UK Civil Aviation Authority

Unmanned Aircraft Operations in an Atypical Air Environment: Policy Concept

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Revision History

Edition	Date	Summary
First Edition	15 October 2024	Initial Policy Concept Publication
Second Edition	03 December 2024	Policy Concept updated the reference to Radio Technical Commission for Aeronautics (RTCA) performance standards RTCA DO-282B.
Third Edition	27 November 2025	General corrections and updates to main policy text and addition of Annexes A - D.

Abbreviations and Glossary of Terms

The definitive list of abbreviations and terms/definitions that are relevant to Unmanned Aircraft System operations within the UK are centralised within CAP 722D – Master Glossary and Abbreviations.

Atypical Air Environment Policy Concept

This document presents the UK Civil Aviation Authority's (CAA) current position on the requirements applicable to organisations wishing to operate Unmanned Aircraft Systems (UAS) beyond visual line of sight (BVLOS) in an Atypical Air Environment (AAE). As technologies mature and operations commence, our collective understanding will grow which will inform the CAA's work to better enable BVLOS activities in the future. In the meantime, the CAA has developed this policy concept as interim guidance to allow stakeholders to proceed with planning operations in line with the CAA's thinking.

The CAA will continuously review this policy concept to consider technological developments, new evidence from operators and any associated research. This will inform safety monitoring processes and may affect our views and this policy.

An applicant who is intending to submit an application for an Operational Authorisation (OA) to which this policy applies should engage early via bvlos@caa.co.uk to ensure that their application can be properly considered within a timescale that is appropriate for their operation.

Introduction

This innovative policy concept is designed to enable UAS operators to conduct BVLOS operations within an AAE. It is guidance that supports 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.

It is not an exhaustive list of what could be deemed an AAE. Similarly, an assessment of the technical, strategic and operational mitigations that may be required will vary from operation to operation.

Operations within an AAE will help us understand how they may scale as well as identify any associated environmental and noise impacts. This policy concept is based on traffic levels today and is subject to review therefore we will work closely with operators who gain an AAE based Operational Authorisation (OA) to maximise information and data sharing opportunities. It will also help manage both the applicant's and the CAA's expectations in an operating environment where AAE activities can evolve safely with appropriate oversight.

The application process to operate within an AAE is initiated through the submission of a UK Specific Operations Risk Assessment (SORA)/ Operational Risk Assessment (ORA) in which it must clearly articulate the full extent of the proposed activity. This policy concept is a supporting document to the application process and only considers the air risk specifics of an AAE operation.

Specific operational volumes must be clearly defined within the application. Although there is no specific limit set out in law for the number of operational volumes that may be authorised within one OA, it is likely that separate procedures and safety arguments will be required for each individual volume. Any applicant for an AAE based OA is advised to engage early with the CAA via bvlos@caa.co.uk prior to submitting their application.

Atypical Air Environment

Operating an Unmanned Aircraft (UA) within an AAE reduces the likelihood of a mid-air collision (MAC) between an UA and other conventionally piloted aircraft. This is particularly useful when operating BVLOS outside of segregated airspace without a detect & avoid (DAA) capability.

There is no single definition for an AAE however, it can be considered as a volume of airspace within which it can be reasonably anticipated that there will be a greatly reduced number of conventionally piloted aircraft due to the close proximity of specific ground infrastructure.

An AAE is not a separate airspace classification but can exist within any class of airspace. Operations within an AAE must adhere to all rules which apply to UAS within that airspace classification, including any applicable restrictions.

Operating within an AAE does not absolve the UAS operator of having to seek any relevant airspace permissions, such as operations within or near controlled airspace (CAS) or a Restricted Area.

This policy concept is designed to help mitigate the air risks associated with operations within an AAE and does not address ground risks. It is likely that certain elements of ground risk will increase by operating close to infrastructure. Ultimately, it is for the UAS operator to propose how they intend to mitigate other areas of risk in the risk assessment which the CAA will assess prior to the issuing of an OA. Early engagement with the land or infrastructure owner must take place to ensure necessary safety mitigations are in place and detailed in the risk assessment.

The following examples of what may be considered an AAE are to be used as a guide.

- Within 100ft of any building or structure.
- Within 50ft of a permanent, above ground level, linear structure. For example, a railway, road, or powerline.
- Within the confines of private property at a height not exceeding 50ft. For example, an industrial site where security personnel use a UA for perimeter inspection.

Given the conceptual nature of this process, an AAE is specific to a geographical location and the infrastructure it is established around. Whilst there is no single definition of what would be routinely accepted as an AAE, applicants will initially be required to define the precise route/Area of Operation (AO) in which they intend to operate, be that a geographical corridor or box. This position may mature as we collectively gain experience of AAE operations.

Further guidance and examples for how an AAE can be defined, presented and operated in can be found at the Annexes listed below. This information is required during the UK SORA application process:

- Annex A - Smoothing
- Annex B - Interpretation of AAE Base Reference for Railway Infrastructure
- Annex C - Interpretation of AAE Base Reference for Windfarm Infrastructure
- Annex D - Defining Operational Volume within an Atypical Air Environment

Note: Some operations, that in concept appear similar, may not be acceptable due to a lack of man-made infrastructure, the proximity to which provides the safety mitigation.

Applicants may propose an alternative example of an AAE; for example, an offshore installation or distances exceeding those recommended above. It is for the applicant to provide compliance evidence to demonstrate why the AO should be considered an AAE. as well as robustly and coherently describe the mitigations required to reduce residual safety risk to an As Low As Reasonably Practicable and Tolerable level.

Operational Requirements

Within the United Kingdom (UK), through ORS4 1496, the CAA has authorised and permitted certain aerial operations to deviate from the Standardised European Rules of the Air (SERA) minimum height requirements as laid down in UK.SERA.5005(f). Whilst it is reasonable to expect an AAE to have a much reduced encounter rate due to their very close proximity to infrastructure, it is not possible in the UK to guarantee it to be free of conventionally piloted aircraft. Therefore, an AAE is not likely to be sufficient as a MAC mitigation on its own and additional mitigations will usually be required prior to operations being authorised.

Military, emergency services and infrastructure owners[1] all operate aircraft in close proximity to airspace that may be considered an AAE and can land without permission in the course of their tasking. Additionally, the general aviation community may operate from any suitable area of land across the UK, including unlicenced aerodromes, without the need to notify their activity or to be electronically conspicuous.

Given the above activity, as a minimum, the following mitigations are to be considered for all operations within an AAE. An applicant may provide evidence which demonstrates that some of the mitigations are not required, or that alternatives are more suitable, for their specific operation. The CAA will assess this evidence as part of the UK SORA/ ORA application.

Note: These mitigations are regularly employed in crewed aviation and are equally as relevant to UA where their use would be expected to mitigate the MAC collision risk, in a similar way.

Pre-tactical Flight Route Notification

To address the residual MAC risk posed by the UA towards other UA and conventionally piloted aircraft, the operator must pre-notify their intended operating route or AO, and the process to achieve this must be described in the UK SORA operation details. The type of pre-notification considered appropriate will depend on several factors such as the location and intended duration of the operation. Initially, whilst in the conceptual phase of this

[1] For example, Helicopter Emergency Medical Service (HEMS), National Police Air Service (NPAS) and National Grid.

policy and unless there is a very good reason not to, submission of a Notice to Aviation (NOTAM) will be considered the default mechanism to satisfy this requirement as it is this process that triggers the CAA's pre-tactical checks. As we learn more, other forms of notification may become more appropriate, such as an Air Information Circular for a regularly used route.

Note: The applicant is not required to have the relevant notification approved prior to applying for an OA, however it must be approved prior to commencing operations.

As is recommended practice with all UA flying, the UAS operator must take all reasonable steps to notify and coordinate their activity with other flying operations that may occur within the AAE. This will vary depending upon the specific geographical location of the intended operation, but must be recorded within pre-flight planning documentation, and would include local HEMS, NPAS, model flying and gliding clubs as well as unlicensed airfields. Additionally, an UAS operator should coordinate their activity with the Military Airspace Management Cell – Low Flying (MAMC LF). Further information about the military low-level flying network can be found here.

Electronic Conspicuity

In December 2022, the Department for Transport (DfT) and CAA published a joint statement detailing their support for the recommended adoption of Automatic Dependent Surveillance-Broadcast (ADS-B) operating on 1090 MHz for manned aircraft and 978 MHz for UA respectively, utilising existing global standards. The DfT and CAA undertook a programme of work to investigate the real-world potential and performance of Electronic Conspicuity (EC) technology, in support of the Airspace Modernisation Strategy and Future of Flight Programme. A consolidated report detailing the results from the studies can be found here.

To help mitigate the MAC risk between UA and other aircraft operating at very low level in the vicinity of an AAE, an UA operating within an AAE should be equipped with a Universal Access Transceiver (UAT) device transmitting on 978MHz and receiving on dual frequencies 978 MHz and 1090 MHz. The device should function, in accordance with the RTCA DO-282B/C performance standards as specified in CAP 1391 Supplementary Amendment 2025-02. In March 2025, the CAA and Ofcom issued a joint statement that made the 978MHz frequency available for airborne transmission onboard UA. An application for an UAS license from Ofcom can be found here.

As per International Civil Aviation Organisation (ICAO) Document 9924, the UK CAA will not normally assign an ICAO 24-bit aircraft address for an UA. UAS operators using a 978 MHz UAT device should use a time-based self-assigned temporary 24-bit aircraft address that is generated once the device is powered up and obtains a Global Navigation Satellite System fix. The device firmware must have the address qualifier set to 001 indicating that the 24-bit address is NOT an ICAO address.

SSR Mode A codes (squawks) differ in the UK to those required by DO-282B/C. Where Mode A codes are used for flights in the UK, they should adhere to UK AIP ENR 1.6. The detailed specification of the UAT equipment should be declared to the CAA RPAS Sector team during application for a Specific category authorisation.

In exceptional circumstances, to address specific safety issues, 1090ES ADS-B may be acceptable by individual agreement with the CAA, upon which the National Identification Friend or Foe/Secondary Surveillance Radar Committee Secretary will allocate an ICAO 24-bit address to be programmed into the device.

UAS operators may elect to employ additional mitigations to the MAC risk by utilising received cooperative surveillance emissions (Flight Alarm (FLARM), PilotAware etc.) either via the receiver/transceiver fitted to the UA or via the use of ground infrastructure. In these circumstances, the UAS operator must detail and describe the operating system and associated procedures as part of their evidence. UAS operators must be aware of the limitations of such systems, particularly being cognisant that all forms of EC may not be detected by the receiver/ transceiver.

The performance of portable ADS-B devices and resulting probability of detection can be affected by many variables. The main causes of signal attenuation are: proximity to a human body, materials used on an aircraft, orientation of the device/aircraft and even geographical terrain.

Further information about EC can be found here.

Safeguarding Operations within Controlled Airspace

AAE BVLOS operations within CAS can add additional complexity and risks and so the UAS operator must co-ordinate with the relevant Air Traffic Control (ATC) service provider prior to conducting an operation and comply with any conditions specified by the ATC unit, such as time restrictions. The applicant is not required to have the relevant coordination in place prior to applying for an OA, however it must be described with the application and be in place prior to commencing operations.

High Intensity Anti-Collision Lighting

To aid in the visual conspicuity of the UA to other air users, any UA operating within an AAE must be equipped with high intensity anti-collision lighting, which is operating throughout the flight by day or night. The CAA has not currently defined specific technical or operational requirements for high-intensity anti-collision lighting for UA operated within the Specific category however, the Federal Aviation Administration require an upwards facing white strobing light that must be visible from a minimum of three statute miles at night under clear atmospheric conditions with a strobe rate of 40-100 cycles per minute. In the absence of a UK standard, this is considered an appropriate best practice with several products readily available on the market which meet this requirement. Alternatively, it may

be appropriate for the UAS operator to make use of aircraft lighting in accordance with SERA.3215.

Containment of the UA within an Atypical Air Environment

Any UA operating within an AAE must be equipped with a technically robust containment solution to ensure a breach of the operational volume is mitigated as far as reasonably practicable. This could be in the form of an onboard software based geo-caging function or, when available, an Unmanned Traffic Management service providers conformance monitoring service.

Collision Avoidance within an Atypical Air Environment

The mitigations within this policy concept render the likelihood of a confliction with a conventionally piloted aircraft unlikely. However, in such circumstances the remote pilot (RP) must take all appropriate action to avoid the confliction. This may be more difficult to achieve when operating BVLOS however, if the RP does become aware of another aircraft in the vicinity of their BVLOS UA they must still make every effort to minimise collision risk.

In any case, RPs must comply with requirements set out in in UK Regulation (EU) 2019/947 UAS.SPEC.060, in particular UAS.SPEC.060(3)(b).

'…the RP shall: … avoid the risk of collision with any manned aircraft and discontinue the flight when continuing it may pose a risk to other aircraft…'.

Part of meeting this requirement, is the following of the procedures set out by the UAS operator, which are based on the mitigations in this policy concept.

Remote Pilot Competence

The CAA has published a Remote Pilot Competence (RPC) framework as AMC to Article 8 of the UK (EU) regulation 2019/947.

The Level 2 RPC was specifically developed for BVLOS operations conducted in UK SORA Air Risk Class (ARC-a).

The minimum requirements for a Remote Pilot (RP) to be granted an L2 RPC are:

- Be registered as an RP on the CAA DMARES and hold a valid Flyer ID
- Hold a valid L1 RPC and have completed 50 hours of VLOS flight recorded in a personal RP logbook
- Have completed additional BLVOS operations theoretical knowledge training and passed an assessment
- Have completed at least 5 hours of BVLOS flight instruction in ARC-a including emergency procedures such as tactical deconfliction

- Have passed a practical flight assessment consisting of two flights lasting at least 30 minutes

Holders of an L2 RPC are also subject to minimum flight currency requirements; more information be found here.

Summary

The recognition and adoption of an AAE within the UK is an innovative concept for the CAA as well as airspace users who will operate in or around them. This AAE policy concept is intended to enable UAS BVLOS operations by exploiting defined airspace environments that offer the potential for a reduced MAC risk due to their close proximity to ground infrastructure. It will help applicants, and the CAA, determine what is acceptable as an AAE and what operational, strategic, and technical mitigations may be necessary to operate within it. It is not a single solution for all UAS operations and is specific to helping address the air risk component of an AAE application only. This policy will evolve as our understanding of how AAEs are used matures. The CAA will closely monitor their use and liaise with successful applicants, adapting and implementing any changes as required.

The guidance contained within this publication is to be read in conjunction with all other OA application, Regulation, Acceptable Means of Compliance and Guidance Material that may be relevant to UAS operations.

Annex A - Smoothing

This Annex provides guidance on the application of smoothing methodologies when defining the reference structure of an AAE. Applicants should use this guidance where variations in infrastructure height or terrain would otherwise create fragmented or inconsistent operational volumes.

The AAE policy concept is intended to enable BVLOS UAS operations in volumes of airspace where the risk of MAC is significantly reduced by the presence of permanent infrastructure. However, in many scenarios, the infrastructure that forms the basis of an AAE is not uniform in height or configuration, resulting in complex and fragmented airspace profiles.

To address this, applicants may propose the use of a smoothing methodology to establish a consistent and practical AAE base of the reference structure across a defined area of operation. Smoothing allows for variations in obstacle height to be normalised, ensuring operational volumes remain coherent while still maintaining the overall intent of reduced MAC risk.

Principles of Smoothing

- An applicant may propose, with appropriate justification, to apply a smoothing methodology to establish the base of the AAE by taking the highest appropriate point across a segment of infrastructure or terrain and applying that elevation as a consistent base level for the AAE.
- This approach may be suitable where variations in infrastructure height, terrain, or building proximity would otherwise create fragmented operational volumes.

Criteria for Application

When proposing a smoothing approach, the applicant should:

- Provide detailed survey data or reliable source documentation confirming the maximum elevations within the defined area.
- Justify the choice of smoothing segment length, up to a maximum of 300m / 1000ft (based on (UK) Standardised European Rules of the Air SERA.3105, SERA.5005(f) and SERA.5015(b) plus ORS4 No 1496) explaining how it supports the integrity of the AAE without introducing unacceptable air risk.
- Identify and assess any outliers (e.g., sudden elevation changes) that may invalidate the smoothing assumption.
- Clearly describe how smoothing has been applied, including diagrams where necessary.

General Considerations

All smoothing proposals will be assessed by the CAA on a case-by-case basis. Applicants must demonstrate that smoothing does not compromise the overarching requirement to maintain an effective MAC mitigation by virtue of proximity to infrastructure.

Smoothing cannot be applied as a blanket mitigation in areas where infrastructure discontinuities are substantial or where the underlying assumptions of reduced MAC likelihood are not adequately supported.

The use of smoothing to define AAE base levels is a pragmatic tool that enables more flexible UAS operations within complex infrastructure environments. However, its application requires careful consideration, accurate data, and transparent justification within the UK SORA process. This Annex should be read in conjunction with CAP3040 and all applicable regulations, Acceptable Means of Compliance (AMC), and Guidance Material (GM).

Applicants are encouraged to engage with the CAA, via bvlos@caa.co.uk, early in the planning process to discuss any proposed smoothing methodologies and ensure alignment with regulatory expectations.

Annex B - Interpretation of Atypical Air Environment Base Reference for Railway Infrastructure

This Annex provides supplementary guidance on how applicants for a UK SORA based OA may determine the appropriate vertical reference point when defining the base of an AAE established over railway infrastructure. The intent is to ensure consistent interpretation when preparing a UK SORA based OA application.

This guidance recognises that certain features associated with railway infrastructure may present varying opportunities to support the establishment of an AAE due to their physical characteristics and proximity to the operational area.

Overhead Line Equipment and Other Continuous Linear Infrastructure

Where railway infrastructure includes Overhead Line Equipment (OLE), catenary systems, or other continuous linear structures positioned above the railway line, these installations may be utilised as the reference structure for the AAE. The presence of such structures represents a persistent physical obstacle within the airspace and contributes to the reduction in the likelihood of conventionally piloted aircraft operating at these lower levels.

- The applicant must ensure that the OLE or equivalent structure extends continuously along the segment of railway intended to form part of the AAE.
- Discontinuous or intermittent infrastructure may require further justification within the UK SORA, including a description of any additional mitigations proposed to address variable obstacle height.
- Applicants must engage with the relevant infrastructure owner(s) to ascertain the precise height and location of such installations and include this data within the risk assessment.

Railways Located within Cuttings

The Network Rail definition of a cutting is:

> "… *where the track is below the level of the surrounding land. The sides of cuttings or embankments are sloped to ensure stability with the degree of the slope depending on the type of soil, e.g. the sides of a rock cutting would be able to stand much steeper than if the sides were of clay*"

In circumstances where a railway operates within a cutting, the uppermost point of any natural or man-made obstacle along the cutting margin may be used as the ground level reference for the AAE. The cutting face and surrounding topography provide inherent vertical containment, reducing the probability of other airspace users operating within this constrained airspace.

- The applicant must provide accurate survey data to define the elevation of the highest obstacle in the cutting boundary along the intended route.
- Particular attention must be given to any sections where the cutting depth reduces or where elevated structures (e.g. bridges, walkways) may modify the effective AAE base height.

Railways in Proximity to Parallel Buildings / Urban Structures / Congested Area of Town or Settlement

Where a railway corridor is immediately flanked by buildings or other substantial man-made structures running parallel to the track, these features may be considered as the reference structure of the AAE above linear infrastructure, provided they present a consistent and substantial linear obstacle within the proposed operational area.

- The UK SORA must clearly define the relationship between the railway and the adjacent buildings, including the lateral separation, relative height, and continuity along the operating segment.
- Where building height or proximity varies, the operator must account for these variations and adjust the defined AAE base accordingly, ensuring that the operation remains within the bounds of reduced MAC risk.
- The presence of adjacent permanent structures may also support justification for operating within a defined airspace volume below SERA (UK Reg (EU) No 923/2012) minimum height requirements, where mitigations are in place and the operation is supported by ORS4 No.1496 exemption, as detailed in the risk assessment.

General Considerations

When proposing any of the above infrastructure features as the base of the AAE, the applicant must:

- Provide detailed maps and survey data to support their proposal.
- Ensure that all measurements are referenced to an agreed datum (e.g. mean sea level or local ground elevation).
- Consider the cumulative interaction of multiple features where applicable.

Applicants are encouraged to engage early with the CAA, via bvlos@caa.co.uk, to review and validate the proposed approach prior to full UK SORA based OA application.

This Annex should be read in conjunction with the main body of CAP3040 and all applicable regulations, AMC and GM.

Annex C - Interpretation of Atypical Air Environment Base Reference for Windfarm Infrastructure

This Annex provides supplementary guidance on how the AAE policy concept may be interpreted and applied to operations involving windfarm infrastructure. The guidance supports applicants in defining appropriate operational parameters when preparing a UK SORA based OA application.

Windfarms, due to their physical characteristics and consistent structural configuration, may offer a suitable environment for reduced MAC risk, allowing BVLOS operations to be conducted safely and effectively within defined operational volumes.

Key Structural Features and AAE Boundaries

Wind turbines present large, permanent structures which can serve as the reference structure for an AAE. When defining the limits of an AAE in the vicinity of a wind turbine:

- The extremity of the turbine structure, including the maximum tip height of the rotating blades, shall be used to determine both the vertical and horizontal boundary of the reference structure.
- The AAE may extend up to 100ft horizontally from the outermost point of the turbine blade rotation envelope or the nacelle to the rear of the turbine.
- This 100ft limit applies to the full swept area and may be considered from both a lateral and vertical perspective.

Continuous Atypical Air Environment Determination

Where multiple wind turbines are co-located:

- If adjacent turbines are positioned such that the distance between their blade extremities does not exceed 1000ft, they may collectively be considered part of a single, continuous AAE.
- Applicants must describe the arrangement and distances between turbines in the UK SORA and justify how the reduced MAC risk applies consistently across the defined area.
- Within a continuous AAE, operations may transition between turbines without the need for additional segmentation or air risk justification.

Discontinuous Turbine Layouts

Where multiple wind turbines are co-located and the distance between individual turbines exceeds 1000ft, the AAE cannot be considered continuous across the entire windfarm:

- In such cases, each turbine (or cluster of turbines meeting the 1000ft proximity condition) should be treated as a separate AAE.
- A transition process must be proposed to safely navigate between these distinct AAEs.

General Considerations

When planning BVLOS operations in and around a windfarm infrastructure, applicants must:

- Clearly define the maximum height and horizontal limits of each turbine structure using manufacturer specifications and/or verified survey data.
- Confirm ownership, operational status, and access rights with the windfarm operator.
- Provide detailed mapping and justification of AAE boundaries and any proposed transitions.

Applicants are encouraged to engage early with the CAA, via bvlos@caa.co.uk, to review and validate the proposed approach prior to full OA application submission.

This Annex is to be read in conjunction with the main content of CAP3040 and all applicable regulations, AMC and GM.

Annex D – Defining Operational Volume within an Atypical Air Environment

This Annex provides clarity on how to structure your Operational Volume within an Atypical Air Environment. The Operational Volume, including the defined Contingency Volume, must fit entirely within the confines of the agreed Atypical Air Environment.

However, to maintain the maximum operational use of the AAE, an applicant may choose to define the minimum possible Contingency Volume. The applicant must recognise the implications of such a decision. With a defined Contingency Volume which lacks the space to meaningfully react to the UA exiting the Flight Volume, the UA may enter the Ground Risk Buffer (GRB). In accordance with the UK SORA AMC, the relevant Emergency Procedures must be followed which may include activating the flight termination system.

This Annex is to be read in conjunction with the main content of CAP3040 and all applicable regulations, AMC and GM.