– ECA Position Paper –

The RPAS 'Open Category' in EASA's Concept of Operations for Drones

Executive Summary

This paper describes the position of Europe's professional pilots on the standards and rules necessary for the safe use of drones in EASA's '*Open'* category. Acknowledging the potential this technology has for innovation and benefit to society, it is absolutely critical that the technology is introduced safely, in particular with regard to existing manned aviation – a future accident involving drones in which people are seriously harmed will do far more damage to the industry's development than carefully thought out, effective, efficient regulation. The following points summarise this paper.

The safety of human beings is paramount

It must always be the case that real people, whether in the air or on the ground, have their safety prioritised over the ability or right to operate a drone. It must be born in mind that most drones in the *Open* category will be mass market consumer products, may have significantly different capabilities in a few years, and any regulation needs to deal with this. This cannot happen without proper risk assessment, especially of midair collision risk.

Design requirements for the physical performance capability of drones in the *Open* category

There is a compromising lack of scientific and engineering research on the effects of drone collisions with aircraft. This must be conducted as a matter of urgency to assess and refine these or any other proposed technical standards**.** They include:

1. Maximum achievable distance from pilot of less than 500m[1] horizontally and 50m in height;
2. Auto avoidance of restricted areas e.g. by geo-fencing, or transponder technology;
3. Auto recovery in the event of loss of control;
4. Weight limited to 500g, subject to density, frangibility and part weight specifications that would prevent catastrophic damage to manned aviation;
5. Maximum speed to allow control, recognition and limit kinetic energy;
6. Colour, visibility and lighting standards to allow visual recognition and avoidance;
7. Marking and registration of the drone to allow tracing of pilot/operator.

Operational requirements for drones in the *Open* category:

1. Unilateral obligation to avoid manned aviation;
2. Operation restricted to Visual Line of Sight (VLOS);
3. No operation in the vicinity of third persons without their consent, or crowds;
4. No operation in areas with manned aviation (e.g. accident sites, operational traffic areas);
5. Appropriate training / education of the drone pilot prior to operation;
6. Operation only for recreational purposes. Commercial operation should be dealt with in the *Specific* or *Regulated* category.

Mandatory insurance, non-punitive safety reporting obligations, and stricter rules for commercial operations all need to be part of the package too.

[1] As regards the 500m limit, see footnote 5 below (page 7).

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Introduction

In March 2015 EASA released its proposed regulatory approach towards Remotely Piloted Aircraft Systems (RPAS), also generally referred to as *'drones'*. This framework – entitled *Concept of Operations for Drones: A risk based approach to regulation of unmanned aircraft* – proposes to divide drones in Europe into three categories and their associated regulatory regime: *Open, Specific* and *Certified*. This will be followed up shortly by a formal EASA Notice of Proposed Amendment (NPA) further addressing the subject.

According to EASA's proposal, the regulatory framework for all the categories should set a level of safety, but at the same time rules in each category should be proportionate to the risk of the specific operation. The Agency foresees that the *Open* category is established for the very low-risk-level drone operations and thus would not require any authorisation by Aviation Authorities. Operators and drone pilots in this group, whether commercial or not, would thereby only be subject to a minimal aviation regulatory system.

While ECA recognises the aim and understands the principle of a regulatory system that is based on risk proportionality, there are a number of concerns about EASA's Concept of Operations for Drones that ECA would like to share.

ECA is particularly concerned that in the *Open* category group, the airspace users operating drones may in many cases not be familiar with aviation rules, and falsely assume that their operations would not affect the safety of manned aviation. A system in which the safety of what are specialist aviation operations is overseen by the police (as it is for cars), but not in practice by aviation authorities, will prove extremely difficult to establish.

One specific, important safety risk that must be taken into account is mid-air collision with manned aircraft. In its position paper "*Airborne threats of low level Remotely Piloted Aircraft Systems (RPAS)*"[2] published in April 2015, ECA already urged Regulators to consider a number of important safety concerns before introducing and defining an *Open* category.

ECA's highest priority when it comes to drones is protecting the safety of human beings, particularly in manned aviation, including helicopters and others in the low level airspace.

ECA therefore defines a set of preconditions to determine an acceptable overall risk level for the *Open* category and to achieve an adequate level of safety for drone operations to safeguard the current high safety record of manned aviation.

Considerations for the Open Category

EASA's Concept of Operations for RPAS/drones plans to base the level of regulation on a risk assessment of the intended drone operation. Performance based regulation is a new concept and trend in rulemaking. Dealing with RPAS, this means a new, probably not fully understood regulatory concept is applied to a new, not fully known field of aviation. Although not impossible, this combination poses additional risks for the process.

- **Risk assessment is a must.** EASA states that operation in the *Open* category shall be low risk. However, to define a low risk operation, an approved, full and transparent risk assessment with substantiation must be made beforehand to identify all the risks, including collision with manned

[2] ECA Position Paper (April 2015): 'Airborne threats of low level Remotely Piloted Aircraft System (RPAS)'

aviation. Taking into account the character of the new, non-proven technology and the missing experience with this new area of aviation, simple operational rules (e.g. loosely-defined, based on a limited geographical area and weight-limits) are not sufficient.

- **Airborne collision risk is real.** Safe separation from other airspace users, also in emergency/ critical situations (e.g. drone problems, weather problems, etc.) must be guaranteed. This risk is proposed to be only mitigated through a simple set of rules, namely operating only in VLOS (Visual Line of Sight, i.e. an area with a maximum height of 150 meters in a diameter of 500 meters). The assumption is, that by limiting height to below the minimum safe height in manned aviation (e.g. 500ft / ca. 150 meters height Above Ground Level, AGL) there will be a separation between manned and unmanned operation.

  However, ECA stresses that such a proposal would not provide enough safeguards to protect manned aviation. Collisions with manned aviation are still possible: Even below 500 ft AGL there is a lot of traffic of manned aviation, especially around permanent and temporary airstrips and landing sites, aerodromes (both controlled and uncontrolled), helicopter spots, but also in the vicinity of areas of rescue and/or emergency operations. Because of the size and shape of drones they may not be visible to manned aviation meaning avoidance of drones by manned aircraft is close to impossible. Significant or catastrophic damage can be caused when such a drone, even less than 1 kg, collides with a helicopter due to the number of its vulnerable, critical components[3], as explained in ECA's position paper on Airborne threats of low level RPAS[4].

  Furthermore, mandating the obligation to the drone-pilot to avoid other (manned) traffic in case of a collision risk – as suggested by the Agency – is positive but does not sufficiently mitigate the risk. Misinterpretation of height and distance, of 'closing' speed, specific geometrical situations (e.g. manned aircraft approaches from behind the drone-pilot), are possible risk factors, but also lack of awareness of other manned aviation from focusing on fulfilling the pilot's (commercial) tasks.

  Therefore ECA considers that additional measures will be needed, such as limiting the operating height to 50 meters, using additional personnel for observing the airspace, or a mandatory electronic collision avoidance system. Also, if flying in the FPV-mode ('First Person View', i.e. the RPAS-pilot uses camera-sight mounted on the drone/RPAS to steer it), an observer without vision enhancement (except protective glasses) with the capability to take over the RPAS ('student-instructor-mode') should be mandatory.

  Further limiting factors are loss of sight of the drone by the pilot, loss of C2 link (C2 – command and control), GPS-problems and other technological problems, and lack of awareness or negligence of the drone pilot in avoiding (forbidden) areas where low-flying manned aviation takes place. Finally, there is a risk of leaving the operational area, since estimating height and distance correctly by sight is difficult.

- **Weight as risk mitigation is insufficient.** Weight alone is not a suitable criterion to help assess the risks and damages, as relative kinetic energy between two colliding objects is crucial too. More research has to be done to estimate the impact and the possible consequences of collisions with manned aviation, including the influence of materials, impact-friendly materials

[3] A study shows that a drone (<2000 grams) could cause dangerous harm to manned aviation. See: 'Potential damage assessment of a mid-air collision with a small UAV', Civil Aviation Safety Authority/ Monash University, 12 June 2013.

[4] Further details see ECA Position (April 2015): Airborne threats of low level Remotely Piloted Aircraft System (RPAS).

design, fragility/frangibility and the resulting requirements for the future low risk drone. The principle must be that a collision with a drone can only lead to damage and not to (fatal) injuries. This has to be proven in a risk assessment.

- **Knowledge and competency to be enhanced.** To be a legitimate airspace user it is necessary to have certain knowledge about airspace structure, including control zones (CTR), locations of aerodromes, prohibited areas, the rules of the air as well as the possible dangers of encountering manned aviation. The lack of indispensable education constitutes a danger. An increase in public awareness is crucial, and the essential safety information should be provided in a clear and comprehensive manner to drone users.

- **Oversight, enforcement & registration are crucial.** EASA's proposal of the *Open* category presumes there will be no oversight by Aviation Authorities in this category even for commercial drone operators and industry; at the same time it establishes self-regulation by industry-standards. Self-regulation can create some risk as previously illustrated in other industries (e.g. oil industry). Moreover, these relatively new airspace users are generally not originally from the aviation sector, and are therefore often not aware of the aviation safety culture and its high safety requirements and standards. The foreseen oversight and enforcement of this sector by regular law enforcement officers from the police might prove to be hard to establish, challenging to resource, and questionable as to its effectiveness. ECA has concerns for example about the feasibility of enforcement of certain rules on users in the *Open* category, such as limiting the use in a defined operational area. Besides that, enforcement bodies need to be provided with both resources and knowledge about drones and with adequate interceptive equipment to allow them to perform their tasks. Finally – and crucially – a registration of any drone that is physically capable of 'doing harm' is a must to allow tracing of its pilot and/or operator and ensure proper enforcement. Equipping drones with electronic chips could facilitate such registration and tracing.

- **Safety Culture and safety management to be built.** Self-regulation and at the same time a desired/acceptable (measurable) safety outcome is only achievable if:
  - All the stakeholders (industry, operators and pilots) feel responsible for the safety of each other and fully assume this responsibility.
  - The desired safety targets are measurable and adjusted in case of undesired outcome.
  - For such an "open system" without an authorization to be put in place, a safety culture in the sector is necessary, as well as a culture of self-reporting safety incidents (see below).

- **Reporting of drone incidents & accidents is a must.** In order to derive the operational safety while at the same time lacking a Safety Management System (SMS), a duty to report safety incidents or accidents must be mandatory. This will allow establishing statistical data and using this data in terms of 'lessons learned' to improve efficiently safety in this 'open' group of RPAS. Furthermore, the national authorities have State Safety Programs (SSP) with the responsibility to guard aviation safety. However, currently there is no reflection of those programs in the *Open* category. Finally, such a reporting system should be non-punitive in order to encourage drone users to provide reports in order to gather all the incidents or accidents with the aim of increasing the data collection for the SSP and thus improving the operational safety awareness and performance of the *Open* category users.

- **Hard technical limits on operational area and performance to be set.** To leave the respect of the *Open* category limitations solely to compliant behaviour of drone users/operators is unlikely to be effective. Hence, the drones themselves need to be designed with technical performance limitations e.g. for operating height, lateral distance, etc. which prevent the users from exceeding these limits.

  For example, the higher the maximum operational height, the higher is the risk for a collision with manned aviation. The maximum (allowed) height must therefore be kept as low as possible depending on the operation/mission. There must be safeguards in place, including technical characteristics like maximum performance, in order to respect that maximum (allowed) height. The same applies to the maximum distance from the pilot.

  This can be achieved by electronic means to limit the maximum distance and hight from the drone-pilot, and geo-fencing is also part of the possible solutions. Furthermore, lost control, lost link or other problems with drones must be mitigated in a safe manner with a proven recovery capability (by built-in safeguards and/or human intervention) to ensure redundancy.

  Finally, the maximum speed of the drone must be limited in order to allow effective operator tracking, reaction times and avoidance maneuvers in case of a collision threat. Future performance capabilities of drones may be significant, and the increase in kinetic energy with velocity necessitates that drones capable of operating above a certain speed are pushed into a more regulated category.

- **Insurance to be mandatory.** A mandatory insurance of a drone and its operational risk is necessary. Insurances tend to evaluate the risks they insure quite carefully and are known to effectively control risks by their insurance conditions. Additionally, data gathered via the insurances could add to data on actual accident figures which would allow better risk analysis.

- **Commercial operations must follow stricter rules.** Setting up a business that envisages the operation of drones should require an authorization by the Aviation Authorities and thus automatically shift the operational and legal framework from the *Open* to the *Specific* category. It is a common principle that professional undertakings follow stricter rule sets, for good reason: not only will the volume and extent of operation increase, but also the exposure to risk, since the aim is no longer leisure/recreation, but fulfilling a certain commercial task (e.g. taking pictures/videos for news, checking power lines, windmills or towers).

- **Qualification of the drone-pilot/operator.** Even operating in the remit of the *Open* category involves complex considerations and a necessary set of skills and knowledge. It is of major importance that the drone-pilot/operator is properly qualified, skilled and trained to not only master his/her mission task within the boundaries defined by the *Open* category, but is also able to react professionally and safely to contingencies and emergencies. Integrating in airspace where potentially also manned aviation operates necessitates a common knowledge and state of professionalism to interact with each other. If the operation in the *Open* category is commercial, a drone pilot license issued by the authority shall be mandatory.

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Key requirements for the Open Category

Taking account of the considerations above, including the safety threats discussed in the ECA position paper '*Airborne threats of low level Remotely Piloted Aircraft Systems (RPAS)'*, ECA defines the following requirements for the *Open* category:

The *Open* category is limited to a group of drones for non-commercial usage and defined by a set of operational and technical limits/standards to minimise the risk of collisions with manned aviation resulting in potentially catastrophic damages as a consequence.

It has to satisfy the following requirements:

Technical requirements:

a) The maximum operating height is 50 meters which must be technically safeguarded (by an industry standard).

b) The maximum lateral distance from the pilot is less than 500[5] meters which must be technically safeguarded (industry standard).

c) The avoidance of forbidden areas and/or restricted areas (e.g. with high density of manned aviation) where explicit separation is required - must be technically guarded (e.g. by geo-fencing, ground based transponder, industry standard).

d) A proven (technical) recovery capability is needed to mitigate technical and/or operational problems with drone and/or pilot (industry standard).

e) The drone should not exceed a maximum mass of 500 grams, unless the maximum density and frangibility (via industry standard) would make it impossible to lead to catastrophic damages to the manned aviation in case of a collision.

f) A maximum speed[6] must be defined to limit the kinetic energy in case of a collision and allow recognition by manned aviation while using common airspace.

g) The material and design of the drone should limit the impact of an airborne collision by using impact-friendly materials, fragility and frangibility standards, maximum overall density, and maximum part weight standards (industry standard).

h) There is a compromising lack of scientific and engineering research on the effects of drone collisions with aircraft (including windscreens, airframes, wings, engines, helicopters and rotors). This must be carried out as a matter of urgency to assess and refine current proposed physical limits and standards (as in e, f and g above).

i) Recognition and visibility of the drone must be provided by colour and/or identification lights.

j) The drone must be uniquely marked to track its owner/operator (e.g. registration number) and a registration system is to be set up. An electronic chip may facilitate this.

[5] Many stakeholders talk at present about 500m as being a desirable lateral maximum distance from the operator. Whilst this may be realistic in the case of comparatively large or highly visible devices, it seems implausible that the majority of drones currently in use that are not so large can be even seen at a distance of half a kilometre, let alone accurately controlled and able to meet avoidance obligations. Accordingly, research needs to be undertaken to set this maximum distance at an appropriate level.

[6] This maximum speed should provide a balance that permits an inexperienced consumer operating a drone to maintain accurate control of it and avoid collision risks, and ensure that persons not associated with the drone are also able to see, avoid, and not be seriously harmed by it if the operator is unable to meet the obligation. In automobile collision research a speed of around 40km/h is commonly held to ensure sufficient reaction time and survivability. Therefore a speed to meet the above requirements of 40km/h is proposed, but research should allow this to be refined with greater confidence.

Operational requirements:

a) The operation should be approved / allowed only in areas with no third persons.

b) The operation should be explicitly forbidden in specific areas with manned aviation, like accident sites, areas of operational traffic (e.g. around airports, heliports etc.).

c) The obligation to avoid all manned air traffic.

d) A drone user is adequately educated or trained prior to operating the drone.

e) The obligation of unaided view (Visual Line of Sight, VLOS) on the drone at all times by the pilot and/or observer.

f) Essential safety information must be provided to the public.

g) Regular law enforcement officers (police) must be able to identify violations of drone pilots/operators and take enforcement action accordingly.

h) The operation in the *Open* category is only for recreational purposes. Any professional/ commercial drone operations are to be subject to the *Specific* or *Regulated* category's rules and requirements.

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