European Aviation Safety Agency

Technical Opinion

Introduction of a regulatory framework for the operation of unmanned aircraft

Related A-NPA: 2015-10 — RMT.0230 — 18.12.2015

EXECUTIVE SUMMARY

This Technical Opinion is the result of the consultation performed with A-NPA 2015-10. It has been developed in parallel to the draft modifications to Regulation (EC) No 216/2008 (hereinafter referred to as the 'Basic Regulation') included in the **'Aviation Strategy to Enhance the Competitiveness of the EU Aviation Sector'** (hereinafter referred to as the 'Aviation Strategy'), published on 7 December 2015.

It includes 27 concrete proposals for a regulatory framework and for low-risk operations of all unmanned aircraft irrespective of their maximum certified take-off mass (MTOM). This regulatory framework is operation centric, proportionate, risk- and performance-based, and establishes three categories as follows:

— 'Open' category (low risk): Safety is ensured through compliance with operational limitations, mass limitations as a proxy of energy, product safety requirements, and a minimum set of operational rules.

— 'Specific' category (medium risk): Authorisation by a national aviation authority (NAA), possibly assisted by a qualified entity (QE), following a risk assessment performed by the operator. A manual of operations lists the risk mitigation measures.

— 'Certified' category (higher risk): Requirements comparable to those for manned aviation. Oversight by NAA (issue of licences and approval of maintenance, operations, training, ATM/ANS and aerodromes organisations) and by EASA (design and approval of foreign organisations).

The present Technical Opinion does not include new draft legal text beyond the one that has been proposed by the Aviation Strategy. Its purpose is to lay the foundation for future work, illustrate the contents of the draft changes to the Basic Regulation and serve as guidance for Member States (MS) to develop or modify their regulations on unmanned aircraft.

The concept proposed by A-NPA 2015-10 has been kept, but adaptations and clarifications have been introduced in several parts. Exact definitions and applicability of some proposals will have to be determined by thorough regulatory impact assessment (RIA) during the drafting of implementing rules (IRs). This Technical Opinion, including a road map presenting the steps to be taken in the future, is only one step in the development of rules for unmanned aircraft.

Applicability		Process map	
Affected regulations and decisions:	N/A	Concept paper:	N/A
		Rulemaking group:	N/A
		RIA type:	N/A
Affected stakeholders:	NAAs; aviation industry; general public; manufacturers and operators of unmanned aircraft; air navigation service providers (ANSPs); airspace users.	Technical consultation during A-NPA drafting:	N/A
		Publication date of the A-NPA:	31.7.2015
		Duration of A-NPA consultation:	2 months
Driver/origin:	Efficiency/proportionality	Review group:	No
		Focused consultation:	No
Reference:	Please refer to Section 5.3	Publication date of the decision:	N/A
		Publication date of the opinion:	2015/Q4

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1. Purpose of the Technical Opinion

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') was requested at the Riga Conference in March 2015 to produce before the end of the year concrete proposals for a regulatory framework and for low-risk operations for unmanned aircraft. The present Technical Opinion is the Agency's response to this request.

It contains no legal text beyond what has already been made public as part of the Aviation Strategy as it is intended to:

— lay the foundation of future work, notably the development of the necessary IRs in accordance with the Agency's rulemaking process;

— illustrate the articles and essential requirements on unmanned aircraft included in the draft revision of the Basic Regulation that was issued as part of the Aviation Strategy on 7 December 2015;

— serve as guidance for MS that have no rules for small unmanned aircraft or plan to modify their existing ones to ensure consistency as much as possible with the intent of the future EU rules;

— provide a road map presenting the steps to be taken in the future.

This Technical Opinion contains revised proposals compared to those of A-NPA 2015-10 together with a simplified comment-response document (Annex I). The concept proposed by A-NPA 2015-10 has been kept but adaptations have been introduced in several parts. As regards subcategories in the 'open' category and the use of technologies, the principles are kept but the definitions and the scope will be determined following a thorough RIA during the drafting of the IRs. Clarifications have been brought to the boundaries between categories and in the definition of 'drone zones'. In the 'specific' category, the mutual recognition of authorisations issued by MS has been confirmed, but local adaptations are accepted. In addition, regarding the 'specific' category, 'standard' cases will be developed. Last but not least, the case of model aircraft has been addressed by proposing the introduction in the IRs of provisions that recognise the high level of safety achieved in this activity.

This Technical Opinion is only one step in the development of rules for unmanned aircraft. The steps presented in the above-mentioned road map will be taken in cooperation with all stakeholders. A communication plan will be developed in liaison with the Commission and the MS. Particular attention will be paid to maintaining the necessary consistency the proposed draft Basic regulation during the comitology procedure..

Regulatory definition

The Agency considered several terms such as 'unmanned aircraft systems (UAS)', 'remotely piloted aircraft systems (RPAS)' — a UAS subcategory — and 'unmanned aircraft'; consistent with the proposed Basic Regulation text and in line with many comments received during the A-NPA 2015-10 public consultation, the term 'unmanned aircraft' is used for regulatory proposals with the following definition:

'Unmanned aircraft' means any aircraft operated or designed to be operated without a pilot on board.'

This wide definition will allow to establish rules for different kinds of operations with a distributed allocation of responsibilities for the flying aircraft and the ground station as well as for autonomous aircraft or 'unmanned aircraft' carrying persons.

It needs to be understood that this definition also includes machines normally not perceived by the general public as aircraft, such as flying toys, small tethered balloons or kites[1]. Special attention is therefore required to not negatively impact any 'operation' that does not cause aviation risk.

The term 'drone' will be used in communications addressing the general public.

[1] Tethered balloons and kites are mentioned in Annex 7 to the Chicago Convention.

2. Proposals for the regulatory framework for unmanned aircraft

This section begins with an overview of the current state of European regulation, including some regulatory principles which are mentioned later in the proposals such as 'operation-centric', 'risk-based', 'performance-based' and 'proportionality'.

2.1. Extending the European Union Regulation for all unmanned aircraft

In accordance with Articles 1 and 4 of and Annex II to the current Basic Regulation, the scope of EU regulations is limited to unmanned aircraft with an MTOM above 150 kg that are not used for military, customs, police, firefighting, search and rescue, or experimental work. This means that the vast majority of unmanned aircraft development and operations today are regulated by national aviation legislation.

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

1. The EASA MS' legislation is not harmonised and there is no obligation of mutual recognition of certificates or authorisations. This means that an unmanned aircraft operator authorised in one MS must obtain another authorisation in another MS if wishing to operate there.
2. The current EU legislation is based on the assumption that unmanned aircraft below 150 kg are operating locally, which is generally true today. However, there are small unmanned aircraft that can fly very high or can operate at long distances away from their base. Operations of such unmanned aircraft could affect several EASA MS and, therefore, could need multiple authorisations.

This results in a situation where the free movement of products is limited, and in a burden for the industry without an actual benefit for the European society.

The proposals for the revision of the Basic Regulation foresee that common EU rules are established for all unmanned aircraft. In line with the general principles of EU law as being the case for most of the common EU rules existing today, these rules will be implemented locally by the NAAs of the MS. Only in few exceptional cases, the Agency will serve as the competent authority to issue certificates.

2.2. Principles for unmanned aircraft regulation[2]

Only the most relevant principles have been outlined here. Other principles such as harmonisation with other countries and clarity of rules are also applicable.

Proportionality

Proportionality is a key, if not the most important, feature of the regulatory framework. The requirements associated with each unmanned aircraft activities are tailored to the risk associated with each activity. In particular, the question whether certificates or authorisations should be issued by NAAs has been carefully evaluated when defining the appropriate limitations, and in particular for low-risk activities.

[2] There are some overlaps between the various principles.

Operation-centric

This regulatory framework is based on the risk posed by unmanned aircraft operations. Another choice would have been the classic approach used today for manned aircraft. However, in most cases there is nobody on board an unmanned aircraft and the consequences of loss of control are highly dependent on the operating environment. A crash in an unpopulated or desert area would lead only to the loss of the unmanned aircraft whereas the same event may have different consequences if occurred in a major city or close to an aerodrome. Therefore, an operation-centric regulatory framework seems more appropriate to mitigate the risks posed by unmanned aircraft operations.

Risk-based

The level of risk depends on: the energy[3], the size and the complexity of the unmanned aircraft; the population density of the overflown area; and the design of the airspace, the density of traffic and the services provided therein. The risk can be best described as a continuum but has been approximated by the use of categories that are defined in section 2.3.2. ('open', 'specific' and 'certified' categories). Further details may be found in sections 3.5. ('open' category); 3.6. ('specific' category) and 3.7. ('certified' category). As the proposed regulatory framework is risk-based, it applies to both commercial and non-commercial operations as identical unmanned aircraft might be used for both commercial and non-commercial activities with the same risk to uninvolved parties. The case of model aircraft will be addressed through provisions in the IRs recognising that the way they are organised, their experience; their safety culture, etc. provide an equivalent level of safety to the one intended by the IRs.

Performance-based

Performance-based regulation is a regulatory approach that focuses on desired, measurable outcomes. It can be objective-based, process-based or performance-standard-based. The Agency proposes to use a combination of objective-based (i.e. require certain functionalities) and process-based rules (e.g. identification, or require a risk assessment to be performed). EU regulations are usually organised in there levels. The first level are basic principles and essential requirements included in the Basic Regulation. The second level are IRs. The third level, or 'soft law', are composed of acceptable means of compliance (AMC) and guidance material (GM). They are adopted by the Agency and are non-binding. AMC provide one means, but not the only one, to comply with the rule and GM provide general information. Certification specifications (CSs) are another example of 'soft law' where industry standards developed by standardisation bodies could be used to provide the means to comply with the safety objectives or provide methods to perform risk assessments.

Progressive

The categories have been established with the idea that a start-up company would start to operate in the 'open' category with small and simple unmanned aircraft in operating conditions that pose very low risk, e.g. visual line of sight (VLOS) and very low-altitude operations, and as its experience increases to move more progressively to the 'specific' and 'certified' category with more complex operations, e.g. heavier and more complex unmanned aircraft and operation beyond visual line of sight (BVLOS).

[3] Kinetic, potential and internal energy of the unmanned aircraft.

Smooth

The introduction of unmanned aircraft in the aviation system should be made in such a manner that it does not create undue burden for other aviation stakeholders. This principle has been introduced in response to a number of comments on A-NPA 2015-10 that clearly perceived unmanned aircraft as intruders in the aviation system.

2.3. Contents of the proposed draft Basic Regulation

This section discusses the proposed draft Basic Regulation from the perspective of unmanned aircraft. It describes the changes as proposed in the Aviation Strategy**.**

Said Aviation Strategy proposes the legal basis to provide for more detailed rules on unmanned aircraft, covering all unmanned aircraft irrespective of their mass.

More specifically:

Draft Article 45 refers to the relevant Annex IX which contains the essential requirements concerning the design, production, operation and maintenance of unmanned aircraft that need to be complied with to ensure safe operations.

Draft Article 46 describes the range of means to demonstrate that the essential requirements are complied with. As unmanned aircraft are able to perform operations that are not possible with manned aircraft, the range of risks associated with unmanned aircraft operations is very wide — ranging from the traditional high-risk operations similar to 'manned aviation risks' to very low risk. In order to keep the rules and procedures proportionate to the risk of the operation, it is necessary to move towards an operation-centric approach that assesses the specific risk of an individual operation or of a type of operations.

With reference to mass-produced unmanned aircraft which pose a low risk, it is proposed to use existing market surveillance mechanisms, as governed by Regulation (EC) No 765/2008[4] and Decision No 768/2008/EC[5], which are specifically devised for the production and marketing of such type of products. However, even in this case, aviation authorities remain indirectly involved, as the operational capability limitations that would be imposed (e.g. that the unmanned aircraft should not fly higher than, for instance, 50 m to keep risks low) will have to stem directly from the traditional aviation safety requirements. While the Agency would not be responsible for the oversight of the market surveillance mechanisms, the Commission is always entitled to verify if the MS fulfil their responsibilities. Moreover, the market surveillance mechanisms rely on justified complaints from citizens or undertakings in order to detect non-compliant products. Findings of non-compliance in one particular MS are then communicated throughout the common market.

[4] Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 (OJ L 218, 13.8.2008, p. 30).

[5] Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC (OJ L 218, 13.8.2008, p. 82).

2.3.1. Applicability

The proposed regulations shall apply 'to the design, production, maintenance and operation of unmanned aircraft, their engines, propellers, parts and non-installed equipment, as well as the equipment to control unmanned aircraft remotely, where such aircraft are operated within the single European sky airspace by an operator established or residing within the territory to which the Treaties apply.' (draft Article 2 — Scope).

This covers both commercial and non-commercial operations as identical unmanned aircraft might be used for both commercial and non-commercial activities with the same risk to non-involved parties.

However, to take into account the satisfactory safety level achieved by aircraft models, measures will be defined in the IRs. Model aircraft flying has been practised for decades with a good safety record because it is a well-structured activity. The intention is to develop rules that will not affect model aircraft flying. One significant element in this respect is that the pilot of an unmanned aircraft will be required, except in the 'harmless' subcategory, to have a minimum knowledge of aviation regulations. The education provided at model-flying associations should be accepted as sufficient.

2.3.2. Categories of operation of unmanned aircraft

Although the risk of the whole population of unmanned aircraft can be represented as a continuum[6], in order to be practical, it has been proposed to set up three categories of operations from low to high risk. The proposed Article 46 describes the range of means to demonstrate that the essential requirements are complied with and provides for the use of three tools, that is market regulations; declaration; and 'certification'. The latter includes issuance of any certificate, approval, licence, authorisation, attestation or other document attesting compliance with the applicable requirements.

Complementing the tools established by Article 46 of the proposed draft Basic Regulation to ensure compliance of unmanned aircraft with their essential requirements, the IRs (delegated acts in accordance with Article 117) shall lay down the detailed rules for the design, production, maintenance and operation of unmanned aircraft.

Proposal 1: Establish three categories for the operation of unmanned aircraft taking into account the nature and risk of the particular activity.

- 'Open' category (low risk): Safety is ensured through compliance with operational limitations, mass limitations as a proxy of energy, product safety requirements[7] and a minimum set of operational rules.
- 'Specific' category (medium risk): Authorisation by an NAA, possibly assisted by a QE, following a risk assessment performed by the operator. A manual of operations lists the risk mitigation measures.
- 'Certified' category (higher risk): Requirements comparable to those for manned aviation. Oversight by NAA (issue of licences and approval of maintenance, operations, training, ATM/ANS and aerodromes organisations) and by the Agency (design and approval of foreign organisations).

[6] The level of risk increases progressively with the energy, mass, size and complexity of the aircraft.

[7] These requirements (yet to be defined) would include performance limitations, carriage of certain functionalities, etc. The CE marking affixed on the unmanned aircraft indicates conformity with the regulation.

These three categories are enabled by the proposed draft Basic Regulation as follows:

— Article 46.1 enables both the 'certified' and 'specific' categories. For the 'certified' category, this is self-explanatory. For the 'specific' category, it may be less obvious. It becomes clear when looking at the definition of the term 'certificate' (in Article 3(9)) which includes the term 'authorisation'. The 'certified' and 'specific' categories will be created by different delegated acts (IRs) under Article 47(1)(a).

— Article 46(2) allows for the creation of declarations that would come in support of the three categories. The delegated acts[8] are created by Article 47(1)(b).

— Article 46(3) enables both the 'open' category and the use of market regulation and is complemented by the delegated act envisaged in Article 47(1)(c).

2.3.3. Essential Requirements

Article 45 refers to the relevant Annex IX which contains the essential requirements concerning the design, production, operation and maintenance of unmanned aircraft that need to be complied with to ensure safe operations.

2.3.4. Use of product legislation

Complementing aviation rules with specific product legislation developed for unmanned aircraft will efficiently contribute to the safety of the operations of mass-produced unmanned aircraft commercialised in retail shops or through the internet, in particular those performed under the 'open' category.

As, under this category, anybody can freely operate without any approval or certificate from NAAs, it would be important to ensure that the products placed on the market and easily accessible to the public comply with a minimum set of requirements defined in a way to ensure not only the safety but also the safe use of these products by non-expert operators, imposing, for instance, performance or geographical limitation systems. This will be achieved by calling upon market instruments like market surveillance and CE marking.

Product legislation covers only the placing of products on the market. It covers neither prototypes nor the use of the products. Operations of unmanned aircraft would remain subject to aviation rules.

The main characteristics of product legislation are: definition of the essential requirements and related standards, assessment and declaration by the economic operator (manufacturer, importer, etc.) of the conformity of the product placed on the market, enforcement by the market surveillance authorities, 'CE' marking easily identifiable by the general public, specifications for a user manual.

The products will be accompanied by customer leaflets to draw attention to safety issues. Enforcement of the quality of the product would be left to 'market complaints' by customers or competitors. So, competitors could check compliance and lodge complaints.

The use of market regulation has received strong support from stakeholders.

[8] A delegated act is a specific process for the Commission to adopt an implementing rule. Indeed, Article 290 of the Treaty on the Functioning of the European Union (TFEU) allows the Council and the Parliament to delegate to the Commission the power, under strict limits, to adopt non-legislative acts of general application that supplement or amend certain non-essential elements of a legislative act (e.g. the EASA Basic Regulation)

Proposal 2:	Manufacturers and importers of unmanned aircraft have to comply with a dedicated product legislation, and will have to issue information to respective customers on operational limitations applicable to the 'open' category. This approach will be applicable to smaller unmanned aircraft and an upper threshold needs to be established by the IRS mentioned below.
Proposal 3:	The Agency will develop as a matter of priority the IRs that could qualify as specific product legislation defining the safety characteristics (e.g. kinetic energy, performance, characteristics, loss-of-link capability) appropriate for the category and subcategory of the unmanned aircraft. It is envisaged to include also provisions for environmental compatibility. The detailed rules will this way drive the standard-setting process.

2.3.5. Use of qualified entities (QEs)

In order to ensure availability of resources, QEs should be able to work on behalf of the Agency or the NAAs as regards the issuing of certificates. Article 58 of the proposed draft Basic Regulation details the requirements on qualified entities and allows the Agency or the MS to grant them privileges to issue certificates. The use of QEs was supported by the stakeholders provided they are accredited and that this activity is subject to the provisions of Article 73 (Monitoring of Member States)

Proposal 4:	QEs will be accredited and audited by the NAAs or the Agency using the risk-based oversight concept.

2.3.6. Oversight and enforcement

Manned aviation has developed its own oversight and law enforcement mechanisms, driven especially by the NAAs. Unmanned aircraft operations will pose additional enforcement challenges to authorities. Experience needs to be gained as to how existing rules on safety, data protection and privacy, security and environmental protection, or liability/insurance shall be implemented[9]. Guidelines are often not available, and those who are engaged in unmanned aircraft operations have low awareness of the applicable rules.

Rules have to be enforced by national forces designated by the MS (e.g. Police). As the police and other law enforcement agencies are expected to play a key role in the oversight of the 'open' category, they will be approached with the help of the NAAs, DG HOME, the dedicated EU agencies (e.g. EUROPOL, CEPOL), existing European associations (European Police Association, Association of European Police Colleges, etc.) to ensure their acceptance. A significant effort must be invested into this activity and an action plan established. For example, they should be provided with an information manual and a training syllabus after coordination with the EASA MS. However, the contacts with law enforcement agencies should not only be limited to briefing them but also to listening to and catering for their needs (e.g. simple rules).

[9] Data protection and privacy as well as liability/insurance will not be included in the EASA IRs.

Proposal 5:	EASA MS have to designate the responsible authorities for the enforcement of the regulations, in particular in the 'open' category where the recommendation is to rely on law enforcement agencies.

2.3.7. Environmental protection

With regard to the environment, nuisance from noise and emissions should be mitigated. Noise is a complex issue that requires a range of mitigation measures. Although the current framework foresees regulatory limitations on noise only for unmanned aircraft subject to type certification ('certified' category), noise even from unmanned aircraft in the 'open' category should be abated as much as possible. This can be achieved by installing the latest noise-reducing technology to limit noise at source and by operating the unmanned aircraft in a considerate way, striving to minimise nuisance to other persons as much as possible. Operating restrictions defined at local level could be another measure including e.g. flight altitude limitations, no-unmanned aircraft zones or curfews. The draft Essential Requirements envisage that unmanned aircraft shall comply with the environmental performance requirements set out in Annex III to the proposed draft Basic Regulation.

2.3.8. Occurrence reporting and accident Investigation

Articles 124 and 125 of the proposed draft Basic Regulation extend the regulation for occurrence reporting and accident investigation to unmanned aircraft.

2.4. Implementing Rules (IRs)

The rules for unmanned aircraft will be included in the proposed draft Basic Regulation (first level: principles and essential requirements) and in the IRs (second level). These two levels are binding 'hard law'. Principles and essential requirements are adopted by the legislator (Council and Parliament) based on a legislative proposal from the Commission; IRs are adopted by the Commission based on an Agency Opinion and after consultation of the EASA MS.

Proposal 6:	The Agency will develop as a matter of priority a dedicated IR for the regulation of the 'open' and 'specific' categories of unmanned aircraft operations.

The new rule should contain an annex covering all aspects of unmanned aircraft operations for these categories including airworthiness aspects, environmental compatibility, operational and organisational requirements, and related processes. It will also include the necessary requirements for NAAs.

Proposal 7:	It is currently not foreseen to have stand-alone IRs for the 'certified' category. Instead, the IRs for manned aviation will be adapted.

Nevertheless, adaptation of the existing rules will need to be developed to better accommodate high-risk unmanned aircraft operations. They will be applicable for:

— the certification and continuing airworthiness of unmanned aircraft and related products and parts;

— design, production and maintenance organisations;

— air operators certificates; and

— licences of personnel used in higher-risk operations or where such certificates are requested voluntarily by applicants.

It is foreseen that these rules will contain objective requirements for detect and avoid, and command and control systems.

IRs will be complemented by 'soft law', that is to say AMC, GM and CS. CS may include or make reference to industry standards.

3. The specificities of unmanned aircraft

This section discusses some of the safety issues and risks which are specific to unmanned aircraft. Due to these specificities, the approach for regulation of unmanned aircraft is different from that for manned aviation. The safety objective for the airworthiness and operation of manned aircraft is to protect the humans on board the aircraft. By reducing this risk to an acceptable level, uninvolved third parties on the ground and in other aircraft are equally protected.

For unmanned aircraft operated in unpopulated areas, the need to protect the aircraft is probably driven by commercial aspects of the operator and not primarily by safety. On the other hand, for unmanned aircraft continuously operating above densely populated areas, the safety objectives for the design of the aircraft might go beyond current objectives for manned aircraft of a similar size. Moreover, additional considerations are needed when the unmanned aircraft interact with the air traffic management (ATM) system.

3.1. Safety risks

The following safety risks of unmanned aircraft operation need to be addressed:

— harm to people on the ground;

— mid-air collision with manned aircraft; and

— damage to critical and sensitive infrastructure.

The risk in terms of severity depends on the ability of the unmanned aircraft to injure persons or to create damages when flying out of control or crashing. From a flight safety approach, the kinetic energy together with density of people on the ground and density of air traffic would be the correct criteria to assess the risk and identify categories of operation and involved aircraft. Unfortunately, these parameters are difficult to determine especially during operation outside of traditional aviation environment and simplified criteria need to be defined and applied.

— For operation and enforcement, ‘mass’ will be used instead of kinetic energy. This simplification is acceptable as the mass is the main parameter defining the impact energy of falling devices or devices being hit by faster flying aircraft. Nevertheless, kinetic energy can be used within technical standards and product safety rules to ensure limited impact energy.

— Density of population on the ground needs to be generally assessed by the responsible authority and is one parameter in order to define areas with limited or no operations at all; additionally, for operation and enforcement, distances from persons or crowds are proposed.

— Density of air traffic, together with the types or airspace need similarly to be assessed by the responsible authority and used in order to define areas with limited or no operations at all. For instance, maximum altitudes are proposed for operation and enforcement. Furthermore, additional limitations are proposed when operations are conducted in proximity of airports.

3.2. Security and privacy risks

The two issues of security and privacy are major concerns of the public. Currently, no additional regulations are foreseen at European level as security and privacy are covered by existing regulations.

The proposed essential requirements for unmanned aircraft in the proposed revised Basic Regulation will give the possibility to:

— promote privacy and security by design;

— limit performance and restrict the accessible airspace;

— facilitate transparency of operations; and

— allow the identification of operators which will support enforcement of current regulations.

Such approach is facilitated by the fact that such measures contribute also to safety.

3.3. Benefits

It is expected that, in general, unmanned aircraft will be beneficial for the society. The purpose of this section is to highlight some safety benefits. In Europe, between 2006 and 2014 the number of fatalities in aerial work fixed wing and rotorcraft involved in photography, agricultural, aerial survey and observations amounts to 146. These are typical activities where unmanned aircraft are likely to replace manned aircraft so one can expect a reduction of fatalities which will obviously depend on the substitution rate. The use of unmanned aircraft in agricultural work or in inspection of industrial structures is likely to save lives as an accident with an unmanned aircraft will be limited to material damages. Also, the use of unmanned aircraft to inspect a building to find where fire is or to find where victims could be trapped, will limit risks to human operators compared to sending a team. The use of unmanned aircraft in disaster areas has also a significant potential to save lives because they are easy to deploy (search for survivors, deliveries of medications). It is difficult to quantify such expected benefits but there is no doubt that they will materialise.

3.4. Risk mitigations

As already indicated above, the different risks require mitigation through different means.

3.4.1. Operational limitations and areas of operation

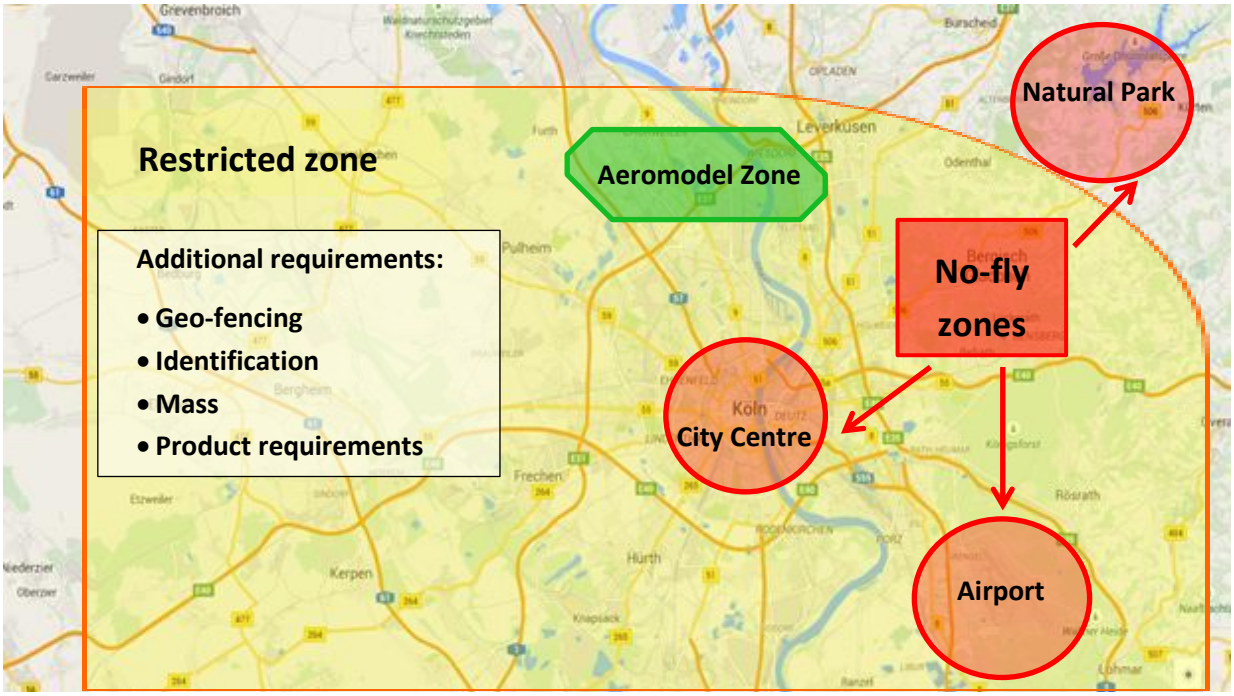
The ‘area’ or ‘airspace’ of operation determines the severity of an unmanned aircraft crashing or out of control. To mitigate the risk for people on the ground, the operation should be performed with adequate safe distance. While for very small unmanned aircraft the awareness of the pilot would ensure adequate protection of other people, this needs to be defined more rigorously with risk increasing with mass.

For areas with very high population density and/or critical infrastructure, the MS should define areas where only limited or no operations at all of unmanned aircraft are permitted.

Similar limitations can be used to mitigate the risk for other airspace users. While in low density airspace low-level-flying unmanned aircraft or unmanned aircraft operated by competent operators under VLOS might not cause a significant risk, areas presenting a higher risk of conflict with manned aircraft should be limited.

Proposal 8: To ensure safety, environmental protection, as well as security and privacy, the Agency will define limitation zones and criteria and guidance for the usage of such zones cooperatively with the MS and in conformity with Articles 1 and 9 of the Chicago Convention.

The NAAs may define 'zones' where no operation is allowed without authority approval or with additional limitations (e.g. additional functions like geographical limitation).The Agency will determine interfaces and acceptable data format standards (e.g. for map data) that should be used to provide the information on no-fly or restricted zones in an open web interface. This information could be made available through service providers, presented through a smartphone app, or directly uploaded to the unmanned aircraft.



3.4.2. Technology and airworthiness

The affordable and easy operation of unmanned aircraft offers the possibility to almost everybody to become an airspace user, but it cannot be assumed that all actors have a strong aviation culture and are aware of the safety consequences their actions have. Embedded safety features, identification means and technologies can improve compliance with regulations and facilitate enforcement in practice and can mitigate the lack of pilot competence.

Proposal 9: To prevent unintended flight outside safe areas and to increase compliance with applicable regulations, a functionality that automatically generates geographical limitations and identification of the unmanned aircraft for certain unmanned aircraft and operation areas should be mandated. The IRs will define the scope of such mandate based on a thorough RIA.

— 'Geographical limitation' means automatic limitation of the airspace an unmanned aircraft can enter. In principle, the feature is already embedded in some commercialised unmanned aircraft.

There are relatively simple two-dimensional (2D) solutions possible requiring some manual update, and in the future the principle might be applicable in a dynamic way to support operators and pilots in complying with temporary limitations or even local needs, e.g. to create a safe bubble around a rescue helicopter when landing at the accident site.

— 'Identification systems' provide:

- the capability to react on interrogations from enforcement entities; and
- information about the unmanned aircraft, the operator and the operation.

Such systems might use technologies like cell-phone networks or radio-frequency identification (RFID). The principle could be combined with a registration similar to the process of registering SIM cards for mobile phones during purchase or could be publicly accessible; for example, through a web-based system or direct communication of the unmanned aircraft with smartphones using Wi-Fi. A portable chip providing that function independently could be attached to the unmanned aircraft in operation. Such systems may also contribute to the transparency of operations when necessary (for instance, in case of personal data processing[10]), ensuring a pro-active emission of the relevant information about the operator and the operation.

Proposal 10: Standards for geographical limitation and identification systems will be endorsed by the Agency and could be referenced in the market regulations system in order to ensure that consumer products comply with these standards, and to ensure harmonisation at technical level. This will enable manufacturers to develop adequate equipment and to declare compliance with these standards. Detailed functionalities and related requirements will be defined during development of IRs and standards including definitions for operation where such limitations and systems are not appropriate to be mandated.

The Agency proposes an overall flexible safety framework that sets concrete essential safety requirements so that industry can then develop the appropriate standards. Technologies to be embedded in unmanned aircraft cannot be defined or mandated in a prescriptive way at IR level, as the regulatory processes at this level cannot follow the speed of the technological development.

In the future, additional features like interoperability with systems for manned aviation or autonomous cooperation and 'traffic management' for low-level operations can be also assumed; that will probably be required once traffic in urban environment increases significantly.

On the other hand, there is the risk that technologies tend to be mandated because they are available. The consequence would be additional costs and efforts for manufacturers and operators, therefore every mandated requirement should be well-justified. Models are normally manually controlled and do not carry a global navigation satellite system (GNSS) unit or similar on board. There must be a clear benefit to mandate future technology on unmanned aircraft. There is definitely a limit towards simplest, low-risk operations where it is not proportionate to increase costs without benefit (e.g. GPS installation on a tethered balloon). Therefore, for the very small vehicles, risks should be primarily mitigated through limitation of performances.

[10] See ARTICLE 29 DATA PROTECTION WORKING PARTY, Opinion 01/2015 on Privacy and Data Protection Issues relating to the Utilisation of Drones, Section 3.5.

3.4.3. Risk awareness, education, training, and safety promotion

The basic principle is that the pilot is responsible for the safe and environmentally compatible operation. Depending on the risk of operation, different levels for the qualification for the pilots are proposed; traditional aviation licensing systems, requirements for specific pilot competence or basic awareness and safety promotion. Security and privacy aspects need also to be addressed.

Especially for the 'open' category, the pilots need to understand their responsibility and the buyers of unmanned aircraft need to made aware of the risks e.g. through leaflets.

3.4.4. Identification, registration and enforceability

Registration and the possibility of identification of operators is a very effective instrument to improve compliance with regulations and to enable enforcement. Operators of unmanned aircraft are even more difficult to identify and therefore it is essential to be able to identify the flying vehicle, as described above, where required by the risk of operation and relate it to an operator that can be held liable.

3.4.5. Authorisation and oversight

For operation in the 'specific' and 'certified' categories, approvals and certificates issued by aviation authorities or qualified entities on behalf of the authorities will be required. For the 'specific' category, the operator needs an authorisation after a satisfactory risk assessment is made. For the 'certified' category, the established system of airworthiness and operational approvals ensures compliance with regulations.

OPEN:

Low risk

Without involvement of Aviation Authority

Limitations (Visual line of sight, Maximum Altitude, distance from airport and sensitive zones)

Flight over Populated area is possible if:

No overflying of crowds

Industry standards (Case of toy of less than 500 g)

SPECIFIC

Increased risk

Safety risk assessment

Approved by NAA possibly supported by Qualified Entities unless approved operator with privilege

Operation Authorisation with operations manual

Concept of accredited body

Airworthiness of drone and competence of staff based on risk assessment

CERTIFIED

Comparable to manned aviation

Limit between specific and certified is not yet defined

Pending criteria are defined, EASA accept application in its present remit

TC, C of A, Noise certificate, Approved Organisations, licences (Case of small drones)

Command and Control and Detect & Avoid can receive an independent approval

3.5. 'Open' category

3.5.1. Rationale

The 'open' category corresponds to small-unmanned aircraft operation, where the risk to third parties on the ground and to other airspace users is low and mitigated through operational limitations and product requirements. The 'open' category operations will not require an authorisation by an NAA for the flight, but should stay within defined limitations for the operation (e.g. safe distance from persons) and be performed with an unmanned aircraft complying with specific requirements. This category of operations would only be subject to a minimal aviation regulatory system, focusing mainly on defining the limits of such a category of operations and permitted areas, and complemented by product requirements established and enforced by product legislation and internal market mechanisms.

Even very small unmanned aircraft can quickly fly high enough, thus posing a severe risk to aviation safety when flying outside the limitations. As mentioned in the Riga Declaration[11], 'Drone accidents will happen' and any attempt to reduce the risk to zero will stop any operation of unmanned aircraft. The challenge is to find the balance and means to ensure appropriate safety while not hampering the market.

The classic assumption is that only the traditional certification and licensing processes would mitigate such hazards and keep the aviation system safe. But even if certification and licensing conditions were kept as 'light' as possible, the traditional manned-aviation approach is likely to produce a too heavy approach to unmanned aircraft, especially to the small-unmanned aircraft market. The level of rigour applied to safety management in manned aviation (involving strict controls of aircraft design, production and maintenance; pilots; operations with (in most cases) ex ante licensing and certification and continuous monitoring) is disproportionate to the risk posed by many unmanned aircraft operations. Overburdening low-risk operations could lead to a climate of indifference or to illegal operations adversely affecting safety.

In the unmanned aircraft sector, most of the operations are typically non-aviation-centric and even most commercial operators do not consider themselves as aircraft operators; they just want to use a tool which is in many cases much safer than, e.g. climbing on oil rigs for inspections.

3.5.2. 'Harmless' subcategory

As requested by many commenters, a harmless category for very small unmanned aircraft, e.g. toy aircraft or nano drones that cannot cause serious injuries or significant damage is envisaged.

A considerably high number of consumer products which are operated in all kinds of operational environments, fall into this subcategory. This subcategory includes tethered balloons, kites, toys as well as some small models.

Proposal 11:	A 'harmless' subcategory of unmanned aircraft only subject to market regulations and local restrictions should be established. They should not be operated in a careless or reckless manner. Operating instructions will come with do's and don'ts on leaflets in the box. Exact criteria need to be defined through the rulemaking process.

[11] http://ec.europa.eu/transport/modes/air/news/doc/2015-03-06-drones/2015-03-06-riga-declaration-drones.pdf

As a starting point, the 250-gram MTOM limit could be used; this limit is in line with the Danish study on mass threshold for 'harmless' unmanned aircraft[12] and the acceptable risk level defined by the FAA Unmanned Aircraft Systems Registration Task Force[13]. The product requirements could additionally impose limited kinetic energy, or energy absorption allowing to increase the mass. Specific criteria need to be developed also for other flying vehicles such as tethered balloons or kites which are deemed to be harmless.

This lower end is not perceived as aviation and apart from do's and don'ts on leaflets, the basic principle is that 'No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another[14].' and local restrictions need to be followed. The operation might include 'first person view' or 'free flight' vehicles (no need for external control) when operated in proper environment.

3.5.3. Compliance with zones

To mitigate the risks to third parties on the ground and in the air, different limitations are foreseen for the operation of unmanned aircraft. One key element is the definition of different areas with limitations, e.g. due to high population density, proximity to airports or critical infrastructure.

Proposal 12: All unmanned aircraft operations in the 'open' category must be conducted within the zones defined by the competent authority, and respect the defined limitations such as:

- zones where active geographical limitation system is required;
- zones where a MTOM is defined;
- zones where identification and registration is required;
- zones with additional environmental protection requirements; and
- no fly zones.

The procedures, requirements and categories used to define the limitations will be harmonised through regulations adopted by the Commission. The system for providing the information will be standardised and made publicly available, to be presented to the general public in a simple way, e.g. using smartphone applications or layers in internet maps. Consistency with the classical aeronautical information system will receive particular attention.

[12] la Cour-Harbo, A. (2015). Mass threshold for 'harmless' drones. Aircraft Engineering and Aerospace Technology, Aalborg University, Denmark, http://vbn.aau.dk/files/218161950/2015_Harmless.pdf

[13] https://www.faa.gov/uas/publications/media/RTFARCFinalReport_11-21-15.pdf

[14] FAR 91.13

3.5.4. Distance from uninvolved persons on the ground

The risk to persons on the ground is mitigated through the use of low-energy aircraft and by requiring a safe distance with respect to persons on the ground unless they are involved in the operation and under the control of the operator.

Proposal 13: To reduce the risk to uninvolved persons on the ground for all unmanned aircraft in the 'open' category, except for the 'harmless' subcategory:

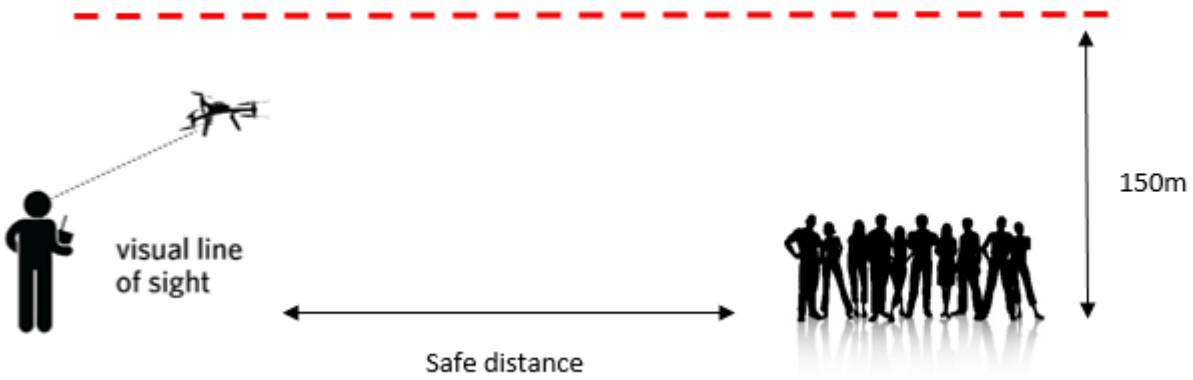
— flights over crowds are not permitted;
— the pilot is responsible for the safe operation and safe distance from uninvolved persons and property on the ground; and
— the minimum safe distance for unmanned aircraft in the highest-risk subcategory of the 'open' category is proposed to be 50 m.

3.5.5. Separation from other airspace users

To separate unmanned aircraft operations from normal manned aviation, operations in the 'open' category need to be performed in direct VLOS where the pilot is capable of and responsible for ensuring separation from other airspace users.

Proposal 14: To separate unmanned aircraft from other airspace users for all unmanned aircraft in the 'open' category, except for the 'harmless' subcategory:

- only flights in direct VLOS of the pilot are allowed;
- an unmanned aircraft in the 'open' category shall have a system ensuring that it limits its performances to acceptable values, in particular that it cannot operate at a height exceeding 150 m above the ground or water. The pilot is responsible for the safe separation from any other airspace user(s) and shall give right of way to any other airspace user(s); and
- the pilot needs to have adequate pilot competence according to the performance of the unmanned aircraft.



3.5.6. Pilot competence

The basic principle is that the pilot is responsible for operation and:

— shall give the right of way to other airspace users;

— shall not be negligent or reckless;

— needs to be fit to fly;

— needs to check that the unmanned aircraft and the equipment are also fit to fly ; and

— is responsible for safety, privacy, security and environmentally compatible operation.

The key element in the 'open' category is, therefore, the responsibility and awareness of the operators. This starts with the need to make unmanned aircraft buyers aware that they operate an aircraft. Clear operation instructions and leaflets listing the *dos and don'ts* for unmanned aircraft operators should be available to every customer buying a consumer unmanned aircraft. Such leaflets have already been developed by some EASA MS. Internet tools, as the one supported by the Commission[15], may also contribute to raise awareness.

Proposal 15:	To ensure compliance with the limitations and conditions for the operation of unmanned aircraft, except within the 'harmless' subcategory, evidence of pilot competence shall be required for a pilot operating an unmanned aircraft that is not automatically limited in performance according to accepted standards.

It is not the intention to create an aviation (remote) pilot licence for the 'open' category, but merely to develop learning objectives or an e-learning tool including means to document or declare the competence. Alternatively, the education provided at model-flying associations and already existing national training could be accepted as equivalent.

3.5.7. MTOM in the 'open' category

Proposal 16:	An MTOM of 25 kg for unmanned aircraft is proposed for the 'open' category based on current thresholds used by EASA MS and internationally (e.g. USA, Canada, Brazil) for the regulation of small unmanned aircraft or models: — Only unmanned aircraft with an MTOM below 25 kg are allowed in the 'open' category.

In theory, depending on the area of operation, even heavier unmanned aircraft would not necessarily increase the risk, but a practical limit needs to be established. Today, EASA MS use mainly MTOM as the criterion for the involvement of NAAs.

Mass is chosen as a simple and 'enforceable' parameter to separate (sub)categories of unmanned aircraft. Together with other simple thresholds for altitude and distance from uninvolved persons, it enables the practical implementation of the division in risk classes.

[15] Under the COSME programme, the Commission is co-funding the development of the DRONERULES.EU website which should promote awareness and offer training tools as from mid-2016.

3.5.8. Additional subcategories

Additional subcategories can enable the practical implementation of the division in risk classes together with other simple limits for height above ground, distance from uninvolved persons and pilot qualification. The proposed thresholds in A-NPA 2015-10 were commented quite controversially, but, in principle, a break-down in subcategories was appreciated.

> ***Proposal 17:*** As proposed by A-NPA 2015-10 and in line with the current practice, in most EASA MS, subcategories will be established for the 'open' category to allow for a more flexible adaptation to the risk. A comprehensive impact assessment and rulemaking process is needed to establish additional subcategories to define the applicability of:
>
> — higher technical requirements (e.g. redundancies);
> — increased minimum distance from uninvolved persons; and
> — limited access to operation areas.

With the shift to a more rigorous control of the pilot competence, the importance of mass as a risk criterion is reduced, as an unmanned aircraft that is operated responsibly at a safe distance from uninvolved persons and other airspace users is not creating any risk. Also, from a pure safety perspective, the impact of a 2-kg unmanned aircraft may be as fatal as the impact of a 20-kg unmanned aircraft. Nevertheless, the (perceived) risk of a consumer unmanned aircraft weighing around 1.5 kg seems to be significantly lower than that of an unmanned aircraft weighing 20 kg, and the practical possibility of people on ground to protect themselves from a unmanned aircraft of 20 Kg losing control in the vicinity is limited; therefore, increased safety distances from persons and more stringent limitations for unmanned aircraft above additional mass thresholds are justified.

With a harmless category below 250 g and a MTOM of 25 kg for the 'open' category, additional thresholds could be the earlier proposed 1 kg and 4 kg. A significant number of comments pointed towards different thresholds in place in some MS (2, 5, or 7 kg). As any limit will have a significant impact on the market development, a comprehensive impact assessment and rulemaking process is needed to define additional MTOM subcategories.

3.5.9. Elements to be included in a draft rule for 'open' category

Based on the proposals above and the best practices identified following a review of national legislation, such elements have been grouped together in a table included in Annex III. The table envisages two cases: rules developed by MS until the adoption of the proposed draft Basic Regulation and the 'future' IR for the 'open' category.

3.6. 'Specific' category

> ***Proposal 18:*** Operation of unmanned aircraft outside any of the limits of the 'open' category requires specific mitigation of a higher risk to persons and properties on the ground and to other airspace users due to the fact that one or several of the safety barriers of the 'open' category are exceeded. Each specific risk needs to be analysed and mitigated through a safety risk assessment.

In the 'specific' category, we could expect operations of unmanned aircraft out of the VLOS of the pilot, limited sharing of airspace with other users where separation assurance with respect to other aircraft.

This cannot be performed by the pilot and this function relies on the safety equipment installed on the unmanned aircraft (i.e. the 'detect and avoid' function), or on specific operational procedures. Operations with larger unmanned aircraft but also with small unmanned aircraft above densely populated areas, like city centres, could also fall into the 'specific' category.

The 'specific' category will require an operation authorisation (OA) issued by an NAA with specific limitations adapted to the risk posed by the operation. For these activities, each specific aviation risk would be analysed and adequate mitigation means need to be agreed by the NAA before the operation can start, based on a safety risk assessment. A typical risk mitigation could be the use of redundant systems ensuring a higher airworthiness level allowing operation in a higher-risk environment. The approval would be materialised with the issue of an OA.

3.6.1. Specific operation risk assessment (SORA[16])

In order to reduce the risk to an acceptable level, a SORA shall be performed by the operator taking into account all the elements that contribute to mitigating the risk associated with the particular operation.

The SORA should identify all hazards to third parties on the ground or in the air generated by the unmanned aircraft operation together with their effects and likelihood. These hazards might be technical (related to the failure of aircraft functions) and operational (related to airspace and pilot competence).

The acceptable methods to perform the SORA as well as the acceptable means of mitigation, guidance and templates for standard cases of operation need to be provided by the Agency to ensure a common understanding and an equal treatment of applicants. The current experience accumulated in the NAAs is an asset in order to define the standard cases of operation at European level.

Key factors of the risk assessment are the following:

— area of operation: population density, areas with special protection, configuration of the terrain, and weather;

— airspace: effect on ATM, class of airspace, segregation, and air traffic control (ATC) procedures;

— design of the unmanned aircraft: functions provided, redundancy and safety features;

— type of unmanned aircraft operation: operational procedures;

— pilot competence;

— organisational factors of the operator; and

— effect on environment.

The operator is responsible for providing a SORA and an operations manual (OM) to the competent NAA (or QE) as the basis of the OA.

[16] 'SORA' is the acronym proposed by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS).

Proposal 19: For all unmanned aircraft in the 'specific' category, a SORA shall be performed by the operator taking into account all the elements that contribute to the risk of the particular operation. For this purpose, the operator shall:

- provide to the competent NAA (or QE) all the information required for a preliminary applicability check of the category of operation;
- provide to the competent NAA (or QE) a SORA covering both the unmanned aircraft and the operation, identifying all the risks related to the specific operation, and proposing adequate risk-mitigation means; and
- compile an appropriate manual containing all the required information, descriptions, conditions and limitations for the operation, including training and qualification for personnel, maintenance of the unmanned aircraft and its systems, as well as occurrence reporting and supplier oversight procedures.

3.6.2. Standard scenarios and mitigations

The majority of expected operators in the 'specific' category are not traditional aviation organisations but small and medium-sized enterprises (SMEs) using an unmanned aircraft or even a small fleet of unmanned aircraft as 'tool' to replace traditional equipment like cranes, or to replace dangerous activities like climbing on industrial infrastructure for inspections.

These users have no experience in performing safety risk assessments and they need simple solutions for standard activities like:

- media use in urban environment;
- industrial inspections;
- precision farming and monitoring;
- infrastructure inspections (power lines, railways, etc.); and
- large tethered vehicles.

Proposal 20: Industry and standardisation bodies are requested to provide standard solutions to address the risks associated with the use of unmanned aircraft in standard scenarios. Together with standard manuals and procedures, the OA process would be radically simplified.

3.6.3. 'Special provisions for operations such as model aircraft'

Today, there are many operations of vehicles below 150 kg that will be impacted by an extension of European regulation, e.g. the operation of model aircraft.

These operations are rarely seen as aviation and have limited effect on traditional aviation and the safety record under the current regulatory regime seems to be acceptable. In case these operations are not covered within the 'open' category, it is intended to 'grandfather' the national or local arrangements; this can be done, for example, by issuing specific authorisations to model-flying associations based on the existing procedures.

Proposal 21:	National or local arrangements for the operation of unmanned aircraft should be deemed to be approved by the competent authority ('grandfathered') or used as a basis for the issuance of an OA.

3.6.4. OA

The 'specific' category is a tool to treat particular operations with requirements proportionate to the risk posed by unmanned aircraft that are capable of performing a certain operation within certain limitations. The outcome would be an OA defining the limitations under which the particular operation with particular equipment in a given condition is safe. These limitations could be a combination of airworthiness (to ensure the reliability of critical equipment) and operational limitations where certain procedures or pilot training could be used to mitigate the risks.

Assumptions within the risk assessment and the resulting operational and airworthiness limitations need to be valid for operation in a certain area. The OM should list the assumptions on which the risk assessment and its mitigation measures are based.

Additional local limitations and conditions (for security reasons, forbidden areas, etc.) defined by the competent authority of the state where the operation takes place need to be complied with or additional authorisation shall be requested.

Proposal 22:	For all unmanned aircraft in the 'specific' category, the competent authority of the State of the operator (or an approved QE) shall be responsible to issue an OA to an operator after the review and agreement with the operator's SORA. The competent authority is the one of the State where the operator has its operational and financial control. The OA should be recognised by the State where the operation takes place. The competent authorities of the State where the operation takes place can only define additional local limitations and conditions (for security reasons, forbidden areas, etc.).

The minimum safety requirements on the design of the unmanned aircraft and the competence of the personnel including the pilot will be an outcome of the SORA.

Proposal 23:	For all unmanned aircraft in the 'specific' category, the operation shall be performed according to the limitations and conditions defined in the OA: — The operator shall not carry out specific operations, unless holding a valid OA; — The operator shall ensure that all involved personnel is sufficiently qualified and familiar with the relevant operational procedures and conditions; — Before the initiation of any operation, the operator is responsible for collecting the required information on permanent and temporary limitations and conditions and to comply with any additional requirement or limitation defined by the competent authority of the State where the operation takes place or for requesting specific authorisation.

3.7. Use of approved organisations or equipment — 'Certified' category

Certification will be required for operations with an associated higher risk due to the kind of operation, or might be requested on a voluntary basis by organisations providing services (such as remote piloting) or equipment (such as detect and avoid). When unmanned aviation risks rise to a level similar to that of normal manned aviation, the operation would be placed in the 'certified' category of operations. These operations and the unmanned aircraft involved therein would be treated in the classic aviation manner: multiple certificates would be issued (as for manned aviation) plus certificates specific to unmanned aircraft.

The operations in the 'certified' category are envisaged for unmanned aircraft operations with a high risk and with a wider scope of operations than the 'specific' category. IRs will define which operation is required to be certified (e.g. complex operations with complex unmanned aircraft).

Examples are international cargo transport operations with large unmanned aircraft, transport of persons or any other operation where the risk assessment process of the 'specific' category does not sufficiently address the high risks involved in the operation. The delimitation between the 'specific' and the 'certified' category may not be easily expressed in terms of mass as it is related to the complexity of the operation and the unmanned aircraft.

While in the 'specific' category a specific type of operation is authorised, in the 'certified' category the design of an unmanned aircraft is considered appropriate for a variety of operations. It is expected that an operator may start operations under an OA with an unmanned aircraft in the 'specific' category with limited support from the unmanned aircraft manufacturer. When the number and variety of such OAs increases, the unmanned aircraft manufacturer could apply to the Agency to obtain a type certificate (TC).

3.7.1. Remote operator certificate (ROC)

A ROC is foreseen in the 'certified' category for high-risk operations of a wider scope that exceed the applicability of the safety risk assessment. Operators holding a ROC could be granted the privilege to authorise their own OAs and later changes also for operation in the 'specific' category when their capabilities are assessed and considered appropriate within a given scope. For example, a company conducting aerial surveillance with an unmanned aircraft fitted with a camera under a ROC may be granted the privilege to change the unmanned aircraft model or authorise the operation in a different area.

Proposal 24: For all operations in the 'certified' category, the operator shall hold a ROC and any pilot shall be licensed. The organisations responsible for the design, production, maintenance and training shall demonstrate their capability by holding respectively design, production, maintenance and training organisation approvals when required due to the risk posed by the operation.

The IRs will define the organisational requirements for the operator to qualify for a ROC and to obtain adequate privileges in order to authorise/modify its own operations.

The operator could demonstrate its capability by discharging its obligations through an approved organisation within the appropriate scope of approval.

The privileges to authorise operations should not be automatic and would only be granted to operators having acquired significant experience.

3.7.2. Airworthiness, organisational and personnel approvals

The ROC holder must ensure that all the equipment related to the operation, either airborne or on the ground, has been granted the appropriate design approval and complies with the limitations and conditions of the aircraft TC or restricted type certificate (RTC), and with the requirements for the type of airspace for which approval is requested.

Proposal 25:	In order to operate an unmanned aircraft in the 'certified' category, the airworthiness of the aircraft and its compliance with environmental standards shall be ensured in the same way as it is done today for manned aviation by issuing a TC or RTC for the type, and a certificate of airworthiness (CofA) or restricted CofA and noise certificate for the particular unmanned aircraft.

The TC or RTC might cover the complete unmanned aircraft system including the unmanned aircraft and the components on the ground (like the control station), or may cover only the unmanned aircraft and its airborne systems. The limitations and conditions for the compatible ground control stations and command and control link including bandwidth, latency and reliability requirements will be established under the TC or RTC. The oversight and control of suppliers providing services (e.g. navigation, communication, control) or of control and release of equipment used to control the unmanned aircraft can be performed under the operator approval.

Proposal 26:	Parts or equipment involved in the operation of unmanned aircraft might be approved independently from the unmanned aircraft itself. The IRs will define the required processes based on the 'European Technical Standard Order (ETSO)' process. The process for release and continuing airworthiness oversight needs to be adapted as equipment might not be installed on certified unmanned aircraft. This might cover ground stations or qualified 'detect and avoid equipment' installed on unmanned aircraft in the 'specific' category.

3.7.3. Certification Specifications (CSs)

CSs will be adopted by the Agency covering a broad range of different configurations such as: fixed wing, rotorcraft, airships, and balloons. A-NPA 2015-06 on the reorganisation of airworthiness requirements for small aeroplanes (Reorganisation of Part 23 and CS-23[17]) could be seen as an example for performance-based CSs where requirements are reduced to safety objectives and detailed standards related to specific technologies are within referenced industry standards.

Proposal 27:	CSs will be adopted by the Agency covering a broad range of different unmanned aircraft configurations, defining the safety and environmental protection objectives. Industry standards will be referenced allowing for fast reaction on technical and operational developments.

[17] http://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2015-06

CSs would include requirements for the control station and command and control link. The demonstration of compliance of the equipment (like the ground control station) that could be used with several aircraft types could also be done within the organisation approval or as independent approval. There is no fixed lower limit for the 'certified' category, and the CSs shall be proportionate to the risk posed by the unmanned aircraft.

Authority approval and oversight

The responsibilities of the Agency and of the NAAs in the 'certified' category are the same as for manned aircraft; meaning that the Agency exercises the responsibilities of the State of Design and MS retain their responsibilities as State of Manufacture, State of Operator, etc.

4. Road map

Integration of unmanned aircraft into the airspace and the aviation system as well as addressing safety issues related to operation of 'other vehicles' like toys and kites requires cooperation of all involved parties. Cooperation of regulators within and outside the European Union, industry, standardisation bodies, air navigation service providers (ANSPs) and research institutes is essential.

A lot can be based on the experience in the MS but as the technologies and applications develop very fast and require a flexible performance-based regulatory framework and fast and responsive development of standards.

4.1. Rulemaking programme

This Technical Opinion will be used as the basis for rulemaking activities in the following months. The first priority is IRs for the categorisation of unmanned aircraft operations and for the 'open' and 'specific' categories. The IRs will be prepared as soon as possible so that they could guide the standard-setting process, support the national regulatory process and be formally adopted shortly after the proposed draft Basic Regulation is amended to reflect the new Agency competence.

In parallel, the work on the 'certified' category could start as large unmanned aircraft are already within the Agency's scope and today unmanned aircraft can receive an RTC or a permit to fly. The full integration in non-segregated airspace may take some more time as essential technologies are not yet fully mature for implementation. Based on the first deliverables from JARUS, consultations can be launched on dedicated subjects, e.g. airworthiness specifications for unmanned aircraft and safety risk assessment process for specific operations.

Further proposals for amending the IRs for the 'certified' category and adapting operational procedures for the 'specific' category need to be aligned with the modifications of the current Basic Regulation as proposed in the draft Basic Regulation, the progress in technical development and international activities (JARUS, ICAO).

A first set of rulemaking deliverables (NPAs) can be expected for:

— CSs for unmanned aeroplanes/rotorcraft (Q2/2017).

— IRs for the 'open' category including proposals for requirements for safety, environmental protection, performance-limiting and identification functions as basis for the implementation of market regulations. The associated NPA will be published in the course of 2016 depending on the evolution of the discussions on the content of the proposed draft Basic Regulation. The first step will be to perform the RIAs necessary to define the regulatory options to define the scope of the mandate for geographical limitations and for the definitions of the subcategories including the 'harmless' one.

— IRs for the 'specific' category based on the JARUS risk assessment process (Q1/2017).

— adaptation of IRs for manned aviation to introduce licenses for remote pilots, the ROC, and unmanned aircraft specific elements like 'ground control station' for the 'certified' category (as soon as deliverables from JARUS are available).

— The terms of reference for those tasks will be issued in the first quarter of 2016.

4.2. Standards development

Based on agreed functionalities and performances, detailed standards need to be developed urgently by the stakeholders. Local requirements can refer to the standards ensuring interoperability and harmonisation as it is done today for required equipment in certain airspaces (e.g. radio communication, transponder).

Activities are already ongoing at national level, and synchronisation at EU and international level has to be initiated to agree on basic principles and establish appropriate standards for:

— interfaces for exchange of information including data formats to enable the function of limiting the geographical location of unmanned aircraft;

— geographical limitation systems;

— identification and registration;

— competence of pilots, related training and documentation;

— development of operational scenarios and related mitigations for standard cases in the 'specific' category; and

— equipment like ground control stations, recovery systems and detect and avoid.

This could enable the implementation of basic principles through national regulation in advance of the transfer of regulatory power to the European Union.

A detailed planning consistent with the rulemaking programme will be finalised in the second quarter of 2016 in cooperation with the standardisation bodies. The planning will also take into account the maturity of the technology and the need for research if needed. However, for the standards that are necessary for the 'open' category such as geographical limitations and identification, the work should start early 2016.

4.3. International harmonisation

The need for globally harmonised rules for the operation of unmanned aircraft is requested even by operators of very small unmanned aircraft. The operation is local but the market is global and going through various and different authorisation systems hinders the market. ICAO and JARUS are the international bodies for discussions on unmanned aircraft regulations.

— ICAO has now set up a Remotely Piloted Aircraft Systems Panel (RPASP), which shall produce draft standards and recommended practices (SARPs) for unmanned aircraft by 2018 focusing its work on international operations.

— JARUS is a cooperation of 40 CAAs worldwide and its aim is to develop harmonised rules for unmanned aircraft. JARUS has been recognised by the European Commission and the European Parliament as the 'working engine' to develop the necessary rules for unmanned aircraft. This will ensure harmonisation worldwide and JARUS is expected to contribute to the ICAO work. The Agency is, therefore, fully engaged in JARUS and provides significant resources.

4.4. Research

The Agency is contributing to the research activities of the European Defence Agency (EDA), the European Space Agency (ESA) and the SESAR Joint Undertaking (SJU). Beyond these activities, the Agency has identified the following ones and is discussing with other organisations how to best finance them:

— Proposal for acceptable levels of safety especially for the operation of small unmanned aircraft in urban areas, above crowds and for low-level operations beyond VLOS;

— Development of a tool for registration, identification and (geo)fencing of certain small unmanned aircraft operations;

— Identification of options for the environmental regulation of small unmanned aircraft;

— Definition of a concept for traffic management of all types of unmanned aircraft operations including low-level airspace design, traffic rule, security of landing zones, the role of the human, interception rules and techniques, and devices for electronic conspicuity and autonomous operations.

— Electric propulsion (not only an issue for unmanned aircraft, but still small unmanned aircraft are making extensive use of electric propulsion).

4.5. Safety promotion and communication plan

Regulations need to be complemented by safety promotion and communication to increase safety awareness and the aviation context of operation of unmanned aircraft. A joint effort is needed to reach the general public and users of flying consumer products in an understandable language.

Safety promotion should be an efficient tool in the case of unmanned aircraft and could take many forms: video, leaflets, animations, posters, etc. Priority should be given to the development of leaflets listing dos and don’ts that could be included in the boxes that contain the unmanned aircraft when it is bought. Increased use of safety promotion instead of regulation is one important Agency objective in all domains. In the case of unmanned aircraft where many actors do not come from the aviation world, safety promotion will be even more important as one cannot expect to see such actors to start reading the voluminous aviation regulation. Providing clear and up-to-date information using modern communication tools will provide for efficiently reaching unmanned aircraft operators.

The situation today is complex for European campaigns due to the fragmented regulation with huge differences in national regulations.

Due to the complexity of the unmanned aircraft issue, the enormous variety of stakeholders and activities in the EU and worldwide, and the rapid evolution of the unmanned aircraft industry, it is necessary to develop a communication plan to explain the concepts, the intentions and the planning. This should be done in parallel with the development of the regulatory framework and the associated IRs. The communication plan should address the stakeholders, international organisations, EU/EASA MS and EU institutions and especially the general public. The communication plan should be established urgently and in close cooperation with the stakeholders. This implies the use of simple language. One particular aspect of this communication plan will be the cooperation with the law enforcement agencies.

4.6. ATM concept of operations (CONOPs)

In the proposed 'open' category, unmanned aircraft are separated from manned aircraft by operating in direct VLOS of the pilot and by limiting the maximum altitude. In the 'specific' and 'certified' categories, the unmanned aircraft can be separated from manned aircraft or they can share the same airspace when the unmanned aircraft comply with the same requirements as manned aircraft. When the number of unmanned aircraft sharing the airspace with manned aircraft increases, an ATM CONOPs will need to be developed to adequately integrate these new airspace users, ensuring that the capability of the ATM system is adequate and the level of safety of manned aircraft is not affected.

Factors to be taken into account could be the following (non-exhaustive list):

— Transfer of unmanned aircraft from one control station to another or operational control of several unmanned aircraft from one control station;

— ATC and operational control done by the same person;

— Extreme endurance (several days, even months) at very high altitude (20 000 m) in quasi-autonomous mode; and

— Development of an unmanned aircraft traffic management system in response to a fast-expanding number of small unmanned aircraft flying at low level, in particular in urban environment (e.g. unmanned aerial system (UAS) traffic management (UTM) system) including autonomous and cooperative operations.

The ATM/ANS aspect of the CONOPs for unmanned aircraft, or a separate ATM/ANS CONOPs for unmanned aircraft, will need to be established with high priority and should address short-, medium- and long-term perspectives. However, these perspectives should be based on the development of the unmanned aircraft market and on the development of the related technologies. These should be carefully monitored and the planning should be adapted accordingly.

5. References

5.1. Affected decisions

Not applicable

5.2. Affected regulations

Not applicable

5.3. Reference documents

- RIGA DECLARATION ON REMOTELY PILOTED AIRCRAFT (unmanned aircraft) 'FRAMING THE FUTURE OF AVIATION', Riga, 6 March 2015
- EASA Concept of Operations for Unmanned aircraft, A risk based approach to regulation of unmanned aircraft
- COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL 'A new era for aviation — Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner'
- European Parliament draft report on safe use of remotely piloted aircraft systems (RPAS), commonly known as unmanned aerial vehicles (UAVs), in the field of civil aviation (2014/2243(INI))
- EASA A-NPA 2015-10 'Introduction of a regulatory framework for the operation of unmanned aircraft'
- EASA A-NPA 2015-06 'Reorganisation of Part 23 and CS-23'
- 'Aviation Strategy to Enhance the Competitiveness of the EU Aviation Sector' published on 7 December 2015

6. Annexes

6.1. Annex I — CRD

This CRD aims to provide a summary of the main topics addressed in the comments on A-NPA 2015-10. It does not intend to be exhaustive but to support the understanding of the modifications introduced in the present Technical Opinion, which updates the A-NPA 2015-10 proposals taking into account comments during the public consultation.

General	More than 250 respondents submitted 3 400 comments. These comments come not only from the unmanned aircraft community but more generally from a broad range of aviation stakeholders. Opinions range from opposition to positive support; however, a lot of positive comments or only minor comments were received. Many airspace users (airlines, helicopters' services, General Aviation, airline pilots, and ANSPs) perceive unmanned aircraft as threats and intruders. Concerning model aircraft, associations and individuals were opposed to the A-NPA proposal. Nevertheless, there is also strong support to treat model and unmanned aircraft in a similar manner.
Response	This Technical Opinion also emphasises the usage of unmanned aircraft to perform 'the dull, dirty, or dangerous work'. Additionally, it introduces the potential for new services supported by unmanned aircraft. The intent is to present a holistic view of unmanned aircraft services for the whole society. Unmanned aircraft operations must mitigate the safety risks posed to manned aviation, the potential harm to people on the ground and the conceivable damage to sensitive infrastructure. Additionally, unmanned aircraft safety regulations must contribute to alleviating the concerns relative to security and privacy/data protection. Society shall also recognise the potential commercial opportunities that unmanned aircraft bring.

Context	The terminology should be harmonised with ICAO. In particular, another term should replace 'unmanned aircraft'. Commenters generally support harmonisation in Europe but they are opposed to prescribing requirements in the Basic Regulation.
Response	This Technical Opinion reminds the performance-based principles in the regulation. The proposed draft Basic Regulation contains the enablers for the 3-pillar regulatory framework ('open', 'specific' and 'certified'). A top-down structure explains how it implements these principles in its introduction. 'Unmanned aircraft' substitutes 'drone' in the official text. Information leaflets will use the word 'drone', which is widely known by the public. ICAO terminology will be used when possible but the present definition of unmanned aircraft has been chosen to anticipate on the future developments (autonomous unmanned aircraft and passengers carrying unmanned aircraft).

3-pillar risk-based approach	Commenters support the 3-pillar risk-based approach. However, the A-NPA indicates arbitrary parameters and limitations, which do not directly relate to safety impact and exposure to risk.
Response	This Technical Opinion introduces the principles, which establish the pillars for the risk-based approach. The categories are an approximation of a risk continuum. Current rules for unmanned aircraft have focused on MTOM, which is easy to interpret. The Agency proposes to the establishment of unmanned aircraft subcategories, each one with different levels of regulation. MTOM only serves to delineate a category for 'harmless unmanned aircraft' (e.g. 250 g) and to define an absolute upper limit for the 'open' category (25 kg). The 250-gram MTOM limit relates to a Danish study on mass threshold for 'harmless' unmanned aircraft[18] and to the acceptable risk level determined by the Unmanned Aircraft Systems Registration Task Force[19]. This value together with other studies can serve as a basis for subsequent impact assessment. There is a solid basis for a20–25-kg threshold in the current MS' regulations for unmanned aircraft. Moreover, the 25-kg upper limit is consistent with current regulations for unmanned aircraft in the USA, Canada and Brazil. Although MTOM is an important criterion in order to establish the safety level, it is not a sufficient criterion and it must be complemented by others. Additionally, operational limitations, operational rules, technology and products' directives apply to operations in the 'open' category. An additional requirement for a basic aviation competence enables the reduction of the risk in the 'open' category. This awareness will be further developed in the IRs. In this 'open' category, MS define the areas where such operations can take place. In all situations, the person flying the unmanned aircraft shall not fly in a manner that is likely to endanger other persons. Communication campaign and safety promotion intend to render the rules understandable by the public. The IR will clarify indoor activities. MS designate the enforcement agencies for the 'open' and 'specific' categories. A significant communication effort will be put in place towards the enforcement agencies for the 'open' category. Article 46 of the proposed draft Basic Regulation contains the means to demonstrate compliance with the essential requirements. For mass-produced unmanned aircraft which pose a low risk, existing market surveillance mechanisms[20] and declarations[21] are used[22]. This Technical Opinion adds operational limitations and requirements in order to achieve adequate levels of safety in the 'open' category. For all the other cases[23], the proposed draft Basic Regulation[Error! Bookmark not defined.] foresees 'certification' and 'certificates'. The present Technical Opinion further splits this demonstration as certification for the 'certified' category and 'operator authorisation' for the 'specific' category. In the 'certified' category, compliance with the requirements for airworthiness and environmental protection, aircrew, air operations and third-country operators[24] is established with the traditional certification process. In the 'specific' category, the competent authority certifies an

[18] Ia Cour-Harbo, A. (2015). Mass threshold for 'harmless' unmanned aircraft. Aircraft Engineering and Aerospace Technology, Aalborg University, Denmark, http://vbn.aau.dk/files/218161950/2015_Harmless.pdf

[19] https://www.faa.gov/uas/publications/media/RTFARCFinalReport_11-21-15.pdf

[20] As governed by Regulation (EC) No 765/2008 and Decision No 768/2008/EC.

[21] Article 46, section 3.

[22] Article 46, sections 2 and 3.

[23] Article 46, sections 1 and 3.

[24] Sections I, II, III and VIII of the Basic Regulation.

	operator to perform a specific operation. The operational safety risk assessment has to demonstrate an adequate level of safety. Each competent authority has to accept the operational authorisation given by another MS but will be allowed, using local considerations, to complement the assumptions used in the operational safety risk assessment for the intended conditions of operations.
Technical means and standards	Some commenters consider that the proposals for geographical limitation systems (also known as geofencing), identification and map are too prescriptive and unrealistic (technical feasibility, maturity, cost). Other commenters require these functions and additional ones in order to ensure segregation of operations as well as tracking of unlawful operations. Some respondents highlight the means of circumventing technical features (homemade vehicles, software deactivation, etc.). Some also observe the transfer of liability from the operator to the technology.
Response	The Basic Regulation and its IRs need to contain the basis for mandatory equipment and functionalities when required to ensure safe operation. The scope in the IRs will be determined from the RIA. Assessment. Standards need to develop in parallel with the technical evolution. This Technical Opinion reflects the fact that the Agency will cooperate with standardisation bodies for the development of a coherent set of technical standards that are consistent with the IRs. The Agency will foster synergies and avoid duplications of efforts.
Specific vs certified categories	Commenters generally support the concept of ‘specific’ category. However, respondents express the need for a clarification between the ‘specific’ and ‘certified’ categories.
Response	The present Technical Opinion proposes improvements in the definitions and in the descriptions. The IR will define the conditions arising from the safety risk assessment of the operation leading to the need of certification. Such conditions will consider the severity of the potential effects of failures, the likelihood of occurrence of failures, the effectiveness of the mitigation means and the overall complexity. It will also illustrate some cases with some examples. It will also foresee the possibility of voluntary request for certification. The IRs will define the operations that would need to be certified (e.g. complex operations with large unmanned aircraft).
Privacy and security	Privacy protection shall apply to all operations. Data privacy requirements shall be communicated to unmanned aircraft operators. This Technical Opinion shall not add anything to existing regulations. Some commenters also point out the need for the protection of rights for data privacy of the unmanned aircraft operator.
Response	This new proposed regulation will contribute to alleviating privacy and security concern by mandating geographical limitation systems and identification. The mandate for such functionalities will be established after a thorough RIA.

Aeromodelling	Aeromodelling activities all around Europe have always shown a very good safety record, despite the fact that there is no European harmonisation. Therefore, although it is not easy to differentiate a model from an unmanned aircraft, aeromodelling operations should continue to exist without significant disruption arising from this regulatory effort about unmanned aircraft.
Response	Model aircraft will not get a distinct definition from unmanned aircraft. However, the difference between 'models' and 'non-commercial unmanned aircraft' lays more in the type of operation than in the characteristics of the vehicle. This Technical Opinion applies the 'grandfathering' principle for aeromodelling activities in the 'specific' category. MS manage the aeromodelling activities.

Research	The stakeholders highlighted the need for an urgent development of the ATM CONOPs in particular below 500 ft.
Response	Such concept is being developed by JARUS and the Agency is considering further research work.

6.2. Annex II — Draft Articles of the proposed draft Basic Regulation concerning unmanned aircraft

Article 3

Definitions

For the purposes of this Regulation, the following definitions shall apply:

(1) 'certification' means any form of recognition in accordance with this Regulation, based on an appropriate assessment, that an organisation or person, product, part, non-installed equipment, aerodrome, aerodrome equipment, ATM/ANS system, ATM/ANS constituent or flight simulation training device complies with the applicable requirements of this Regulation and of the delegated and implementing acts adopted on the basis thereof, through the issuance of a certificate attesting such compliance;

(2) 'certificate' means any certificate, approval, licence, authorisation, attestation or other document issued as the result of a certification attesting compliance with the applicable requirements;

(3) 'aircraft' means any machine that can derive support in the atmosphere from the reactions of the air other than reactions of the air against the earth's surface;

(4) 'non-installed equipment' means any equipment carried on board of an aircraft but not installed in the aircraft and which may have an impact on safety;

(5) 'unmanned aircraft' means any aircraft operated or designed to be operated without a pilot on board;

(6) 'equipment to control unmanned aircraft remotely' means any equipment, apparatus, appurtenance, software or accessory that is necessary for the safe operation of an unmanned aircraft; …

SECTION VII

Unmanned aircraft

Article 45

Essential Requirements for Unmanned Aircraft

The design, production, maintenance and operation of unmanned aircraft and their engines, propellers, parts, non-installed equipment and equipment to control them remotely shall comply with the essential requirements set out in Annex IX.

Article 46

Compliance of Unmanned Aircraft

1. Where the delegated acts adopted pursuant to Article 47 so provide with a view to achieving adequate levels of safety, having regard to the principles laid down in Article 4(2), the design, production, maintenance and operation of unmanned aircraft shall be subject to certification. Certificates shall be issued upon application, where the applicant has demonstrated that it complies with the rules established by the delegated acts adopted pursuant to Article 47 to ensure compliance with the essential requirements referred to in Article 45. The certificate shall specify the safety-related limitations, operating conditions and privileges.

2. Where the delegated acts adopted pursuant to Article 47 so provide with a view to achieving adequate levels of safety, having regard to the principles laid down in Article 4(2), the design, production, maintenance and operation of unmanned aircraft shall be subject to a declaration. The declaration shall be made when the essential requirements referred to in Article 45 and the

corresponding detailed rules established in accordance with Article 47 to ensure compliance with these essential requirements are complied with.

3. Where the delegated acts adopted pursuant to Article 47 so provide, given that adequate levels of safety can be achieved without the application of Chapters IV and V of this Regulation, those Chapters shall not apply to the essential requirements referred to in Article 45 and the corresponding detailed rules established in accordance with Article 47 to ensure compliance with these essential requirements. In such cases, those requirements and rules shall constitute 'Community harmonisation legislation' within the meaning of Regulation (EC) 765/2008 of the European Parliament and Council of 9 July 2008 setting out the requirement for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) N° 339/93, and Decision 768/2008/EC of the European Parliament and Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC.

Article 47

Delegated Powers

4. For the design, production, maintenance and operation of unmanned aircraft and their engines, propellers, parts, non-installed equipment and equipment to control the aircraft remotely, the Commission shall be empowered to adopt delegated acts in accordance with Article 117 in order to lay down detailed rules with regard to:

   (a) the conditions and procedures for issuing, maintaining, amending, suspending, or revoking the certificates for the design, production, maintenance and operation of unmanned aircraft referred to in Article 46 (1) and (2), including as regards the situations in which, with a view to achieving the objectives set out in Article 1 and while taking account of the nature and risk of the particular activity concerned, such certificates shall be required or declarations shall be permitted, as applicable;

   (b) the conditions and procedures under which an operator of an unmanned aircraft shall rely on the certificates or declarations issued in accordance with Sections I, II, III and VIII;

   (c) the conditions under which the requirements concerning the design, production and maintenance of unmanned aircraft and their engines, propellers, parts, non-installed equipment and equipment to control them remotely, shall not be subject to Chapters IV and V of this Regulation, for the purpose of Article 46(3);

   (d) the privileges and responsibilities of the holders of certificates and operators making declarations;

   (e) the marking and identification of unmanned aircraft;

   (f) the conditions under which operations of unmanned aircraft shall be prohibited, limited or subject to certain conditions in the interest of safety.

2. As regards the design, production, maintenance and operation of unmanned aircraft and their engines, propellers, parts, non-installed equipment and equipment to control the aircraft remotely, the Commission shall be empowered, by means of delegated acts adopted in accordance with Article 117, to amend or supplement Annex IX and, if applicable, Annex III, where necessary for reasons of technical, operational or scientific developments or safety evidence related to air operations, in order and to the extent required to achieve the objectives laid down in Article 1.

6.3. Annex III — Proposal for elements to be included in a rule for the 'open' category

Introduction

This is not a rule (no legal text) but a list of elements expected to be found in a rule.

For each element, there is an interim (i.e. until new European regulations are in place) proposal essentially coming from the best practices identified in the A-NPA, and a future proposal (after adoption of the proposed draft Basic Regulation). Both proposals are included in this Technical Opinion.

Scope

Interim	Future
— Unmanned aircraft with an MTOM below 25 kg. — Where suitable regulations for non-commercial operations (e.g. for recreational models) exist that are able to cover the growing number of recreational consumer unmanned aircraft operations, it is recommended to keep the system until EU regulations are applicable.	— An MTOM of 25 kg for unmanned aircraft is proposed for the 'open' category based on current thresholds in the EASA MS and internationally (e.g. USA, Canada, Brazil) for the regulation of small unmanned aircraft or models. — As in the A-NPA, it is proposed to 'grandfather' the national or local arrangements In dedicated areas the operation of unmanned aircraft (e.g. model airfields, test centres) can be performed in the 'open' category according to the conditions and procedures defined by the competent authority.

Definition

''Unmanned aircraft' means any aircraft operated or designed to be operated without a pilot on board.'

Limitations and rules

Interim	Future
— height above ground or sea level: 150 m or 50 m depending on pilot competence; — VLOS; — Pilot competence: basic aviation awareness; — distance from people: see subcategories; — no reckless or negligent operations; — right of way to all other aircraft; and — a minimum distance of 5 km from airfields and other sensitive infrastructure is	— It is proposed that all unmanned aircraft operations in the 'open' category be conducted within the defined limitations as defined by the competent authority, such as: • no flight zones; • active geographical limitation system; • MTOM; • identification and registration; and • environmental protection.

recommended.	— To reduce the risk to persons on the ground, it is proposed that, except for the 'harmless category', for all unmanned aircraft in the 'open' category, • flights over crowds are not permitted; • the pilot is responsible for the safe operation and safe distance from uninvolved persons and property on the ground; and • the minimum safe distance for unmanned aircraft in the highest-risk subcategory of the 'open' category is proposed to be 50 m. — To separate unmanned aircraft from other airspace users for all unmanned aircraft in the 'open' category, except for the 'harmless' subcategory: • only flights in direct VLOS of the pilot are allowed; • an unmanned aircraft in the 'open' category shall have a system ensuring that it limits its performances to acceptable values, in particular that it cannot operate at a height exceeding 150 m above the ground or water. The pilot is responsible for the safe separation from any other airspace user(s) and shall give right of way to any other airspace user(s); and • the pilot needs to have adequate pilot competence according to the performance of the unmanned aircraft. — To ensure compliance with the limitations and conditions for the operation of unmanned aircraft except within the 'harmless category', evidence of pilot competence shall be required for a pilot operating an unmanned aircraft that is not automatically limited in performance according to accepted standards.

Use of the market regulation

Interim	Future
Interim: no rules/standards available	Manufacturers and importers of unmanned aircraft have to comply with the applicable product safety Directive, and will have to issue information to respective customers on operational limitations applicable to the 'open' category. The market regulations will be applicable to smaller unmanned aircraft and an upper threshold needs to be established.

'Open' subcategories

Interim	Future
— Interim: from 0 kg < 4 kg: keep safe distance from persons, do not fly above crowds, do not fly over 50 m above ground unless aviation competence is available; and — from 4 kg < 25 kg: keep minimum 50 m distance from persons or vehicles on the ground, do not operate in congested areas, fly below 50 m above ground unless the pilot has aviation awareness.	— As proposed by the A-NPA and in line with the current practice, in most EASA MS it is proposed to establish subcategories for the 'open' category to allow for a more flexible adaptation to the risk. A comprehensive impact assessment and rulemaking process is needed to establish additional subcategories to define the applicability of: • higher technical standards (e.g. geographical limitation system or redundancies); • increased minimum distance from uninvolved persons; and • limited access to operation areas — It is proposed to establish a 'harmless category' of unmanned aircraft only subject to market regulations, local restrictions and they should not be operated in a careless or reckless manner. Operating instructions will come with do's and don'ts on leaflets in the box. Exact criteria need to be defined through the rulemaking process.

Zones

Interim	Future
Interim: Minimum distance of 5 km from aerodromes or sensitive areas	To ensure safety, environmental protection, as well as security and privacy, the competent authorities may define 'zones' where no operation is allowed without authority approval or 'zones' where unmanned aircraft must provide additional functions (e.g. for identification) or have to comply with additional limitations (e.g. limited MTOM).

Technology

Interim	Future
None; only minimal distance of 5 km from aerodromes or sensitive areas	To prevent unintended flight outside safe areas and to increase compliance with the applicable regulations, it is proposed to mandate a functionality that automatically generates geographical limitations and identification for certain unmanned aircraft and operation areas.

Registration

Interim	Future
The set-up of an information/registration portal is recommended.	To prevent unintended flight outside safe areas and to increase compliance with the applicable regulations, it is proposed to mandate a functionality that automatically generates geographical limitations and identification for certain unmanned aircraft and operation areas.

QEs

Interim	Future
The use of QEs should be considered in accordance with national legislation.	QEs will be accredited and audited by the NAAs or the Agency using the risk-based oversight concept.

Reporting

Interim	Future
Suitable means should be implemented to monitor this segment, like a central data base of occurrences. The data should be made available so that the Agency can substantiate the low (and probably medium) risk.	The draft Aviation Package proposes modification to the existing accident and occurrence reporting regulations.

Enforcement and oversight

Interim	Future
Enforcement is a key element to avoid intentional and unintentional misuse of unmanned aircraft. It is recommended to cooperate internationally and to develop training material and establish suitable enforcement measures.	EASA MS have to designate the responsible authorities for the enforcement of the regulations, in particular in the 'open' category where the recommendation is to rely on law enforcement agencies.

Best practices

It is recommended to harmonise the EASA MS regulations according to the Agency's proposal — especially when regulations have not yet been implemented, prior to the extension of the Agency's competence below 150 kg. As the proposed regulations have to be complemented by development of standards, the proposal cannot be implemented immediately.

The subcategories and limitations proposed for the 'open' category are already seen as a good average of the existing national regulations. The absence of some of the proposed technical mitigations (e.g. common standards for information on 'no-unmanned aircraft zones' and limitation areas) for the future 'open' category could be compensated by simple remote pilot qualification programmes or increased distance from critical infrastructure and persons:

— from 0 kg < 4 kg: keep safe distance from persons, do not fly above crowds, do not fly over 50 m above ground unless aviation competence is available;

— from 4 kg < 25 kg: keep minimum 50 m distance from persons or vehicles on the ground, do not operate in congested areas, fly below 50 m above ground unless aviation competence is available;

— from 25 kg < 150 kg and any operation exceeding the limitation above: establish a safety assessment process[25]; and

— a minimum distance of 5 km from airfields and other sensitive infrastructure is recommended.

[25] The Swiss CAA (FOCA) developed a specific risk assessment process. The process includes a safety and risk assessment to be approved by the authority, as well as user-friendly templates and guidance material. The Austrian CAA (Austrocontrol) and the French CAA (Direction générale de l'aviation civile (DGAC)) have similar processes with rules tailored to the risk of the operation. These examples of practical approach are the stepping stones the EU could use to develop its rules and processes. Aviation authorities can request more information from JARUS.

Where suitable regulations for non-commercial operations (e.g. for recreational models) exist that are able to cover the growing number of recreational consumer unmanned aircraft operations, it is recommended to keep the system until EU regulations are applicable.

Suitable means should be implemented to monitor this segment, like a central database of occurrences. The data should be made available so that the Agency can substantiate the low (and probably medium) risk.

Most important and most effective for the consumer activities are safety promotion activities in order to increase aviation awareness.

Enforcement is a key element to avoid intentional and unintentional misuse of unmanned aircraft. It is recommended to cooperate internationally and to develop training material and establish suitable enforcement measures.

6.4. Annex IV — Use of market regulation

The 'Blue Guide' on the implementation of the EU product rules is available at http://ec.europa.eu/growth/single-market/ce-marking/index_en.htm.

The 'Blue Guide' explains the new legislative framework for regulating the free movement of products, goods and services, and relies on a system of essential requirements, harmonised standards, conformity assessments, accreditation of notified bodies, and market surveillance.

One important piece of legislation in the new legislative framework is Directive 2001/95/EC[26] (the general product safety Directive), the purpose of which is to ensure that products put on the market are safe.

On the basis of the legislation on internal market, unmanned aircraft may be covered in the future by a product legislation, which would ensure that the product placed on the market is safe and environmentally compatible. Such legislation applies only to the products placed on the market. It covers neither prototypes nor the use of the products. Operations of unmanned aircraft would remain subject to aviation rules.

The main characteristics of a product legislation would be: definition of the essential requirements and related standards, certification by the manufacturer of the conformity of its product, same treatment applied to EU manufacturers and importers, enforcement by the market surveillance authorities, 'CE' marking easily identifiable by the general public, and specifications for a user manual.

The purpose of the 'open' category is to define well the safety barriers in which the operations take place and to keep the threshold as low as possible, preferably with very limited aviation rules, processes and enforcement. As this category concerns mainly operations by individuals without an aviation safety background, safety systems, identification systems (I-unmanned aircraft), geographical limitation systems, and performance limitations, should be embedded in the unmanned aircraft. It is required to develop performance requirements (e.g. I-Unmanned aircraft shall take the form of an electronic chip that enforcement authorities must have easy access to). Some unmanned aircraft of a very low mass are indeed toys. They should only be subject to very light regulation as the risk they pose is very low.

Industry would apply the product rules. The products will be accompanied by customer leaflets to draw attention to safety issues. Enforcement of the quality of the product would be left to 'market complaints' by customers or competitors. So, competitors could check compliance and lodge complaints.

[26] Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety (OJ L 11, 15.1.2002, p. 4).

6.5. Annex V — Data protection and privacy

The 'Article 29 Data Protection Working Party' (Art. 29 WP) — set up under Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data[27] — has advisory status and acts independently. It is composed of a representative of the supervisory authority(ies) designated by each EU MS, a representative of the authority(ies) established by the EU institutions and bodies, and a representative of the European Commission. The Art. 29 WP has issued Opinion 01/2015 on privacy and data protection issues relating to the utilisation of unmanned aircraft:

'Among others, the opinion also addresses recommendations to European and national policy makers for the strengthening of a framework that guarantees the respect for all fundamental rights at stake, not only data protection, by also introducing specific rules ensuring a responsible use of unmanned aircraft (which must necessarily include respect for private areas). Furthermore, WP29 calls on policy makers for the introduction of data protection aspects among the key features of national provisions regulating the commercial use of unmanned aircraft (in connection with pilot qualification and training, among airworthiness and certification requirements, while issuing/revoking operating licenses and aerial work permits), calling for a strict cooperation between Data Protection Authorities and CAAs.

WP29 also recommends manufacturers and operators to embed privacy friendly design choices and privacy friendly defaults as part of a privacy by design approach and to involve a Data Protection Officer (where available) in the design and implementation of policies related to the use of unmanned aircraft and to promote the adoption of Codes of conduct that can help the various industry stakeholders and operators to prevent infringements and to enhance the social acceptability of unmanned aircraft. Specific recommendations for the use of personal data collected by means of unmanned aircraft for law enforcement purposes are also set out. In particular, law enforcement data processing carried out by means of unmanned aircraft should, as a rule, not allow for constant tracking and technical and sensing equipment used must be in line with the purpose of the processing.'

The European Data Protection Supervisor (EDPS) also issued an opinion (dated 26 November 2014) on the Communication from the Commission to the European Parliament and the Council on 'A new era for aviation — Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner'[28]. The following extract of the opinion provides a good summary of it:

'10. Whenever personal data is processed by RPAS operated in the EU, the EU legal framework for data protection applies in principle. Together with other requirements (including aviation safety rules, certification/type-approval, health etc.), the respect of data protection requirements and the right to private and family life will enhance the development of the market of RPAS within the EU in compliance with the fundamental rights of the individuals concerned. In fact, only those RPAS that will have integrated data protection and privacy in their design will be well regarded by society at large, that is, not only by data protection authorities, not-for-profit fundamental rights organisations and associations but also by the public at large.

11. The EDPS therefore welcomes that the Communication not only underlines the expected social and economic benefits but also identifies privacy, data protection and security as key elements with which

[27] More information can be found at: http://ec.europa.eu/justice/data-protection/article-29/index_en.htm.

[28] The full Opinion of the European Data Protection Supervisor is available at: https://secure.edps.europa.eu/EDPSWEB/webdav/site/mySite/shared/Documents/Consultation/Opinions/2014/14-11-26_Opinion_RPAS_EN.pdf

to ensure compliance for the dissemination of RPAS. Their added value to activities such as agriculture, journalism or infrastructure monitoring is obvious but it is crucial to ensure that, whenever they imply the processing of personal data, their use complies with data protection law. As stated in the Commission's Communication, compliance with data protection requirements will preclude that their capacities 'represent a threat to citizens' privacy'.

12. This Opinion identifies several situations where RPAS process personal data and where controllers are, therefore, subject to the existing applicable data protection framework. It responds to the consultation of the EDPS on the Communication and aims at ensuring that further legislation on the subject takes data protection fully into account. It also aims at raising awareness of the public at large (manufacturers, controllers and data subjects) in this regard.

13. This Opinion does not aim at analysing all the data protection requirements that should be met for operating RPAS. This may be the subject of guidance by the national data protection authorities, by the Article 29 Working Party or even by the EDPS in its supervisory role if RPAS were to be used by EU institutions and bodies to process personal data.'

6.6. Annex VI — Frequency spectrum

Aviation, being a global and interoperable sector, requires a harmonised allocation and use of spectrum. Two main international institutions have a role in regulating this at international level: the International Telecommunication Union (ITU) and ICAO.

The ITU is a specialised agency of the United Nations (UN) and is responsible for issues that concern information and communication technologies. ITU coordinates the shared global use of radio spectrum and assists in the development and coordination of worldwide technical standards. The ITU is active in areas including aviation. It also organises the World Radio-communication Conference (WRC) to review the use of the radio-frequency spectrum. The Conference is held every three to four years. The last one was held in November 2015. UN MS attend these WRCs.

ICAO aims to protect aeronautical frequency spectrum for all radio communication and radio navigation systems used for ground facilities and on board aircraft. Therefore, ICAO defines its position at WRCs addressing all radio-regulatory aspects on aeronautical matters on the agenda. The ICAO position for the ITU WRCs is developed with the assistance of the Aeronautical Communications Panel (ACP) Working Group F (frequency). EASA MS and international organisations are requested to make use of the ICAO position, to the maximum extent possible, in their preparatory activities for the WRCs at national level.

At EU level, the Network Manager (NM), as one of its functions described in Commission Regulation (EU) No 677/2011[29], will also perform the central function for the coordination of radio frequencies. NM is cooperating with the ICAO regional (EU) Frequency Management Group (FMG). DG MOVE can directly liaise with ICAO (in coordination with the NM) to promote a Commission position.

The Directorate-General for Communications Networks, Content & Technology (DG CONNECT) has the role of counsellor to the Conférence européenne des administrations des postes et des télécommunications (CEPT) in which EASA MS (but also other States such as the Russian Federation) are represented. CEPT coordinates its MS' position to be submitted to the ITU.

With this in mind, the way in which the Commission's position on the use of aviation frequencies can be represented at WRC is threefold: through ICAO, through CEPT (both entities will promote the Commission's position to the corresponding MS), and directly through the EASA MS.

At national level, frequency managers and/or ANSPs are in charge of ensuring that the regulation is followed by spectrum users by providing access to it and monitoring its use.

[29] Commission Regulation (EU) No 677/2011 of 7 July 2011 laying down detailed rules for the implementation of air traffic management (ATM) network functions and amending Regulation (EU) No 691/2010 (OJ L 185, 15.7.2011, p. 1).