

**Comment Response Document (CRD)
to Notice of Proposed Amendment (NPA) 16-2005**

POLICY FOR UNMANNED AERIAL VEHICLE (UAV) CERTIFICATION

Explanatory Note

I. General

The purpose of the Advance Notice of Proposed Amendment (A-NPA) was to propose a policy for the certification of UAV (Unmanned Aerial Vehicle) Systems (the Policy) and is a first step towards more comprehensive UAV regulation. The scope of this rulemaking activity is outlined in Task 21.034.

II. Consultation

1. The A-NPA was published on the web site (www.easa.europa.eu) on 7 November 2005.
By the closing date of 7 February 2006 the Agency had received 320 comments from around 45 organisations and individuals including national authorities, professional organisations and private companies.

III. Publication of the CRD

2. All comments received have been acknowledged and incorporated into a Comment Response Document (CRD). This CRD contains a list of all persons and/or organisations that have provided comments and the answers of the Agency. An Inventory of main issues and replies is attached for your convenience as a quick reference to the main issues and the replies hereto. The replies on these main issues take into account all comments expressed on the issue
3. In responding to comments, a standard terminology has been applied to attest EASA's acceptance of the comment. This terminology is as follows:
 - **Accepted** – The comment is agreed by the Agency and any proposed amendment is wholly transferred to the revised text.
 - **Partially Accepted** – Either the comment is only agreed in part by the Agency, or the comment is agreed by the Agency but any proposed amendment is partially transferred to the revised text.
 - **Noted** – The comment is acknowledged by the Agency but no change to the existing text is considered necessary.
 - **Not Accepted** - The comment is not shared by the Agency
4. Next steps after CRD:

The *Agency's Policy* for UAV system certification will be issued at least two months after the publication of this CRD to allow for any possible reactions of stakeholders regarding possible misunderstandings of the comments received and answers provided. Compared to the one presented into the A-NPA, this policy will take into account the comments and reactions received. This policy may be seen as guidance material to Part-21 to address the specific case of UAV

The *steps beyond the publication of the policy* as described into the standard reply relative to the regulatory framework for UAV.

5. Such reactions should be received by EASA not later than **XX Month** 2008 and should be sent by the following link: CRD@easa.europa.eu;

INVENTORY OF MAIN ISSUES AND REPLIES

CRD-16-2005

'POLICY FOR UNMANNED AERIAL VEHICLE (UAV) CERTIFICATION'

General introduction:

Comments were received from 45 organisations and individuals:

- Authorities: e.g. UK; France (civil and military), FAA, Sweden (civil and military), Italy, Germany
- Stakeholders (e.g. UAV Industry, IFATCA, IFALPA).

The main comments are highlighted below:

- regulatory framework for UAV: Role of EASA and development of a comprehensive framework for UAV regulations
- UAV below 150 Kg
- UAV or UAS?
- Coordination with military working group on UAV
- Conventional versus safety target approach for certification
- Total system approach as proposed by Sweden
- The two alternatives for selecting the manned CS.
- 'sense and avoid'
- UAV system safety analysis
- Security
- Need for DOA
- Certificate of airworthiness and control stations
- Environment

Standard replies taking into account when appropriate the diversity of expressed views, have been used to reply to these comments and they are presented in this inventory.

The policy uses a specific interpretation of the definition of parts and appliance to be able to certify UAV as a complete system: parts of the UAV that are not in the air vehicle (e.g. control station) are accepted as part of the whole system (and therefore may be certificated) because they are used for functions that in manned aircraft are on board the aircraft. This interpretation is used for the short term but the Agency plans to update the definition of parts and appliances in due time.

Standard reply for regulatory framework for UAV: Role of EASA and development of a comprehensive framework for UAV

Noted.

Many comments regret that EASA does not develop a comprehensive framework for UAV regulation (Option 3 of the A-NPA). However they accept as a first step the development of the Policy as envisaged in the A-NPA.

The Agency agrees that option 3 is the long term solution and proposes that a group be created to identify building blocks and define a road map for a comprehensive framework for UAV regulation.

Such a group should report to the Commission because the Commission is competent for all issues related to UAV regulation. It should include the main players and take into account existing or planned activities. A specific task for the group would be to develop a detailed regulatory impact assessment (in particular the safety case).

The group should allocate responsibilities so that each player is responsible to organise its work.

The group may also organise further studies as appropriate (e.g. Total System Approach, Safety Target approach). Concerning the safety target approach, the study should also establish its conformity with Article 2 (d) of the EASA Regulation (Regulation 1592/ 2002)

Standard reply for UAV below 150 kg
--

Noted.

Several commentators requested that the Agency develops guidelines for the certification of small UAV.

The comment is understood however the EASA is only competent for UAV above 150 kg Maximum Take-Off Mass (MTOM). Member States are competent for UAV below that limit and are expected to regulate the activity of such UAV and therefore complement the Agency's efforts. It is worth noting that the report of the joint JAA-EUROCONTROL initiative on UAV proposes a model for such regulation based on the work done by the UK-CAA.

Because it sees merit in a harmonised approach between Member States, the Agency proposes that Member States agree that EUROCAE WG-73 develops guidelines for certification of such UAV. The guidelines drafted by the joint JAA-EUROCONTROL initiative only address the case of UAV that remain in direct line of sight of their pilot (e.g. crop spraying). However today application for UAV below 150kg envisages operations that would not remain in line of sight of the pilot (e.g. coastal surveillance) and therefore the guidelines need to be updated.

Standard reply for UAV or UAS?

Accepted.

Some comments have raised the issue of the acronym that should be used.

The policy presented by the A-NPA uses the acronym UAV. Other bodies such as FAA or the EUROCAE WG-73 are using UAS for Unmanned Aerial Systems. The Agency policy is to approach the UAV as a system and the policy uses several times the words UAV systems. Therefore the Agency will use UAS to align with other important partners and the policy will be modified accordingly.

Standard reply for Coordination with military working group on UAV

Noted.

Several commentators stress the importance of the coordination between civil and military activities on UAV. It has been suggested that the code developed by the French military Authorities (USAR: Unmanned Systems Airworthiness Requirements) could also be used for civil purposes. This code has served as a basis for the development of a NATO standard.

USAR is not the comprehensive framework for UAV regulation as envisaged by option 3. It does not address 'sense and avoid', operational regulations and flight crew licensing regulations.

The Agency recognise however that USAR has been developed using a methodology closely related to the one described in the policy and accept to consider USAR version 3 as an acceptable means of compliance to the policy provided that:

- Its applicability is limited to the scope of present CS-23
- The safety targets included in the safety analysis reflect the ones resulting from the application of the EASA UAV policy.

Standard reply for Conventional versus safety target approach for certification

Not accepted.

Some comments queried the detailed presentation of the two approaches when the Agency seemed to have decided to use the conventional approach.

The A-NPA presented two main options to address UAV certification:

- A conventional approach using as a starting basis manned certification specifications (e.g. CS-23; CS-25)
- A safety target approach setting an overall safety objective for the aircraft within the context of a defined mission and operating environment.

The Agency has tried to present both options and their evaluation in an objective way. The Agency expressed also the view that it has chosen the conventional approach for the general case accepting the use of the safety target in specific cases (e.g. operations in remote areas). The presentation of the two options was done for transparency reasons to explain the choice made by the Agency. The purpose of asking comments was to identify if no major issue would result from the choice of the conventional approach. The review of comments on this issue reflects a general support to the conventional approach.

The idea is that the conventional approach leads to certificates of airworthiness and that the safety target approach leads to restricted certificate of airworthiness. The safety target approach is mainly meant for operations above remote areas and for operations in segregated airspace.

The group to develop the road map for a comprehensive framework for UAV regulations could further study the safety target approach.

Standard reply for Total system approach as proposed by Sweden

Noted.

Sweden has proposed a total system approach (TSA) and provided a rather detailed justification for it. The TAS concept reflects the constantly increasing integration of the Aviation system. It is introduced to a certain extent by the set of regulations implementing the Single European Sky.

The Agency is of the opinion that this TSA is an attractive concept but that goes beyond UAV certification with the applications as envisaged to day. TSA may be considered in the long term when the applications described by the commentator have come to maturity.

The Agency believe there is a need for an in-depth study of the TSA and based on this study will consider further actions including modifications to regulation 1502/2002. This study could be performed by the proposed group to define building blocks and road map for a comprehensive framework for UAV safety regulation.

Standard reply for the two alternatives for selecting the manned CS.

This reply is presented either as accepted when the comment supports the kinetic energy method and not accepted when the comment supports the safety objectives method.

In the conventional approach, one issue is to select the manned certification specification that will be used as a starting basis for a given UAV certification. Two methods were proposed in the A-NPA and the Agency indicated it would retain only after having reviewed the comments:

- One method is based on kinetic energy consideration
- One method is based on safety objectives consideration.

The Agency believes that the two methods proposed for selecting the relevant manned CS will not lead to equivalent results (For example the safety objective method would allow to certify a UAV with a maximum take-off mass of 20 000kg using CS-23 when the kinetic energy considerations method would require in such case the use of CS-25). As a consequence there is a need to make a choice. The purpose of the consultation was to get further information to allow the Agency to make such choice in an informed manner.

The review of all comments relative to the appropriate method for selecting airworthiness codes indicates that a majority of the commentators prefers the kinetic energy method for the following reasons:

- The method based on safety criteria is not fully justified.
- The selected population density criterion of the safety objectives method does not reflect population densities in several countries of Europe.
- The criteria selected for the lethal crash area of the safety objective method does not reflect a forced landing.

- In addition the safety objective method leads to unequal treatment of manned and unmanned aircraft of identical maximum take-off mass: as explained above, this method would allow certifying an UAV of 20 000kg using CS-23 when a manned aircraft of the same mass would use CS-25. Such a situation will be difficult to explain to the public..

The Agency concurs with these comments and will include in the policy only the kinetic energy method.

However the Agency plans to further study the method based on safety criteria in cooperation with the EUROCAE WG-73 on UAV.

Standard reply for ‘sense and avoid’

Partially agreed.

Many comments regret that EASA certification does not address ‘sense and avoid’

EASA recognise ‘sense and avoid’ as a critical issue for safety and operations but considers that the criteria for ‘sense and avoid’ should be defined by the Authorities responsible for the safety regulation of ATM.

When such criteria are developed, they can be complemented by specifications developed by standardisation bodies such as EUROCAE to help certifying the necessary equipment.

When such specifications are available, EASA will be able to certify the systems.

The Agency also accepts that to a certain extent the certification specifications (CS) deals with ‘anti-collision’: anti-collision lights are specified in CS; pilot compartment view is also addressed; minimum crew considerations also take into account collision avoidance. These specifications reflect the concept of ‘see and avoid’.

It is therefore expected that during the tailoring of manned certification specifications, such paragraphs will be taken into account: aircraft lights should be installed and the UAV crew should be provided with means or procedures to obtain a certain amount of situational awareness. However this will not achieve the necessary criteria to operate in non-segregated airspace: the limitations of the ‘see and avoid’ concept are well known even for slow aircraft.

The consequences of not considering ‘sense and avoid’ as part of the airworthiness certification will be a limitation to operate in segregated airspace only. This situation will be reflected by a statement in the flight manual indicating that operations are limited to segregated airspace only unless mitigating measures to the absence of ‘sense and avoid’ certification have been accepted by the Authority responsible for a specific airspace. Examples of such measures could be: a NOTAM creating a segregated airspace covering the zone of the UAV operation, the UAV remaining constantly in line of sight of its pilot. The policy will be modified to clearly request the existence of a statement in the flight manual.

In addition, the Agency will request the EUROCAE WG 73 to start developing a Special Condition based on criteria of EUROCONTROL draft specification for THE USE OF MILITARY UNMANNED AERIAL VEHICLES AS OPERATIONAL AIR TRAFFIC OUTSIDE SEGREGATED AIRSPACE. It is proposed to do so by

reviewing the specifications of the above mentioned document that have an impact on 'airworthiness' and built on this review. A very preliminary review of the EUROCONTROL document (Reference 07/08/09-42 version 1.0) indicates that its specifications UAV2, UAV3, UAV5, UAV6, UAV7, UAV8, UAV9, UAV11, UAV12, UAV13, UAV14, UAV15, UAV18, UAV19, UAV20, UAV22, UAV 29, UAV31 would have an impact on the design of the UAV and its systems.

Standard reply for UAV system safety analysis
--

Noted.

Several comments addressed the UAV system safety analysis and its detailed objectives.

The guidance relative to the safety analysis contained in attachment 2 of the policy envisaged by the A-NPA is expressed in qualitative terms. Such terms are applicable for all categories of UAV. Quantitative values to be used should be those used for the 1309 analysis contained into the manned CS that has been selected as a starting basis for the certification of a given UAV. As a result, numerical values will depend of the selected CS.

However the Agency accepts that the guidance provided with the policy need improvements. It will be kept as it is for the first issue of the policy but EASA plans to ask EUROCAE WG-73 to further develop the guidance based on the comments received on the A-NPA.

Standard reply for security

Noted.

Many comments regret that EASA certification does not address Security issues.

The Agency agrees that security is a key issue for UAV but the Agency has no remit for Security. EASA can not mandate security requirements. However if security systems are mandated by the appropriate authority or installed voluntarily, they should not impact safety. In such case, EASA would have to develop specifications so that safety is not impacted. For example some failure cases of encryption devices could impact control commands. The group envisaged to develop the road-map for a comprehensive framework for UAV regulation could be used to identify how and by whom the security concern would be addressed

The Agency draws the attention of the commentator to the work of the EUROCAE WG-72 Aeronautical System Security that is developing guidelines addressing security related to aeronautical systems including relevant airborne systems, relevant ground systems and their related environment but excluding land side equipment such as baggage screening for instance). UAV designers may elect to voluntarily comply with this standard when adopted to improve the security of the data-link.

Standard reply for DOA

Partially accepted.

The policy envisaged by the A-NPA requires systematically a DOA (design organisation approval) for the designer. Several comments have questioned this requirement.

The use of CS-VLA can be accepted as a starting basis: designers of CS-VLA aircraft do not need to obtain a DOA and can demonstrate their capability to design by using alternative procedures to DOA. However even if the air vehicle is of simple design, the UAV system (air vehicle, data-link, control station) is not so simple: this would justify requiring a DOA. However the Agency is ready to accept alternative procedures based on an appropriate substantiation by the designer. The policy will be modified accordingly for UAV that would use CS-VLA or CS-VLR as a starting basis following application of alternative I.

Standard reply for Certificate of airworthiness and control stations

This reply is presented either as accepted or not accepted depending of the views expressed by the comments.

Several views were expressed here and not all views were in line with the present EASA Regulation (1592/2002).

There seem to be only one view fully in line with the present regulation: a certificate of airworthiness covering one flying vehicle-one control station. The policy will be modified to clarify this point. The Agency accepts that this leads to operational limitations. The policy may be re-evaluated in the future taking into account experience gained but this will need to modify the existing regulatory framework.

Standard reply for environment

Noted.

There is no principal reason why one should distinguish between a manned and an unmanned aircraft when considering environmental protection measures. Therefore, for noise at the moment it might be the best solution to stick with the requirements of ICAO Annex 16, Volume I having in mind that possible additional requirements for jet aircraft with take-off distances below 610 m have to be taken into account. In addition, if it turns out that UAVs due to their special mission cause additional annoyance to people, certain measures have to be taken. If, for example, a reasonable number of "larger" UAVs are intended to operate at low altitudes and/or stay for some time at a certain location, then more stringent source requirements and/or operational restrictions may have to be taken into consideration.