UK Civil Aviation Authority

Unmanned Aircraft Operations in an Atypical Air Environment: Consultation Reply

CAP 3036

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Introduction

The Civil Aviation Authority (CAA) consulted on a proposed policy position for the recognition and implementation of Atypical Air Environments (AAEs).

The CAA published a consultation (CAP 2968)[1], which closed on 2 April 2024, setting out a proposed AAE policy concept to help enable Unmanned Aircraft System (UAS) operators to conduct specific beyond visual line of sight (BVLOS) operations. The consultation policy paper explained the benefits, whilst also highlighting the challenges, of introducing AAEs into UK airspace.

The fundamental principles of the AAE are:

- The underpinning rationale of the UK AAE concept is that there are areas of airspace that UAS can operate in, which, by virtue of their proximity to infrastructure, significantly reduces the likelihood of interacting with other crewed aircraft and, in doing so, reduces the risk of a Mid Air Collision (MAC).
- This is not a new type of airspace, or an airspace change proposal, but existing airspace that can potentially be exploited to support BVLOS operations.
- The policy is intended to aid an applicant in deciding what may reasonably be considered an AAE as well as what operational, strategic, and technical mitigations might be appropriate for such an operation.
- The policy is not exhaustive in terms of what could be considered an AAE and similarly, an assessment of what technical, strategic, and operational mitigations may be required will vary from operation to operation.
- An AAE cannot be used as a sole mitigation to MAC because it does not eliminate the risk completely. As such, other mitigations will be required in order to reduce the residual risk to a level that can be considered As Low As Reasonably Practicable (ALARP) and Tolerable.
- This policy concept is designed to help mitigate the air risks associated with operations within an AAE and does not address ground risks.

As new and novel aircraft are introduced into the operational environment, these activities must take place safely and without unreasonable disruption to the existing mature environment. Therefore, a suite of foundational principles of aviation are as relevant to new entrants as they are to existing operations to keep the risk of MAC and Controlled Flight into Terrain (CFIT) at a tolerable level. These principles are:

[1] 21224 (caa.co.uk)

- It is the responsibility of the commander of the aircraft to avoid collisions and ensure their aircraft does not endanger other persons or property. A fundamental method of discharging this responsibility is the on-board pilot being able to use see and avoid techniques, sometimes in association with other services and technological solutions, to achieve that safety requirement.
- The rulesets that facilitate safe aircraft operations have mutual detection and avoidance at their heart. In many situations, this is achieved by visual detection, but in circumstances where visual detection is known or likely to be compromised, technological or procedural mitigations (which can be airborne, ground-based or both) are employed so that aircraft can still 'see and be seen' or can 'detect and be detected'. That detection enables a subsequent decision and if necessary, avoidance manoeuvre to be executed.
- Where detection is not achievable, sometimes, procedural separation methodologies can be employed; although in today's environment, procedural operations are often supported by onboard traffic detection because the limitations associated with procedural operations are recognised.
- In circumstances where visual detection is not achievable, where technological detection is not available and where procedural alternatives cannot be employed, segregation is utilised to ensure an acceptable level of safety.
- Perhaps most importantly, the aviation community understands that safe operations are only achieved by identifying and assessing safety risks and addressing them with effective and proportionate mitigations, rather than simply relying on probabilistic arguments or providence.

Prior to consultation, the policy proposal was subjected to an internal CAA operational review by aviation SMEs covering the specialisms listed below, and included information drawn from external emergency rotary and military operators. This approach was undertaken to give us an understanding of the real-world operational environment to help identify the existing operations that could interact with atypical operations.

- Rotary and fixed wing pilots with experience in military, commercial, emergency services, general aviation (GA) and low-level operations.
- Glider pilots.
- UAS operators/remote pilots (RPs).
- Air Traffic Controllers.
- Subject Matter Experts (SMEs) with technical knowledge relating to relevant communications and surveillance equipment.
- SMEs currently working in CAA Airspace Regulation, Airspace Policy, Airspace Modernisation, Flight Operations Policy and Innovation.

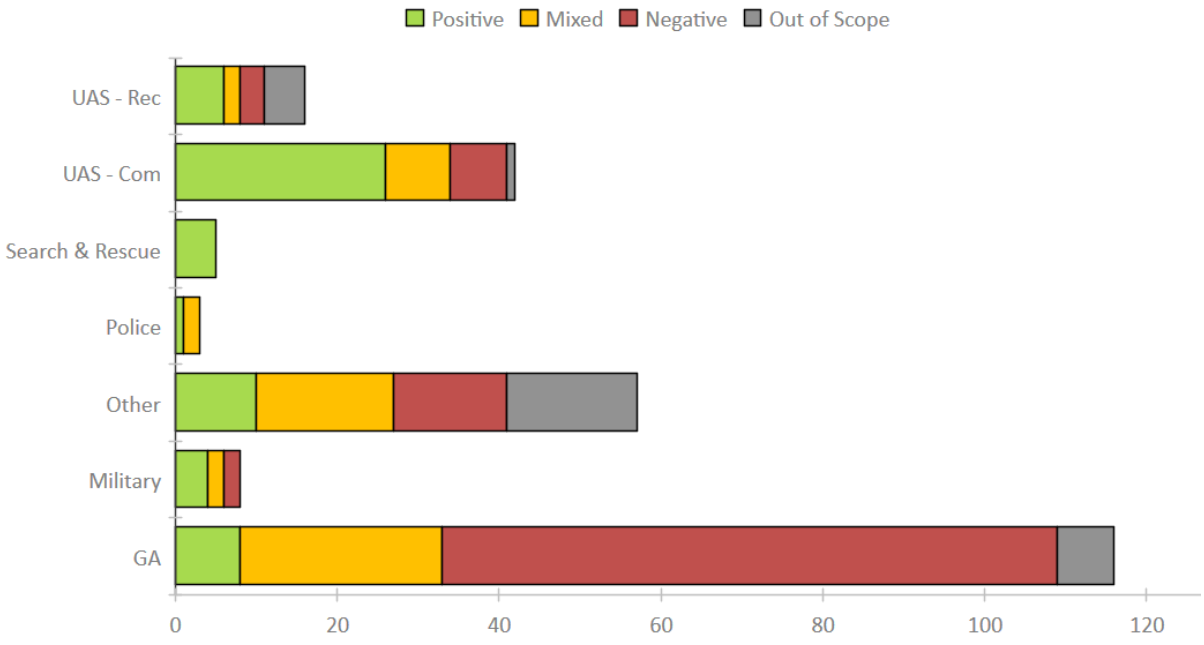
Consultation Feedback

We received a total of 239 responses from across the aviation community including UAS commercial and recreational users, military, emergency services, Air Navigation Service Providers, GA, other formal aviation related bodies and organisations as well as the general public.

Responses broken down into categories are shown below and at Figure 1:

- UAS - Recreational: 16 responses (6 positive, 2 mixed, 3 negative, 5 out of scope)
- UAS - Commercial: 43 responses (26 positive, 9 mixed, 7 negative, 1 out of scope)
- Search & Rescue: 5 responses (5 positive)
- Police: 3 responses (1 positive, 2 mixed)
- Other: 48 responses (11 positive, 17 mixed, 14 negative, 6 out of scope)
- Military: 8 responses (4 positive, 2 mixed, 2 negative)
- GA: 116 responses (8 positive, 25 mixed, 76 negative, 7 out of scope)
- **Totals: 239 responses (61 positive, 57 mixed, 102 negative, 19 out of scope)**

Figure 1: Responses by community



Consultation Themes

A number of themes were identified from the consultation responses and are grouped below. Responses to these themes are covered in the next section.

a. **Increased Risk of MAC**: It was raised by a number of responders that by introducing AAEs the risk of MAC with conventionally piloted aircraft would increase.

b. **Collision Avoidance**: Queries were raised over where the responsibility lay for avoiding a confliction when operating within an AAE.

c. **Heights/Distances**: These were considered too close by some land and infrastructure owners, potentially increasing the risk of CFIT, risk of the Unmanned Aircraft (UA) causing a distraction to third parties and risk of the UA being affected by high speed vortices from rolling railway stock. They were also considered too close by commercial operators to be able to conduct surveys in a single run.

d. **AAE Definition**: Expansion on the definition of what can be considered an AAE to include natural features, rivers, lakes and forest blocks.

e. **Ground Risk**: AAE operations and their relationship with ground risk including attacking wildlife and electromagnetic effects on an UAS.

f. **Standardised European Rules of the Air (SERA)**: Rationale for deviating from SERA and not employing the European Union Aviation Safety Agency Pre-defined Risk Assessment-03.

g. **Flight Volume**: Based on the example limitations, challenges around containment, flight speed and profile limitations.

h. **Engagement**: Land and infrastructure owners, including local authorities, beneath the airspace want to be consulted on proposed AAEs with agreements sought before an AAE based Operational Authorisation (OA) is issued. Conversely, UAS operators were concerned by the need to conduct such engagement. Similarly, established air operators were seeking consultation for proposed AAEs within their area of operations prior to the issue of an OA, including airspace operators, field strip, glider and soaring communities.

i. **Preflight Notification**: Concerns over the system's ability to cope with a potentially large uplift in requirement.

j. **Operational Risk Assessment (ORA) Review**:

    1) Resource: Concern over CAA resource and its ability to efficiently deal with

applications consistently and in an appropriate time scale.

2) Variations: More information required on whether multiple variations were required for different operating areas. e.g. is an AAE (ORA) transferable to different operating areas.

3) Responding to conflicting views: Who mediates if there are overlapping applications or stakeholder disagreements during the engagement process.

k. **Onboard Equipment**: Clarity required on the CAA's approach to onboard equipment investment by operators.

1) Suitability of ADS-B In/Out as a mitigation in low-level operations.

2) High Intensity Anti-Collision Lighting (HIAL) Requirements: HIAL visibility day/ night.

l. **Global Navigation Satellite System (GNSS) Outage:** How does the CAA propose to deal with issues surrounding GNSS outage, spoofing, and denial with regards to geo-caging.

m. **Nuisance**: Privacy, trespass, noise and light pollution concerns.

n. **Metrics**: Rationale for the use of metres instead of feet in aviation.

o. **Mitigations**: Obligation to employ them.

CAA Response

This section sets out the CAA's reply to the thematic consultation responses described above.

a. **Increased Risk of MAC**: An AAE is designed to significantly reduce the risk of MAC due to the reduced likelihood of encountering conventional aircraft owing to its very close proximity to man-made infrastructure. Atypical in the UK is not the same as atypical in Europe, or atypical within countries that have large expanses of open terrain. As such, it is not possible to completely rule out the risk of a conflict therefore, an AAE is one of a proposed series of layered mitigations all designed to work collaboratively to minimise the risk of MAC. All mitigations are covered in more detail in the policy concept paper.

   An AAE risk assessment (RA) has been completed where five MAC risks were identified. These were against military and emergency services aircraft, elements of the GA community as well as disruption to controlled airspace and a breach of the UAS's containment volume. With SME input and targeted stakeholder engagement the CAA was able to better understand these risks, and consider appropriate mitigations, which resulted in the risks sitting in the 'review' category. The stakeholder workshops, detailed below under 'Engagement', agreed that with the proposed mitigations in place, the likelihood of a UAS being in the exact same location at the exact same time as another aircraft was very low.

   Current internal Regulatory Safety Management System (RSMS) processes will be utilised to manage the implementation of the policy. The risks associated with AAE operations will be routinely reviewed and assessed. RSMS arrangements will be established to specifically monitor this safety risk (MAC within an AAE) as part of the wider MAC RSMS process.

   To further mitigate the MAC risk there will be increased oversight and monitoring of each operation by the Remotely Piloted Aircraft System Sector and Test & Evaluation Teams. This is in addition to each application being subjected to the usual RA and review. As data is collected, it will be analysed and fed into the above-mentioned review process and used to test, and track, our current assessment on 'likelihood' in the RA, as well as ensure the management of the policy remains valid. Reviewed data will include feedback on application numbers, live operations, hours flown and reports received (Mandatory Occurrence Reports).

b. **Collision Avoidance**: Normal Rules of the Air still apply and the responsibility to avoid a collision sits with all pilots, as described in Assimilated Regulation (EU)

2019/947 AMC1 to Article 7(2) . However, in such circumstances within an AAE, the RP must remain mindful that there may be aircraft or balloons that cannot manoeuvre as easily, especially if landing or taking off, and take all appropriate action to avoid the confliction. Additionally, RPs are reminded of the specific requirement set out in UAS.SPEC.060(3)(b) to avoid risk of collision, and UAS operators are expected to set out within their procedures how this is achieved.

c. **Heights/Distances**: The atypical concept is built around a much reduced likelihood of encountering a crewed aircraft due to the close proximity of infrastructure. The proposed heights were agreed through a series of workshops, consisting of the SMEs detailed above.

   We have engaged with infrastructure owners to discuss their concerns and considered all feedback. In doing so, we reviewed the SME agreed heights/distances to assess whether they could be expanded. It was considered that extending them would undermine the effectiveness of an AAE as a mitigation against MAC. Additionally, it is considered appropriate that infrastructure owners should be engaged when applicants are developing their ORA to ensure all suitable agreements are in place prior to submission. This engagement should raise discussions over potential risks caused by the UA to second or third parties (e.g. railway staff and road users) such as distraction or confusion, as well as possible effects on the UA from high speed vortices caused by vehicles or railway rolling stock. This engagement will highlight these risks, specific to the operating environment of the infrastructure, and identify areas where a risk cannot be appropriately mitigated, or where further mitigations are required.

   The heights/distances described in the AAE policy concept are a guide. An applicant may propose alternatives however, they will need to be supported by a robust safety case, with detailed mitigations, explaining why the operation is safe without this specific mitigation.

d. **AAE Definition**: There is no single definition of what could be considered an AAE so there is potential for any area to be proposed as long as it ensures that the risk of MAC, due to the operation's close proximity to ground infrastructure, is mitigated. Whilst some operations will be permissible, others that in concept appear similar may not be acceptable due to a lack of man-made infrastructure (vehicle, vessel or structure), the proximity to which provides the safety mitigation. Rivers, lakes and forest blocks don't necessarily have close proximity ground infrastructure and could attract greater low-level crewed aviation activity.

e. **Ground Risk**: The scope of the AAE policy concept is as a supporting document to the OA application process aimed to assist UAS operators mitigate air risk elements of an AAE operation. Ground risk is to be addressed by the UAS

operator and covered in the ORA for assessment via the normal OA application process. This should include the risk, and potential effects, from wildlife attacks and electromagnetic interference from certain infrastructure.

f. **SERA**: The Joint Authorities for Rulemaking on Unmanned Systems definition of Atypical (ARC A) is where the encounter rate with manned aircraft is 'negligible'. The definition of negligible is typically 'so small a value that it is of very little importance and can be disregarded.'

   In the UK we wouldn't disregard the potential for other aircraft to occur in an AAE. This is partly due to the difference in operating environment in the UK, including SERA exemptions, described in the policy concept. Consequently, the values suggested stem from the additional caution that the UK needs to apply in its AAE environments where encounter rates may not satisfy the 'negligible' definition.

g. **Flight Volume**: It is for the UAS operator to propose how they intend to ensure robust containment measures are in place. This may involve adaptation of speed and flight profiles and/or, when available, the use of a conformance monitoring system provided by an Unmanned Traffic Management service provider.

h. **Engagement**: Airspace in the UK is a state asset. However, as detailed in the policy document good liaison/relationships with all stakeholders and adjacent activities, airspace, land and infrastructure owners is key to ensuring appropriate agreements are in place prior to submitting an ORA. This will avoid potential delays in starting operations post successful issue of an OA.

   Opportunities to engage with the CAA on the AAE policy concept, via a series of workshops, were offered to the Flying Farmers Association, field strip users, balloon, glider and soaring communities to help us better understand this area of regulated and deregulated operations.

   We explained the very specific criteria of an AAE and sought to understand exactly how close the above operations came to explicit infrastructure. It was agreed that the likelihood of encroaching into an AAE at the exact same time and the exact same place as an UAS operation was very low, and potentially only when there was no other alternative e.g. in an emergency or through a loss of thermal lift. We acknowledged that there are some strips and soaring sites established very close to infrastructure however, we also agreed that the mitigating measures proposed in the policy concept would reduce any risk; for example, detailed site surveys along proposed routes.

i. **Preflight Notification**: This element will be monitored as AAE use grows through the process described in part (a) of the response. This policy concept adopts a

crawl, walk, run approach and a large initial uptake is not expected.

j. **ORA Review**:

1) Resource: A recruitment and training programme has been underway for some time to ensure capacity is in place to avoid unnecessary delays to application process times. Whilst there will always be a degree of subjectivity when numerous individuals are conducting a similar task our management oversight processes aim to ensure consistent output quality. The introduction of the Specific category Operations Risk Assessment (SORA) methodology will also maintain and improve consistency.

2) Variations: An AAE is specific to a geographic location and the infrastructure it is established around. The OA issued will specify which location(s) have been approved. As such, any change in location, AAE dimensions, infrastructure or obstacle contained within the AAE requires a variation or separate application. This position may mature as we collectively gain experience of AAE operations.

3) Responding to conflicting views: The CAA must take all relevant considerations into account in its decision-making process on a case-by-case basis, in particular where another UAS operator or land or infrastructure owner has raised an environmental or safety-related issue.

k. **Onboard Equipment**:

1) Suitability of ADS-B: It was considered appropriate to require UA to carry, as a minimum, ADSB out, or in/out so as to be as conspicuous as possible to any other aircraft in the vicinity that may also be ADS-B equipped (notwithstanding the operational limitations of ADS-B/ variable level of equipage amongst other operators). As such, the policy concept describes the requirement to transmit on 978MHz as a minimum but ideally coupled with a 978/1090Mhz receiver. A transceiver would clearly give the greatest benefit, because for interactions with an ADS-B crewed aircraft, both could consider appropriate avoidance actions. Given this consideration, it is believed that instead of just a transmitter (single frequency) as the minimum, the UA should also be fitted with an accompanying (dual frequency) receiver as an alternative to a transceiver. It is acknowledged that Electronic Conspicuity won't be a universal solution for a number of reasons which led to the 'multi-layer' range of mitigations employed to reduce the MAC risk to an ALARP and Tolerable level.

2) HIAL Requirements: Day and Night - Acknowledging that the Federal

Aviation Authority require HIAL for just night operations it was agreed that without any UK technical or operational requirements established, at this early stage of policy development, all sensible mitigations should be employed until such times that we had evidence to indicate they were unnecessary.

l. **GNSS Outage**: Issues surrounding GNSS outage, spoofing and denial with regards to geo-caging is part of a wider CAA work strand currently underway with the Department for Transport (DfT). This work is looking to improve the methods used to assess Position, Navigation and Timing (PNT) systems used in safety cases, and ways to evidence robustness in line with UK SORA 2.5. Satellite-based Augmentation Systems and alternate PNT sources are key to reducing the impact of GNSS denial and degradation and we are looking at how we can support development of these tools. GNSS monitoring data is being actively collected and assessed to understand the impact and improve our decision making.

m. **Nuisance**: The CAA and the DfT are working collaboratively regarding wider societal acceptance of UAS including their potential to increase privacy, trespass, noise and light pollution nuisance. Whilst we wait for this work to be completed UAS operators are directed to Assimilated Regulation (EU) 2019/947 UAS.SPEC.050 - Responsibilities of the UAS Operator which details operator responsibilities regarding noise. Additionally, the CAA's assessment of the ORA, coupled with regular engagement with successful applicants, will ensure potential for causing nuisance is mitigated.

n. **Metrics**: Traditional aviation utilises 'feet' as its unit of vertical measurement and meters/nautical miles as units of horizontal measurement. The distances in the policy concept are both vertical, and horizontal. As UAS integrate more with traditional aviation it is important that a common unit of measurement is employed to avoid any potential for confusion when deconflicting. The policy concept now reflects feet as this is a more appropriate unit of measurement for distance in the AAE context.

o. **Mitigations**: The proposed mitigations are for consideration and are not mandatory however, they are the minimum recommendations from SME collective thinking and therefore are considered the most appropriate, and most likely, to contribute towards a successful application. If an operator does not wish to apply, or cannot meet, one or more of the mitigations, then justification as to how they intend to mitigate the risk is required in the ORA. The CAA needs to be assured that the operation will be conducted as safely as possible.

Next Steps

A comprehensive communications and publicity campaign, raising awareness of the AAE policy concept, will be co-ordinated with the policy's publication. This will be via formal communications using a number of means but will include broad, organisational and target emails to the following organisations:

- GA Community
- Flying Farmers Association
- Model Flying Clubs
- Gliding and Soaring Clubs
- Balloon Clubs
- Ministry of Defence
- Helicopter Emergency Medical Service
- Police (National Police Chiefs' Council and National Police Air Service)

Summary

This consultation has proved to be a valuable means to gather comments on public opinion towards this proposed policy concept. We have listened and worked hard to address concerns and modified the policy concept where required. It is designed to be a first step towards enabling sustainable BVLOS outside of segregated airspace but it is not a one size fits all policy and will initially be more useful to some operators than others.

UK airspace is some of the most congested and complex in the world so any proposal to operate BVLOS outside of segregated airspace within the UK will always require a measured and monitored process to ensure safety remains paramount. Safe operations are only achieved by identifying and assessing safety risks and addressing them with effective and proportionate mitigations.

All airspace users have to be considered, many of whom have differing operational priorities and so as a community, we have to pay considerable attention to detail when integrating new users into an existing and mature aviation environment.

This will be published as a ‘Policy Concept’. The purpose of this is to work closely with UAS operators to ensure that, at this early stage of policy development, safety risk is managed carefully and the policy concept is reviewed on a regular basis. Applications for AAE operations will need to detail exactly where these operations are planned to take place, and the suite of mitigations employed to mitigate the air and ground risks at that specific site. As such, at this stage, it is unlikely that operators will be able to use this policy concept to carry out significantly more complex activities, such as large delivery operations or complex routing through multiple AAEs.