NATS OpenAir

Consultation Proposal

November 2024

Contents

1. Summary

Driven by technological progress and innovation, the accelerating growth of the uncrewed and advanced air mobility sectors is poised to change the skies above us, putting new demands on the airspace of the future.

In response to this opportunity, the UK has set out an ambitious Airspace Modernisation Strategy to unlock this growth, with System Wide Information Management (SWIM) at its core. This will enable Integrated Traffic Management – crewed and uncrewed aircraft in the same volume of airspace – safely, fairly and efficiently.

The OpenAir proposals outlined in this document are intended to create a UK-wide digital data backbone that contributes to the realisation of the benefits of SWIM and accelerates the transition to airspace integration across all applicable regions of the UK. OpenAir would not be a UTM Service Provider and would not provide services directly to new airspace users.

Our vision of a safe, fair and efficient future integrated airspace for new and existing users starts with NATS OpenAir, a new suite of network management services that would pave the way to safe and seamless airspace integration by collating and distributing real-time, accurate, reliable and comprehensive aeronautical data to its customers.

We are now consulting on our updated OpenAir proposition. This builds on an extensive and ongoing programme of stakeholder engagement and feedback from previous industry consultation.

As an economically-regulated company NATS (En Route) plc – NERL – is required to secure regulatory approval from the UK Civil Aviation Authority (CAA) before its licence is amended to include new Specified Services for which a clearly defined means of charging would be adopted. Your responses to this consultation will help to inform our detailed OpenAir proposal to the CAA in June 2025.

In parallel to this consultation NERL is also developing future services we believe will be of relevance to other categories of new airspace users such as commercial space flights – before making proposals to the CAA concerning these new services and charging mechanisms, we will consult potential users during a separate round of engagement.

At this stage of developing our OpenAir proposition, we are seeking your views on:

- our updated proposals for OpenAir services;
- an indicative charging mechanism by which the cost of OpenAir services would be recovered equitably over time from OpenAir customers, a wide range of air traffic service providers using the service;
- an outline regulatory framework that would reassure users of OpenAir services that these services would be delivered and charged for in a transparent, fair, reasonable and non-discriminatory manner, and subject to regulatory oversight and enforcement by the CAA.

This consultation document is structured as follows:

- Chapter 2 describes the context of UK aviation and the policy objective of enabling integrated airspace
- Chapter 3 sets out OpenAir's proposed role in supporting the realisation of this goal
- Chapter 4 describes our updated proposals for OpenAir services
- Chapter 5 describes the range of benefits and offsetting costs that we envisage could be enabled by the deployment of OpenAir
- Chapter 6 assesses the available evidence on the potential market demand for new airspace user flights, which in turn would create demand for OpenAir services
- Chapter 7 sets out indicative proposals for a charging mechanism for the fair and efficient recovery of OpenAir costs
- Chapter 8 proposes an outline regulatory framework within which OpenAir services and charges would be governed to protect users' interests
- Chapter 9 brings together the questions on which we now seek your views.

We welcome your written responses to our proposals and the supporting evidence we have presented in this consultation. As we develop further our OpenAir technical and regulatory proposition your views will be assessed alongside industry feedback from our ongoing stakeholder engagement programme, all of which will inform our detailed submission to the CAA in June 2025.

2. Enabling integrated airspace

2.1. Introduction

The safe and efficient integration of new airspace users into our skies brings the prospect of significant benefits for consumers, public services and the aviation industry. This introductory section provides an overview of the UK policy landscape guiding the industry and regulators towards a practical and sustainable model of integrated airspace. The remainder of this consultation is intended to set out the ways in which NATS OpenAir could enable future integrated airspace by providing regulated services paid for by those who use them.

2.2. UK Government's Future of Flight programme

In 2022 the UK Government published its Flightpath to the Future strategic framework addressing the themes of sustainable and innovative future aviation that could realise benefits for the UK and deliver for users.

These four themes were underpinned by an action plan that included an objective to:

> *'… capture the potential of new technology and its uses' to enable the routine use of 'new aircraft to provide new and improved low carbon services, and local and regional air mobility for goods and people. This will include aircraft such as drones and electrical vertical take-off and landing aircraft. This will be achieved through providing additional funding to CAA to scale up support to innovators and setting up a Future of Flight Industry Group to work with industry and the CAA to develop, publish and implement a plan for Future of Flight. The plan will include delivery of the necessary regulatory framework for aviation innovation to thrive.'*

Following the publication of this framework the Future Flight Industry Group (FFIG) was established, comprising key stakeholders from across government and industry. In early 2024 the FFIG Action Plan was published, outlining the steps necessary to bring about routine sustainable operations covering beyond visual line of sight (BVLOS)[1] drone and electrical vertical take-off and landing aircraft (eVTOL)[2] operations.

At the core of this action plan are five strategic outcomes:

1. demonstration of BVLOS Uncrewed Aircraft Systems (UAS) operations in non-segregated airspace;
2. piloted eVTOL flights in operation;
3. routine BVLOS UAS operations in integrated airspace at scale;
4. routine piloted eVTOL flight operations;
5. demonstration of autonomous eVTOL flight.

These outcomes reflect the collective ambition of government and industry and the potential benefits that could be accrued from their realisation. To deliver these outcomes the plan specifies a number of technology-specific activities related to UAS and eVTOL flight technology and identifies the need for a series of building blocks that are common to all types of user and operation, and within integrated airspace.

One of these building blocks is a digital infrastructure that connects stakeholders 'across a secure UK-wide network that supports a safe and efficient ecosystem'. The action plan requires industry to undertake a consultation in 2024 and deliver digital services to support safe airspace integration from 2025. The NATS En Route Ltd. (NERL) proposal for OpenAir and this consultation are direct responses to this call for action.

[1] See Glossary for definition of BVLOS

[2] See Glossary for definition of eVTOL

2. Enabling integrated airspace

2.3. CAA Airspace Modernisation Strategy

In January 2023, in direct response to the Government's strategic framework outlined above, the UK Civil Aviation Authority (CAA) outlined its Airspace Modernisation Strategy (AMS) for 2040. This states that:

> *'…airspace modernisation should wherever possible satisfy the requirements of operators and owners of all classes of aircraft, including the accommodation of existing users (such as commercial, general aviation, military, taking into account interests of national security) and new or rapidly developing users (such as remotely piloted aircraft systems, advanced air mobility).'*

This strategy aims for an integrated airspace in which, from the outset, new users can operate alongside existing airspace users. This is different from the approach being taken by the European Union, which is exploring the segregation of airspace for Uncrewed Traffic Management (UTM) operations subject to the European Commission's U-Space regulations.

The AMS identifies the following key requirements to deliver a modernised, integrated UK lower airspace:

- **Electronic Conspicuity (EC).**
  Aircraft operators will choose to adopt EC as part of a cooperative environment in which all airborne vehicles are visible to all other vehicles.
- **Flight Information Service – Broadcast (FIS-B).**
  These digitised services will exploit existing industry standards to provide a wide-area broadcast of data products transmitted to any air system in range. The data will include forecast meteorological information as well as near real-time airspace notifications.
- **Traffic Information Service – Broadcast (TIS-B).**
  This digital traffic information will be available by direct reception of cooperative air systems, locally deployed to re-broadcast the surveillance picture where needed.
- **Transponder Mandatory Zones (TMZs).**
  New digital flight rules will enable the integration both of new and existing users.

2.4. System Wide Information Management (SWIM)

SWIM is identified as one of the six focus areas for implementation within the CAA's AMS Part 3 (Deployment Plan) as published in July 2024.

The importance of System Wide Information Management (SWIM) underpins much of the AMS modernised lower airspace ambition. The deployment plan recognises that SWIM has the potential to improve decision-making by all stakeholders during all strategic and tactical phases of flight (pre-flight, in-flight, and post-flight) through:

- improved shared situational awareness;
- improved availability of quality data and information from authoritative sources;
- increased system performance;
- more flexible and cost-effective communications by the application of common standards for information exchange;
- loose coupling that minimises the impact of changes between information producers and consumers;
- support of ATM Service Delivery Management (SDM).

The OpenAir proposals outlined in this document are intended to create a UK-wide digital data backbone that contributes to the realisation of these benefits and accelerates the transition to airspace integration across all applicable regions of the UK.

2.4.1. SWIM Safety and Operational requirements

In light of the CAA's goals for SWIM, NERL proposes the following set of safety and operational requirements for a SWIM digital data backbone for UK lower airspace:

2. Enabling integrated airspace

Table 1: Potential SWIM Safety and Operational requirements

Reference	Requirement – the digital data backbone should:
SO1	provide a means of authenticating and exchanging critical data to facilitate safe flight and interoperability between different actors in the airspace;
SO2	provide a single, consistent picture of UK airspace to improve situational awareness for all airspace users;
SO3	provide clear and transparent service obligations for service providers and operators;
SO4	facilitate the exchange of data in a manner that is timely and relevant to each mission and service provider's requirements;
SO5	provide a safe and secure service, assured to a level sufficient to meet service providers' safety requirements consistent with, for example, the UK SORA framework;
SO6	contribute to enhanced consistency and a standard compliance process amongst different operators and service providers, thus reducing Civil Aviation Authority (CAA) time and resourcing;
SO7	be capable of evolving to meet growing and emerging needs of stakeholders;
SO8	contribute to the ability of General Aviation (GA) users to maintain airspace access in line with UK regulations;
SO9	monitor airspace to enhance policy making by government and the CAA.

2.4.2. SWIM Business and Organisational requirements

Reflecting on NERL's understanding of the Airspace Modernisation Strategy's goals and NERL's engagement to date with industry participants, NERL proposes the following set of business and organisational requirements for a SWIM digital data backbone for UK lower airspace:

Table 2: Potential SWIM Business and Organisational requirements

Reference	Requirement – the digital data backbone should:
BO1	reduce market entry barriers for new service providers and operators by enabling clearer regulatory pathways;
BO2	maintain and encourage competition, both amongst service providers and operators, building on the existing contestability of the UK air navigation service provider (ANSP) market;
BO3	help decouple technological solutions through the use of open standards, thereby maximising supplier and platform choices for all stakeholders;
BO4	support fair and equitable airspace access through the provision of trusted data that is independent of all downstream commercial interests;
BO5	allow service providers the freedom to offer unconstrained airspace management solutions, thus allowing the market to evolve according to user needs and regulatory requirements;
BO6	support all potential models of airspace management (subject to future approval and certification) including UTM Service Provider (UTMSP)/ANSP collaboration and ground/air based Detect and Avoid (DAA) solutions;
BO7	establish a commercial funding model that is consistent with the principle of 'user pays', is affordable to OpenAir customers and encourages fair and efficient use of airspace.

Question 1 relates to '2. Enabling integrated airspace': To what extent do you agree or disagree with our assessment of the requirements for a UK-wide SWIM data network for UK lower airspace as outlined in Tables 1 and 2 above? Please explain your comments or provide any alternative suggestions.

3. NATS OpenAir – the proposition

3.1. Enabling integrated airspace: NERL's response

NERL's proposals for NATS OpenAir are its response to the CAA's Airspace Modernisation Strategy (AMS) vision for lower airspace and potential System Wide Information Management requirements as outlined in the previous chapter of this document.

We believe NERL's OpenAir proposition is a critical pre-requisite for building the foundations of a nationwide integrated airspace and are seeking your views on our proposition.

OpenAir would enable early access to centralised aeronautical data and integrated network management functions. Using secure and scalable technology, OpenAir would be capable of meeting increased demand in future as the market grows.

OpenAir would provide to its customers:

- access to safety-related and other data necessary for safe flight, interoperability and efficient use of airspace;
- data exchange capabilities to allow all responsible parties to share data in a secure, authenticated, reliable and open way;
- certified aviation/air traffic management data;
- an application programming interface enabling the exchange of data on operators, flight plans, approval requests, approvals, check-ins, location/flight actuals, incidents/infringements, and central control directives.

NERL's OpenAir proposition has been shaped and influenced by extensive engagement with industry and consultation with stakeholders. Figure 1 below summarises the key features of our proposals:

Figure 1: NATS OpenAir - a digital integrated airspace

UK-wide information infrastructure to enable integrated airspace

Integrated aeronautical and network management to serve the needs of all airspace users

Ensures a consistent and assured picture of all planned airspace activity

Collects, collates and distributes real-time, accurate and reliable aeronautical data to service providers

Provides a safe foundation for seamless airspace integration

Supports all downstream airspace management models, and enables ANSPs to deliver integrated air traffic services to their airspace users

Expands on NERL's existing services to offer a broader range of capabilities to all users

Access to data will be provided to all service providers on a fair, transparent, and affordable basis

3. NATS OpenAir – the proposition

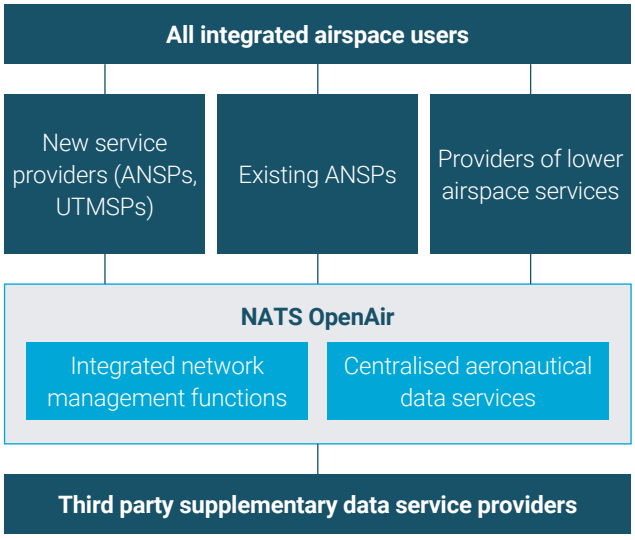
3.2. OpenAir network and customers

We envisage OpenAir would be the single source of truth for a UK-wide and assured integrated airspace picture. It would therefore be the primary means by which OpenAir customers could secure access to assured and shared integrated aeronautical data.

All operators and service providers are responsible for demonstrating their compliance with CAA regulations, so any decision regarding the use of OpenAir would be taken in the context of meeting their own safety obligations – OpenAir is being developed with the intention of providing the most effective, consistent and widely applicable means of regulatory compliance.

OpenAir would provide its customers with a consistent nationwide source of secure aeronautical data and integrated network management services, enabling them to provide services to new airspace users. Figure 2 below illustrates this:

Figure 2: NATS OpenAir - overview



In this context, an OpenAir customer is deemed to be any provider of integrated airspace services, including:

- new service providers (such as UTMSPs) offering digital services to crewed and/or uncrewed operators in controlled or uncontrolled airspace;
- existing ANSPs providing airport tower services and utilising OpenAir data to authorise new airspace users in their controlled airspace;
- providers of lower airspace services, as described in the CAA's AMS, including flight information services.

3.3. Data management

Access to data would be provided to all OpenAir customers on a fair and transparent basis, taking account of respective scales of operation and relative levels of data consumption.

The establishment of a single, consistent picture of the airspace and its planned use depends upon the receipt and processing of data from each OpenAir customer and other third party Supplementary Data Service Providers (SDSPs). Figure 2 illustrates how OpenAir would interact with each of these different entities.

Each OpenAir customer would be obliged to share data in accordance with agreed interface specifications, business rules and service level agreements yet to be established. They would be obliged to submit to OpenAir only that data deemed necessary by the CAA and essential to support safe flight and interoperability.

NERL recognises the potential commercial value of OpenAir customers' data and would therefore, while protecting those characteristics necessary for safe flight, anonymise data before transmission or publication.

OpenAir customers would not be financially recompensed for data they were required by the CAA to share with OpenAir but would derive benefit from the ability to provide services in integrated airspace that their connection to OpenAir enables. OpenAir would recompense commercial SDSPs for data when required (see Chapter 4 of this document for more details).

3. NATS OpenAir – the proposition

3.4. Why NERL?

We believe NERL is optimally placed to become a central data provider and thereby facilitate safe airspace integration in the UK for the reasons set out below.

- **Safety and security** – NERL is already responsible for the maintenance, development and protection of critical national infrastructure and has the ability to ensure the safety and security of all airspace users.
- **NERL's existing service framework** – NERL is already licensed by the CAA to provide a range of specific functions, described and defined as specified services by the airspace regulator. OpenAir could therefore be enabled through updates to existing frameworks, avoiding the additional cost and complexity of establishing new UK-wide licensed entities.
- **Fair and equal access** – NERL's current licence requires it to "not unduly prefer or discriminate against any person or class of person in respect of the operation of the Licensee's systems"[3]. This requirement for equitable service provision would also apply to OpenAir, protecting fair airspace access.
- **Timescale** – NERL is committed to developing its service proposition and validating requirements with customers from 2025 onwards. This would ensure OpenAir is ready for use ahead of any necessary licence or regulatory updates.
- **Market uncertainty** – NERL recognises the degree of uncertainty regarding the profile of future airspace users and the scale of market demand for ANSP services. An economically-regulated framework would enable OpenAir to provide critical infrastructure into the future with the assurance of an effective long-term cost recovery mechanism.
- **Transparency** – NERL is already committed to engaging with customers and other stakeholders on an ongoing basis under the terms of its current licence. This commitment will continue, ensuring the transparency of any future charging mechanism. Future OpenAir service development decisions would be taken under CAA governance.
- **User pays principle** – NERL proposes to establish a separate 'till' for the funding of OpenAir services. This approach ensures that only OpenAir customers pay directly for the service they receive.

Question 2 relates to '3. NATS OpenAir - the proposition': To what extent do you support our OpenAir proposition as a response to the requirements for a UK-wide SWIM data network for UK lower airspace? (see also Chapter 2). If you don't support our OpenAir proposition, is there an alternative you favour?

[3] NERL licence, condition 2.7

4. Service description

4.1. Introduction

This chapter sets out a high-level description of each of our proposed NATS OpenAir data services. In previous stakeholder engagement and industry consultation, eleven separate data services were proposed; in line with feedback we received, we are now presenting a revised set of twelve data services as the proposed basis of OpenAir.

Table 3 lists the original data services we proposed alongside our revised proposition:

Table 3 Changes to NATS OpenAir proposed services

Services originally proposed	What changed?	Services currently proposed
Airspace Authorisation	Evolved	Airspace Authorisation
Geographical Awareness	Evolved	Geographical Awareness
Traffic Information	Evolved	Traffic Information
Discovery and Synchronisation	No change	Discovery and Synchronisation
Strategic Deconfliction	Evolved	Strategic Deconfliction
Communication	No change	Communication
Registration Management	No change	Registration Management
Remote Identification	No change	Remote Identification
Fairness Monitoring & Negotiation	No change	Fairness Monitoring & Negotiation
Weather	No change	Weather
Conformance Monitoring	Removed	
	Added	Flight Notice Board
	Added	Advanced Air Mobility Network

4.2. Overview of remaining chapter sections

In the remainder of this chapter, we discuss the purpose and function of each service in section 4.3; section 4.4 discusses the prioritisation of the four data services we propose as 'initial' services; section 4.5 discusses the service obligations resulting from these services; in section 4.6 we highlight associated safety and security requirements.

4. Service description

4.3. Data services

4.3.1. Airspace Authorisation Service

The OpenAir Airspace Authorisation Service would provide a standardised authorisation format for a flight from the airspace controlling authority such as an ANSP, airport operator, or other relevant authority (e.g. police, local council, port authority etc.) to the uncrewed aircraft system (UAS) operator via an Uncrewed Traffic Management Service Provider (UTMSP). For this purpose, OpenAir would provide an interface between its customer and the airspace controlling authority, enabling the authorisation process to be automated whenever possible.

We envisage this data service would apply in all flight restriction zones (FRZs), restricted areas and above 400ft in control zones (CTR) or control areas (CTAs) as detailed in the UK Aeronautical Information Publication (AIP), and when the number of UAS flight requests exceeds a predetermined level. Where automatic authorisation is not possible, the proposed flight is queued for manual attention by the airspace controlling authority until it has been authorised, whereupon the relevant information would be passed to OpenAir.

By design, the interfaces of OpenAir would be based on existing UTM standards to ensure they are interoperable with UTMSPs and with the flight approval systems of airspace controlling authorities whose systems are based on UTM technology.

OpenAir would retain a repository of all UAS flights approved by the airspace authorisation data service. This would also be available to suitably-authorised customers via the Flight Notice Board, enabling them to understand what flights are already planned in the airspace.

4.3.2. Flight Notice Board

A Flight Notice Board service has been included in our OpenAir initial services portfolio in response to stakeholder and industry feedback. This data service would provide a live and historical repository of all drone flights as approved, rejected, or notified to the OpenAir Airspace Authorisation Service to facilitate pre-flight strategic deconfliction.

The OpenAir Flight Notice Board would support demand analysis and airspace utilisation from such perspectives as safety, capacity, efficiency, and fairness of use.

4.3.3. Geographical Awareness Service

The OpenAir Geographical Awareness Service would consolidate airspace constraints, terrain models, population density, maps and ground-based obstacles (cranes, tall structures, etc.), and make the information available to OpenAir customers. This would provide a common access point to an authoritative repository of all UK aeronautical information, ensuring all customers are basing their activities on a complete data set of known and assured quality.

Information on airspace constraints could be sourced for example by NATS En Route plc (NERL) as the UK Aeronautical Information Management provider, the CAA, law enforcement, defence, or local authorities and would include airspace advisories, data for static and dynamic geo-fencing such as UAS geo-zones, and other approval-relevant information.

Terrain and obstacle data would provide all information of a terrestrial nature required to meet the safety and mission needs of individual UAS operations or to support the needs of its customers' flight planning services.

The OpenAir Geographical Awareness Service would provide an application programme interface (API) to make its data accessible, and a central distribution function to manage the distribution of information bulletins affecting UAS operations, including real-time flight information and current serviceability of the OpenAir network.

4.3.4. Traffic Information Service

We propose that OpenAir would hold an authoritative and complete picture of traffic information in order to support the needs of UAS operators for situational awareness and to help them remain well clear of other aircraft.

This data service could also hold historical traffic information. This would enable operators, via OpenAir customers, to interrogate historical traffic data for the airspace in which they plan to fly. The outputs could be used to deconflict with known routes and/or support the SORA Air Risk Classification (ARC) assessment.

This data service is being designed to satisfy the CAA Detect and Avoid (DAA) policy[4] that was released for consultation in summer 2024. The policy was drafted with reference to industry standards and encompasses a range of approaches, including ground-based detect solutions. Part of this policy solution requires that all UASs receive timely, accurate, and assured surveillance data.

[4] CAA, Detect and Avoid Policy Concept Consultation, July-September 2024

4. Service description

In addition to the DAA policy, in its Airspace Modernisation Strategy the CAA describes an objective for a new Lower Airspace (enhanced) Surveillance Service to create a national, assured situational awareness picture. The OpenAir Traffic Information Service could form the basis of such a data service.

We anticipate OpenAir customers would partner with SDSPs to deploy and operate regional surveillance infrastructure when establishing services for BVLOS operations. We also assume the cost of operating these services would be borne by their own customers. Each SDSP would be required to supply the track information to OpenAir, thus contributing to an authoritative national traffic picture.

The Traffic Information Service would accept track information from multiple sources and publish this track information for suitably-authorised customers. The initial format of this traffic information would be ADS-B on 1090MHZ and UAT on 978MHZ, in line with the CAA's policy[5] on Electronic Conspicuity, and secondary surveillance radar.

This presents three potential ways in which an OpenAir Traffic Information Service could be used to support BVLOS operators and the wider aviation community (see Table 4, below).

Table 4 Traffic Information Service options

Option	Description
1	Traffic Information assured for general situational awareness only as a lower airspace surveillance data service
2	Traffic Information with sufficient assurance to provide an assured, real-time detection capability as part of a ground based DAA capability
3	Historical Traffic Information with sufficient assurance to support pre-flight planning and/ or UK SORA Air Risk Classification (ARC) assessments.

Question 3 relates to '4. Service description' (sections 4.1. - 4.3.4.): How strongly do you support each Traffic Information Service option? (where 5 is strongly support and 1 is strongly against). If you don't support our OpenAir proposition, is there an alternative you favour?

4.3.5. Discovery and Synchronisation Service

Embedded in recent UTM standards development activities is the requirement for a Discovery and Synchronisation Service (DSS) that would allow for operations amongst UAS operators to be anonymised for commercial sensitivity while ensuring constraints of a time-dependent nature, e.g. intended flight volumes and trajectories, are discoverable for the purpose of strategic deconfliction or avoidance.

OpenAir could host the DSS and provide a data service/ registry function for all connected entities such as UTMSPs and SDSPs.

4.3.6. Strategic Deconfliction

At the time of publication (November 2024) the CAA is developing policy for integrating new airspace users through Transponder Mandatory Zones (TMZ), as envisioned in the AMS. It is anticipated this will require the flight plans of all UAS flights in such airspace to be strategically deconflicted in advance against all already-planned UAS flights and against all known crewed aircraft flight plans.

Strategic deconfliction between UASs may also be required for any flight requests in other types of regulated airspace such as flight restriction zones (FRZs), restricted areas and above 400ft in control zones (CTR) or control areas (CTAs) as detailed in the UK AIP.

OpenAir Flight Noticeboard could be available to support strategic deconfliction. OpenAir customers could also use the OpenAir Discovery and Synchronisation Service to identify other service providers with which to deconflict UAS flights. OpenAir could forward the completed deconflicted flight request to the airspace controlling authority for authorisation in the case of controlled airspace or, in the case of a TMZ, as a notification to the Flight Noticeboard.

Strategically deconflicted flight plans could be shared with OpenAir to provide a single authoritative repository of all approved UAS flights. Flight plans could be shared using the same automated process as is employed by OpenAir's Airspace Authorisation Service. The repository of approved UAS flights could be made available to OpenAir customers to support their planning of operations and, in time, their conformance monitoring.

In the case of local drone-based delivery services taking place outside integrated airspace, emerging industry standards (such as ASTM F3548-21[6]) put forward an approach by which these operations would be managed by a network of federated UTMSPs strategically deconflicting flights amongst themselves. Such flights would not be shared with OpenAir if they took place entirely outside integrated airspace.

However, the UTMSP would need to connect with OpenAir for any flights transiting regulated and unregulated airspace, for geo-awareness information, for registration management, or for a discovery and synchronisation data service.

[5] CAA aeronautical information circular y 141/2019

[6] ASTM F3548-21 Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability

4. Service description

The perceived benefits of a federated approach include increased service resilience within a competitive ecosystem that fosters the relatively rapid adoption of best practice. However, for some services, Strategic Deconfliction for example, federation introduces a more complex system in which data quality assurance between parties poses a greater challenge. Therefore, such a design may be more appropriate in a mature market with equally mature technical standards and oversight.

OpenAir could offer a deconfliction solution that supports the benefits of federation while adding a centralised model in the nearer term that would be more capable of assurance in integrated airspace.

4.3.7. Communication Service

An OpenAir Communication Service would provide quality of service assurance for UAS command and control capabilities to UAS operators. It is highly likely that many aspects of this data service would be facilitated via industry solutions acting as SDSPs, although a centralised 'source of truth' could be maintained by OpenAir. It is anticipated that this data service would only consider command and control communications over mobile telecommunication networks. Future iterations may need to consider catering for the hyper-connectivity of multiple different communication pathways, such as satellite communications.

4.3.8. Registration Management Service

An OpenAir Registration Management Service would allow all stakeholders to register as participants in the OpenAir integrated network environment, including UTMSPs, supplementary data service providers (SDSPs), ANSPs and local airspace approval authorities. It is expected that all providers of air navigation services to new airspace users will be subject to some form of licensing or registration by the CAA.

Providing a secure and authenticated network, the Registration Management Service would be a fundamental building block of OpenAir. It could offer an all-inclusive registration management solution as well as an interface to the CAA Drone and Model Aircraft Registration and Education Scheme (DMARES) for UAS operator validation.

This data service would support other OpenAir services by providing a data service/registry function for users to discover other relevant users in any given volume of airspace.

4.3.9. Remote Identification Service

We understand that legislation is already in place committing the UK to the implementation of direct Remote Identification (RID). Meanwhile, the CAA consulted on the implementation of network-based RID in late 2023; the outcome of that consultation is not yet known.

We believe OpenAir could support the integration of network-based RID information as part of a single UK digital data infrastructure. In a manner consistent with other data services described in this section, OpenAir would be commercially independent from each downstream RID service provider.

4.3.10. Fairness Monitoring and Negotiation Service

A key aspect of airspace management is ensuring fair and competitive access to airspace for all users. This principle is particularly relevant when integrating new airspace users into airspace already used by conventional crewed aircraft.

An OpenAir Fairness Monitoring and Negotiation Service could function as a completely independent entity in the UTM and air traffic management (ATM) ecosystem. OpenAir would validate customer decisions from the perspective of fairness between UTMSPs, and between new and existing airspace users. This data service is intended ultimately to reduce the likelihood of anti-competitive behaviours.

4.3.11. Weather Service

An OpenAir Weather Service would provide meteorological information such as forecast conditions, observed conditions and warnings, in support of BVLOS operations. OpenAir could source weather information from a SDSP and make that available to OpenAir customers as an authoritative weather data source.

4.3.12. Advanced Air Mobility Network Service

The Advanced Air Mobility (AAM) Network Service would provide real-time information on key ground and airspace infrastructure for use in all phases of flight, from planning to inflight services, to enable electric and other forms of flight. This information would include airfield status (i.e. open/closed/planned changes), Final Approach and Take Off area (FATO) availability, charger availability and aircraft parking, as well as services to facilitate the booking of routes, FATO slots, and chargers. OpenAir would source this information from network airfields. This information could then be made available to ATM, aircraft operators, and UTMSPs as an authoritative source enabling freedom of choice of systems at airfields.

Question 4 relates to '4. Service description' (sections 4.3.5. - 4.3.12.): How likely or unlikely are you to use (directly or indirectly) OpenAir data services?

4. Service description

4.4. Data Service Implementation

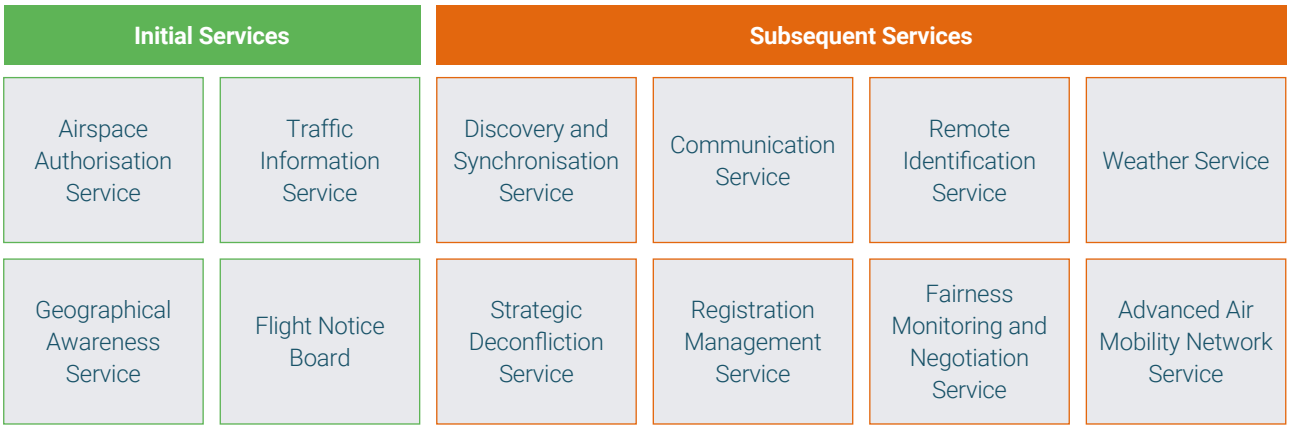
4.4.1. Initial Services

During the course of our stakeholder engagement and consultation with industry we have outlined the data services described above and sought feedback on customer priorities, including opinions on which features would be of greatest value in enabling BVLOS operations within integrated airspace in the short term. Four initial data services were clearly identified as priorities:

- Airspace Authorisation Service
- Flight Notice Board
- Geographical Awareness Service
- Traffic Information Service

Subsequent data services could help to scale BVLOS operations to a larger capacity and, in time, contribute to full BVLOS integration. This prioritisation is summarised in Figure 3 below.

Figure 3: NATS OpenAir - initial and subsequent services



Question 5 relates to '4. Service description' (section 4.4.1.): To what extent do you agree or disagree with the proposed service priorities outlined above? If you disagree, please explain your views.

4.4.2. Provisional timescale

It is envisaged that each data service would undergo an evolutionary development through three major releases to customers as follows:

- **Pilot:** implementation of data service to demonstrate functionality, test integration, and validate requirements – the pilot data service would not be assured and therefore inappropriate for operational use.
- **Early Release:** implementation of data service could remain limited by functionality and/or geography but would now be assured to a specified level and should therefore be capable of operational use in support of operator safety cases.
- **Full Deployment:** full scope of technical and functional data service as agreed with customers.

Our proposed timescale for OpenAir deployment is set out below:

4. Service description

Table 5 Provisional timescale for deployment of NATS OpenAir services

Date	Milestone	Regulatory framework
2025	Initial Services – Pilots	Test and validation only
2026	Initial Services – Early Release	Limited operational use by OpenAir customers
2026-2027	Remaining services – Pilot and Early Release	Specific bilateral arrangements to be established where required
2027-2028	All services – Full Deployment	Full operational use nationwide
2028	Modification of NERL licence to reflect agreed framework	Tariffs, charges and obligations in accordance with NERL licence
2029 onwards	Ongoing service evolutions to be agreed with customers	Governance to be agreed and determined with the CAA

We envisage pilots of the initial four data services would take place in 2025, with early deployment planned for 2026. The remaining data services could be introduced in two further tranches of pilots and early deployments during 2026 and 2027. Once sufficient demand exists for each data service, they could evolve to full UK deployment.

Prior to a change in the NERL licence, all operational service provision would require CAA-approved bilateral contracts between OpenAir and its customers.

Question 6 relates to '4. Service description' (section 4.4.2.): To what extent do you agree or disagree with the provisional timescale outlined above? If you disagree, please explain your views.

4.5. Service Obligations

4.5.1. Data dependencies

The provision of OpenAir services would depend on each OpenAir customer fulfilling specific obligations; we anticipate such a requirement would feature in future industry regulation relevant to service providers wishing to manage integrated airspace (see also Chapter 3, 3.3). These obligations could include, for example:

- connection to the OpenAir secure integrated network;
- sharing of relevant data necessary to support the specified services, including:
  - UAS operator flight plans
  - UAS track information
  - aeronautical information
  - basic meteorological information
  - connected stakeholders' registration information;
- provision of the requisite data in accordance with a pre-specified service level agreement including data quality, latency and availability;
- adherence at the commencement of services to a predetermined onboarding process including data test and validation;
- adherence to business resilience processes and procedures to mitigate service or data unavailability risks.

Question 7 relates to '4. Service description' (section 4.5.1.): To what extent do you agree or disagree with the data sharing obligations we propose? If you disagree, what alternative solution do you suggest?

4. Service description

4.5.2. Data standards

OpenAir is being designed to use open and consensus-based standards and thereby to support the process of connecting the sector and help stakeholders navigate the future flight landscape, accelerating innovation.

We believe consistent standards would promote smooth communication and data exchange between systems, and underpin safe, efficient, and inclusive products and services operating across different technical platforms and operational environments.

Given the safety-related nature of our OpenAir proposition, the use of recognised standards is key in assuring the overall system's safety, performance, and interoperability – factors we believe are critical for UAS operators seeking to gain approvals for their operations.

Accordingly, OpenAir would use standards emerging from the developing UTM industry and existing standards from the ATM industry to ensure OpenAir has the capability to work well with other systems, applications, and components within NATS' existing technology infrastructure. These standards would cover the functional performance of each service as well as data exchange processes and interoperability formats supporting appropriate safety and security assurance requirements.

4.6. Safety and Security

The OpenAir platform would provide data services to existing and new airspace users by gathering, validating, integrating, and disseminating data from a wide range of sources, including NATS' own infrastructure. This would generate a consistent and assured picture of all planned and in-flight activity in the airspace.

Detailed technical specifications are in development; technical and assurance requirements are expected to underpin OpenAir standards, configuration and performance requirements. An overview of a potential development timeline is set out in section 4.4.2. above.

The OpenAir proposition is intended to support and enable the safety and mission needs of individual UAS operators via customer interfaces. We envisage the CAA would set requirements on OpenAir services to help maintain safety and security standards that are appropriate for current and new aviation environments while supporting new airspace user integration.

Our OpenAir service proposition is being developed to incorporate best practice from reliable and secure software engineering standards. This includes, for example, demonstrating compliance or equivalence to Assurance Level 4 in the ED-109A standard for software assurance.

Specific Operations Risk Assessment (SORA) is a method of classifying risks posed by a UAS operation and identifying mitigations and safety objectives to counter those risks. From 2025, BVLOS operators will increasingly be expected by the CAA to use UK SORA as part of their operational approval requests. SORA allows the UAS operator to identify operational limitations and training objectives for the personnel involved in the flights as well as technical requirements for the aircraft, and to develop appropriate operational procedures.

OpenAir would provide assurance to operators as to how the data services listed above, accessed through their chosen service provider, could be relied upon as a means of mitigating some of the risks identified by SORA for each UAS operation. This aspect of OpenAir would remain under review to ensure alignment with the CAA's SORA definitions as they evolve.

OpenAir would also be aligned with a recognised and relevant security framework or policy set (such as NIST, CIS Level 2) as well as with current aviation security regulations (such as CAP1753[7]).

We recognise and acknowledge that some participating users, UK state or defence operators for example, may require some data to remain anonymous or protected from open access and view. Accordingly, within OpenAir the management of such data could be configured to restrict access and, where required, data could be appropriately anonymised. In such cases, OpenAir would retain the complete and relevant data, enabling the safe management of integrated airspace via an assured, authoritative platform.

[7] CAA, The Cyber Security Oversight Process for Aviation, CAP 1753, v3 April 2024

5. Benefits for stakeholders

5.1. Introduction

In this chapter we provide an overview of the benefits NATS OpenAir aims to deliver to the full range of stakeholders potentially impacted by an integrated UK airspace:

- Drone and eVTOL operators
- General Aviation
- Service providers (ANSPs and UTMSPs)
- Airports
- Commercial airlines
- Public service agencies
- Regulators and government

To deliver these wider benefits, which are diffused through the aviation sector and out to the wider economy and general public, OpenAir would primarily interact with and impact its customers in the following ways:

- exchanging data to support safe and efficient operation in integrated airspace;
- receiving customer data, in accordance with interface specifications and service standards, to build a comprehensive aeronautical data picture for all users;
- charging customers for the services they receive, within a regulated and transparent cost-recovery framework.

5.2. Direct stakeholder benefits

Table 6 (below) assesses potential stakeholder benefits that could be derived from OpenAir. We anticipate many of these wide-ranging benefits would arise from OpenAir's contribution to System Wide Information Management (SWIM), as outlined in Chapter 2 of this document, and its central role in the CAA's Airspace Modernisation Strategy.

We believe the key stakeholder benefits OpenAir could offer are:

- As an integral part of a SWIM framework, a UK-wide information infrastructure such as OpenAir would enable integrated airspace and provide all airspace users with accurate and assured real-time data, enhancing overall safety;
- we believe our proposition would provide a consistent and assured picture of all planned and current airspace activity, allowing for efficient and safe pre-flight planning;
- by incorporating real-time information updates and emergency notifications, OpenAir could mitigate many common safety risks;
- OpenAir would provide users with a single point for flight authorisation communication, removing the need to interact with multiple stakeholders to ensure safe operations.

5. Benefits for stakeholders

Table 6 Potential stakeholder benefits arising from NATS OpenAir

Stakeholder	Potential OpenAir benefits
Drone and eVTOL operators	> Reduction in costs per flight for VLOS and BVLOS operations as scaling is unlocked; > Realtime access to flight information and dynamic aeronautical data, improving safety and operational planning and increasing efficient use of airspace; > Sharing of data to enable coordination with other users of local airspace, including Atypical Air Environment requirements; > Reduction in administrative time and cost via increasing automation of flight authorisations; > Mitigation of air risks under the SORA framework – operational consistency, ease of compliance, long-term authorisation of operations; > Distribution of up-to-date data concerning the availability of network assets in support of dynamic traffic management of eVTOLs, e.g. routes, parking, charges etc.
General Aviation (GA)	> Reduced need for segregated airspace for new users, thereby maintaining shared access to Class G airspace; > Improved situational awareness of all aircraft in shared airspace, thereby reducing potential conflicts and enhancing safety; > Enhanced safety through the provision of real-time flight information and conflict resolution services to drone and eVTOL operators; > New airspace user services built on OpenAir data could also be useful to GA, e.g. streamlined airspace authorisations.
Air Navigation Service Providers (ANSPs) and UTM Service Providers (UTMSPs)	> Improved ability to manage and control all air traffic (crewed and uncrewed) in controlled airspace; > Single, accessible point for flight authorisations, removing the need for individual interactions with multiple stakeholders to share data or communications; > Assured airspace surveillance data that increases operational confidence and security, mitigating safety risks; > Enhanced ability to provide real-time services such as urgent flight authorisations, dynamic rerouting, and emergency notifications; > Support of downstream airspace management models, enabling OpenAir customers to deliver integrated air traffic services to their airspace users; > OpenAir services would be consistent with current and emerging international data standards, reducing integration cost; > Sustainable airspace model for integrated airspace would allow realisation of UTMSP commercial opportunities as demand for UTM services grows with scaling of BVLOS drone operations; > OpenAir would contribute to UTM services that mitigate air risks under the SORA framework, bringing consistency to operations; > Multiple models of service provision, with or without ground surveillance infrastructure, lowering barriers to entry; > Federation of UTM service provision with the possibility of multiple service providers within the same airspace region; > Sharing of data to enable coordination with other users of local airspace, including Atypical Air Environment requirements.

5. Benefits for stakeholders

Airports	> Improved coordination of drone operations around airports, minimising disruption and maximising safety for passenger-carrying services; > Enhanced situational awareness for airport operations, enabling safer and more efficient ground and airspace management; > No investment required from airports as costs would be recoverable from new users via their service providers; > Clearer framework within which to integrate new users in and around airports.
Airlines	> Increased safety assurance via improved air traffic information in lower airspace and conflict resolution provision (between UTMSPs, drones and crewed aircraft), improving safety in and around airports; > No investment required from airlines as costs would be recoverable from new users via their service providers.
General Public	> Improved tracking and control of new air vehicles, which would reduce air and ground risks, would result in greater safety assurance for general public; > Single airspace picture alongside data on legitimate usage enables easier identification of unauthorised drone use, contribution to enhanced national security; > Enablement of use cases that provide direct societal benefit.
Ministry of Defence	> Single airspace picture alongside data on legitimate usage enables easier identification of unauthorised drone use, contribution to enhanced national security; > Maintained access to Class G airspace, which would be shared with new users; > Improved coordination and communication between civil and military airspace management service providers, allowing faster response to potential threats in lower airspace.
Public Service Agencies	(e.g. Maritime & Coastguard, NHS, Police, Fire Service, Environment Agency) > Unlocking of ad hoc urgent operations, enhancing ability to deploy drones nationally in emergency response capacities; > Access to real-time aeronautical data, resulting in faster response times and improved situational awareness in emergency situations.
Government and CAA	> Enables scaling, creating openly competitive future marketplace, unlocking this industry and allowing for the creation of jobs and economic benefits; > Data provision, helping build safety cases and collect evidence to inform future regulatory policy; > By supporting the provision of digitised flight information and traffic services to all airspace users, OpenAir would be central to the CAA's Airspace Modernisation Strategy.

5. Benefits for stakeholders

5.3. Indirect stakeholder benefits

By providing a safe foundation for scalable operations, OpenAir could contribute to many indirect benefits associated with the wider objectives of Future Flight and the CAA's Airspace Modernisation Strategy, including the following:

- airspace integration: greater flexibility in the use of airspace, maintaining access for existing users whilst opening access to new user categories;
- availability to new entrants: new business models and valued services such as improved access to healthcare and transportation;
- reduced air and ground risks: greater safety assurance for aviation operations;
- environmental benefits: increased transportation choices allow for a reduction in congestion, noise and air pollution from road traffic;
- economic benefits: a diverse and expanding new airspace users market could boost job creation and economic growth.

However, the scaling of drone and eVTOL operations could result in additional costs for those benefiting from the new services and more widely. These may include:

- compliance costs for aircraft operators due to a potential acceleration of additional regulatory compliance and systems requirements, including ADS-B transponder mandates;
- coordination costs for ANSPs and airports, incurred by increased activity required to coordinate additional drone traffic; this is likely to be offset by revenues arising from services to new airspace users.

Question 8 relates to '5. Benefits for stakeholders': To what extent do you agree or disagree that OpenAir would deliver benefits to you or your organisation? If you disagree, please explain your views.

6. Market assessment

6.1. Introduction

NATS OpenAir is being designed to meet an anticipated growth in demand for access to integrated airspace by new users flying a wide variety of missions. Given the current high degree of uncertainty in the fields of technology, commercial viability and future airspace regulation, finding a consensus view on the level of future demand is challenging.

This chapter is intended to set out NERL's assessment of potential future market evolution, segmentation and demand, based on industry insights and on our ongoing engagement with a wide range of partners and stakeholders.

We will continue to update this assessment of market trends via horizon scanning and through continued close engagement with industry and regulatory stakeholders. We welcome responses to this consultation that will further inform our views and help us shape an appropriate and effective charging mechanism – for more details on potential tariff levels please refer to Chapter 7.

6.2. Our understanding of the market

Our involvement in a number of industry forums with BVLOS and eVTOL operators has helped us reach a more informed view of the potential market in which new airspace users will operate. From this engagement the following key trends are apparent:

- the number of BVLOS operations proposals from operators of uncrewed aircraft is increasing;
- appetite from eVTOL manufacturers and operators to introduce low level operations in the UK is increasing;
- industry operators note improvements to the CAA regulatory framework (re. safety, licence requirements, and airspace authorisations) but state the UK is adopting 'a more conservative approach to risk and a more complex and lengthy process for obtaining permissions'[8];
- operators of uncrewed aircraft are currently limited to temporary airspace structures and have yet to transition into commercially sustainable models.

Initial reactions from new airspace users to our future market assessment have been positive, recognising the key roles of innovation and technology in integrating airspace and the importance for business investment of clear policies and effective regulation, and acknowledging the heavy financial burden that a temporary airspace change proposal could impose on the evolution of the market.

The new airspace user market has developed in recent years, particularly thanks to the evolution of four user types:

- delivery drones (last mile);
- beyond visual line of sight (BVLOS);
- urban and regional air mobility (UAM and RAM);
- high altitude platforms (HAPs).

6.3. Market segmentation – new users

For the purposes of considering potential demand for OpenAir services, we have focused on potential future users of lower airspace. This market segment comprises two broad groupings:

- **uncrewed (drone) operations:** beyond visual line of sight (BVLOS) operations, with further sub-categories by range (e.g. last mile delivery versus urban/rural missions), payload type (e.g. retail logistics versus critical medical deliveries), and mission type (e.g. delivery versus inspection);
- **advanced air mobility:** passenger-carrying electric vertical take-off and landing (eVTOL) vehicles mostly envisaged to operate with an on-board pilot for initial operations, which are categorised by range (e.g. UAM and RAM).

We have not considered a potential HAPS market as part of our assessment because of uncertainty of future demand.

Our assessment of future demand for OpenAir services does not include activities taking place outside integrated airspace that have not received CAA authorisation; we anticipate such operations would not be initially supported by OpenAir.

These market segmentation assumptions underly our assessment of future market demand; our estimates of OpenAir service usage and tariff level proposals are based on our assessment of future market needs.

Our future market assessment is based on a variety of publicly-available resources as referenced in the Table 7 below. These reports discuss how the market could evolve over time and provide a good starting point for the user-case segmentation we have applied in Chapter 7 to determine tariff levels.

[8] PwC (2024) Skies without limits, v3.0

6. Market assessment

Table 7: Publicly available reports on market evolution

Author	Title	Expected market evolution
PwC	Advanced Air Mobility, UK Economic Impact Study (July 2023)[9]	Total of 145 eVTOLs by 2030 Total of 2,257 eVTOLs, of which 2,136 with 4-5 pp capacity and 121 with 11-12 pp capacity by 2040. This assumes 376 vertiports in the UK and a maximum of 6 eVTOLs operating at each vertiport.
PwC	Skies without limits v2.0: the potential to take the UK's economy to new heights (July 2022)[10]	Total of 923,000 commercial drones by 2030
PwC	Skies without limits, Drones - taking the UK's economy to new heights (2018)[11]	76,233 drones in use across UK skies
UKRI Research and Innovation	UK Advanced Air Mobility (AAM) Market Assessment: An analysis of 20 potential routes in the UK for AAM aircraft operations (2022)[12]	224 eVTOLs in the UK (no timeline specified)
Bryce Tech	Advanced Air Mobility - an assessment of a coming revolution in air transportation and logistics (2023)[13]	321 VTOLs in operation and 1,152,000 VTOLs flights by 2030. N.b. in this report 'VTOLS' include helicopters for urban and rural mobility in addition to eVTOLs
EA Maven	The UK Advanced Air Mobility Opportunity[14]	RAM: 63 airports serving 650 routes, total of 430m passengers annually by 2035 UAM: 264 airports serving 990 routes, total of 320m passengers annually by 2035

We have followed the approach used in the Bryce Tech report (2023)[15] for the market definition and user cases, the PwC reports[16] and other confidential reports to determine the total number of BVLOS drones and eVTOLs in use by 2030, and the IATA and McKinsey studies to estimate a proxy for the OpenAir contribution to estimate the total air traffic service revenues per users. Our initial assessment focuses on the following segments:

- **Low value (logistics) BVLOS:** these flights usually carry payloads of up to 20 kg over short distances (i.e., less than 100 km) and carry out business-to-business or business-to-consumer operations;
- **Mid-value BVLOS flights:** this segment includes operators carrying out insurance surveillance, asset inspections and media and telecommunications activities;
- **High value BVLOS:** these operators carry out activities that include offshore inspections, health and education services, and advanced air mobility public defence eVTOLs.

6.4. Market evolution

Assumptions based on the above market segmentation can be used to tailor OpenAir services, estimate potential market evolution and determine cost drivers for our preferred charging mechanism as discussed in Chapter 7.

The PwC reports estimate a total of 932,000 commercial BVLOS drone movements and 934,380 eVTOL movements will be operating in UK skies by 2035. We propose using these values to determine initial OpenAir tariff levels; as more robust information becomes available tariff level determinations will be updated as appropriate.

Question 9 relates to '6. Market assessment': To what extent do you agree or disagree with the PwC estimates for total commercial BVLOS and eVTOLs by 2035? If you disagree, please explain your views.

[9] PwC (2023) Advanced Air Mobility, UK Economic Impact Study

[10] PwC (2022) Skies without limits v2.0: the potential to take the UK's economy to new heights

[11] PwC (2018) Skies without limits, Drones - taking the UK's economy to new heights

[12] IUK-02112022-Advanced-Air-Mobility-Demand-Assessment-Report.pdf (ukri.org)

[13] Advanced air mobility evidence review (publishing.service.gov.uk)

[14] Full UK AAM Potential (usrfiles.com)

[15] Bryce Tech (2023) Advanced Air Mobility , an assessment of a coming revolution in air transport and logistics

[16] PwC (2023), Advanced Air Mobility, UK Economic impact Study; PwC (2022), Skies without limits ; PwC (2018), Skies without limits, Drones - taking the UK's economy to new heights

7. Tariff structure proposal

7.1. Introduction

In this chapter we present our preferred tariff structure for NATS OpenAir services with regards to the charges levied on OpenAir customers. We do not address the future framework for charges levied by OpenAir customers on their users. Our proposals reflect the views we received during industry consultation and via other stakeholder engagements during 2024.

This section discusses:

- principles for designing a charging mechanism;
- OpenAir services and charging principles;
- OpenAir cost recovery model assumptions;
- our preferred tariff structure.

7.2. Principles for designing a charging mechanism

This section sets out an updated version of our preferred charging principles based on feedback received during recent OpenAir industry engagement. We discuss the principles likely to be relevant when designing a charging mechanism for new regulated services.

We have considered standard practices for applying local and international transport sector tariff principles, including those taking account of social and environmental impacts; for example, the key charging principles outlined in ICAO's Policies on Charges for Airports and Air Navigation Services include cost relatedness, non-discrimination, transparency, and meaningful user consultation with airlines.

The key principles we have identified, to be weighed against each other, are:

- **efficiency:** recognising marginal costs of production and any costs of externalities; ensuring charges reflect users' willingness/ability to pay;
- **equity:** demonstrable fairness and accessibility to a range of users;
- **sufficiency of revenue:** recovery of production costs over time;
- **transparency:** clear relationship between costs and tariffs;
- **simplicity:** easily understood tariff structures;
- **stability:** to enable users to plan their future demand for service.

Informed by these principles, which are commonly used in aviation and other regulated sectors, Table 8 describes how we have applied these principles to the design of a potential OpenAir charging mechanism.

7. Tariff structure proposal

Table 8: charging principles

Charging Principle	
User pays	The user should pay for the cost of delivering the service received. This principle relates the current costs to the current charges, so each group of users pays for the costs of service they use. It can be applied to users who collectively pay over time for the costs of developing and delivering the services they use. This principle is likely to be relevant to OpenAir as it requires upfront investment to develop a suite of services that may be offered initially to a small but potentially rapidly growing customer base. Therefore, to avoid early users bearing the full costs of initial OpenAir services, this principle could be extended to state: 'user group pays over time'. This revised statement would allow for initial below full-cost charging, with early losses recovered later from the same category of users.
Cost-reflective	The proposed charges should broadly reflect the actual cost of providing the service. However, this principle cannot easily be adapted to take into account individuals taking varying levels of service, nor different balances of charges enabling more users to access the market thereby lowering unit cost.
Fair and equitable	Charges should be fair and equitable, applied equally to all users without discrimination or bias; charges should be clearly linked to objective factors concerning the nature of the service, including where and when it is consumed. Within this principle, to ensure the fairness of the charge, we include the concept of willingness to pay, also known as 'value of service' pricing or 'charging what the traffic will bear'. This is intended to enable smaller users to access OpenAir services via tariffs that shift the recovery of fixed costs proportionately towards larger users, ensuring all users are treated fairly in terms of ability to access the market.
Efficient and effective	The charging scheme should be effective, efficient and straightforward to implement. It should not impose unnecessary burdens on individual users, groups of users, or the provider.
Avoid cross-subsidy	As a corollary of the 'user pays' principle, the revenue generated by any other NATS service should not be used to subsidise OpenAir services and vice versa.
Transparent	The explanation of the mechanism used to generate OpenAir charges should be clear and transparent, informed by consultation with stakeholders.
Incentivise efficient use of scarce resources	The charging scheme should promote good behaviours and improved performance, such as energy efficiency and better use of integrated airspace.
Simplicity	The charging scheme should be easy to understand.

7. Tariff structure proposal

7.3. Charging structure

This section outlines how the charging principles described above could be applied to develop a charging structure.

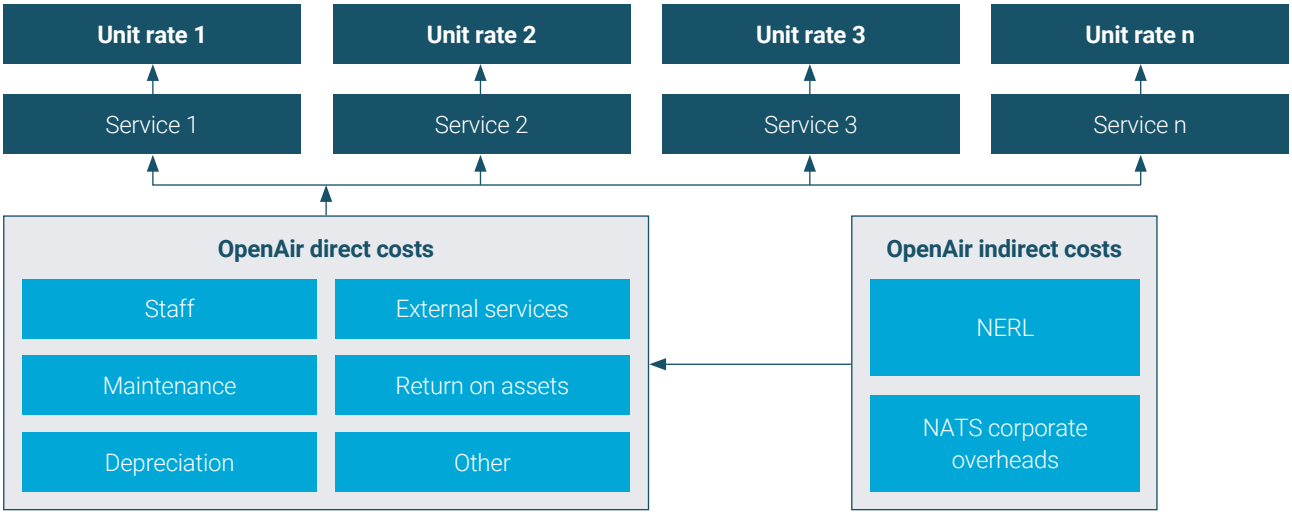
Cost reflective principle: The determined cost of OpenAir services should reflect the actual costs incurred to produce the services. This production cost is the sum of the costs directly associated with production of the services (direct costs) and all the other costs assigned to OpenAir to produce and deliver the services (indirect costs).

Cost allocation: The total costs are allocated/apportioned to specific individual services based on the proportion of resources used by OpenAir to produce each service.

It is common in regulated sectors to use a cost allocation approach to identify the unit rate of a service. The unit rate is used as the basis of the charging structure so that the price (or tariff) paid by customers for the service they receive is the combination of the unit rate and other factors, also known as service-specific cost drivers.

OpenAir is being designed to provide a range of services to its users, so the proposed charging scheme would reflect resultant differences in the services provided.

Figure 4: NATS OpenAir cost allocation



The charging structure we envisage for OpenAir would follow a cost-reflective principle and apply a cost allocation approach to any services, facilities or data provided by third parties to OpenAir including, for example, other parts of NERL. This approach would ensure that:

- OpenAir recovers the cost of producing its services from customers in a fair and transparent manner;
- these costs include the direct costs of producing OpenAir services (labour, investment depreciation, maintenance and return on assets, bought-in services and other inputs) as well as an appropriate share of the indirect costs associated with being part of the wider NATS group;
- OpenAir uses objective and consistent cost drivers when apportioning these costs. The cost drivers should be easy to identify via their links to specific services/assets;
- when OpenAir incurs indirect costs from other parts of NATS, such as business support functions and corporate overheads, the current approach on the allocation of intra-company costs and revenues (which has been periodically scrutinised by the CAA as being fit for purpose) should apply. This would provide assurance to users and the CAA that there is no implicit cross-subsidy or misallocation of costs within the NATS group between its separate regulated tills.

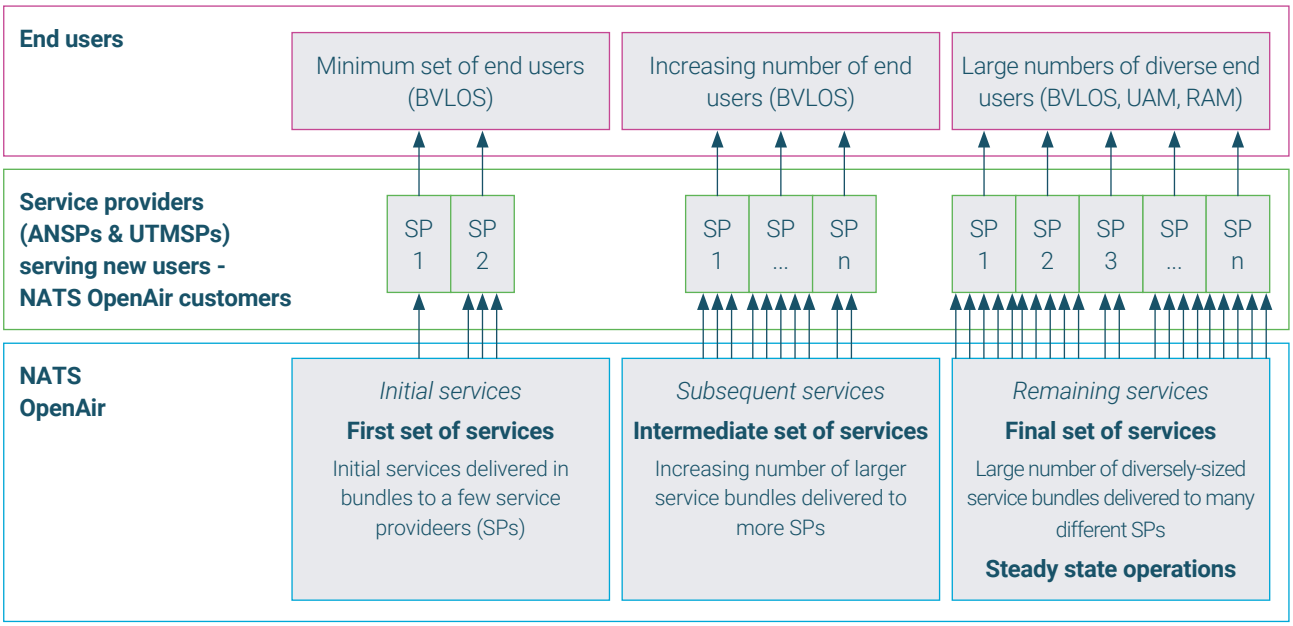
We consider that building on the current cost allocation approach, based on an existing model subject to regulatory oversight, would help the CAA to monitor OpenAir and strengthen confidence among other stakeholders that the cost reflective and cost allocation principles are being correctly applied.

7. Tariff structure proposal

7.4. OpenAir services and charges

In Chapter 4 we describe the OpenAir service offering and consider how it may evolve as the market develops, starting with a set of initial services that would then be expanded. Figure 5 below illustrates how OpenAir services could evolve, building the number of users among the service provider customer base and the range of OpenAir services taken over time by each OpenAir customer.

Figure 5: potential evolution of NATS OpenAir services



We envisage the charging scheme being set up as simply as possible to assist early adoption and easy take up of the services. The initial charge could take the form of a unit rate for a defined unit of service, with a volume factor to increase the charge for higher volume use. This initial charge could then be complemented by a subscription fee, in addition to a usage charge, which would help to share the demand risks between OpenAir and users, as some of OpenAir's start-up costs would be covered by fixed fees and therefore less exposed to market demand.

As the service matures, it is likely that OpenAir would gain insight into the pattern of demand by type of service, geography and time of day, and the nature of the end-user activities that are supported by OpenAir infrastructure services. For example, demand is likely to be concentrated in urban areas and around transport hubs. This would help build a picture of which services are most commercially valuable and could provide the basis charge modulation based on willingness/ability to pay factors. We propose to introduce a charge that is proportionate to the size of the user and based on the volume of service used. This could encourage a wider variety of users across the full range of OpenAir services.

In line with ICAO and other charging principles, we would consult with users on the evolution of the charging structure and tariff levels in light of updated information about market demand and OpenAir costs. This commitment would be an integral part of the economic regulatory framework governing OpenAir, as described in Chapter 8.

7. Tariff structure proposal

7.5. Stakeholder feedback

In developing our charging model proposals, we have considered feedback emerging from industry engagement and regular update sessions with stakeholders. Overall, stakeholders have expressed a positive consensus on the key principles underpinning our initial charging mechanism. The inclusion in the unit rate definition of cost drivers such as volume modulation and willingness/ability to pay were appreciated and considered essential to guarantee a flexible and fair pricing structure. However, concerns were aired over how user pays, cost-reflective, and fair and equitable principles could be applied in a transparent manner for early adopters of OpenAir services.

In accordance with this feedback we aim to develop a charging mechanism that emphasises:

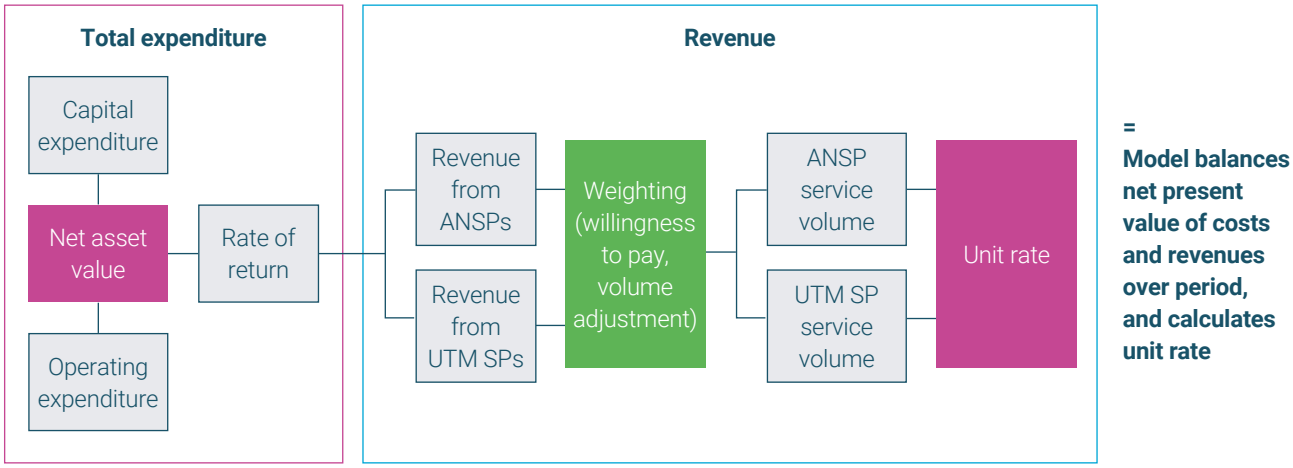
- **simplicity:** a basic charge per service per user per year, not directly related to the flight activity enabled by OpenAir customers;
- **equity:** smaller users should pay less than larger users, based on a scale-factor applied to the basic charge;
- **users pay over time:** cost recovery spread over a period of years;
- **transparency and consultation:** charges to be updated annually taking account of latest demand, revenue and cost inputs and in consultation with users.

7.6. Cost recovery model

Our suggested approach to charging is a simple one based on a 'bottom-up' cost recovery model. In this we combine assumptions on the costs that OpenAir could incur over time to set up and deliver the services, assuming potential take-up of the services over time by OpenAir customers. We then overlay assumptions about the relative scale of different users, and hence their relative willingness/ability to pay. The model is 'solved' to recover all costs over a 15-year period, including cost of carrying investment and operating deficits in the early years.

This model, based on the initial set of input assumptions, then generates a basic charge per OpenAir service per user per year, along with a scale factor adjustment recognising inequalities in cost relative to value.

Figure 6: NATS OpenAir charging model: bottom-up approach



This total expenditure (totex) approach combines both operating and capital costs in one category. Operating expenditure (opex) is typically recovered during the year in which it is incurred, while capital expenditure (capex) is recovered over a longer period. The totex approach allows for the rate of capex and opex recovery to be varied over time, with the sum of costs incurred less revenues received treated as a capital value financed by a return on this capital.

7. Tariff structure proposal

For the purposes of modelling, we have assumed OpenAir services would be developed in three stages, (see Chapter 4, 4.4.2., Table 5) with additional opex and capex incurred at each stage. Our initial cost component assumptions are the following:

- capex is the expenditure needed to develop, implement, transition to service and upgrade OpenAir services. Capital costs are used to build the core OpenAir platform and to develop up to 12 different services. Each service is assumed to be deployed in three stages: pilot, early release, and full deployment. We have made the simplifying assumption of three phases of investment during the cost recovery period, each of which creates a bundle of services. We have applied three cost scenarios (low, medium, and high) to the initial estimates.
- opex is the cost of operating and maintaining OpenAir systems and processes, including internal maintenance and any external support. The scale of opex is assumed to increase in line with the investment cycle – each phase of investment in the next bundle of services is then followed by a period of opex to deliver these services. Opex is then subject to the three cost scenarios as for capex. In addition, we have assumed an efficiency factor per each year after the first year of operation for each bundle of services, reducing opex over time.
- depreciation rate for technology used has been included in our model.

On the revenues side we have made assumptions on:

- **unit rate:** the blended average cost over time that OpenAir incurs in producing a defined unit of a specified service. It is equivalent to the sum of the net present direct and indirect costs divided by the number of expected units of consumption of the service over a given period. It includes the financing costs of investing in the services ahead of revenue recovery, on the assumption of a rapidly rising demand over time as BVLOS and other services become established. The dimensions of the defined units of service may include factors such as complexity of the data requested and managed (measured e.g. by the number of bytes of data transmitted) and duration of the service provided. For modelling purposes, we have assumed a fixed unit rate across the years of the service period. With an assumed rising demand curve over time this serves to shift revenue recovery away from the early years, thereby avoiding penalising early users of OpenAir services.
- **willingness to pay:** charges may be varied by a factor closely linked to OpenAir customers' willingness/ability to pay. This approach is currently applied for UK and European en route ATC charges, which vary by aircraft weight as a proxy for carrying capacity and hence its commercial transport value. By varying charges in this way, the overall costs of the service can be recovered more efficiently from a wide range of users. For OpenAir, service location such as urban areas and transport hubs versus rural settings could be used as a proxy for the underlying commercial value of airspace services and thus form a basis for applying variable charges. When considering ANSPs as OpenAir customers, we have equated willingness/ability to pay with approximate user size.
- **volume modulation:** where the costs of providing a service vary positively with the number of units of service consumed, this factor should be reflected in the charge. For example, this is comparable to NERL's en route services, for which the charge is the product of a unit rate, a distance factor, and a weight factor. The distance factor here represents a greater volume of ATC service consumed and is an approximate measure of the costs driven by longer flights. However, volume modulation does not need to be one-for-one but could instead be used to design tariffs that provide discount mechanisms for large scale consumers: doubling the volume of service consumed would lead to a less-than-doubling of the service charge. This variation could be introduced once the service has reached some maturity and stability, and market demand is easier to forecast.

For the purposes of cost modelling, we have considered the following two OpenAir customer types:

- **Airport ANSPS:** these are categorised as major hub, large, medium, and small airport operators.
- **UTMSPs:** these are assumed to provide UTM services in defined blocks of airspace outside airports and are categorised as large city, town, rural and remote UTMSPs.

In our modelling to date we have used a simplifying assumption that within each customer group, the willingness/ability to pay factor between categories would be approximately 4 to 1, from the largest to the smallest entities. We have also assumed that the largest OpenAir customers would, for the same bundle of services and volume of consumption, pay the same charge. These scale and consumption factors would be evolved as we move towards operational service and a regulated charge to ensure they are based transparently on objective factors reflecting the financial scale of each user and its consumption of OpenAir services.

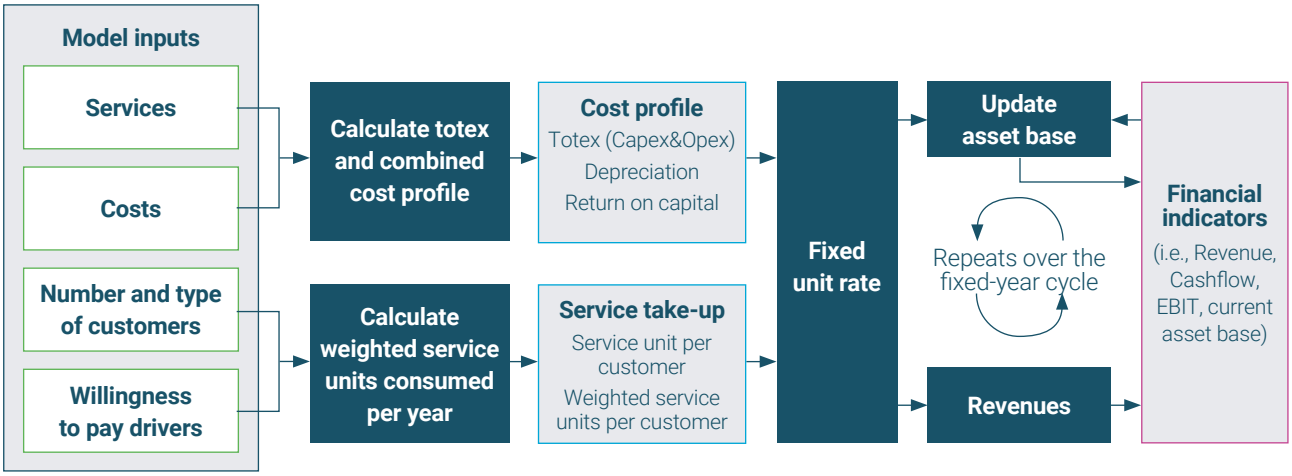
Question 10 relates to '7. Tariff structure proposal' (sections 7.1. - 7.6.): To what extent do you agree or disagree with our proposed cost recovery model? If you disagree, please explain your views.

7. Tariff structure proposal

7.7. Explaining the charging model

In this section we provide a brief description of how the OpenAir charging process would work in practice, as illustrated by the following simplified model:

Figure 7: Charging model



The main inputs to the model are derived from the number of users of OpenAir services and the service they use.

- **Step 1:** Quantify the number of services and associated costs, including capex, opex and an estimate of annual opex efficiency improvements. This would identify the cost profile. Then, based on the number and type of customers combined with their willingness/ability to pay for the service, we can estimate the service uptake. The charging model calculates the cost profile and the service uptake on an annual basis for a fixed 15-year period.
- **Step 2.** Combine the cost profile of the services with their uptake to estimate the fixed unit rate. This fixed unit rate is obtained using net present value of the costs and revenues that are then spread across the length of the investment (assumed to be a 15-year fixed period).
- **Step 3.** Using the unit fixed rate, determine the revenue as the sum of the product of the unit rate and the weighted service units for each customer. We use the revenue to calculate the asset base (revenue minus totex). This ensures the asset value is the result of the capital value and the current value in progress.

7.8. Charges and market demand

To determine the affordability of our charges we have used the market demand forecast (see Chapter 6) and compared these values with our bottom-up cost recovery model.

Based on our professional knowledge and our desk research (including academic, government and industry reports) we have developed assumptions on user case value of flights (i.e. low medium and high) and on the potential share of revenue OpenAir could capture from providing its services to customers. Our research indicates that, in the current air traffic management market, ANSPs typically earn approximately 5% of the average value of the flights they serve. We have adopted this as a starting assumption for the purpose of scaling the potential revenue available to OpenAir customers supporting new airspace users. We have made a further assumption that customers would be able and willing to pay a fee towards OpenAir that is equivalent to 1% of the revenue value of the flight. So, for example, a BVLOS delivery flight for which the cargo owner paid the drone operator £100 would, on the basis of these assumptions, result in revenue to an OpenAir customer of £5 from the drone operator for its UTM services, and revenue of £1 from this customer to OpenAir.

7. Tariff structure proposal

7.9. Summary

Feedback from our previous industry and stakeholder engagement has indicated a market preference for a simple and flexible tariff structure that would neither limit growth nor overload businesses with complex bureaucratic process.

Accordingly, subject to consultation with users and following the economic regulatory framework discussed in Chapter 8 of this document, we propose a flat annual tariff structure for OpenAir that would be tailored to take into account different use types (ANSP/UTMSP), with charges fixed for the first year.

Question 11 relates to '7. Tariff structure proposal' (sections 7.7. - 7.9.): To what extent do you agree or disagree with our preferred tariff structure? If you disagree, please explain your views.

8. Economic regulatory framework

8.1. Introduction

In this chapter we outline our proposal for an economic regulatory framework for NATS OpenAir, the shape of which has been informed by feedback from industry, government, and the regulator.

During the course of ongoing engagement with a wide range of stakeholders we have explored three options for an economic regulatory framework:

- **option 1:** light touch, 'by exception' regulation;
- **option 2:** price and performance monitoring;
- **option 3:** cost-based price control.

Taking into account the early stage of market development and the need to allow for innovation, our initial preference was for option 2 as a good balance between regulatory oversight and the flexibility to tailor services, investments, costs, and charges to the market demands. Stakeholder feedback has supported the further development of a regulatory framework such as could support the growth of this emerging market, ensure appropriate customer protection, and provide enough tools for regulatory intervention.

This chapter explores this preferred way forward, focusing on:

- setting an economic regulatory framework;
- developing a price, performance, and monitoring regulatory model;
- establishing fair, reasonable, and non-discriminatory regulation.

8.2. Setting an economic regulatory framework

This section provides an overview of the goals the CAA could set for the economic regulation of OpenAir operating in an emerging and innovative new airspace user market – see Table 9 below:

Table 9: Regulatory framework goals for NATS OpenAir

Regulatory framework goals	Means
Evolve over time	The regulatory framework should respond to emerging evidence about market structures, user demand, and a cost-effective means of delivering services to enable the safe and efficient use of integrated airspace. Changes in technology, ways of operating, and user demand could alter the degree of market power that OpenAir possesses – this should result in changes to the degree of regulation required to meet the CAA's statutory duties and strategic priorities.
Support investment and deployment of services	The regulation should enable the integration of new airspace users, contribute to the delivery of the Airspace Modernisation Strategy, and support economic growth.
Enable technology and innovation	The economic regulation of OpenAir should enable innovation and the rapid deployment of technology to support any new services that may evolve to meet users' demands.
Balance the risks of regulatory control	Intense anti-monopolistic regulation in the early stages of market development could have the unintended consequence of slowing innovation, investment and the delivery of new services, to the detriment of future users.
Limit regulatory burden	The costs of compliance should be proportionate to the economic value generated by the regulated services and the risk to consumers. In the early years of market development a lighter-touch approach may be more proportionate than a more prescriptive regime.

8. Economic regulatory framework

Accordingly we propose the CAA regulates OpenAir by developing a framework that is:

> proportionate and flexible;

> supportive of innovation and in service of wider UK airspace and economic growth strategies;

> predictable and understandable, to avoid unintended consequences;

> cost effective and cost efficient, to generate benefits while minimising compliance costs;

> outcome-based, designed to achieve specific results.

8.3. Price and performance and monitoring model

The central concept behind a price and performance and monitoring regulatory framework is to provide the regulator with information and the power to intervene promptly, if required, while relying primarily on the regulated company to supply services at a reasonable price and quality according to principles of fair dealing. In this model, the regulated company sets the terms of its services, informed by regular engagement and consultation with users, and the regulator observes and monitors the outcomes and conduct of the regulated company. The key features of such a regulatory framework would be:

> the CAA's clear expectations are set out in advance for the fair operation of specified services;

> OpenAir has the flexibility to develop its services, costs, and charges;

> OpenAir would report regularly on financial and performance data, enabling real-time monitoring;

> the CAA would have defined powers to step in and correct any identified failings.

In Table 10 below we summarise the main regulatory features linked to a price and performance monitoring approach.

Table 10: Price and performance monitoring approach features

Feature	Explanation
Fair, reasonable, and non-discriminatory principles for the pricing and supply of services	This provides some discipline on the behaviour of the regulated company by setting out standards in advance, against which it can be challenged by users and/or the regulator if it is perceived to have deviated materially to the detriment of users. It has been applied extensively in the field of intellectual property, where patent holders have a monopoly in specific technology, and in broadcasting regulation (Ofcom's regulation of electronic programme guides, for example, and access control provided by television platform services).
Fair dealing principle, preventing undue preference or discrimination in the provision of services	This would place a clear obligation on the regulated company to provide fair terms to all users; it would not be able to offer favourable terms to some users to exploit its service provision market power. To enable growth in the new airspace user market, maintaining effective competition in the provision of services would be crucial; a fair dealing obligation placed on OpenAir would be one means for the regulator to influence outcomes and to avoid abuse of market power.
Transparency of charges and costs	This requires the regulated company to publish its charges and the method for determining its charges, terms, and conditions, and to keep separate financial accounts regarding its operation of the specified services. By providing up to date and explanatory cost and revenue information to all stakeholders OpenAir would demonstrate openly that it was not obtaining undue advantage from its market position. Regular reporting would enable OpenAir to evolve its services, cost base and tariffs flexibly over time, while keeping market participants and the regulator fully informed. Separate accounting for OpenAir costs and revenues would allow the regulator to scrutinise the allocation of costs between each of the regulated entities within the NATS group, and therefore to detect and deter any cross-subsidy and assess the rate of profit or loss over time.

8. Economic regulatory framework

Feature	Explanation
Transparency of service performance	This requires the regulated company to publish its proposed service coverage and performance indicators and targets, set against its achieved outcomes. This would provide up-to-date and relevant information for the user and the regulator to assess ongoing performance. Unlike a more formal price control, the service indicators and targets would be defined and set by OpenAir after consulting users rather than the regulator; there would be no financial incentives specified in advance for over- or under-performance against targets.
Consultation and engagement obligation	This places a responsibility on OpenAir to consult regularly and effectively with its users on all dimensions of the services offered, in addition to being required to publish cost, charging and service data.
Regulatory powers to investigate and to impose remedies	This subjects OpenAir to the possibility of investigation by the CAA, either on its own initiative or in response to user complaints. The prospect of market investigation and resultant remedies (such as enforced price reductions or changes to terms of supply) would act as an ongoing incentive for OpenAir to comply with the regulatory guidelines.

8.3.1. Advantages and disadvantages

The advantages and disadvantages of such a price and performance monitoring approach are summarised in Table 11 below.

Table 11: Advantages and disadvantages of the price and performance monitoring option

Advantage	Disadvantage
Ease of implementation – this approach would allow OpenAir to develop its service offering and to establish regular services for customers while remaining transparent.	**Setting expectations of acceptable performance** – in the absence of historical performance data, there could be a wide range of views in the market about acceptable levels of service and price as well as the financial return that OpenAir should expect to earn.
This approach **does not require historical data** in order to establish a regulatory framework. This approach ensures the **CAA receives relevant information on a regular cycle** to enable active performance monitoring. The CAA would retain the power to increase reporting frequency, and the power to intervene as appropriate.	**Absence of historical performance** – in the early years of the evolution and delivery of services, there would be an absence of data on which to make firm regulatory findings, potentially making it difficult for the CAA to reach a decision.
Balance of service flexibility and regulatory control – this approach would enable the CAA to exert a reasonable level of control over OpenAir via the regular reporting process, the imposition of principles governing its behaviour, and the CAA's power of intervention to investigate and seek remedies.	**Uncertainty over the CAA's decision** could inhibit OpenAir's investment decisions as well as users' engagement in the market. The CAA could mitigate this risk through guidance on its approach to assessing potential market abuse and a commitment to set a high bar for any intervention in the early years of market development

A price and performance monitoring approach would allow OpenAir to retain flexibility to develop its services and charging policies while operating within a comprehensive regulatory market structure. The CAA could monitor OpenAir's overall performance via OpenAir's published information, and step in as and when necessary to investigate any apparent abuse of market power.

Question 12 relates to '8. Economic regulatory framework' (sections 8.1. - 8.3.1.): What are your views on our preferred economic regulatory framework? Please explain.

8. Economic regulatory framework

8.4. Fair, reasonable, and non-discriminatory regulatory model

Our preferred regulatory approach as governance for OpenAir is based on the fair, reasonable and non-discriminatory (FRAND) model. In this section we provide a description of the FRAND model, how it has been applied to other sectors and why we think this model would be suitable for the economic regulation of OpenAir.

The central duty of an economic regulator[17] is typically to promote the interests of users of a service provided by a supplier holding a monopoly or enduring market power. The presence of regulation, put in place ex ante, is to deter the regulated supplier from seeking to abuse its position of market power. This is in contrast with most markets that are not subject to economic regulation in which a regulator can step in ex post to investigate any company alleged to have sought to abuse a position of market dominance or to have substantially lessened competition such as via merger.

FRAND monitoring and pricing rules are a form of ex ante regulation that specifies the principles to which the regulated company should adhere in its dealings with its customers. In establishing rules of conduct and enforcing transparency, the regulator can more easily monitor performance and judge whether the regulated company is operating fairly, and step in as required to enforce 'correct' behaviour. FRAND provides a continual incentive for the regulated firm to self-police, while providing some leeway on the precise means by which it demonstrates its services and charges are fair.

Adopting a FRAND model for OpenAir could be an efficient means of:

- protecting users' interests by disciplining OpenAir to seek to deliver a fair outcome;
- providing timely information for users and the CAA to assist in monitoring and thus inform any enforcement actions by the regulator;
- providing sufficient flexibility for OpenAir to adjust its services, costs and terms in light of the latest evidence while providing sufficient incentives for it to invest, thanks to the prospect of recovering its costs including that of risk capital.

The FRAND model has already been applied to a range of markets (e.g. financial services[18], EU digital market services[19] [20] and telecoms[21]) in which suppliers hold a degree of market power by virtue of the nature of their product, such as Standard Essential Patents (SEP). There are some parallels with the market structure in which OpenAir would operate, for example an emerging market and the need for users to access 'essential facilities' such as those that would be supplied by OpenAir.

In the SEP case, patents represent the means through which the patent owner secures a degree of market power, enabling it to control the use of its intellectual property and thus generate revenue sufficient to recover the investment costs needed to create the IP and incentivise future such investment. The essential nature of some patents, linked to industry standards, could lead to increasing monopoly power for the patent owner. The FRAND regulatory model provides a constraint on the exploitation of essential intellectual property, while at the same time encouraging investment in the development of new technology and the wide adoption of services that are accessible to all potential customers. The provision across the market of services that embody industry standards is beneficial for consumers, as they facilitate the interoperability of devices and systems[22]. Such interoperability among new airspace users and service providers, supported by the use of open standards as far as possible and by fair access and pricing, is a core feature of our integrated airspace proposals.

[17] The Transport Act 2000 sets out the CAA's statutory duties to which it must have regard when performing its function of licensing air traffic services in the UK. The CAA's principal duty is safety, and it is required to balance its secondary duties. The CAA is also required to impose on licence holders the minimum restrictions that are consistent with the exercise of its licensing functions and may further airspace users' interests by promoting competition in the provision of air traffic services.

[18] Financial Conduct Authority (June 2015), Fair, reasonable and non-discriminatory access to regulated benchmarks (link)

[19] Frontier Economics (2021), Fair, reasonable and quite unclear "FRAND" conditions in the EC's Digital Markets Act (link)

[20] Frontier Economics (2022), FRAND in the DMA. The quest for a fair price in the digital world (link)

[21] Frontier Economics (2021), Access all areas? Lessons from telecoms as regulators debate what to do with digital giants (link)

[22] An example is the cellular standards like 2G, 3G, 4G and 5G that allow devices to exchange data, even if they are produced by different manufacturers. To implement any standard, there is a set of technologies that are 'essential' and patents covering these essential technologies are SEP (source: Kalmus C. et al (2024) "What are Fair and Reasonable prices? Making a flexible concept tractable")

8. Economic regulatory framework

8.4.1. Application of the FRAND regulatory model to NERL

In this section we explore how the FRAND regulatory framework could be used to guarantee that OpenAir's customers have fair access to the services and that there is a transparent process preventing market power exploitation.

Our preferred regulatory model has some similarities with an existing economic regulatory framework for one of NERL's Specified Services, the North Sea Helicopter (NSH) Advisory Service. The regulatory requirement for full consultation built into this framework provides protection for customers, ensuring NERL provides a fair and transparent cost-based service.

Economic regulation of the North Sea Helicopter (NSH) Advisory Service

The NSH Advisory Service is a Specified Service under NERL's licence. It is a delegated service, delivered by NATS Services Ltd (NSL) at Aberdeen Airport. NERL purchases the NSH service from NSL and then recovers the costs via a charge on the operators of helicopters flying in the relevant areas of the North Sea. The costs and revenues of the NSH service are included in NERL's UK air traffic service single till.

Condition 23 of NERL's licence states:

'Charges for North Sea Helicopter Advisory Service

The Licensee shall, not less than one month before it intends to give effect to such charges, or to changes to the basis on which they are calculated, show to the reasonable satisfaction of the CAA that charges in respect of North Sea Helicopter Advisory Services for any period have been set following, and taking into account the outcome of, appropriate consultation with Users and other interested parties.'

The main features of this regulatory framework are as follows:

- as with all other regulated NERL Core and Specified Services, NERL is required under its licence to operate in a non-discriminatory manner and on the basis of terms that are themselves not unduly discriminatory between different users.
- NERL is required to run a consultation with its NSH users and stakeholders. The minutes of the consultation meeting are shared with the CAA, consultees, and stakeholders. The consultation document outlines NSH service performance and includes updates on actual traffic movements, planned investments including an explanation of how investments might influence future charges, service quality, traffic forecasts, and proposed charges for the next year.
- NSH users are invited to the consultation and have the power to challenge the proposed charges.
- The CAA monitors service price and performance on the basis of the information NERL submits. If the CAA were to judge NERL was not fulfilling its licence obligation (for example, by failing to consult properly with users or not demonstrably taking into account their views when setting charges), the CAA could find NERL in breach of licence and impose remedies and/or a fine.
- The CAA has no explicit power in the licence to intervene specifically in relation to the charges for or the quality of the NSH service. But, as with other regulated services, the CAA does have the power to propose licence modifications to address any perceived shortcomings in NERL's performance. Any such changes must be in accordance with the CAA's own statutory duties, be subject to a formal consultation process, and could be appealed by NERL and/or users of the service or others affected by it to the Competition & Markets Authority.

8. Economic regulatory framework

Under a FRAND regulatory model, we envisage the inclusion of a fuller licence specification for OpenAir (compared with the NSH service example, above) of the principles to which it must adhere in providing services, and the terms on which services would be supplied. Such specification could include the following requirements:

- to provide services on a fair, reasonable, and non-discriminatory basis;
- to supply services within a specified timeframe;
- to supply services at a reasonable commercial price, taking into account the price of supply to other users;
- to propose different fees for different users only when this is objectively justified on reasonable commercial grounds such as the quantity, scope, or field of use requested, and/or with regard to the objective of efficient recovery of central costs across all users who vary in the commercial value they place on the services supplied.

The licence could then specify criteria for the CAA to consider when assessing whether OpenAir's operation adequately meets FRAND principles. These could include:

- the degree of competition and potential competition in the market for the supply of the specified services;
- whether the aggregate of the fees charged to users bears a reasonable relationship to the costs and risks of producing the specified services, including a reasonable return on capital;
- whether the fees charged for the specified service would prevent an efficient competitor from competing effectively in the downstream market on a lasting basis;
- whether OpenAir applies dissimilar conditions to equivalent transactions with different users or categories of users, thereby placing them at a competitive disadvantage.

We envisage OpenAir would consult annually with users, the outcome of which would be reported to the CAA. The purpose of consultation would be to ensure customers have a clear understanding of forthcoming investments, operational programme updates including the delivery of new services and/or any changes to planned services, and any other changes that might impact services and/or fees. The consultation process would be simple and transparent, offering users the opportunity to voice their feedback, and could include the following information:

- traffic updates for each user category, comparing actual and forecast traffic levels;
- costs updates, comparing actual and forecast costs;
- operational updates, detailing deployment of planned services and outlining next steps including timeline;
- operational environment updates, including information on planned trials and other activity that may impact service performance;
- summary of proposed charges, comparing previous year/s and analysing factors driving changes.

We would like to hear your views on our preferred economic regulatory framework for OpenAir and welcome any feedback on how our proposal could help shape this evolving market.

Question 13 relates to '8. Economic regulatory framework' (sections 8.4. - 8.4.1.): To what extent do you agree or disagree with our preferred fair, reasonable and non-discriminatory (FRAND) regulatory model? If you disagree, please explain your views.

9. Your Opinion Matters

NATS OpenAir is our proposal for a new regulated service that could enable integrated lower airspace in the UK. Our proposition is the basis of this consultation, although we would also welcome your opinion on alternative new services NERL could in the future provide directly to new airspace users.

Our proposals for OpenAir have been shaped by working with industry and a wide range of other stakeholders. Building on our work so far, we now need to hear from you to ensure we fully understand your needs.

To that end we are seeking your views on the proposed new OpenAir service offering, the best mechanism through which to apply a charging structure, and what you might need from an integrated airspace traffic management system of the future.

Please submit your written responses online to our consultation questions by 31 January 2025, giving as much detail as possible on the questions you feel are most relevant to you. You are not required to answer all the questions, which have been summarised below, only those that apply to you or about which you have an opinion. Thank you!

9.1. Questions about you

Please state your

> organisation

> role

Please select the type of company / activity your organisation carries out

> ANSP

> UTMSP

> drone operator

> eVTOL operator

> general aviation

> oversight/regulator

> other (please state)

How many employees does your organisation have?

> up to 25

> between 26 and 100

> between 101 and 500

> between 501 to 1000

> more than 1001

Please select the services you are currently providing

> transport

> delivery

> inspections

> leisure

> military

> data provider

> technology provider

> other (please state)

> none

Which of the services outlined in the question above are you planning to provide next, if any?

> transport

> delivery

> inspections

> leisure

> military

> data provider

> technology provider

Which airspace classes are relevant for your services? (tick all those that apply)

> Class A

> Class C

> Class D

> Class E

> Class G

9. Your Opinion Matters

9.2. Consultation questions

Question 1: To what extent do you agree or disagree with our assessment of the requirements for a UK-wide SWIM data network for UK lower airspace as outlined in Tables 1 and 2? [ref. Chapter 2, 2.4.2]. Please explain your comments or provide any alternative suggestions.

Question 2: To what extent do you support our OpenAir proposition as a response to the requirements for a UK-wide SWIM data network for UK lower airspace? [ref. Chapter 3, 3.4 – see also Chapter 2]. If you don't support our OpenAir proposition, is there an alternative you favour?

Question 3: How strongly do you support each Traffic Information Service option? [ref. Chapter 4, 4.3.2] (where 5 is strongly support and 1 is strongly against). Please explain your views.

Question 4: How likely or unlikely are you to use OpenAir services? [ref. Chapter 4, 3.12]. Please explain your views.

Question 5: To what extent do you agree or disagree with the proposed service priorities outlined above? [ref. Chapter 4, 4.4.1]. If you disagree, please explain your views.

Question 6: To what extent do you agree or disagree with the provisional timescale outlined above? [ref. Chapter 4, 4.4.2]. If you disagree, please explain your views.

Question 7: To what extent do you agree or disagree with the data sharing obligations we propose? [ref. Chapter 4, 4.5.1]. If you disagree, what alternative solution do you suggest?

Question 8: To what extent do you agree or disagree that OpenAir would deliver benefits to you or your organisation? [ref. Chapter 5]. If you disagree, please explain your views.

Question 9: To what extent do you agree or disagree with the PwC estimates for total commercial BVLOS and eVTOLs by 2035? [ref. Chapter 6, 6.4]. If you disagree, please explain your views.

Question 10: To what extent do you agree or disagree with our proposed cost recovery model? [ref. Chapter 7, 7.6]. If you disagree, please explain your views.

Question 11: To what extent do you agree or disagree with our preferred tariff structure? [ref. Chapter 7]. If you disagree, please explain your views.

Question 12: What are your views on our preferred economic regulatory framework? Please explain. [ref. Chapter 8, 8.3.1].

Question 13: To what extent do you agree or disagree with our preferred fair, reasonable and non-discriminatory (FRAND) regulatory model? [ref. Chapter 8, 8.4.1]. If you disagree, please explain your views.

Question 14: Do you have any other comments about our OpenAir proposition that have not been covered by your answers to the above questions?

10. Next Steps

This consultation is an essential part of the development of our potential new NATS OpenAir services. We have followed government guidance and applied best practice to present our proposition in a fair, transparent, and effective manner in order to gather feedback on our proposals.

We intend to collect, categorise, and analyse your responses so that we can outline the main conclusions and identify any aspect of our proposition that may need further elaboration. The timeline for our consultation process is outlined in Table 12 below.

Table 12: NATS OpenAir consultation timeline to June 2025

Timeline	Key Activities
25 November 2024	Phase 2 consultation begins
31 January 2025	Phase 2 consultation closes
Q1 2025	Phase 2 consultation feedback is collated and analysed
Spring 2025	Proposals for new OpenAir service definitions and charging mechanisms are further developed and finalised, incorporating industry input and consultation feedback
June 2025	OpenAir final proposal submitted to the CAA

Glossary of terms & abbreviations

Term	Definition
AAM	Advanced Air Mobility. Air transportation services for people and/or cargo between places local, regional, intraregional, urban – using revolutionary new aircraft that are only just now becoming possible (source: NASA).
Airspace Classification	Airspace is broken down into different classes, defined by ICAO. In the UK, Classes A, C, D and E are controlled airspace and Class G is uncontrolled airspace. Classes B and F are currently unused in the UK.
Airspace Change Proposal	Airspace change proposals are requests from a 'change sponsor', usually an airport or a provider of air navigation services (including air traffic control), to change the notified airspace design. Airspace change proposals must follow the CAA's airspace change process.
Airspace Manager	An organisation that co-ordinates and manages the movement of air traffic within defined areas of airspace, ensuring flights can operate safely and efficiently and ensuring equal access to airspace.
ADS-B	Automatic Dependent Surveillance - Broadcast is a surveillance technique where an aircraft broadcasts information about its GPS location, altitude, ground speed and other data to ground stations and other aircraft, once per second.
AIP	Aeronautical Information Publication. A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation. (UK Reg (EU) No 923/2012 Article 2(13)).
AMS	Airspace Modernisation Strategy.
ANSP	Air Navigation Service Provider. Any public or private entity providing ANS for general air traffic, including an organisation having applied for a certificate to provide such services. (UK Reg (EU) No 1035/2011 Article 2(15).
ATS	Air Traffic Service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service). (UK Reg (EU) No 923/2012 Article 2(32)).
ATC	Air Traffic Control.
ATM	Air Traffic Management. The aggregation of the airborne and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations. (UK Reg (EC) No 549/2004 Article 2(10)).
ATMSP	Air Traffic Management Service Provider.
Autonomous Aircraft	An unmanned aircraft that does not allow pilot intervention in the management of the flight. ICAO Doc 10019: Manual on Remotely Piloted Aircraft System.
Autonomous Operation	An operation during which an unmanned aircraft operates without the remote pilot being able to intervene. UK Regulation (EU) 2019/947.
BVLOS	Beyond Visual Line of Sight. The operation of a Remotely Piloted Aircraft beyond a distance where the Remote Pilot is able to respond to or avoid other airspace users by visual means. (CAP 722).
CAA	Civil Aviation Authority.
Controlled Airspace	An airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification. Note: Controlled airspace is a generic term which covers Classes A, C, D and E airspace in the UK. ICAO Annex 11.
CTA	Control Area. Controlled airspace extending upwards from a specified limit above the earth. (UK Reg (EU) No 923/2012 Article 2(56).

Glossary of terms & abbreviations

Term	Definition
CTR	Control Zone. Controlled airspace extending upwards from the surface of the earth to a specified upper limit. (UK Reg (EU) No 923/2012 Article 2(61)).
Datalink	A term referring to all interconnections to, from and within the remotely piloted aircraft system. It includes control, flight status, communication, and payload links. JARUS SORA.
DAA	Detect and Avoid. The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action to comply with the applicable rule of the air. ICAO Doc 10019: Manual on Remotely Piloted Aircraft Systems.
Deconfliction Instructions	Instruction issued by a controller to pilots in receipt of a Procedural Service, which if complied with, shall achieve deconfliction minima against other aircraft participating in the Procedural Service. (CAP 774).
Deconfliction Service	A Deconfliction Service is a surveillance based ATS where, in addition to the provisions of a Basic Service, the controller provides specific surveillance derived traffic information and issues headings and/or levels aimed at achieving planned deconfliction minima against all observed aircraft in Class F/G airspace, or for positioning and/or sequencing. However, the avoidance of other traffic is the pilot's responsibility. (CAP 774).
DMARES	Drone and Model Aircraft Registration and Education Scheme.
DSS	Discovery Synchronisation Service.
EC	Electronic Conspicuity. It is an umbrella term for a range of technologies that can help airspace users to be more aware of other aircraft in the same airspace.
eVTOL	Electrical Vertical Take-Off and Landing Aircraft. A major subset of VTOL often used interchangeably – the "e" referring to electric engine used for propulsion, or in part (i.e. 'hybrid').
FFIG	Future of Flight Working Group.
FIS	Flight Information Service. A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. (UK Reg (EU) No 923/2012 Article 2(77)).
FIS-B	Flight Information Service Broadcast works alongside ADS-B to provide meteorological and aeronautical data to the cockpit.
FRZ	Flight Restriction Zone. Airspace of defined dimensions around a protected aerodrome consisting of the aerodrome traffic zone, any runway protection zones and any additional boundary zones, within which the permission of the relevant ATS unit or aerodrome operator, as appropriate, is required before a UAS flight can take place. ANO 2016: Articles 94A and 94B.
GA	General Aviation.
Geo-Awareness	A function that, based on the data provided by the CAA, detects a potential breach of airspace limitations and alerts the remote pilots so that they can take immediate and effective action to prevent that breach. UK Regulation (EU) 2019/947.
Geo-Fencing	An automatic limitation of the airspace a UA can enter.
ICAO	International Civil Aviation Organisation.
ITM	Integrated Traffic Management.
Meteorological information	Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions. (ICAO PANS-ATM (Doc 4444)).
Remote Pilot	A natural person responsible for safely conducting the flight of an unmanned aircraft by operating its flight controls, either manually or, when the unmanned aircraft flies automatically, by monitoring its course and remaining able to intervene and change the course at any time. UK Regulation (EU) 2018/1139.

Glossary of terms & abbreviations

Term	Definition
SDSP	Supplementary Data Service Providers. They offer additional data services and information to inform decision-making and tailor services to the environment, sector or geography of drone operations, e.g., weather services, geographical information services (terrain and obstacle data), surveillance data and aeronautical information.
SUA	Special Use Airspace. A defined volume of airspace designated for operations of a nature such that limitations may be imposed on aircraft not participating in those operations and segregation of that activity is required from other users. It is the general term overarching all type of the airspace that could be used for military purposes. SUA could be subject of application of different ASM levels. (CAP 740).
SWIM	System Wide Information Management. It is a concept that consists of standards, infrastructure and governance for the exchange and management of ATM information between approved parties.
Traffic Information	Information issued by an air traffic services unit to alert a pilot to other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision. (UK Reg (EU) No 923/2012 Article 2(132)) Note. Traffic information may also be passed between ATS personnel.
Traffic Service	A Traffic Service is a surveillance ATS, where in addition to the provisions of a Basic Service, the controller provides specific surveillance derived traffic information to assist the pilot in avoiding other traffic. Controllers may provide headings and/or levels for the purposes of positioning and/or sequencing; however, the controller is not required to achieve deconfliction minima, and the pilot remains responsible for collision avoidance. (CAP 774).
TIS-B	Traffic Information Service Broadcast is a service that provides ADS-B equipped aircraft with surveillance information about aircraft that are not ADS-B equipped.
Transponder	A receiver/transmitter which will generate a reply signal upon interrogation. (CAA).
TMZ	Transponder Mandatory Zones. Airspace of defined dimensions wherein the carriage and operation of pressure-altitude reporting transponders is mandatory. (UK Reg (EU) No 923/2012 Article 2(136)).
TRA	Temporary Reserved Area. A defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily reserved, by common agreement, for the specific use by another aviation authority and through which other traffic may be allowed to transit, under ATC clearance. (EUROCONTROL Airspace Management (ASM) Handbook).
UA	Unmanned Aircraft. Any aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board. UK Regulation (EU) 2018/1139.
UAM	Urban Air Mobility. Air transportation service(s) for people and/or goods ('cargo') in a city or other urban environment(s).
UAS	Uncrewed/Unmanned Aircraft Systems. An Unmanned Aircraft System comprises individual 'System Elements' consisting of the Unmanned Aircraft (UA) and any other System Elements necessary to enable flight, such as a Remote Pilot Station (RPS), Communication Link and Launch and Recovery Element. There may be multiple UAs, RPS or Launch and Recovery Elements within a UAS. (CAP 722).
UK FIS	The suite of air traffic services detailed in CAP774.
Uncontrolled Airspace	Airspace with a classification that does not fall under Controlled Airspace. E.g. Class G airspace. JARUS SORA.
User Case	An operation or single set of operations outlining its goals and operating environment. An illustrative example of an Integrated Traffic Management (ITM) concept.

Glossary of terms & abbreviations

Term	Definition
USS	UAS Service Supplier.
UTM	Uncrewed Traffic Management. A specific aspect of air traffic management which manages UAS operations safely, economically, and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions. A UTM system is a tool for managing uncrewed aircraft to ensure mid-air collisions are avoided. A UTM Provider is an organisation that provides this service.
Uncrewed Aircraft	In the context of BVLOS operations, the aircraft is an uncrewed remotely piloted system that may be operated using automatic pre-programmed flight.
UTMSP	Uncrewed Traffic Management Service Provider.
VLOS	Visual Line of Sight. A type of UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to other aircraft, people and obstacles for the purpose of avoiding collisions. UK Regulation (EU) 2019/947.