‘Prototype’ Commission Regulation on Unmanned Aircraft Operations

22 August 2016

Explanatory Note

<u>Legal notice</u>: This explanatory note is provided to support the understanding of the ‘Prototype’ Commission Regulation on Unmanned Aircraft Operations published by the European Aviation Safety Agency.

It represents the current views of the Agency, however it does not constitute any formal commitment on behalf of the European Aviation Safety Agency nor of the European Commission.

1.1 Background: the operation centric concept of operations

Unmanned aircraft is a sector of aviation that is developing very fast and has a great potential for producing new jobs and growth. This activity must be developed in a safe, secure and environmentally friendly manner and at the same time respecting the concerns of the citizen concerning privacy and protection of data

Following the publication of an Advance-NPA on 31 July 2015 (A-NPA 2015-10), the Agency has adopted a Technical Opinion in December 2015.

The Technical Opinion includes 27 concrete proposals for a regulatory framework for all unmanned aircraft (UA) which is operation centric, proportionate, risk- and performance-based, and establishes three categories as follows:

- 'Open' category (low risk): There is no pre-approval of the design of the unmanned aircraft, of the operator, or of the pilot. 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 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 down 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.

An important point of terminology should be addressed up front. The Draft Basic regulation has introduced two definitions: one for unmanned aircraft and one for equipment used to remotely control the unmanned aircraft. The reason was to avoid that the equipment to remotely control the unmanned aircraft be systematically part of the "certification" of the unmanned aircraft. Therefore the EASA interpretation is that unmanned aircraft covers only the flying element (the aircraft). As the equipment to remotely control the unmanned aircraft is a key element of its operations, this equipment must also be regulated by the prototype regulation. A writing convention uses Unmanned Aircraft System (UAS) to cover both the unmanned aircraft and the equipment to remotely control it. Unmanned Aircraft System is an internationally recognised definition and its acronym (UAS) well known. A consistency review has been made to make sure that unmanned aircraft and UAS are used where they should be.

The choice for an operation centric approach is justified by the fact that there is no one on board unmanned aircraft as of yet. Therefore the consequences of a loss of control of an unmanned aircraft is highly dependent on the operational environment.

The operation centric approach should be risk-based and proportionate. Intellectually a legislation only based on risk assessment could work but would lead to a significant burden for operators and competent authorities (e.g. operators to produce risk assessments, authorities to approve risk assessment). In addition for complex operations conducted with complex unmanned aircraft, there could be benefit to adopt a certification approach as it would avoid re-doing compliance demonstration and as it would give confidence to the public. The balance between these considerations has led to create the three categories. The 'open' category does not require any pre-approval as safety is ensured notably by a combination of measures including requirements and limitations on the operation, the unmanned aircraft system and the involved personnel and organisations. These general measures are complemented by conditions to access to airspace determined by the Member States.

The 'specific' category requires operators to obtain an authorisation given by the competent authority based on a risk assessment performed by the operator. As this could be burdensome for authorities and operators, a concept of standard scenario covering certain types of operations or flights has been developed. As operations with different risk levels are envisaged, the standard scenario will identify the cases where in lieu of the authorisation, a simple declaration by the operator will be sufficient to start the operation. These standard scenarios will be included in Certification Specifications (CS). More details may be found in paragraph 1.10.

The rapid development of unmanned aircraft both in terms of technology and in terms of operational use[1] leads naturally to a performance based approach where requirements are as far as possible expressed in terms of objectives. As a consequence, they need to be complemented by the development of Industry standards. This standardisation activities should be a key international priority.

The Draft Basic Regulation has envisaged the use of product legislation[2] as one of the tools to set-up the regulatory framework for unmanned aircraft. This is mostly valid for small unmanned aircraft where manufacturers are indeed small organisations that are quite familiar with product legislation. Some of these unmanned aircraft can be considered as toys, which are regulated by the product legislation. As a consequence, the prototype regulation integrates aviation safety rules and product legislation. More details on this integration may be found in paragraph 1.5.

Some of the provisions of the prototype rules will contribute to the application of other legislations such as security, privacy, data protection and environment. For example the requirements for geofencing[3] together with the possibility for Member States to define zones where the activity of drones is prohibited or limited contributes to security and privacy. This provides an effective means to adapt unmanned aircraft operations to the specific context of each Member State. More may be found in paragraph 1.4.

Another significant flexibility is relative to the register of unmanned aircraft operators: Member States have quite an amount of flexibility in its implementation provided it includes the information required by the rule.

Further flexibility has been provided by introducing in the cover regulation the same paragraph on means of compliance than in other regulations to introduce the concept of alternative means of compliance (Alt MOC). For example, this could apply when procedures are defined as Acceptable Means of Compliance (AMC) or in the case of standard scenarios that should be included in Certification Specifications (CS). The AMC included in such CS may be complemented by alt MOC.

The cover regulation introduces these operation centric concept in a clear and logical manner. The intention is to facilitate the understanding of the rules by the general public. The structure of the cover regulation is further described in paragraph 1.6.

Although not directly covered by this prototype regulation, the intention is that EASA will conduct inspection of competent authorities (EASA Standardisation) in accordance with the provisions of Commission implementing regulation (EU) No 628/2013 of 28 June 2013 on working methods of the European Aviation Safety Agency for conducting standardisation inspections and for monitoring the application of the rules of Regulation (EC) No 216/2008 of the European Parliament and of the Council and repealing Commission Regulation (EC) No 736/2006. This may be quite challenging when Member States will choose enforcement agencies such as Police to be the competent authorities for the 'open' category. Appropriate working methods will need to be developed.

The operation centric concept is not applicable to indoors operations for the reason that the concept is applicable only in the Single European Sky Airspace. EASA is aware that in-doors operations are contemplated by stakeholders (for example: inspection of fuel tanks; checking the stock in warehouse), but assume that such operations will be covered by other legislations such as health and safety regulations.

1.2 Why 'prototype' regulation?

It was agreed with Member States that the Dutch Presidency, the Commission and EASA would develop a roadmap to provide more clarity on what are the plans to roll out the operation centric concept. The roadmap includes information on rulemaking tasks, development of standards, research, cooperation with international organisations and FAA. It was developed during three workshop with Member States (March, April and May 2016) and presented to Industry at a workshop in June.

However, this roadmap did not fully clarify all issues and EASA decided to produce a prototype regulation for 'open' and 'specific' categories by the end of the summer. This prototype regulation proposes actual rules[4] providing the necessary clarity, notably on what are the responsibilities of the Member States and what is the flexibility offered to

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[1] Paragraph 1.12 further elaborates on this.

[2] Regulation (EC) 765/2008 of the European Parliament and Council of 9July 2008 and decision 768/2008/EC of the European Parliament and the Council of 9 July 2008. This regulation and this decision specify how products can be placed on the market.

[3] 'geofencing' means an automatic function to limit the access of the unmanned aircraft to airspace areas or volumes provided as geographical limitations based on the unmanned aircraft position and navigation data.

[4] Acceptable means of compliance (AMC) and Guidance material (GM) will be published at a later stage

them. It has been called 'prototype' to reflect the fact that they should help preparing the formal rulemaking process that will follow. Indeed, the intention is to publish this 'prototype' regulation and gather reactions which will be used to develop the necessary Notice of Proposed Amendments later this year. Reactions will be collected using a dedicated mailbox and dedicated workshops.

In addition, as this prototype regulation will be available at the start of the negotiations between the European Commission, the Council and the Parliament, they may facilitate debates and avoid that the Basic Regulation text becomes too specific. The detailed cover regulation should become a key elements in these discussions.

1.3 Focus on 'open' and 'specific' categories

The prototype regulation focuses on the 'open' and 'specific' categories because these are the areas where the activities are developing at a quick pace. The 'certified' category will be developed in parallel however the requirements for the 'certified' category will be included as amendments to existing manned aircraft regulations and not as part of a stand-alone regulation. The planning for these amendments is as follows:

RMT.0230 subtask	Subject	Proposal	Input	Technical consultation	NPA publication planned for	Opinion/ Decision publication planned for
B	Part-ROC 'Remote operator certificate'	New or amend	JARUS-ORG	NPA	2017/Q2	2018/Q1
B	Part-CAT Part-ARO Part-ORO	Amend	JARUS-ORG	NPA	2017/Q4	2018/Q3
C	Part-RPL 'Remote pilot licence'	New or amend	JARUS–FCL ICAO	NPA	2017/Q4	2018/Q3
C	Part-ARA Part-ORA Part-MED	Amend	JARUS-FCL	NPA	2017/Q4	2018/Q3
D	Part-21 Part-M Part-66 Part-145 Part-T	Amend	JARUS-ORG	NPA	2018/Q1	2018/Q4
E	SERA	Amend	Basic Implementation UAS	NPA	2017/Q4	2018/Q3
E	Rules for UA low-level traffic management	Amend	JARUS-ATM	NPA	2017/Q4	2018/Q3
E	Part-ACAS	Amend	ICAO/JARUS-D&A	NPA	2017/Q4	2018/Q3
E	CS-ACNS	Amend		NPA	2017/Q4	2018/Q3
F	CS-UAS	New	JARUS CS-LURS and CS-UAS	NPA	2017/Q2	2018/Q1
F	AMC UAS-1309	New	JARUS 1309, EUROCAE	NPA	2017/Q2	2018/Q1
F	CS-ETSO	Amend	Industry MOPS	NPA	2018/Q2	2019/Q1
G	CS-36	Amend		NPA	2018/Q2	2019/Q1
H	Part-TCO PART-ART	Amend		NPA	2017/Q4	2018/Q3

1.4 Security; privacy; data protection and insurance

The prototype regulation will not directly address these important issues because they are regulated at European or National level. They will however contribute to implementing them as follows:

- operators must register except if they operate only unmanned aircraft (UA) of the simpler sub-categories;
- the Member State may define zones or airspace areas where UA operations are prohibited or restricted: these can be created, for instance, for security reasons;
- obligation for the operator to comply with security requirements (Operator: natural or legal person that operate the drone);
- the pilot of a UA must not fly close to emergency response efforts;

- the learning objectives for the pilot involved in flying the most complex sub-categories of the 'open' category envisage the knowledge of flight restrictions (e.g. security) and the understanding of ethical airmanship. The same applies for the competence of a pilot for the 'specific' category;
- the risk assessment of the 'specific' category must take into account areas with special limitations (e.g. for Security or privacy reasons);
- geofencing and electronic identification will be required in the standards of sub-categories A2 and A3 in the 'open' category.

Insurance is not regulated by these rules as it falls outside the scope of the EASA's competencies. However, there are already existing aviation insurance requirements, as regulation (EC) No 785/2004 establishes minimum insurance requirements for air carriers and aircraft operators in respect of passengers, baggage, cargo and third parties. Regulation (EC) 785/2004 excludes 'model aircraft' below 20kg for the minimum insurance requirements and is, therefore, applicable to an unmanned aircraft not qualifying as 'model aircraft'. Further explanation on 'model aircraft' may be found in paragraph 1.6 (see Article 14). Furthermore, insurance may also be required by national legislation.
The prototype regulation does not address the issue of anti-drone defences at aerodrome and other sensitive areas

1.5 Structure of the prototype regulation and integration of Aviation Rules and Product Legislation rules

The prototype rules are organised as follows:

- A cover regulation that introduces in a clear and logical way the operation centric concept of operation,
- Two annexes supporting this cover regulation:
  - Annex I (Part-UAS) contains the aviation rules for 'open' and 'specific' categories and the requirements to be complied with to obtain a Light UA Operator Certificate (LUC). This LUC is not mandatory for an operator in the 'specific' category however it provides useful privileges.
  - Annex II contains the framework for the product legislation: obligations of manufacturers and other economic operators; conformity assessment procedures; notifying authorities, notified bodies; obligations and powers of Member States.

The interface between the two annexes is created by defining classes of UAS. As envisaged by article 46.3 of the draft Basic Regulation, the prototype regulation establishes essential requirements for unmanned aircraft systems so that they become Community harmonisation legislation within the meaning of Regulation (EC) 765/2008 of the Parliament and the Council.

The annex for UA operations (Annex I: Part-UAS) introduce in particular the sub-categories of operations for the 'open' category. The broad limitations (class of unmanned aircraft systems, pilot competence, etc.) for the sub-categories are provided in Part-UAS and the associated essential requirements in the sense of regulation (EC) 768/2008 together with examples of conformity assessment are included in several appendices for Part-UAS.

1.6 Cover Regulation

As indicated in paragraph 1.1, a particular effort has been made to introduce the operation centric concept in a clear and logical manner.

Article 1 provides a detailed scope introducing the operation centric concept and the condition for making available on the market UAS intended to operate in the 'open' category (product legislation). In addition, article 1 provides a list of important elements of the prototype regulation (e.g. registration, electronic identification and geofencing). Moreover it excludes the 'certified' category from the applicability of this regulation.

Definitions relative to the operations centric concept are included in article 2. The ones relative to product legislation may be found in Annex II paragraph II.2. The only exception is the definition of 'placing on the market' which is provided in article 2, as it is an important one for the understanding of Annex I.

Article 3 provides high level definitions of the categories of operations. Recitals 2 and 3 of the preamble provide the rationale for the categorisation itself which is based on two main elements: a risk assessment of UA operation, and the proportionality and progressivity of applicable rules and administrative requirements or procedures. When the first element is quite self-explanatory, the second one deserve some clarification. The 'open' category should be such as to incorporate a significant number of activities so that the need for authorisations and declarations as envisaged by the 'specific' category is reduced.

Article 4 lists the main responsibilities of the operator (organisation that operates the UA) relative to safe operations, registration, electronic identification and geofencing. These are three important elements that contributes to the safety of the 'open' category. Registration and electronic identification help to identify the operators of unmanned aircraft that would conduct illegal operations. Geofencing together with the definition by Member States of zones where the circulation of unmanned aircraft is limited or prohibited is a functionality that makes unmanned aircraft remain where they should be.

Registration of UA operators is envisaged at Member States level. The main requirements are that the registers would provide the required information and be interoperable. A standard should be developed to ensure interoperable databases. Registration will also require new resources and it is envisaged that these resources will come from a proportionate fee to be paid by the people who register as UA operators.

It also clarifies that the operator shall comply with applicable regulations on security, privacy, data protection, liability insurance and environmental protection. The use of applicable regulations has been made on purpose to address both national and EU regulation. These obligations have been defined to ensure that other key elements for the public acceptance of UA are covered. In addition, it empowers competent authorities to designate zones where UA operations are prohibited or restricted. Usually obligations for operators and authorities are separated but in this case, the idea was to highlight key items for UAS regulation. Also geofencing and the definition of zones are interrelated.

Article 5 introduces the high level limitations for the 'open' category. These are essential for safety, harmonisation and to remain true to a concept that does not require pre-approvals. It clarifies that the sub-categories are operation oriented and that their definition rely on three elements: the class of UAS, operational limitations and pilot competence as appropriate. These three elements ensure proportionate requirements for the 'open' category that take into account the wide range of UAS being used. The requirements for the class of UAS constitute Community harmonisation legislation in the sense of the Product Legislation. Last but not least, article 5 also provides a link with Part-UAS which therefore complement it.

Article 6 deals with the 'specific' category and highlights that the requirement underlying the 'specific' category is a risk assessment leading to an authorisation after agreement by the Authority. Article 6 also recognises that conducting systematically risk assessments would be burdensome for authorities and industry alike and as a consequence introduces the concept of standard scenarios. These standard scenarios will be published by the Agency as Certification Specifications (CS) where the risk assessment for a specific scenario is already carried out and the required mitigation measures are identified. Compliance to a standard scenario is an alternative to a risk assessment. The standard scenario would define if a declaration or an authorisation is necessary. Article 6 also introduces the concept of a light UA Operator Certificate as another way to comply with the requirement of the 'specific' category. There is no reference to the Product Legislation for the 'specific' category. Indeed the design requirement for the UAS are defined by the risk assessment or the standard scenarios. Finally, article 6 provides a link with Part-UAS which therefore complements this article.

Article 7 introduces requirements for the providers of safety critical services. The rationale is, for example, to ensure the quality of data defining the zones in the transmission chain from the Member State to the Operator. It should be noted that we have included in those requirements some provisions relative to the organisation and the personnel of the service provider. This is more severe than what we ask for operators because an error done by the service providers will affect many operators. In addition, operators may be private persons operating unmanned aircraft for recreational purposes. In such case, it is difficult to put on them organisational requirements.

Article 8 refers to the designation of competent authorities. It makes clear by a reference to the EASA Basic Regulation that these are the competent authorities for the implementation of Part-UAS. The designation of the notifying authority for the product Legislation is defined in Annex II. This approach has been chosen to avoid any confusion.

Article 9 defines the responsibilities of the competent authorities in particular the one to define zones regulating the operations of UA. Although not mentioned here, but as envisaged by the Basic Regulation, the competent authority may make use of qualified entities.

Article 10 requires competent authorities (aviation) and market surveillance authorities (product legislation) to create a network for cooperation on safety matters. This would complement the exchange of experience provided by the European Commission for notifying authorities. The reason is that they both have access to information relative to the safety of a product and they both may take action to ensure the continued safe operation of a UA.

Article 11 develops the concept of acceptable means of compliance in a comparable manner to what is done in other areas such as manned aircraft operations and flight crew licenses. This text includes the concept of alternative means of compliance (Alt MOC). For example, this could apply when procedures are defined as Acceptable Means of Compliance (AMC) or in the case of standard scenarios that should be included in Certification Specifications (CS). The AMC included in such CS may be complemented by alt MOC.

Article 12 defines the different types of zones and requires competent authorities to provide the necessary information in a form and manner acceptable to the Agency. This form and manner are necessary for standardisation purposes (inspection of competent authorities to check how they implement the regulations).

Article 13 deals with immediate reaction to a safety problem: this article requires to collect, analyse and exchange safety information between EASA and the competent authorities. Based on such information, EASA or the relevant competent authority will take adequate measures. This is an important requirement to ensure proper implementation of the rules. It is supported by the reporting requirements put on the operators. This article, together with article 11, ensures that cooperation exists between the EASA, the competent authorities and the Market surveillance authorities.

Article 14 defines the applicability timeframe of this Regulation..
Placing on the market UAS complying with the prototype regulation will be mandatory 2 years after the entry into force of the regulation. This raises the issue of the legacy unmanned aircraft placed on the market before that date. It is proposed that such UAS, where the UA has a mass of 250 g or less including payload, are deemed to be classified as UAS class 0 as defined in Appendix I.2, and can continue to be operated according to operation sub-category A0.

Another important transitional provision is the one that keeps valid the national authorisations or declarations up to 3 years after entry into force of the regulation after which they need to comply with the new rules.

Article 15 provides the transitional provisions for recreational operations of UA in the frame of associations or clubs ('model aircraft' operations).It is proposed that they can continue to operate as of today in accordance with National regulations or practices. After 3 years after the entry into force of the regulation an authorisation shall be issued by the national authorities to associations or clubs taking into account their safety record and defining limitations and deviations to the subpart B. No risk analysis will be necessary as the idea is that the safety record, the procedures, the safety culture of the associations and clubs provide an equivalent safety level.
'Model aircraft' are not defined but are covered by the reference to leisure flights, air displays, sport or competition activities.
The reference to associations or clubs has been made because they have a structure, procedures and safety culture that created good safety record.
This also means that individual hobbyist should either comply with the rules or join an association or club.
The option of excluding 'model aircraft' was seriously envisaged taking into account their good safety record. We had several attempts to make a definition that could accurately separate classical 'model aircraft' from unmanned aircraft. This has proven difficult as a 'model aircraft' is indeed an unmanned aircraft, and the variety of model aircraft goes far beyond manually controlled fixed wing aircraft. As we could not identify a satisfactory definition, the option of a transition period combined with an authorisation taking into account the good safety record has been adopted. In our reflexions, we also took into account that the official Fédération Aéronautique Internationale policy is to attract unmanned aircraft hobbyists. This will allow hobbyists to benefit from the experience of 'model aircraft' associations and clubs. Other reasons to keeping 'model aircraft' under the prototype rules are as follows:

- Excluding 'model aircraft' from these prototype rules would allow operators to declare their UA as a model and escape to the requirements, therefore opening a safety gap. It must be kept in mind that a significant number of incidents are caused by UA operated non-commercially;
- Member States would have to develop rules for 'model aircraft'. Not all have such rules. They would have to provide a definition of 'model aircraft' which, as explained above, is not an easy task;
- The approach being to consider the risk of the operation, being it commercial or non-commercial, excluding 'model aircraft' may not be in line with this principle.

Note 1 concerning articles 14 and 15: The dates have taken notably into account a finding coming from the survey conducted by the EASA geofencing task force that indicates that the majority of the small unmanned aircraft have a production life of around two years.
Note 2 concerning product requirements: It is acknowledged that some requirements proposed in the appendices to Annex I may be difficult to comply with by mass produced 'model aircraft', and therefore deeper consultation with stakeholders will be organised to solve this issue.

1.7 Annex II – Product legislation framework

The prototype regulation specifies essential requirements in the sense of Regulation (EC) 765/2008. They detail the essential requirements included in the Annex IX of the draft Basic Regulation that the UAS must comply with, in order to be authorised to operate in the 'open' category. As envisaged by article 46.3 of the draft Basic Regulation, these requirements shall constitute Community harmonisation legislation within the meaning of Regulation (EC) 765/2008 of the Parliament and the Council. These means in practice that these requirements will have to be taken into account in the conformity assessment process leading to the declaration of conformity and CE marking of the products intended to be operated in the 'open' category together with the requirements defined by other legislation applicable to these products, like for instance the Radio Equipment Directive (RED) 2014/53/EU.

The requirements applicable to the UAS authorised in the 'open' category are defined in Appendixes I.2 to I.5 of Annex I. These requirements create classes of products which will be identified on the product by a specific label to facilitate enforcement. The legislation ruling the making available of these products on the Union market is provided in Annex II.

One important dimension of any Community harmonisation legislation consists in the selection by the regulator of the appropriate conformity assessment procedures (modules) to be provided in the legislation amongst all those provided by Decision 768/2008/EC of the European Parliament and Council of 9 July 2008. The conformity assessment procedures may range from a simple declaration of conformity by the manufacturer to a thorough verification based on full quality assurance for the manufacturer and assessment of the design of the product by a conformity assessment body notified by the Member State. The selection of the procedure depends on the type of products and industry involved, the complexity of the requirements and the level of risks covered. It can only be finalised once those elements will be stabilised. The procedures included in the present prototype rules are only provided as examples.

In order to facilitate the conformity assessment procedures, industry standards may be developed under the responsibility of the European Standardisation Organisations (ESO). Once published in the Official Journal of the European Union, compliance to these standards provides a presumption of conformity to the requirements they relate to. ESO are: the Centre Européen de Normalisation (CEN); Centre Européen de Normalisation for electrical product (CENELEC) and the European Telecommunications Standard Institute (ETSI). ESO may cooperate with other Standardisation Bodies (e.g. EUROCAE, SAE, RTCA, ASTM etc.).

Homebuilt UAS and UAS modified by a person other than the manufacturer do not fall under the scope of Regulation (EC) 765/2008. The reason is that this regulation is meant for mass production of objects for which the compliance with product standards can be demonstrated.

1.8 Common issues to 'open' and 'specific' categories

1.8.1 Scope and applicability

The prototype regulation regulates the operation of all unmanned aircraft in the 'open' and 'specific' category within the Single European Sky (SES) airspace. It does not regulate 'state' operations (e.g. police, military, customs, firefighting, etc.) because such operations with whatever kind of aircraft are not regulated by the draft Basic Regulation. However, the draft Basic Regulation has introduced an opt-in provision that could be used by Member States to put such operations under EU rules.
In line with a risk approach, the prototype regulation applies to commercial and non-commercial activities. This decision would have a significant impact on existing model aircraft activities if transition provisions had not been introduced (Article 15 of the cover regulation).

The prototype regulation does not introduce changes to the Standardised European Rules of the Air (SERA). There will be a need in the short term to review SERA and identify provisions that could hinder operations in the open and specific categories. For the longer term, it will be necessary to modify such rules to introduce a concept of Traffic Management system for unmanned aircraft. To fully take into account the range of unmanned aircraft operations, such concept should address very low level (VLL) below 150 m; the integration into non-segregated airspace (above 150 m and Flight Level 600) and very high altitude operations (above FL 600). The concept should address the interface between these three domains. This approach developed by JARUS is more encompassing than the UTM (unmanned aircraft traffic management system) which are usually limited to the VLL. UTM are under discussion now in various instances (JARUS; EC and the global UTM Standardisation group)

Transport of passengers is forbidden but the transport of cargo and mail is authorised. Transport of passengers would indeed change one of the main assumptions made to draft these rules. Transportation of cargo and mail reflects the experimentations already done in Europe.

1.8.2 Competent authorities

The competent authority for aviation rules in the 'open' category and the notifying authority in the sense of the product legislation will be defined by the Member State.
In the case of the 'specific' category, there are two cases:

- the operator is located in one of the EASA Member States. In such case, the competent authority for the 'specific' category is the one of the principal place of business of the operator. The principal place of business is defined by the place where the operational and financial management are located. The authorisation given by the competent authority will be recognised by other competent authorities and the operator will be responsible for the adaptation of his risk assessment to the local conditions existing in another country;

- the operator is located in a third country. In this case, the model adopted for the TCO (Third Country Operator in commercial air transportation) has not been chosen. Indeed, in the case of TCO, EASA is the competent authority. However, the risk assessment need a good knowledge of the environment and the authority of the Member State where the operations are intended is better placed to review the risk assessment. The competent authority is therefore the one of the state of operations.

1.8.3 Operator and remote pilot responsibilities

They have been clearly separated. The operators responsibilities are of a structural nature, for example, the obligation to register is on the operator. The remote pilot responsibilities are of a tactical nature and included into UAS.OPEN.40 for the 'open' category. For example, the remote pilot should fly the unmanned aircraft within the limit of its user manual. One noteworthy task is to ensure safe separation from other manned aircraft. Although this is different from what is defined in SERA, it can be explained by the fact that the unmanned aircraft remote pilot is better placed to detect another manned aircraft than the reverse also because of the typical smaller size of the unmanned aircraft in this category. It should be noted that the FAA has adopted the same approach in its Part 107.

1.8.4 Occurrence reporting and analysis

In both 'open' and 'specific' categories, occurrence reporting by the operator is envisaged in compliance with Regulation (EU) 376/2014. In the case of the 'open' category this is limited to fatal or serious injuries to person or when a manned aircraft is involved. In the case of the 'specific' category, the operator must report to the competent authority any occurrence that involves injury to any person or damage to any property, vehicle or another aircraft.

1.9 Main issues on 'open' category

1.9.1 Limitations

The safety of the 'open' category relies in particular on a set of limitations: unmanned aircraft maximum take-off mass must be below 25kg as a proxy to a limitation in energy, flight are limited to height below 150 m (500ft) above ground or sea level and the unmanned aircraft must remain in visual line of sight (VLOS) of the remote pilot in order to reduce the risk of collision with other unmanned aircraft. These limitations are defined in the Part-UAS and its appendices.

The 25 kg limit was chosen because it is quite frequently the limit for 'model aircraft' to fly without an approval of its design. It is also the limit adopted by our main bilateral partners: FAA, ANAC Brazil and Transport Canada. Of course with such a maximum take-off mass, there is a need to have subcategories in order to have rules proportionate to the risk. The limitations to 150m and VLOS are very important to mitigate the risk of collision with other aircraft.

1.9.2 Sub-categories

Sub-categories of operations have been created to ensure that the rules remain proportionate.

They are characterised as follows:

- a class of unmanned aircraft system. The essential requirements for the class of UAS may call for installation of geofencing functionality and electronic identification;
- a set of limitations (maximum height; distance from uninvolved persons; VLOS) as appropriate;
- requirement for pilot competence as appropriate.

The combination of these three factors ensures the safety of the sub-category.

Four categories have been defined from A0 to A3, ranging from the less complex to the more complex one.

An important driver for the class of UAS is an objective requirement relative to AIS (Abbreviated Injury Scale).

A UA does not *inherently* put people at risk, since no pilot or passengers are on-board. The greatest risk is experienced by those impacted by a UAV on the ground (or possibly in an aircraft). Focusing on people on the ground possibly hit by a UA, as part of the risk-centric approach it is necessary to define a relationship between the kind / category of UA and the injury possibly being suffered by an unprotected human hit by the UA. To this aim, the AIS scale is useful. AIS is an anatomical-based coding system created by the Association for the Advancement of Automotive Medicine to classify and describe the severity of injuries. It grades injuries according to 6 levels, from minor (0) to fatal (6). Annex 1 to this explanatory note, provides more details. Based on this injury grade the A0 threshold has been identified as the maximum weight (and speed) providing a reduced energy such as to make improbable the injury of a person in case of impact of a UA. These value are set to 250g and a speed of 15 m/s.

The next thresholds A1 and A2 are set to 2 higher grades of injuries in case of impact while there is no threshold for A3 as for such masses the impact on a person will have serious consequences. The compensating factors in these cases are competence required to the remote pilot including a specific training to operate in A3 sub-category and the requirement to fly at minimum distances from uninvolved people persons
The EASA is aware that the definition of uninvolved person will certainly raise a debate but has not proposed one at this stage.

Another important element to be highlighted is the use of specific functionalities: geofencing and electronic-identification. For practical reasons, they have been made mandatory only for the sub-categories A2 and A3. The details of the functionalities are defined in appendix I.6.

Pilot competence requirements have been only introduced for sub-category A3 which is the most complex one. In other cases compensating factor is a limitation to 50 m for the maximum height above ground level.

A minimum age of 14 has been introduced for categories A1 to A3. This age has been chosen as it is the minimum age at which student pilot can fly solo in a glider or a balloon after having been authorised by his/ her instructor and be under the supervision of the instructor.

1.10 Main issues on 'specific' category

1.10.1 The risk assessment

The 'specific' category is relying on a risk assessment. The key factors to be taken into account are indicated in paragraph UAS.SPEC.60. An acceptable means of compliance is the Specific Operation Risk Assessment (SORA) developed by JARUS. The standard scenarios described in paragraph 1.10.2 will already include the risk assessment of that specific operation. Therefore an operator willing to conduct an operation covered by a standard scenario will not be required to carry out the risk assessment but only to verify that its operation is not exceeding the envelope defined in the scenario.

1.10.2 The standard scenarios

As performing systematically risk assessment would prove burdensome for operators and authorities, a concept of standard scenarios have been introduced. These standard scenarios will be published by EASA and will be based on the performance of risks assessments for specific type of flights or specific operations (i.e. precision agriculture or infrastructure inspection). This document will also identify the mitigation measures to ensure the safety of the operations. EASA considers these standard scenarios as a key to a successful implementation of the 'specific' category. Therefore, proposals for such standards are welcome.

1.10.3 Authorisation and declarations

As envisaged by the draft Basic Regulation, the operator may receive an authorisation or simply declare compliance for the low risk cases. The standard scenarios will identify the cases where an authorisation is required before starting the operation or when a simple declaration to the competent authority, in which the operator states that he will not exceed the standard scenario envelope and he complies with the defined mitigation, is sufficient.

1.10.4 Optional light UA operator certificate (LUC)

The light UA operator certificate has been introduced as an option. This allows more flexibility to operators performing operation covered by standard scenarios requiring an authorisation by the competent authority or an operation not covered by a scenario. In these cases an operator may request a certificate from the competent authority (LUC – Light UA Operator Certificate) with privileges to authorise those specific operation.

1.11 Consistency with international activities

1.11.1 ICAO

EASA is participating in the ICAO RPAS panel. ICAO has recently released a draft concept of operations which scope is: << *The scope is limited to certified RPAS operating internationally under instrument flight rules (IFR) in non-segregated airspace and at aerodromes in 2030*.>>The panel focus on international IFR operations (close to the certified category), therefore the risk of inconsistencies is limited at this stage.

1.11.2 JARUS

EASA is involved in JARUS and intends to make maximum use of JARUS products. All deliveries provided by JARUS have been and will be taken into account in the EASA regulation. For example the risk assessment methodology (SERA) considered as an AMC for the risk assessment was developed by JARUS.

1.11.3 FAA

FAA and EASA keep each other informed on their activities. Part 107 is the recently adopted FAA regulation for small unmanned aircraft systems below 25kg. It will create a process that will replace their present exemption process (around 3000 delivered). It corresponds broadly to our 'open' category.

- Some common points: MTOM 25kg, operation VLOS; maximum altitude 400ft (we propose 500ft); competence requirements for the pilot;
- Some differences: it does not apply to model aircraft when our prototype regulation does; it does not require geofencing or identification; no-subcategories; no essential requirements for design.

The use of the Abbreviated Injury Criteria is also coming from discussion we had with FAA when participating into the ARC for "nano" drones.

1.12 Unmanned aircraft market outlook[5]: Important growth over the next years

According to a recent market research focusing on small drones which weigh less than 55 pounds (25 kg) including payloads and which can be controlled remotely the market over the coming years is expected to boom, especially for quadcopters. Indeed this type of drones has the biggest market size (among four types of drones analysed, namely fixed wing, quadcopter, nano, hybrid) and it is expected to increase to USD 4.934 million in 2020 from the 2014 value of USD 663,4 million with a compound annual growth rate (CAGR) for 2015-2020 of 31,42 %. The current second most important type of drones in terms of market size is the fixed wing one that could reach a value of USD 272,3 million in 2020 (from the 2014 value of USD 61,9 million) with a CAGR for 2015-2020 of 19,95%. However according to estimate in 2020 the second group could become the hybrid one (currently third) with an expected value of USD 385,4 million in 2020 and a 2015-2020 CAGR of 66,15%.

In terms of number of drones units, the first, among the four types of drones mentioned above, is the rotary blade that is expected to reach 3.830.073 units in 2020 (CAGR 2015-2020 33,96%, 887.755 in 2015). The current second group is the fixed wing one with 17.698 in 2015 (expecting to be fourth in 2020 with 48.365 units, CAGR 2015-2020 22,27%), the current third one is the nano one with 8.110 units in 2015 and 57.721 in 2020 and the current fourth one

[5] Main source of input for this paragraph is the market research "UAV Drones Market by Type (Fixed wing, Rotary Blade, Nano, Hybrid), Application (Law Enforcement, Precision Agriculture, Media and Entertainment, Retail) & Geography (Americas, Europe, APAC, Row) —Analysis & Forecast to 2020' MarketsandMarkets, 2015.

is the hybrid one (second in 2020 according to projections) with 2.771 units in 2015 and 75.837 in 2020 (CAGR 2015-2020 69,45%).

Quadcopters held the largest market share of 91% of the overall UAV drones market in 2014. Rotary blade drones can fly vertically, horizontally, and can hover at the same place which makes them convenient for the applications where stability of the operation is required, such as media & entertainment, inspection/monitoring, surveying/mapping among others. Nano and hybrid drones are at the initial stage of their product development due which they hold a small market size compared to others types of drones. Fixed wing drones are said to be professional drones: they are mainly preferred by the professionals for the precision agriculture application.

As regards the geographical distribution of drones across world regions, the Americas (U.S., Canada, Mexico, and Brazil) are expected accounted for the largest share of the global commercial drone market in 2015. The European region is expected to account for the second largest share (about a third of the Americas figure). Among all the geographies, the Asia-Pacific region is expected to grow at the highest rate in the next years, at a CAGR of 37.74% between 2015 and 2020.

Looking at the evolution of drones from 2015 to 2020 by application, the media and entertainment application seem to account for the highest market share both in 2015 and in the 2020 forecast with a CAGR of 26% (2020 value: USD 1.323,8 million). In 2020 the second largest group for drones' application could be the inspection and monitoring (USD 1.228,9 million), followed by precision agriculture, hobbyist and do-it-yourself (DIY), surveying and mapping, education, law enforcement, retail.

1.13 Initial elements for the impact assessment

1.13.1 List of issues to further analyse

A detailed regulatory impact assessment (RIA) will support the NPA to be published by the end of 2016. A preliminary list of issues has been defined. These issues will be taken into further consideration, especially where relevant impacts are foreseen, and a detailed analysis could be included in the RIA, also depending on the feedback provided by the stakeholders.

- Geofencing systems, e.g.: categories that should install these systems; definition of geographical data format and reference; way information should be provided to the operator and uploaded in the UA;
- Identification, e.g.: interoperability with other manned aircraft; ways enforcement authorities could identify UA.
- Registration and authorisation, e.g.: minimum threshold; factors to take into consideration (such as privacy, UAS carrying a HD camera); possibility of declaration as alternative to registration
- Pilot Competence, e.g.: categories for which license is needed; use of online tutorial for less risky sub-categories;
- Procedure for authorities, e.g.: different authorities to identify: aviation, market surveillance and enforcement; monitoring and enforcement activities; how to check that the flight limitations are respected; training courses; role of Competent Authorities with regards to oversight, registration, designation and certification; flow of information of authorities across Member States; resources needed (e.g. for examining a document, testing or inspecting the UAS, issuing certificates, authorisations and approvals; maintain register of UA operators, declarations and authorisations and certificates);
- Categorisation, e.g.: sub-categorisation of the 'open' category and criteria according to which this should be done (e.g. weight, risk elements); model aircraft;
- Link to traditional ATM system, e.g.: large number of drone operations and risk of saturating ATM; performances of some UAS do not comply with ATM requirements; role of traditional Air Navigation Service Providers (ANSP's); interoperability (e.g. transponders); dedicated Unmanned Traffic Management (UTM); transition between the ATM and UTM;
- Occurrences reporting, e.g.: category and damage to be reported; how this should be done; by whom (e.g. self-reporting of the operator);
- Fragmentation of rules, e.g.: currently rules quite fragmented at national level and the need to foster harmonization;

- Product conformity, e.g.: Essential product requirements and conformity assessment modules.

Stakeholders affected: 1) Manufacturing companies; 2) Importers and distributors of products on the market; 3) Operators (civil private and commercial), including flight crews and maintenance staff; 4) National Authorities (Competent ones); 5) EASA; 6) ANSP/ATM; 7) Aerodromes; 8) General public; 9) Other airspace users (manned aircraft)

Safety issues: part of the problem definition in the RIA will be the safety risk assessment. Some initial information have already been highlighted in the Annual Safety Review 2016 published by EASA[6] occurrences in the European Central Repository identified 584 occurrences of all severity levels, of which 37 accidents had been classed as accidents, none of the accidents involved fatalities and there were only four minor injuries reported in the period since 2010. The collection of data on RPAS occurrences is still in its infancy and there is still work to be done to ensure the correct application of taxonomy terminology related to RPAS. Further analysis is ongoing.

1.13.2 Objectives

The specific objectives to be achieved, as highlighted in the Terms of Reference of RMT.0230, are:

- ensure a high and uniform level of safety for UAS enabling operators to safely operate unmanned aircraft in the single European sky airspace, especially for high risk operations;
- fostering innovation and development of UAS;
- harmonize the regulatory framework in order to enhance clarity and cover gaps and inconsistencies of a fragmented system (e.g. cross-border use of UAS);
- foster an operation centric, proportionate, risk- and performance-based regulatory framework taking into account various important aspects such as privacy, data protection, security, safety.

1.13.3 Options

Options and their impacts will be further analysed in the NPA foreseen for end 2016.

[6] http://www.easa.europa.eu/system/files/dfu/209735_EASA_ASR_MAIN_REPORT.pdf

Annex 1
The Abbreviated Injury Scale (AIS)

A UA does not *inherently* put people at risk, since no pilot or passengers are on-board. The greatest risk is experienced by those impacted by a UA on ground (or possibly on board a manned aircraft). With regard to people on the ground, possibly hit by a UA, as part of the risk-centric approach it is necessary to define a relationship between the kind / category of UA and the injury possibly being suffered by an unprotected hit human. To this aim, the AIS scale is useful. AIS means Abbreviated Injury Scale and it is an anatomical-based coding system created by the Association for the Advancement of Automotive Medicine to classify and describe the severity of injuries. It grades injuries according to 6 levels, from minor (0) to fatal (6).

These 6 AIS levels can be loosely correlated with a probability of fatality (PoF) as follows:

AIS = 2: PoF < 1%
AIS = 3: PoF < 10%
AIS = 4: PoF < 30%
AIS = 5: PoF < 50%

Kinetic Energy (KE) should be considered as the main contributor to the injury level. For a complete analysis of ground collision severity, KE should be examined both in terms of magnitude and on a per unit area basis. Nevertheless the energy level per unit area should not be considered as a good measure to assess the overall damage but only a complementary tool. Consensus standards will define, where required, constraints on the shape of UAs such that protruding parts are properly minimized or protected, and this should capture the energy level per unit area aspect. Globally, KE is the factor taken into account.

Several studies have attempted to determine the correlation between KE transferred to the human body during an impact and PoF. The most recent estimates for impact with a standing person, averaged on the different body areas of the person which can be hit, are the following:

PoF (%)	**KE (Joules)**	**AIS threshold**
1	44	2
10	66	3
30	92	4
50	114	5
90	194	6

Multi-rotor aircraft makes up, currently, a large part of commercially available UA in the 'open' category. For this class of UAS, terminal velocity can be considered as a conservative measure of the possible velocity at which they may collide with objects and people on ground. It has been estimated by recent research that current multi-rotor UA under 2.2 Kg have about 48.3 Joules of terminal KE per 250 g of mass.

From the above, the following relationships can be established between weight of mass market drones and PoF assuming that 100% of KE is transferred to the human body during the impact:

- 250 g drone: PoF slightly more than 1%, injuries probably distributed on AIS level 1 / 2 (depending especially on the body area impacted and the impact direction)
- 500 g drone: PoF slightly more than 30%, injuries probably distributed on AIS level 3 / 4
- 600 g drone: PoF less than 50%, injuries probably distributed on AIS levels 4 / 5
- 1.4 Kg drone: PoF of 90% or higher, injuries probably distributed on AIS levels 5 / 6

It is important to note that a 100% transfer of the UA's KE to the human body is never the case. During any UA collision with any object (like human, building or vehicles, etc.), the UA transfers some of its energy to the object, retains some of its energy (in form of translational and rotational energy) and loses some energy (deformation, frangibility). Recent studies consider that, in average, 60% of the energy is transferred to the human body in case of drone impact. This value could be further improved. Material selection directly effects frangibility. Energy absorbing materials are ideal choices for the construction of UA structural components. It is therefore well possible, to make an example, that, with a careful design and choice of materials, a 1 Kg UA would be able to demonstrate an average amount of KE transferred to the human body of less than 90 J putting it into the PoF of less than 30% category.

The above considerations, based on KE and energy transferred to the human body in case of collision, is considered the main energy criteria to differentiate among UAS classes.

Considering the single constituent of a UA, batteries, and payloads are dense, non-frangible components. Designs that integrate the payload and batteries into the UA structure are more likely to provide some level of protection to people or property during a collision. Batteries are quite dense elements but tend to be well-integrated into the structure of most multi-rotor UAS. Camera are integrated in some cases and not in others. On the other side the calculated density of a camera, much less than the one of a battery, give cameras some frangibility property and therefore some inherent protection in case of collision with the human body. Motors are even denser than batteries (about the double) but have a mass about 10 times smaller than the one of the batteries.