***cooperation and integration among different RPAS types*** has to be considered as a mean to augment the Service capabilities, while defining the missions.

Small RPAS: have the possibility to be launched quickly and anywhere:

- Could be useful when rapid, close-in monitoring is needed;
- Flying at low altitude, weather could be an issue.

Big RPAS: are typically more persistent and can integrate various heterogeneous payloads

- Persistence and operational altitude;
- Medium to high level of automation;
- Complex missions with complex payloads.

After the mission analysis and the ***evaluation of benefits the RPAS can give*** to the tasks, other secondary benefits the RPAS could ensure should be considered, like the ***favourable carbon/noise footprint*** respect to the equivalent manned aircraft. The long missions sometimes performed by maritime patrol aircrafts give one macroscopic example. These aircraft are typically two engines turboprop weighting tens of tons, having a doubled crew and embarking necessarily kitchen and beds. Comparison with RPAS possibilities/cooperation could result in evident benefits.

A big support in accomplishing the above complex tasks can be supplied by ad-hoc stakeholders consultation.

The contribution of institutional European Stakeholders is deemed as necessary during this process, in order to evidence which uses envisaged for RPA could be acceptable or not by the Citizens point of view. In particular, Stakeholders should give their advice in the areas of Ethics and Fundamental Rights, indicating not only what is "not possible" but helping in finding ways to make RPA possible.

At the end of the process, or better, at the end of each of the above tasks, **proper dissemination to the citizens** should be performed. The introduction of RPAS technology courses in the high schools and university is also considered a good mean to create the RPAS culture in Europe.

As a resume, the milestones to be achieved are listed here below:

- ***Initial dissemination and workshops to advise that RPAS are being to be considered for relevant tasks in Europe;***
- ***Mission requirements definition (MRD);***
- ***Missions identification and analysis;***
- ***Manned aircraft analysis and comparison with RPAS;***
- ***ATM/SES integration analysis;***
- ***Business case;***
- ***Dissemination and workshops.***

In parallel, some seamless tasks of close coordination with other part of the RPAS Roadmap should be considered to maximise the effort, in particular with:

- Regulatory developments: plan the Insertion demonstration showing concrete possibilities of RPAS in helping the citizens, in coordination and **supporting** dissemination activities;
- R&D: plan the new technologies insertion in coordination and **supporting** the dissemination activities;
- Acceptable risk, Liability, Insurance and Ethic have to work in strict coordination to maximise the effects of dissemination.

5.5 Recommendations

Description of the Issue	Proposed solution
The RPAS are actually not known or just known as "killing machines"	Give to the citizens a different vision

At the moment it is not yet clear which missions the RPAS could perform and, among them, in which missions they could ensure benefits to the Citizens. **Mission definition is a critical task to be performed in a pragmatic way because of its possible implications on ATM and on other part of the RPAS Roadmap.** **Possible ethical impacts have to be addressed.**	Define the range of activities the RPAS could perform. Consider ethical limitations.
	Define the requirement and constraints for RPAS missions and following define their missions. Also consider possible ethic issues
Once the missions for RPA have been decided, the possible benefits for Citizens have to be assessed and demonstrated in order to augment the societal acceptance	Assess and quantify the possible benefits for each one of the identified missions as well as possible reason for negative acceptance
	Contribute to augment the societal
At the moment manned aircraft performs the missions. It is needed to analyse in which cases RPAS could perform better than manned aircraft	Perform a Manned Aircraft analysis and compare with RPAS performing comparable missions under some pre-defined measure of merit (E.G. carbon / noise footprint etc.)
RPAS missions will not be performed into segregated areas, then their execution has to be integrated into actual and future ATM (SES) **Identically, legal and insurance implication on mission performance have to be considered**	Analysis of possible specific requirements that the identified missions could have on actual ATM and future SES.
	Analysis of possible legal implications on missions compared with manned situation
	Analysis of possible specific insurance needs compared with actual situation

6 RPAS ACCEPTABLE RISK

While there are detailed methods for the objective measure of the likelihood of a hazardous event based on a quantitative measure of historical safety performance, there are substantial differences in what is measured and what is perceived. Risk perception, and not the objective measure of risk, will be the driver behind the acceptance of RPAS operations in civilian airspace. Therefore, it is necessary to discuss the key factors influencing the perception of risk.

The **perception of risk** (1) is driven by the magnitude of consequence more so than the associated likelihood of occurrence. Public perception of risk focuses on those hazards that have the potential to cause large consequences, such as that of a mid-air collision between a RPAS and a commercial passenger aircraft.
These hazardous situations, despite their likelihood, must meet a higher public expectation than those hazards of less severe consequence of higher likelihood, such as that of an impact with the ground.

Building public awareness and familiarity with RPAS technologies **(2)** will be an important aspect to gain acceptance of the technology. People's risk perceptions are

based on a combination of subjective judgment and limited knowledge of the true risks imposed by a new technology. According to a recent study into RPAS credibility with the public, there is a tendency by the public to overestimate small risks and to underestimate large risks, and that the public tends to focus on risk and how they can protect themselves from those risks. Conversely, experts tend to perceive risks within their competence area as much lower than the public. As a result, public trust seldom conforms to expert assessments of hazards associated with technologies, particularly when the technology is new to the public. That is why it is necessary to create credibility for the RPAS industry and not merely impose RPAS.

In most cases, society has opposed any new technology that has associated risks. Such examples include nuclear power generation and fly-by-wire commercial jet aircraft. In the case of RPAS technologies, it is expected that the public will place higher demands on the safety of RPAS operations than that of manned aircraft operations. Distinctions must be made between those RPAS applications where the principal risk exposure is voluntary from those of involuntary risk exposure.
This is because the public places a higher demand for protection from involuntary risks as opposed to voluntary. The nature of risk exposure is therefore an important factor in the definition of acceptable risk criteria. ***It is worth noting that the question relates to the public's acceptance of the risks associated with a new technology and not the public's acceptance of a new technology.***

The ***quantification of an acceptable level of risk***, although an important factor, is only one component characterizing the public's acceptance of a technology. Other complex and often immeasurable factors such as morals and the economic and political climate are equally as important. A study characterizing these complex social factors and importantly a means to address them is necessary before acceptance of civil RPAS operations can become a reality.

The basic theory behind the acceptance of risk is the subjective assessment between:

- Society's perception of the level of exposure to the hazard;
- Society's perception of the **benefits due to the hazardous activity.**

On a general basis the media and public must be convinced that for RPAS ***the perceived benefits*** (i.e., higher security level, improved information, more services, lower costs) outweigh potential "costs" (i.e., increased noise, pollution, privacy concerns, safety risks, delays).

The impact of RPAS on the environment can also influence society acceptance. RPAS may be limited by noise, emissions, or other environmental constraints and, if flown low and in great numbers, will become a nuisance. Also, merely adding to the aviation fleet will suggest further fuel consumption and more emissions. However, current research trends in aviation will make RPAS quieter (many being electrically powered) and fuel efficient, and their use may ultimately replace many of the larger and less efficient

manned aircraft. Use of solar power, fuel cells, and other low emissions propulsion systems, could encourage their use among people caring for the Environment. Further RPAS will be used to support environmental issues (i.e., aerosol dispersion, wildlife tracking, atmospheric sampling…).

The perceived benefit from a hazardous activity directly influences an individual's willingness to accept risk. It has been shown that the level of benefit awareness is directly proportional to the acceptable level of risk. For human-piloted aviation, the benefits are easily identifiable to the general public, in terms of efficient transportation of people and freight. However, this was not always the case. In the early periods of human-piloted flight, the immediate benefits of aviation to the general public were not so clear. A similar situation exists for RPAS technologies: awareness of their benefits will push acceptability in their risks. Therefore it is important that the RPAS industry acknowledges the relationship between benefit awareness and acceptability of risk.

To foster awareness in the general public, familiarity with the technology, as well as its **benefits**, will also reduce the risk due to the uncertainty in the unknown. In addition, the perceived benefit coupled with **societal values and obligations** may result in **different levels of acceptance for different types of RPAS operations**. It is likely that the public will make a distinction between those operations which provide a "greater good" (for example fire fighting or search and rescue) and those operations, which have only limited community benefits.
Gaining public trust in RPAs needs time and specific actions, remembering that any obtained trust could be easily damaged or lost in a high exposure accident.

To reduce the possibility of an adverse public reaction to RPAS, a strategy for communicating with the public is needed based on the following actions:
• Make people perceive RPAS technology as a natural part of future society-increasing familiarity;
• Create positive interest in RPAS-awareness about benefits;
• Quickly and accurately report good and bad news concerning RPAS perception versus objective evidence;
• Create a website where the public can get information and ask questions increasing familiarity;
• Select a person or group to be responsible for industry's information flow-public acceptance facilitator role assignment;
• Deliver information to the public through presentations in the media-proper dissemination;
• Select a group of public relations experts to be responsible for comments from industry public acceptance facilitator role assignment;
• Create a strategy to be used in case a RPAS accident occurs.

In line with these recommendations, **the benefits of RPAS must be better explained** to the public. For example, the RPAS community could stress the roles RPAS have in

conducting humanitarian operations or in testing for airborne toxins, rather than focusing only on the military and security applications. Another message could emphasize the environmentally responsible technologies being researched and employed on RPAS (e.g., solar and fuel cell), or the many environmental research and humanitarian applications that RPAS will allow. Other matters of facts are listed in the following:

- RPAS can do what helicopters do for a fraction of the cost. The cost savings could be even greater as technology improves and regulations relax .

- Many RPAS models are electrically powered, and thus significantly quieter than any helicopter. RPAS operation would reduce unwanted helicopter noise, which would be especially valuable to residents who live in designated noise-sensitive areas.

- RPAS models for police expand either very little fuel or none at all, as opposed to fuel consumption by helicopters. While this difference in fuel consumption may not have a significant environmental impact, it might have a small effect on public attitudes towards police aviation.

- Compared to helicopters, small RPAS represent a decreased risk to the general public in the event of a loss of flight control. Although no data exist yet on small RPAS accident rates, their small size and lightweight will translate to minimal collateral damage on the ground in the event of a crash.

- RPAS flight could enable liberty, enhancing policy changes such as extending park hours at night, allowing citizens to feel safer in otherwise potentially dangerous conditions.

Furthermore the policy making process supporting the development of civil RPAS applications needs to *be* ***transparent and involve the consultation of stakeholders***, for example bodies like the European Group on Ethics, the LIBE Committee of the European Parliament or the European Union Agency for Fundamental Rights and European Data Protection Supervisor.

Last but not least, a ***certain range of permissible or forbidden uses of RPAS*** could be defined to increase the confidence of citizens. Guidelines for certain civil uses of RPAS would be based on a 'privacy and data protection impact assessment' and involve interested stakeholders.

An ad hoc group promoting Public Awareness (RPAS Public acceptance facilitator) will be responsible for researching and analysing the sentiment of an often forgotten

stakeholder, the public. The public opinion of RPAS technology must be considered in order to assess where the public stands on the issue, and what must be done to gain public acceptance. One way to do this is to get information directly from the public, specifically by means of a survey.

The survey should give an idea of public opinion relating to RPAS, using a sample that will allow it to be applicable to the general public. At its most basic level, it will give an idea of what the public knows about RPAS and how they feel their safety is affected by various uses of RPAS. Taking demographic factors into account, it will be possible to draw generalizations of different public groups. In addition, it will compare perceived risks associated with various RPAS uses with their perceived benefits.

The demographic groups include; age, gender, level and type of education, voting status, flight frequency, and pilot status. Participants will be asked to assess the benefit and risk they associate with specific civil RPAS applications (e.g. pipeline monitoring, traffic monitoring, border patrol, agricultural monitoring, and disaster response) compared to the current way these services are being performed.
These applications could vary in benefit to the public, as well as vicinity to highly populated areas. This will allow assessing the differences between these factors.

This assessment will include risks to those on the ground as well as in the air, and benefits to the RPAS user as well as society in general. This will also allow drawing correlations between certain types of uses in order to determine which RPAS applications are more easily accepted. It is difficult to exactly predict what the public response will be; there are some responses that seem more likely than others. It is possible that the public will have a significant level of discomfort with RPAS. This discomfort will likely be more evident in older respondents, who are generally seen as more conservative when it comes to technology. Younger age groups will have a greater level of confidence in the safety and effectiveness of the technology. More prior knowledge of UAVs will correlate with less risk perception, as will a higher level of education.

As far as safety concerns are associated with different applications, the closer a person is located to a site where RPAS might be in use, the more risk they will perceive. Additionally, more risk will be associated with flying in an airplane near a RPAS than being on the ground in the vicinity of a RPAS. The more benefit a respondent associates with a certain application, the less risk they will associate with it. It could be possible not come to an agreement on a prediction regarding frequency of flying. One on hand, those who fly more frequently might perceive higher risk because they are sharing the airspace with RPAS. On the other, those who fly less frequently might have a high-perceived risk as well, which is why they do not fly often. While any of these predictions can be off the mark, they are a good starting point for gauging what type of results the survey analysis will produce.

Responses will be compared to the various demographic responses and generalizations will be made based on different groups, highlighting which are significant. Correlations will be drawn between applications that receive similar risk perception responses, and a trial to analyse how or why these relationships exist. Risk associated with being in an airplane versus being on the ground will be compared, as will benefits associated with society and the RPAS user.

A survey can be conducted in many ways - from interviews in person to online forms - and each have their own benefits. A written survey handed out in person could be used. This will allow to easily conducting simultaneous surveys and to efficiently use incentives to draw respondents, speeding up the information collection process and eliminating waste associated with non-respondents. The survey should only take about 15 minutes to complete, and respondents will be compensated for their time in some way. Ideas include scores like frequent flyers' miles and related gifts, raffle for a toy airplane.

Summarizing the approach towards public acceptance could involve the following steps:

1. ***Definition of a "public acceptance facilitator group";***
2. ***Implementation of a survey;***
3. ***Evaluation of the survey results to plan facilitation strategy;***
4. ***Implementation of the facilitation strategy;***
5. ***Measurement of results and improvements.***

A survey to:

- ***Assess current public acceptance;***
- ***Identify ways to foster public acceptance.***

The facilitation strategy will improve familiarity with RPAS, benefits' awareness, influence the regulatory and technical developments.
It will identify some civil missions to be used as demonstration of the previous aspects.

Some allowed missions (missions related to Civil Protection, Security and Environment Protection) to rise:

- ***Familiarity;***
- ***Awareness of risk;***
- ***Awareness of benefits;***
- ***Reliability data source;***
- ***Push industry competitiveness;***
- ***Start to insert RPAS applications in civil airspace;***
- ***Provide requirements and hints to regulatory and R&D activities***

6.1 Recommendations

Description of the Issue	Proposed solution
A strategy to foster public acceptance has to be defined by an ad hoc team.	Definition of a "public acceptance facilitator group"
The public opinion of RPAS technology must be considered in order to assess where the public stands on the issue, and what must be done to gain public acceptance.	One way to do this is to get information directly from the public, specifically by means of a survey.
A certain range of permissible or forbidden uses of RPAS could be defined to increase the confidence of citizens.	Civil mission definition and implementation based on a 'privacy and data protection impact assessment' and involvement of interested stakeholders
To make society familiar. To make society aware of the benefits of the insertion towards challenges: security, civilian aid, environment, and competitiveness for the whole society. **To make society confident of the safety implementation (restricted use in time and space: predetermined flying corridors, fixed time frames,..** **Possibility to be informed on time about their positions).** **To promote payload industry technology improvement**	Dissemination

7 ETHICS

Ethics is commonly considered as a common sense definition of what is good for the humans and what is correct to do or not to do. As an extension, is also considered as a personal behaviour ruled by what each one believes or perceive as correct.

In a more formal way, Ethics is concerned with ***how we should conduct relations with others***. When approved and codified by a State they become laws. Such correct behaviour is not native in human characters but needs to be acquired via a complex teaching and training, eventually associated with continuous practicing of what has been learned. Ethics could have different priorities depending on the traditional and cultural background of different Countries and peoples.

As far as RPA are concerned, up to now information about their characteristics are not part of common culture and knowledge. ***EU Citizens risk to wake up one day and discover that the world they know has suddenly changed into a "less human" society where robots are among them in a perceptibly invasive and out of control way.*** This must not happen, because fundamentally it is not ethic and Citizens have the right to be informed as a become part, maybe active, of such technological advancement of the society as it is happening right now with the smart phones.

The big difference between the smart phones and the RPA is that, as per today, the first are perceived as a mean to enhance social activities, while the latter are associated to un-ethical war scenarios where it is possible to kill people while seated on an armchair thousand kilometres away. Experts well know that such vision is far away from the reality, and then they have the responsibility to spread their knowledge in an understandable and popular way. Accordingly, they have to tell the truth and be trustworthy.

Like for all human activities, Ethics will be part of the RPAS world and is foreseeable the creation of public associations aimed to critically observe the ethical aspects of the RPA activities. The RPA business development should then be anticipated by a correct **information campaign**, informing citizens about capabilities, ensuring them that ethic behaviour will be ensured and plan accordingly rules and laws to enforce the concept.

Generally speaking, ***Citizens will expect RPAS to have an ethical behaviour comparable with the human one***, respecting some commonly accepted rules. Then, they will expect to identify a legal or physical entity to blame and condemn in case ethical rules are broken. More in particular, eventual accidents with casualties could logically have big impact on the societal acceptance of the RPAS, despite similar accidents involving actual commercial aviation are widely accepted as "normal" risk related to daily human activities, partly because eventual responsibilities are verified and judged via existing laws.

If instead, they will be able ***to prove on a constant basis their capability in assisting human activities*** recognised as helpful like Civil Protection, Security and Environment protection, the Citizens will probably start to consider them as part of their life, like the smart phones.

There is no doubt that some incorrect behaviour from RPAS will have to be prosecuted. In this case could be an important issue to define the boundaries among engineers responsibility for erroneous decisions taken during the design and operator responsibilities for the way they operate the system. Of course, future enhancements in technology could facilitate the production of "independent " machines but probably such capability will never be introduced on RPAS, preferring systems oriented to some kind of **advanced human-machine cooperation**, expanding the actual autopilots modes or pilot assistance systems.

The RPA systems will enhance the cooperation possibilities among humans and machines, exploiting the available technology: this will probably create a link among the

actions of the RPAS and of the operators, known as **cognitive cooperation**. Such link, probably, will be ethically perceived as a whole, and could be difficult, when not adequately addressed, to mark the border between human and systems. In this context, RPAS level of autonomy represents a critical issue to be addressed in support of Public Acceptance and, consequently, **proper levels of responsibility and accountability have to be defined**.

The technologies related to the human-machine cooperation will be mainly software related, then ***the ethical problems will include also the SW integrated on RPAS, consequently the SW code programmers*** as they could influence the system behaviour. In this field, the cinematography has widely diffused the idea that programmers could maliciously hidden dangerous behaviours in the software code or that the software is capable of autonomous malicious behaviours. This is obviously not true, and anyway, unethical programmers could right now introduce hidden malicious code in the on-board computers of the commercial aviation.

At the time of today, the more known unmanned operated are the military **unmanned vehicles** that are right now governed by a number of different sets of laws and regulations. Despite what is normally believed or shown by catastrophic movies, the military unmanned air vehicles are subject to the standard safety regulations set down by the civil and military authorities for safe use of such systems within their designated environments. Then, there are international Laws of Armed Conflict (LOAC), national laws and caveats and national Rules of Engagement, which govern how armed forces operate within a given theatre. For expeditionary operations, this may be further complicated by the national laws of the country in which they are operating and by the national caveats of coalition forces. There are many elements that can be common to civil and military use of UAS.

Then, all the existing unmanned are right now already subject to a relevant number of **laws, rules, standards and limitations**. Is then of general interest to ***analyse the differences with the commercial aircrafts***.

One common aspect of all the types of RPA, both civil and military is represented by the ***Pilot in Command that is not in the cockpit*** but in some place, maybe very far away, inducing actions and behaviours to the air vehicle using the same equipment of a on board cockpit (or at least very similar). The risk of de-concentration is indeed real, aggravated by ***absence of personal risk in case of emergencies*** that could lead to accidents when not properly and promptly managed. This problem pose specific requirements to the morality and attitude of the RPA pilots, then should be properly addressed when will be defined the requirements to form the pilots. The ***issuing of a code of conduct*** having some moral and ethical aspects to be used as reference for the regulating framework of insertion is also considered as necessary.

In addition to the Pilot in Command, the RPA have another "human-factor" to be considered, the Operator, whose behaviour could have ethics concerns from people. The Operators (regardless if they will be people or legal entities) will be probably responsible for the overall mission execution as well as any event happening during the RPA

operations. There is the need to guarantee citizens that Operators and the business they will manage, will not only respect the laws and rules to operate the RPA but at the same time they will maintain the mission operations inside the boundaries permitted by the pre-defined mission rules. It is foreseen that RPA will perform missions under precise and limiting authorisations clearly stating which operations can be performed during the mission and under which particular constraints.

As an example, RPA could perform flood monitoring but the images collected during this task could never been used to monitor people private activities, if not authorised by some authority. Proper rules have to be issued to define clear boundaries for the actions allowed by the RPA Operators together with clear limitations about the "owner" of the collected data and about their elaboration, consultation and storage.

While designing the **rules for pilot selection and training** (and consequently those rules for the system design related to human interfaces and interactions) it should also be considered the already demonstrated difficulty for humans subject to stressing activities to maintain for long time a sustained level of cognitive attention. ***This is again a field of intervention for pilot selection and training and for the system design***. In particular the system design could benefit of the future mission management and decision enabling technologies for maintaining the pilot attention and engagement on the task, relieving him from simple repetitive operations.

It is demonstrated by experience that people are inclined to accept risks (or at least to accept what they perceive as a risk) when they realise that the risk is associated to some real benefit. It is then important to work on this aspect, highlighting benefits and demonstrating that, when real risks exist, they are comparable to others that are already accepted. ***Creating knowledge in the new technologies*** will also reduce the risk perception, especially if the knowledge comes from scholar education.

But **sharing risk for benefits could not be enough as far as Ethics is concerned**, because societal values are anyway at a higher moral level than benefits in most of the citizens. In addition, coupling benefits with societal values and Ethics can result in a dangerous mixture, resulting in different degrees of acceptance for RPA, depending on their specific utilisation, that is far away from the scope of this roadmap. For this reason a close coordination between Ethics and Acceptable Risk should be initiated.

In addition to the ethic issue related to the single and combined human and machine interaction, some other aspects citizens could perceive RPAS as unethical behaviour. As an example, some small RPAS are today claimed to have an **animal-like behaviour**. Specialisation of such behaviour in next future could imply possibly intrusive studies on animal or anyway can be perceived as an **illegal intrusion in wildlife**, potentially provoking concern from the animalist associations. It is not actually clear how many situations like this one could occur in the future, due to popular perception or, in the worst case, to specific manipulation of the reality from groups of people that are against any kind of innovation.

Probably, one of the major keys for the public acceptance of RPA is the **creation of public awareness** and showing compliance with recognised ethical principles. Then, a close correlation with the Benefits for Citizens has to be considered.

At the start of this chapter, laws were indicated as one the means of the States to define ethical limits. Manned aircraft and their pilots already have ethical principles and laws to fix the rules that can be used as a basis to create more specific ethical rules and consequently laws for RPAS, if proper studies will recognise the need. Ethical principles and other related issues could be grouped into a specific **Code of Conduct** contributing to create transparency and consideration, complementing the laws.

As a resume, are below listed the milestones to be achieved:

- ***Define ethical principles for RPAS,***
- ***Contribute to address the responsibilities for pilots in command, operators and manufacturers considering the ethical principles and possible code of conduct,***
- ***Contribute to define the rules for pilots selection and training,***
- ***Contribute to demonstrate that RPAS are useful and give benefits, despite their possible risk,***
- ***Contribute to demonstrate that achieved benefits are in line with ethical principles,***
- ***Avoid misinterpretation of human-machine cooperation and pre-programmed behaviour,***
- ***Contribute to demonstrate that software programmers are already at work on commercial aircraft and they respect some code of conduct,***
- ***Contribute to creating knowledge in new technologies,***
- ***Address the military RPA specific rules and laws to show they already respect them,***
- ***Address possible problem deriving from misinterpretation of RPA behaviour (animal-like),***
- ***Contribute to information campaign.***

In parallel, some seamless tasks of close coordination with other part of the RPAS Roadmap should be considered to maximise the effort, in particular with:

- Regulation: plan the insertion demonstration showing concrete possibilities of RPAS in respecting the ethical behaviour,
- Technology: plan the new technologies insertion supporting the demonstration of limited risks and respect of Ethics,
- Acceptable risk, Liability, and Benefits for Citizens have to work in strict coordination to maximise the effects of dissemination.

7.1 Recommendations

Description of the Issue	Proposed solution

Ethic is a critical issue for RPAS acceptance and needs to be addressed and defined	Fix the boundaries of Ethics: few general concepts of wide validity
	Plan adequate rules and laws
The responsibilities for pilots in command, operators and manufacturers have to be addressed also from an ethic point of view, considering the defined ethical principles, and the different situations involving the pilots, as they are no more in the cockpit, contributing to built a code of conduct. **In this context, the rules for pilot's selection and training represent an important cornerstone.** **There is also the need to consider the possible ethical issues involving the Operators during the mission execution.**	Built a code of conduct for RPAS pilots and operators, starting from the pilot selection and training.
RPAS acceptance is related not only to their capability to help citizens but also to their capability to respect accepted ethical rules / code of conduct	Organise demonstration campaign according to the code of conduct.

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8 Conclusions

The study has designed a scenario for Complementary Measures to address the societal impact of RPAS, indicating the existing set of rules or the major elements that should be taken into consideration for a smooth integration of RPAS into the common airspace. The main issues and obstacles have been identified and actions to overcome these obstacles have been suggested.

It is important to acknowledge that most of the subjects of Complementary Measures have been analysed and developed by members of Academia who have the necessary background which comprises the deep knowledge of national, international and European provisions as well as the international Conventions and Treaties, background often enhanced by a professional international activity.