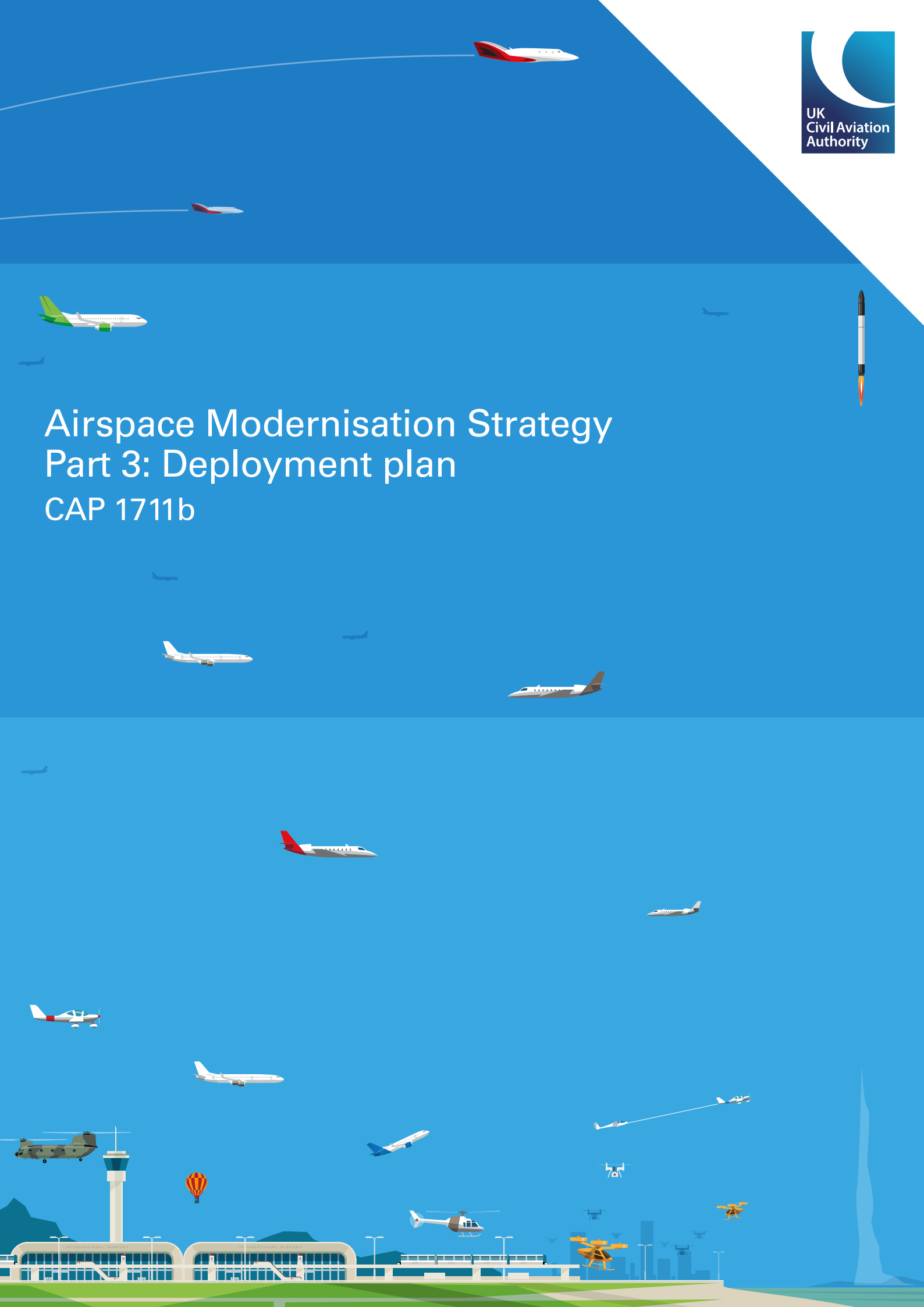
UK Civil Aviation Authority

Airspace Modernisation Strategy Part 3: Deployment plan

CAP 1711b



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Foreword by the co-sponsors of airspace modernisation

In January 2023, following an extensive engagement, the CAA published the first two parts of the UK's Airspace Modernisation Strategy (AMS).

This publication separated the strategic vision (AMS Part 1: Strategic objectives and enablers) from the specific elements needed to deliver the vision (AMS Part 2: Delivery elements). Following the UK's departure from the European Union Aviation Safety Agency (EASA), the 2023 AMS fulfils an important role including:

- Ensuring the UK meets its obligations to the ICAO Global Air Navigation Plan
- Shaping the future of the Assimilated European regulation known as the Pilot Common Project
- Maintaining strategic interoperability alignment with our neighbouring states, and
- Charting a strategic pathway for the safe integration of 'new entrants' (for example space launches, drones, high-altitude platforms) into the UK's airspace, while ensuring more existing users can access more airspace than ever.

We are now publishing the third and final part of the Strategy, which sets out a technical deployment roadmap (AMS Part 3: Deployment plan).

Over the last year the CAA has, in consultation with its airspace and air traffic management policy subject matter experts, NERL and others, looked in detail at the various delivery elements. The CAA's Airspace Modernisation team have mapped these elements against the competencies and resources available to develop a viable 'two plus five year' delivery framework. Those elements listed within the 'two plus five year' window are subject to detailed planning of their near-term tasks, while those beyond 2030 are only provided as an overview, with many of these being dependent on earlier deliverables or not required either by the Global Air Navigation Plan or the UK Pilot Common Project before then.

The AMS Part 3 portfolio represents a programme delivery plan supporting over 100 projects, with 23 of these already in progress, including the Future Airspace Strategy Implementation (FASI) Airspace Change Programme. Nearly half of the projects in this Part 3 iteration are being progressed by industry partners. This delivery plan will enable all stakeholders to better understand the route to achieving a holistic modernisation of airspace; from underpinning operational policies and clearly sequencing milestones, to outlining dependencies between the various delivery elements. In turn, this should allow all parties to plan their delivery activities with more certainty moving forward.

As the UK operates a Joint and Integrated (J&I) approach to airspace policy, planning and management, as well as to the provision of Air Traffic Services, close cooperation is required between the CAA, Ministry of Defence and NATS (En Route) plc (NERL) to ensure the UK's airspace is managed in a safe, orderly and efficient manner. One of the guiding principles of J&I is that airspace is a shared resource, apart from airspace segregated for safety reasons, with expeditious access for as many users to as much of it as possible at all times. This integration of airspace users is at the heart of the UK AMS and this Part 3.

It is anticipated that Part 3 will need to be refreshed annually to reflect progress and upcoming milestones which are brought into the 'two plus five year' window. It will also need to be refreshed as required to reflect changes to the Global Air Navigation Plan or as the AMS Parts 1 and 2 evolve.

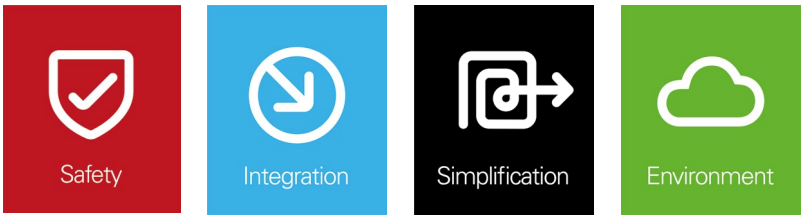
UK Civil Aviation Authority **Department for Transport**
Co-sponsors of the UK airspace modernisation programme

About this document

Airspace Modernisation Strategy

1 The vision of the UK CAA's Airspace Modernisation Strategy (AMS) – a coordinated strategy and plan for the use of UK airspace up to 2040 – is to deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace. The AMS is in three parts (of which this document is Part 3):

- **Part 1** *Strategic objectives and enablers*[1] sets out the strategic objectives for airspace modernisation under four headings:



  Part 1 explains in broad terms the developments in innovation and technology level that will enable those objectives, as well as the governance arrangements for overseeing their delivery.
- **Part 2** *Delivery elements* (CAP 1711a[2]) describes the essential detail of the development activities – known as delivery elements – making up the strategy.
- **Part 3** *Deployment plan* (**this document**, CAP 1711b) sets out CAA progress with delivery plans and activities, including research activities in support of deployment.

More about Part 3

2 Chapter 1 of Part 3 provides an overview of the AMS delivery plans. It explains how these link with other programmes, both international and national, and with policy considerations, under the governance of the airspace modernisation co-sponsors (the UK Department for Transport and the UK CAA).

3 The delivery plans in Part 3 cover a seven-year period, arranged as:

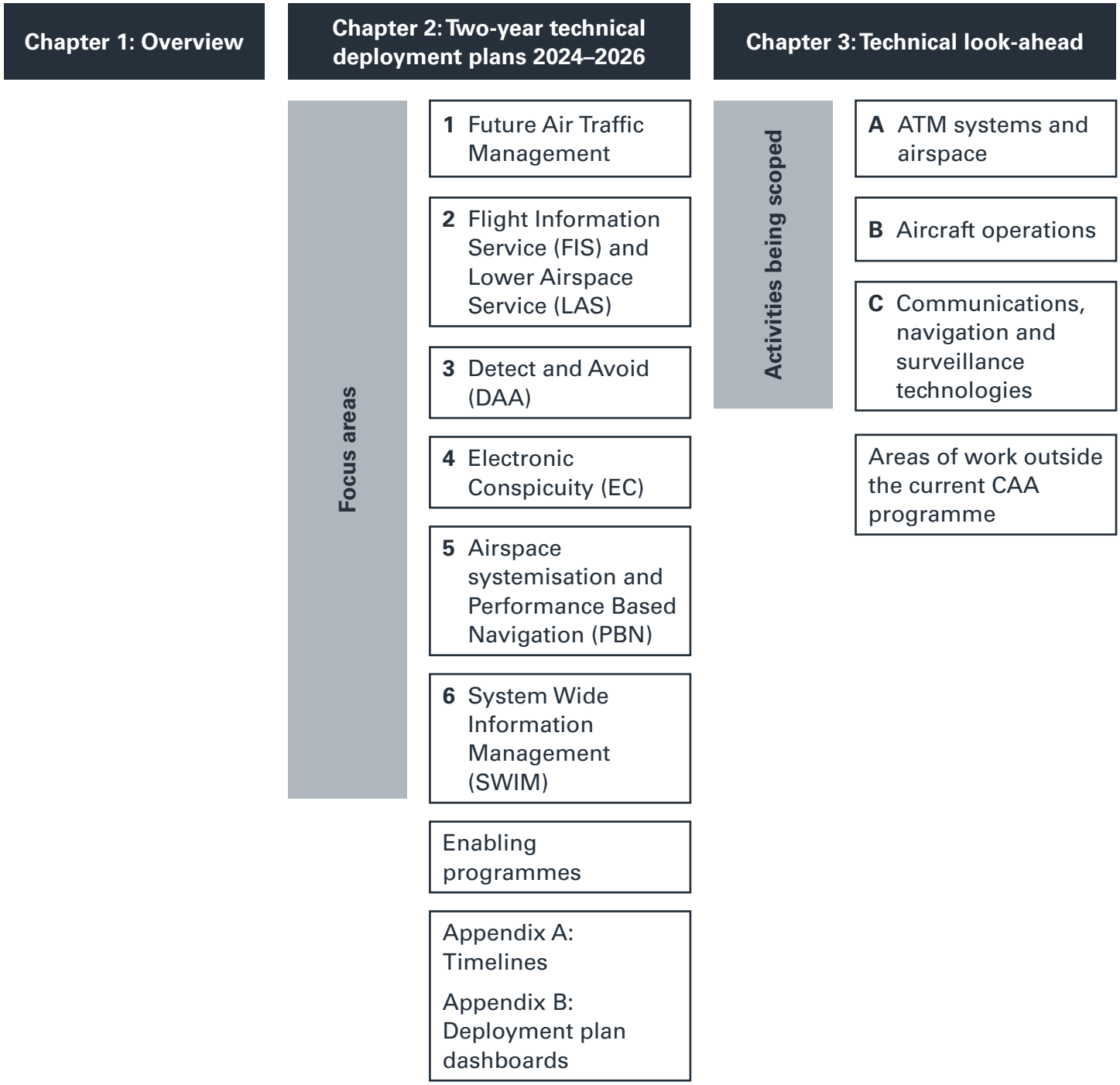
- **Chapter 2, a technical description of the current six CAA focus areas, including committed projects and work that is ongoing or commencing within the next two years.**
- Note that Chapter 2 scope includes only a **summary** of the delivery plans led by industry, although it takes account of them and may refer to them. We intend to include a fuller description of these non-CAA activities in future versions of Part 3, which we expect to publish annually (alongside other AMS progress reports) complete with suitably updated 'two plus five year' plans.

[1] caa.co.uk/cap1711

[2] caa.co.uk/cap1711a

- **Chapter 3, an overview of other CAA activities currently being scoped, arranged under three headings, largely to take place over the subsequent five years.** This chapter offers information on possible nearer-term activities, projects, concepts and challenges that the CAA needs to consider but where detail, clear deliverables and specific timeframes are not currently known.
- **Appendix A, a chart summarising timelines of all committed CAA deliverables,** including those in Chapter 2.
- **Appendix B, deployment plan dashboards listing all committed CAA deliverables,** including those in Chapter 2, and building on Appendix A, to provide greater detail on activities.

4 The diagram below shows the structure of AMS Part 3:



5 After Chapter 1 Overview, Chapter 2, Two-year technical deployment plans 2024–2026, covers six focus areas. These are:

1 Future Air Traffic Management

2 ICAO Flight Information Service (FIS) and Lower Airspace Service (LAS)

3 Detect and Avoid (DAA)

4 Electronic Conspicuity (EC)

5 Airspace systemisation and Performance Based Navigation (PBN)

6 System Wide Information Management (SWIM)

followed by a section about enabling programmes. Related to Chapter 2 are Appendix A, Timelines and Appendix B, Deployment plan dashboards.

6 Chapter 3, Technical look-ahead, covers activities being scoped under three headings:

A ATM systems and airspace

B Aircraft operations

C Communications, navigation and surveillance technologies

followed by a section about areas of work outside the current CAA programme.

Appendix A

8 The chart at Appendix A lists agreed CAA airspace modernisation deliverables with a target date for completion of each deliverable. Further detail on each deliverable can be found in the dashboards at Appendix B.

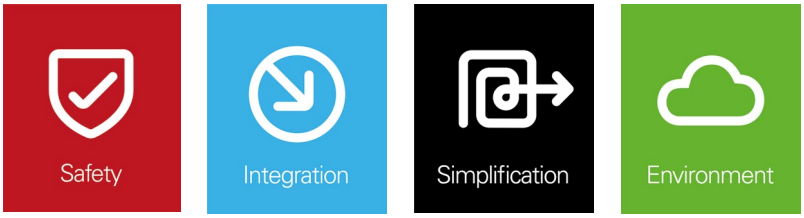
Appendix B

9 The deployment plan dashboards in Appendix B set out further detail for the deliverables listed in Appendix A for which the CAA has an agreed project plan and target date. Each of the deliverables links back to both a specific delivery element in the AMS and the AMS strategic objectives. At the beginning of the appendix is an example showing how to interpret the information shown under each programme of work.

Chapter 1: Overview

Airspace Modernisation Strategy

1.1 This document forms Part 3 to the UK CAA's Airspace Modernisation Strategy (AMS). The co-sponsors' vision and strategic objectives for airspace modernisation are summarised at the beginning of Part 1 of the AMS.[3] The vision is to deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace. The strategic objectives are categorised under four headings: **safety, integration, simplification** and **environmental sustainability**.



1.2 The AMS was refreshed in 2023. It is a coordinated strategy and plan for the use of all UK airspace for air navigation out to 2040, as required by the Air Navigation Directions.[4] It sets out how airspace modernisation will take account of the latest changes and development in innovation and technology. It places integration of all airspace users at its core and seeks to accommodate diverse airspace users such as remotely piloted systems, advanced air mobility and spacecraft.

1.3 The AMS sets out the **ends, ways** and **means** of modernising airspace and is split into three parts:

- **Part 1** *Strategic objectives and enablers* (CAP 1711) describes the **ends**, which are the policy objectives for achieving the shared strategic vision for modernising UK airspace from 2023 to 2040. Part 1 sets out, at a high-level, what will enable those objectives (the **ways**) and governance arrangements for overseeing delivery.
- **Part 2** *Delivery elements* (CAP 1711a[5]) describes how the strategy is being delivered. It includes the essential detail of the development activities – known as delivery elements – making up the strategy, and the **ways** of achieving them (the enablers). It has a linked online database.[6]
- **Part 3** *Deployment plan* (this document, CAP 1711b) sets out deployment activities for the delivery elements in the form of delivery plans and activities, including research activities in support of deployment – the means of delivering modernised airspace.

[3] caa.co.uk/cap1711

[4] The Civil Aviation Authority (Air Navigation) Directions 2023 https://www.caa.co.uk/media/lzrl3drs/caa-air-navigation directions-2023.pdf

[5] caa.co.uk/cap1711a

[6] The database linked to AMS Part 2 is a working tool to help manage industry planning of AMS activities and distribution of available funding, and to support tracking and reporting of deployment activities for each AMS element and sub-element. www.caa.co.uk/cap1711x

Purpose of AMS Part 3

1.4 Modernisation of the UK's airspace and air navigation operational environment is a long-term and complex programme. The AMS Part 3 is a collection of delivery plans in support of the vision, strategic objectives and outcomes described in AMS Parts 1 and 2. Part 3 will be updated more frequently than Parts 1 and 2. Part 3 presents:

- a detailed description of the current six CAA focus areas, including committed projects and work that is ongoing or commencing within the next two years
- an overview of other CAA activities currently being scoped, arranged under three headings, largely to take place over the subsequent five years, including information on possible nearer-term activities, concepts and challenges that the CAA needs to consider but where detail, clear deliverables and specific timeframes are not currently known.

1.5 Part 3 therefore sets out the intended direction of airspace modernisation over the next seven years. This will assist aviation stakeholders with their planning and allow them to better understand the opportunities for them to engage on topics of particular interest.

1.6 Because of the size, complexity and duration of this long-term modernisation programme, the scope of Part 3 is confined to CAA activities. This document is therefore not a complete picture. It does not describe in detail the delivery plans led by the Airspace Change Organising Group (ACOG), NERL or others in support of the AMS, although it takes account of them and may refer to them. We intend to include a fuller description of these non-CAA activities in future versions of Part 3.

1.7 The plans in Part 3 capture work already underway through the original 2018 AMS as well as activity commissioned or completed since we published the refreshed AMS in 2023. It is a first version, drawing together the means of delivering modernised airspace through organised project teams. We will add to and develop these plans as work progresses. We also anticipate that there will be some changes to both Parts 2 and 3 as the aviation landscape continues to evolve, as international and UK policy obligations change, and as we begin to deliver against AMS objectives.

1.8 As well as the content, the method of presentation is likely to evolve as the AMS develops over the coming years. We will consider whether we can present the plans online in a form that is easier for users to interact with and interrogate than the current Part 3 document.

Alignment of the AMS with the ICAO Global Air Navigation Plan

1.9 The AMS is the mechanism by which the UK meets its international obligations to develop and modernise airspace and air navigation systems in alignment with the ICAO Global Air Navigation Plan (GANP). The ICAO GANP is the highest-level air navigation strategic document. It also serves as the plan to drive the evolution of the global air navigation system in conjunction with the ICAO Global Air Traffic Management Operational Concept and Air Traffic Management System Requirements, which span several decades. The AMS was refreshed in 2023, pulling together the initiatives from the original 2018 AMS and those objectives set out in the ICAO GANP.

1.10 GANP uses a guiding deployment framework known as the Airspace System Block Upgrade (ASBU) with workstreams organised into 'threads' and 'elements' (see Chapter 3 of the AMS Part 1). The AMS delivery elements use the ASBU deployment framework, aligned with the ASBU threads.

Reporting

1.11 The Secretary of State for Transport requires the CAA to report on the progress of airspace modernisation on an annual basis. These progress reports can be seen on our website.[7] As a member of EUROCONTROL, the UK is also required to contribute to EUROCONTROL's Local Single Skies Implementation (LSSIP). LSSIP documents provide an annual view of how European Civil Aviation Conference (ECAC) States and relevant stakeholders are progressing in planning and deploying the mature elements of the European Air Traffic Management (ATM) Master Plan. The European ATM Master Plan is the agreed roadmap that connects ATM research and development with deployment activities to achieve the objectives of the Single European Sky.[8]

1.12 The UK has replaced the European ATM Master Plan with the AMS, but as a member of EUROCONTROL the UK is still required to update it on modernisation progress through the LSSIP mechanism.

1.13 Progress against the detailed AMS Part 3 activities informs the UK CAA's annual AMS progress reports to the Secretary of State and reporting to EUROCONTROL in line with LSSIP obligations.

[7] https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy/ams-governance-and-progress-reports/

[8] SESAR Joint Undertaking | European ATM Master Plan (sesarju.eu)

AMS Part 3 versions

1.14 The activity timelines in this document are regarded as a first iteration of Part 3 that provides the foundation for the modernisation programme. This Version 1 is correct as of March 2024. However, we recognise that there are many other activities in progress or planned against the nine AMS delivery elements; therefore we will continue to develop the content of AMS Part 3.

1.15 An annual publication of the AMS Part 3 plan will be delivered in April each year. This will align with the UK CAA's annual AMS progress reports to the Secretary of State and with the EUROCONTROL LSSIP reporting process.

Version 1 seven-year timeframe (two plus five years)

1.16 As explained at the beginning of this chapter, this first version of Part 3 is based around a 'two plus five year' outlook of the modernisation timeframe:

- A **detailed view** of activities that are **ongoing or commencing within the next two years** to support immediate areas of focus. These are activities with greater, short-term planning certainty and form the 'focus area' content of Chapter 2. There are specific, isolated activities taking place within the two-year timeframe that are not included in the Chapter 2 focus areas but are included in both appendices.
- An **overview** of longer-term activities largely required **over the subsequent five years**. This forms the primary content of Chapter 3; however, Chapter 3 also includes some possible nearer-term activities where detail, clear deliverables and specific timeframes are not currently known.

1.17 This approach is aligned with other activities related to airspace modernisation such as the NERL Service Investment Plan (SIP), which simplifies cross-referencing from AMS Part 3 to plans that are external to the CAA.

Role of the airspace modernisation co-sponsors

1.18 The UK Department for Transport and the UK CAA are co-sponsors for airspace modernisation and are working together to deliver the shared strategic vision. The co-sponsors have developed a governance structure for airspace modernisation, designed to oversee delivery of the elements contained within the AMS. The governance structure is set out in Annex A of AMS Part 1.

1.19 The Department for Transport is responsible for development of the legislative and policy framework for airspace modernisation. The CAA is responsible for development of the AMS, including specifying the elements to deliver it and overseeing that delivery.

1.20 The co-sponsors can commission work from delivery entities or a lead in a delivery group, including a delivery plan for each element the entity is delivering. For example, the airspace change masterplan that ACOG is developing under element 2, Terminal Redesign.

1.21 Through the CAA's airspace modernisation oversight function, the co-sponsors monitor delivery of the elements within the AMS by reviewing the high-level metrics and timelines proposed by the delivery entities for commissioned projects. The expectation of the co-sponsors is that these metrics and timelines are signed off at director level by the relevant delivery entities.

1.22 The co-sponsors are the point of escalation on issues where progress of delivery is stalled and will consider when and how to intervene. That may include considering whether to use powers in the Air Traffic Management and Unmanned Aircraft Act 2021[9], where it will assist in the delivery of the AMS.

UK Airspace Design Service

1.23 The current delivery model for airspace change is based on sponsors of individual airspace change proposals, normally airports and air traffic service providers, being responsible for taking forward and funding changes in airspace design through the CAA's CAP 1616 airspace change process. No single party has responsibility for designing how the UK airspace works effectively and efficiently as a holistic system.

1.24 This approach creates significant risks to the delivery of airspace modernisation. The Department for Transport and CAA agree that airspace design would be more successfully delivered through a single entity, that we currently term a 'UK Airspace Design Service' (UKADS). This would be in line with the model operated in many other countries.

1.25 Therefore a proposal to create a UKADS will be the subject of a formal consultation by the Department for Transport and CAA later in 2024. The UKADS would initially focus on the complex airspace in the London area.

CAA focus areas over the next two years

1.26 In developing this deployment plan, we have first looked internally at the CAA's programme of policy and regulatory work to enable the foundations of modernisation. From this, we have identified six focus areas to be addressed as part of the 'two plus five year' planning approach, although there are a small number of isolated activities that fall within the window but outside the scope of the focus areas. These are captured in the appendices.

1.27 The six focus areas pull together common but complementary projects delivering societal, environmental and economic benefits, while contributing to the AMS strategic objectives.

[9] Air Traffic Management and Unmanned Aircraft Act 2021 (legislation.gov.uk)

1.28 For this first version of Part 3, we have grouped together those projects which deliver a shared outcome under the following six headings:

- Future Air Traffic Management
- ICAO Flight Information Service (FIS) and Lower Airspace Service (LAS)
- Detect and Avoid (DAA)
- Electronic Conspicuity (EC)
- Airspace systemisation and Performance Based Navigation (PBN)
- System Wide Information Management (SWIM)

1.29 Establishing and understanding the services needed to support diverse airspace users, such as UAS, is important in developing an integrated operating environment.

1.30 These requirements support the development of a LAS that delivers the capabilities needed by airspace users, enabled through improved alignment with ICAO FIS provisions and FIS-Broadcast. This will support the integrated airspace operation the AMS describes.

1.31 To achieve the above, the ability for UAS operations to detect and avoid (DAA) other airspace users, replicating through electronic means, existing users' capabilities, must be a core requirement.

1.32 DAA and the integration of existing users require a common means to detect and avoid each other. Through electronic conspicuity, position information can be transmitted and received by all users via air-to-air or air-to-ground-to-air transmission (Traffic Information Service–Broadcast). Aviation frequency spectrum management is an important part of this project to ensure capacity is available for the expected level of transmissions.

1.33 PBN is an airspace route and procedure design tool that provides certainty, assurance and containment where defined tracks are required for any airspace user. The use of PBN reduces air-to-ground interactions and reduces flight deck workload. The accuracy of PBN routes and procedures ensures that the controlled airspace protection around them is minimised, thus providing more airspace for other users.

1.34 The modernisation of airspace is reliant on greater availability of digitised aviation-related data and information. System Wide Information Management (SWIM) is a framework that enables the secure movement of digital data and information between airspace stakeholders, enabling the right data to be accessed at the right time. By delivering the seamless integration and interchange of aviation data, the use of SWIM will enhance situational awareness and decision-making capabilities across the aviation ecosystem and enable improved ATM and airspace management.

Environmental sustainability

1.35 The duties of the CAA to take environmental factors into account when carrying out modernisation activities were outlined in Part 1 of the AMS. Chapter 2 of Part 1 recognises that this is a topic requiring further work, and 18 months on, we can add some further detail.

1.36 In addition to the duty to maintain and, where possible, improve on the UK's already high levels of aviation safety, Part 1 of the AMS published in 2023 states, as a strategic objective, that:

- Environmental sustainability will be an overarching principle applied through all airspace modernisation activities
- Modernisation should deliver the Government's key environmental objectives with respect to air navigation as set out in the Government's Air Navigation Guidance and, in doing so, will take account of the interests of all stakeholders affected by the use of airspace.

1.37 Our understanding of how we might capture, quantify and address these objectives across the broad programme of AMS activities is still building and requires more development, in the context of the UK legal and policy framework and the evolving UK and international focus on aviation environmental sustainability.

1.38 In terms of the UK legal and policy framework (see Appendix B to AMS Part 1), the CAA is bound by, in particular, section 70 of the Transport Act 2000, the Air Navigation Directions and the Air Navigation Guidance.

1.39 ICAO has established a long-term global aspirational goal for international aviation of net-zero carbon emissions by 2050, which will help to focus this aspect as it is incorporated into the next edition of the GANP. In turn this will be reflected in the UK AMS and complement the UK's own net-zero obligations and aviation decarbonisation as described in Chapter 2 of the AMS Part 1. More recently the increased UK[12] and international focus[13] on resilience and adaptation as climate change effects start to be realised, is another aspect that will need to be reflected in the AMS.

1.40 When applied to airspace, environmental and sustainability challenges are multifaceted and include noise, emissions (CO_2 and non-CO_2 emissions), climate change resilience, air quality and biodiversity considerations.

1.41 The CAA is working with internal stakeholders (such as our Sustainability Team and the Environmental Sustainability Panel) and external stakeholders (such as EUROCONTROL, NATS and the Department for Transport's Chief Scientists Advisory Council) on defining how environmental sustainability as an overarching principle can be applied to deliver the Government's key environmental objectives with respect to air navigation. The CAA provides funding to help support airspace modernisation projects in these areas[14] and a theme for the Oct 2024 call for proposals is 'Environmental Sustainability'.

[12]Climate change adaptation reporting, Department for Environment, Food & Rural Affairs

[13]https://www.eurocontrol.int/update/adapting-aviation-changing-climate

[14]Airspace Modernisation Strategy Support Fund | Civil Aviation Authority (caa.co.uk). For example Fair and Equitable Distribution Interim Report - Distribution of aircraft noise Gatwick Airport (caa.co.uk)

1.42 The CAA continues to engage with the Government on delivery of net zero aviation by 2050 and other environmental policies, including on how they may lend weight to the CAA's own environmental policies and inform the AMS. To ensure that environmental impact considerations are integrated into the development of the airspace change masterplan, the CAA is conducting a strategic environmental assessment (SEA) and a Habitats Regulations assessment (HRA) of the masterplan. More information on these assessments can be found in CAP 2528 Airspace Change Masterplan: Approach to Strategic Environmental Assessment and Habitats Regulations Assessment.[15] The regulator's growth duty does not apply to our airspace functions.

1.43 Concepts enabled as part of the AMS are making it possible to explore more novel activities that may address environmental concerns either today or in the future. For example, a greater ability to support the integration of new types of aircraft, zero- and low-emission propulsion technologies and operating profiles for future aircraft that may be different from those seen today.

1.44 Qualitative and quantitative measures are being developed against which progress on the environment and sustainability principle can be shown. This will require a progressive approach as the levels of maturity and knowledge in the sector themselves grow. We will tie development and delivery of the environmental sustainability objective with existing AMS development and oversight processes and associated timescales (for example reporting cycles).

1.45 Regarding the six focus areas described above over the next two years, the following three areas have been identified as those with expected environmental benefits.[16,17,18]

- **Airspace systemisation and PBN:** ATM system changes and optimisation of airspace designs will enable the benefits of PBN technology to be realised. Reduced environmental impacts, better management of noise, increased fuel efficiency and a commensurate reduction in CO_2 emissions from less congestion can be delivered on a per-flight basis alongside more flexible and optimum routeings. Through operational flexibility in route design, it may be possible to avoid populated areas or environmentally sensitive receptors. Resilience will be enhanced since this evolution of navigation reduces the vulnerability associated with the use of conventional ATS routes dependent solely on ground-based navaids in areas prone to severe weather events.

[15] www.caa.co.uk/cap2528/

[16] The Guide to GreenATM: A Manual for the CANSO Environmental Accreditation Programme

[17] ICAO Global ASBU Environmental Benefits Assessment – To 2025 ENVReport2019_pg131-137.pdf (icao.int)

[18] Objective Skygreen 2022-2030 The economics of aviation decarbonisation towards the 2030 Green Deal milestone (eurocontrol.int/publication/objective-skygreen-2022-2030)

- **Electronic conspicuity:** Surveillance plays a critical role in air traffic control and can aid more efficient flights. Improving surveillance coverage and applying appropriate surveillance standards directly impacts upon the separation distances required between aircraft and therefore influences the efficient use of airspace. Enhancing surveillance to include areas that are not currently well covered by traditional radar technologies (for example because of low altitude or terrain) can enable improved management of aircraft trajectories, such as level changes or improved arrival procedures into airports, reducing the fuel burn and CO_2 emissions of each flight. Having assurance of actual aircraft positioning and intentions helps air traffic controllers avoid inefficient vectoring commands against unknown traffic, reducing fuel burn and emissions. Furthermore, surveillance provides data which is the basis upon which the accurate assessments of our airspace performance are made. A greater granularity of this information will support monitoring, reporting and assessment on noise and air quality over time.

- **SWIM:** Disruptive weather is a significant cause of ATM delays and inefficiencies. Through the more accurate and timely provision of meteorological information the impacts can be mitigated. The move towards the inclusion of meteorological information within the System-Wide Information Management (SWIM) concept supports the consistent and timely sharing of crucial information among all stakeholders. There are air traffic concepts already in use, such as time-based separation at Heathrow, where the use of such information is used in conjunction with aircraft performance data and analysed to optimise arrival spacing, reducing fuel burn and emissions. Aircraft technology can exploit the optimal flight trajectory in near real time enabled by high resolution meteorological information sent as part of SWIM. Optimising flight trajectories based on meteorological information using this technology has the potential to deliver significant emissions savings.

Chapter 2: Two-year technical deployment plans 2024–2026

CAA focus areas

2.1 This chapter describes the six current focus areas in relation to the AMS requirements and the GANP ASBU evolution:

- Future Air Traffic Management
- ICAO Flight Information Service (FIS) and Lower Airspace Service (LAS)
- Detect and Avoid (DAA)
- Electronic Conspicuity (EC)
- Airspace systemisation and Performance Based Navigation (PBN)
- System Wide Information Management (SWIM)

2.2 Each focus area has a description of the topic, associated activities and, where appropriate, detail on next steps for the CAA in the short term.

Enabling programmes

2.3 Additionally, Chapter 2 describes other significant AMS enabling and deployment programmes that are led by organisations other than the CAA. NERL has a five-year capital investment programme, and a Service Investment Plan, which is described as a 'two plus five year' programme and is one of the most important enablers for the airspace modernisation programme. The airspace change masterplan, being developed by the Airspace Change Organising Group (ACOG), describes the strategically important changes required in UK airspace.[19]

Focus area 1: Future Air Traffic Management

The development of additional air traffic management (ATM) requirements and policy will set the framework for future ATM service provision. Traffic management services provided to all airspace users in integrated airspace will be described and considered as ATM. Current CAA workstreams described in Appendix B aim to deliver by 2028 with associated key milestones due to be delivered before the end of 2027.

2.4 The integration of diverse[20] airspace users into UK airspace will require the development of new traffic management services, alongside the use of existing ATM.[21]

[19] https://www.acog.aero/airspace-masterplan/

[20] Diverse users include those such as UAS and AAM

[21] 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.

2.5 The development of the concept of operations, system architecture and ultimately the tools and processes to support new airspace users is not yet standardised on the global stage. While not standardised, ICAO has published material for UAS Traffic Management (UTM).[22] The definition ICAO uses can be applied to both segregated and non-segregated airspace operations. The ICAO AAM Study Group[23] is tasked with developing the vision and framework for Advanced Air Mobility (AAM). This work includes developing positions on ATM for new airspace users. The UK CAA holds the chairperson role for the AAM Study Group.

2.6 In a UK context, UAS Traffic Management and the needs of other vehicles such as VTOLs are considered part of the overall ATM service provision. The AMS recognises that UAS and VTOLs will have different traffic management service needs in the short term when demonstrating the capability and in the medium term when operations are scaling. The AMS recognises the need for a coherent approach to managing services which will require development. Where appropriate the UK may choose to align with other regions' approach to ATM.

2.7 The strategic vision for airspace modernisation to 2040 aims to safely facilitate access by diverse airspace users, with a transition towards greater integration of air traffic. Incorporating this ever more complex and growing mix of traffic requires advanced technological tools and ATM solutions. Developments in ATM is one of the key enablers to integrating unmanned aircraft system (UAS) beyond visual line-of-sight (BVLOS) operations at scale, the introduction of piloted VTOL aircraft (including day 1 operations with low flight numbers) and supporting future large-scale autonomous flight.

2.8 Through ATM, it is envisaged that air navigation service providers (ANSPs) will be able to provide real-time information regarding airspace constraints and the intentions of other aircraft to all airspace users.

2.9 UTM is accepted as supporting the real-time or near-real-time organisation, coordination, and management of UAS operations, including the potential for multiple BVLOS operations. Specific services for UAS will include, among other things, flight planning and flight notification. The CAA, with input from stakeholders, is developing traffic management to support new airspace users.

2.10 The work will identify the traffic management services that will be applicable in the UK (the Technical Requirements (TR)). The Authority Requirements (AR) and the Organisational Requirements (OR) will also need to be identified by the CAA. The process of certification for any service provider will need to be assessed against the existing CAA regulatory requirements for ANSPs. A sandbox[24] will undertake a desk-top (no live trials) assessment to support this.

2.11 The output from the sandbox will enable the AR and OR requirements to be set out in a second policy paper. A final policy paper will identify the options for the provision of traffic management services in UK low-level airspace. Live testing of dedicated service provision in low-level airspace would then be validated to ensure it achieves its safety objectives and to identify the level of integration possible.

[22] ICAO Unmanned Aircraft Systems Traffic Management (UTM) – A Common Framework with Core Principles for Global Harmonization Edition 4

[23] Advanced Air Mobility Study Group (AAM SG) (icao.int)

[24] A regulatory sandbox is a programme established by the UK CAA to create an environment where innovation in aviation can be explored in line with UK CAA core principles of safety, security and consumer protection. https://www.caa.co.uk/our-work/innovation/about-the-innovation-hub/

2.12 The introduction and management of new airspace users as well as the development of associated infrastructure should not negatively affect the safety or efficiency of the existing ATM system. Modernisation of ATM and airspace will use technology to manage airspace in a flexible, near-real-time operation, from high-altitude airspace to very low-level urban airspace environments. New service provision in lower airspace will address the needs of all airspace users including traditional aviation and piloted VTOL[25] through increased situational awareness, avoidance of Controlled Flight into Terrain (CFIT), and flight planning generally.

2.13 Key CAA activities for the deployment of traffic management in support of new airspace users:

- Policy concept for Technical Requirements
- Policy concept for Authority Requirements
- Policy concept for Organisational Requirements
- Concept of operations

2.14 A pertinent near-term enabling activity for airspace integration is a review of certain aspects of the rules of the air: UK Reg (EU) No 923/2012 (the UK Standardised European Rules of the Air (SERA)). SERA lays down the common rules of the air and operational provisions regarding service and procedures in air navigation. The objective of the activity is to review and make recommendations in respect of SERA.3205 (Proximity) and SERA.3210 (Right-of-way) in particular in order to accommodate UAS. This task has been raised by the Airspace Integration Steering Group (AISG).[26] An action group – the SERA Action Group (SERA-AG) – has been established under the direction of the AISG to undertake this activity to review SERA.

2.15 This work will review relevant regulatory material including acceptable means of compliance (AMC) and guidance material to SERA (specifically those provisions relating to the avoidance of collisions) and to make proposals and recommendations about any changes that may be required to these provisions. UK Reg (EU) No 923/2012 does not apply to model and toy aircraft operated as visual line of site (VLOS) in the 'open' category.[27] However, SERA requires that the Secretary of State for Transport must take appropriate steps, such as establishing national rules, to ensure that model and toy aircraft are operated in such a manner as to minimise hazards related to civil aviation safety to persons, property or other aircraft (Reg (EU) No 923/2012 Article 1, subject matter, and scope). Open category VLOS operations are also not in scope of this group.

2.16 Any UAS operating BVLOS will be operating in either the 'specific' or 'certified' category, depending upon the type of platform and the operation being undertaken. Not all requirements within SERA are relevant to UAS in the 'specific' category. UAS operators are charged with considering specific requirements and, where relevant, incorporating them within their operations manuals as procedures as necessary, whereby the inclusion of such procedures will make them mandatory for the UAS operator to follow (AMC to UK Reg (EU) 2019/947 Article 7(2), Rules and Procedures for the Operation of UAS).

[25]Vertical take-off and landing aircraft.

[26]https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy/ams-governance-and-progress-reports/

[27]https://www.caa.co.uk/publication/download/17981

2.17 UK Element UK-ABN/4 (Integration) utilises the relevant ICAO GANP ASBU Thread (known as NOPS) to describe the development of the airspace network operations planning and management for all users, incorporating ATM/UTM services.

ICAO GANP Operational thread NOPS

Network Operations

Block 0 & 1 (2013 – 2024)

Many ATFM processes are automated, while some elements are still managed procedurally. NOPS Network Operations introduces enhanced processes to manage flows or groups of flights to improve overall fluidity. It refines ATFM techniques, integrates the management of airspace and traffic flows through a holistic network operational planning dynamic/rolling process to achieve greater efficiency and enhance network performance. It also increases the collaboration among stakeholders in real time to better know airspace users' preferences, to inform on system capabilities and ATC capacity and further enhance Collaborative Decision Making (CDM).

Block 2 (2025 – 2030)

ATFM evolves to support Trajectory-Based Operations (TBO). There will be an improved trajectory forecast based on the qualification and quantification of uncertainties, probabilistic approaches and enriched en-route and airport information sharing.

Enhanced Demand and Capacity Balancing (DCB) provides capabilities which create a paradigm shift, with all stakeholders expressing dynamically and precisely their needs which must be accommodated within an agreed performance framework. The Collaborative Network Operations Planning will be further enhanced. Initial steps towards airspace user driven priorities and extended airports integration with ATM network planning are envisaged.

Specifically, within the current AMS Part 3 timeframe: NOPS B2/7 UTM Network Operations and NOPS B2/8 High Upper Airspace Network operations.

2.18 The UTM services will be supported by enabling technology UK AM/7 (Future Surveillance and Spectrum) which utilises the GANP ASBU Thread known as ASUR, and by UK-ABN/4 (Integration) which utilises the GANP Thread known as CSEP.

ICAO GANP Operational thread ASUR

Advanced Surveillance

Block 0 & 1 (2013 – 2024)

Surveillance is provided supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems. These capabilities will be used in various ATM services, for example, traffic information, search and rescue and separation provision. ADS-B OUT and MLAT systems complement ASUR surveillance systems and existing cooperative surveillance radar and may be deployed independently or together. Depending on local airspace needs, ADS-B or MLAT may replace cooperative radar.

ADS-B surveillance is provided using receivers on spacecraft, allowing improved options for surveillance in oceanic and remote areas.

Block 2 (2025 – 2030)

The evolution of ADS-B and transponder avionics provides new aircraft/atmospheric information to support ANSP and vehicle-to-vehicle applications. New community and internet-based surveillance system to track airborne vehicles at low altitudes and/or high altitudes. Performance-based surveillance framework is provided for ANSP services. Within this timeframe, vehicle identities/ positions/velocities may be shared using the internet. ADS-B vehicle-to-vehicle potentially is provided in a different spectrum in lower airspace for small RPA operations.

Specifically within the current AMS Part 3 timeframe: ASUR-B2/2 electronic conspicuity-based surveillance system for airborne aircraft (low and higher airspace).

ICAO GANP Operational thread CSEP

Cooperative Separation

Block 0 & 1 (2013 – 2024)

Enhanced traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations and visual separation on approach are enabled by the evolutions of ADS-B IN capabilities and associated applications.

In oceanic airspace, the use of Performance-Based Longitudinal Separation minima and Performance-Based Lateral Separation minima will enable the optimisation of trajectories.

Block 2 (2025 – 2030)

The Interval Management (IM) procedure using distance or time will be implemented to improve traffic flow and aircraft spacing. Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. In the lower airspace, separation rules apply based on aircraft-to-aircraft interaction. In the high upper airspace separation is provided strategically through sharing of operators' business and mission trajectories.

Specifically, within the current AMS Part 3 timeframe: CSEP-B2/2 Cooperative separation at low altitudes.

Focus area 2: Flight Information Service and the Lower Airspace Service

The improved alignment of Flight Information Service; deployment of a Lower Airspace Service, including FIS-B; and the publication of associated guidance for determining the need for air traffic services in volumes of airspace will deliver several modernisation benefits for lower airspace, simplifying service provision and improving airspace access for a diverse range of airspace users. The aim is to deliver these between 2027 and 2031.

2.19 The UK currently offers a bespoke suite of air traffic services (ATS) outside controlled airspace and to visual flight rules (VFR) flights within class E airspace; these are known as the UK Flight Information Services.[28] Within the UK, the scope of flight information service (FIS), as defined in ICAO Annex 11[29] and UK SERA, is met through the application of any of the UK Flight Information Services. However, while the UK Flight Information Services are aligned with UK SERA and ICAO Annex 11, there are subtle but significant differences to the operational provisions described within ICAO Doc 4444 PANS-ATM. These result in the UK having a complex and nuanced position with regard to its ATS arrangements in class G airspace. Additionally, the provision and availability of the UK Flight Information Services varies across the UK due to the fractionalised nature of air navigation service providers and the differing capabilities among ATS personnel for the utilisation of surveillance data in the provision of ATS.

2.20 The challenge of demand from existing and new types of aviation operations for access to UK airspace is not purely about the numbers. The challenge is also the complexity of the interactions created through the different performance capabilities of these users. That requires a more innovative and flexible approach to the structures and procedures we put in place to ensure the safe integration of these different operations.

2.21 UK-ABN/4 Integration sets out two significant deliverables that encapsulate the AMS vision for FIS: improved alignment with ICAO FIS provisions and deployment of a Lower Airspace Service (LAS). These are reflected in the AMS Part 2 as UK B1/1, UK B2/3 and UK B3/2. Together they will deliver a FIS aligned with the intent prescribed by ICAO, enabling current and future airspace users to participate in a modernised FIS that is internationally recognisable, simplified and which embraces emerging technologies and service delivery capabilities. Moreover, it will allow us to better satisfy the requirements set out by the Civil Aviation Authority (Chicago Convention) Directions 2022[30] to ensure that we act consistently with the obligations placed upon the UK under the Chicago Convention.[31]

[28] https://www.caa.co.uk/publication/download/19298

[29] ICAO Annex 11 Air Traffic Services

[30] https://www.caa.co.uk/media/hfpherwy/2022-08-05-caa-chicago-directions-signed.pdf

[31] https://www.icao.int/publications/Documents/7300_cons.pdf

Improved alignment of FIS with ICAO provisions

2.22 The UK CAA will develop, through engagement with relevant stakeholders, a series of procedures for flight crews and air traffic services providers which address the differences referred to above, offer a degree of simplification from the existing arrangements and support the delivery of inter-related AMS elements relating to operations in the 'lower airspace'.

2.23 In early 2024 the CAA invited feedback with regard to UK Flight Information Services.[32] This will build on the feedback that the CAA received in response to our 2022 consultation on a draft AMS in helping shape policy development. The CAA will publish a formal consultation for industry once detailed policy proposals have been developed.

Lower Airspace Service

2.24 A LAS will need to deliver a safe, simplified and unified lower airspace operation, which includes collation and dissemination of flight intent information, where available, to augment existing flight plan data to better understand demand for UK airspace. PBN, EC, DAA, future ATM, SWIM and the improved alignment of FIS with ICAO provisions will be integral to the safe delivery of this improved concept of operation. These often-interdependent technological advancements will lead to a progressive transition of proven functions and services to enhance existing ATM systems. The multiple and complex projects will require oversight and coordination to ensure harmonisation and interoperability for airspace users including adherence to the Joint and Integrated approach with the Ministry of Defence, to UK airspace management including collaborative decision making as detailed in CAP 740.

2.25 The LAS will:

- Be provided 24/7, concentrated in daylight hours
- Act as a lower airspace management cell
- Enable flexible airspace access and airspace crossing
- Act as a technology conduit taking into account aircraft capability and technology for self-management of piloted aircraft and UAS
- Exploit the advantages of cooperative surveillance to enhance the safe and efficient provision of FIS (traffic information and where necessary traffic avoidance advice – not separation).

2.26 The deployment of LAS will follow the ASBU-aligned path contained within AMS Part 2. Successful deployment will only be achieved through the active and continuous engagement and involvement of all relevant airspace and aviation stakeholders, existing and new. Further detail on key activities will be published in due course, including milestones and possible funding models.

[32]Skywise SW2024/036 ICAO FIS Implementation Call for Input https://skywise.caa.co.uk/alerts/alert/6u32ZLUyk98JvrdgeHM5

Supporting requirements and guidance material

2.27 The ICAO airspace classifications are used to support the right air traffic services to deliver a safely managed operation. In addition to the delivery of improved alignment with ICAO FIS provisions and deployment of LAS, there will be a supporting project that addresses the requirements for determining the areas where ATS are provided, and the designation and design of airspace to support the determined ATS provision. This supports the ambition to deliver the right airspace volumes in a more flexible and real-time way. The right-sized airspace volume with appropriate classification supports existing and new users but is fixed and notified through aeronautical information management (AIM). This project is yet to be fully scoped but is likely to include the following CAA activities:

- Development of guidance material to assist industry in determining the need for the provision of ATS
- Development of guidance material to assist industry in determining their requirements for airspace structures, including potential flexible use scenarios and processes
- Consideration of AIM and/or CNS and spectrum rulemaking activity to facilitate dynamic airspace configuration
- Review and, if necessary, refinement of appropriate CAA airspace policy statements.

2.28 One aspect of the improved alignment of FIS with the source ICAO provisions is the proposed removal of planned deconfliction minima for IFR flights currently seen delivered as part of a Deconfliction Service and a Procedural Service. Any proposed changes will be considered holistically, alongside other AMS activities described in the AMS Part 3. The CAA does not consider that this change automatically leads to a need to establish controlled airspace. Our expectation is that ANSPs will manage their traffic in class G airspace through the provision of FIS. Any perceived need for the provision of an air traffic control service and the associated notification of controlled airspace will require an airspace change proposal in accordance with the process currently described in CAP 1616.

2.29 The overall delivery of the AMS strategic intent for ATS provision in class G airspace will depend on multiple workstreams, such as those listed above, being coordinated to ensure a holistic approach to implementation. This will be achieved through the AMS governance structure.

2.30 The development and understanding of the ATM service requirements in UK airspace enables the operational development of LAS provision in the UK, supported further by ICAO GANP ASBU deliverables and UK-specific AMS Elements.

Flight information service – broadcast

2.31 As part of digitised FIS for all types of airspace user, FIS-B will be a wide area broadcast of aeronautical and meteorological information data products transmitted for the use of any airspace user where aircraft can receive data over 978 MHz (UAT) and are within range of the broadcast. The products will be provided by the UK aeronautical and meteorological information service providers and will include observed and forecast meteorological information as well as near real-time airspace notifications, such as NOTAM. The broadcast will use internationally recognised formats and operate within the aviation spectrum and will be free at the point of use. UK Element UK-ABN/4 (Integration) utilises the UK Thread UK-ICAO Alignment to describe the UK ambition of greater consistency with ICAO.

UK Element #4 thread UK-ICAO Alignment

UK-ICAO Alignment

Block 0 & 1 (2013 – 2024)

Policy development commences with the objective to deliver improved alignment of UK ATS provision with ICAO PANS-ATM.

Block 2 (2025 – 2030)

UK ATS have increased alignment with ICAO PANS-ATM; supported by some basic broadcast services to include weather, basic aeronautical information and traffic information. Following extensive engagement to determine where specific ATS are required, a series of airspace changes such as TMZ/RMZ and some flexible CTRs have been introduced, with others in the change process. A new Lower Airspace Service (LAS) has been developed, ANSP nominated and is in the process of deployment.

2.32 UK Element UK-AM/5 (Integration) utilises the UK Thread UK-Flexible Airspace to describe the UK management of lower airspace volumes.

UK Element #4 thread UK Flexible Airspace

UK-Flexible Airspace

Block 0 & 1 (2013 – 2024)

Airspace change process allows sponsors to introduce concepts for flexible activation.

Block 2 (2025 – 2030)

Some flexible access is introduced, coordinated with the airspace changes brought about through improved ATS alignment with ICAO PANS-ATM. An annual review of Special Use Airspace is undertaken to determine the current and future use and the necessary safety requirements. Airspace activity status is provided initially by airspace controlling authorities and in some cases via FIS-B type systems.

2.33 The LAS will be supported by enabling technology UK AM/7 (Future Surveillance and Spectrum) which utilises the GANP ASBU Thread ASUR and UK-ABN/4 (Integration) which utilises the GANP CSEP Thread.

ICAO GANP Technical thread ASUR

Advanced Surveillance

Block 0 & 1 (2013 – 2024)

Surveillance is provided supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems. These capabilities will be used in various ATM services, for example, traffic information, search and rescue and separation provision. ADS-B OUT and MLAT systems complement existing cooperative surveillance radar and may be deployed independently or together. Depending on local airspace needs and coverage, ADS-B or MLAT may ultimately reduce dependency on cooperative radar.

ADS-B surveillance is provided using receivers on spacecraft, allowing improved options for surveillance in oceanic and remote areas.

Block 2 (2025 – 2030)

The evolution of ADS-B and transponder avionics provides new aircraft/atmospheric information to support ANSP and vehicle-to-vehicle applications. New surveillance systems to track airborne aircraft at low altitudes and/or high altitudes. Performance-based surveillance framework is provided for ANSP services. Within this timeframe, aircraft identities/positions/velocities may be shared using the internet, albeit the use of such data will need to be managed. ADS-B aircraft-to-aircraft potentially is provided in a different spectrum in lower airspace for small RPA operations.

Specifically, within the current AMS Part 3 timeframe: ASUR-B2/2 Electronic conspicuity-based surveillance system for airborne aircraft (low and higher airspace).

ICAO GANP Operational thread CSEP

Cooperative Separation

Block 0 & 1 (2013 – 2024)

Enhanced traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations and visual separation on approach are enabled by the evolutions of ADS-B IN capabilities and associated applications.

In oceanic airspace, the use of Performance Based Longitudinal Separation minima and Performance Based Lateral Separation minima will enable the optimisation of trajectories.

Block 2 (2025 – 2030)

The Interval Management (IM) procedure using distance or time will be implemented to improve traffic flow and aircraft spacing. Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. In the lower airspace, UTM separation rules apply based on vehicle-to-vehicle interaction. In the high upper airspace separation is provided strategically through sharing of operators' business and mission trajectories.

Specifically, within the current AMS Part 3 timeframe; CSEP-B2/2 Cooperative separation at low altitudes.

Focus area 3: Detect and Avoid (DAA)

The development of DAA requirements and policy will, along with other activities, address the need for UAS operating BVLOS to operate within the extant ruleset. The DAA work aims to deliver two specific policy deliverables by the end of 2025.

2.34 An air system's conflict management relies on the capability to detect and take action to avoid collisions where there is not a human operator on board to apply the 'see and avoid' principle. DAA systems are essential for ensuring safe airspace integration and play a crucial role in beyond visual line of sight (BVLOS) activity. In time, DAA may also become part of assisting crewed flights as part of a suite of Airborne Collision Avoidance Systems that already exist.

2.35 The UK aspiration for BVLOS UAS is for routine activity in unsegregated airspace. The premise of DAA is that it should be a capability that is at least equivalent to the 'see and avoid' principle used in manned aviation to avoid collision with other aircraft and obstacles. When operating VLOS, the rules apply to UAS in the same way that VFR apply to manned aircraft. However, BVLOS operations in a non-segregated airspace will not normally be permitted without an acceptable DAA capability. To maintain the appropriate levels of safety, a suitable method of aerial collision avoidance is required for all UAS operations. To gain access to all classes of airspace without segregation, UAS will have to be able to display a capability that is equivalent to the existing safety standards applicable to manned aircraft types. These capabilities will need to be appropriate to the class (or classes) of airspace within which they are intended to be operated.

2.36 Conflict management within the existing global aviation system is premised on cockpit-based see-and-avoid supporting both Remain Well Clear and Collision Avoidance functions within the following three-layer system:

- **Layer 1:** Strategic conflict management – Airspace design, demand and capacity balancing, traffic synchronisation. Strategic is used here to mean 'in advance of tactical'. The objective of this layer is to minimise the need to apply the second layer.
- **Layer 2:** Separation provision – This is a tactical (in-flight) process where the pilot must ensure that the aircraft is not operated in such proximity to other aircraft as to create a collision hazard. Typically, this is achieved via cockpit-based see-and-avoid but may be supplemented through the application of separation minima or provision of collision hazard information by an ATM service, dependent upon the airspace classification and flight rules followed.
- **Layer 3:** Collision avoidance – Required when the separation mode has been compromised, this layer is predominately based on cockpit view pilot 'see & avoid', although for some categories of aircraft, and in some categories of airspace, this may be augmented by systems such as Traffic Collision Avoidance System (TCAS).

2.37 The context within which the CAA's DAA policy will sit is the UK Specific Operating Risk Assessment (SORA) Air Risk Model. The initial version of the Air Risk Model will not in itself enable new UAS BVLOS operations within the UK. Rather, it embeds current CAA policies for approval of UAS operations within the SORA structure and terminology, creating a framework within which new policies that are currently in progress will sit, including:

- Atypical air environment
- Electronic conspicuity
- Detect and Avoid (DAA)
- Unmanned Traffic Management (UTM)
- Airspace requirements for integration of BVLOS in unmanned aircraft in UK airspace.

2.38 The DAA capability will be supported by enabling technology UK AM/7 (Future Surveillance and Spectrum) which utilises the GANP ASBU Thread ASUR and UK-ABN/4 (Integration) which utilises the GANP CSEP Thread.

ICAO GANP Technical thread ASUR

Advanced Surveillance

Block 0 & 1 (2013 – 2024)

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ADS-B surveillance is provided using receivers on spacecraft, allowing improved options for surveillance in oceanic and remote areas.

Block 2 (2025 – 2030)

The evolution of ADS-B and transponder avionics provides new aircraft/atmospheric information to support ANSP and vehicle-to-vehicle applications. New community and internet-based surveillance system to track airborne vehicles at low altitudes and/or high altitudes. Performance-based surveillance framework is provided for ANSP services. Within this timeframe, vehicle identities/positions/velocities may be shared using the internet. ADS-B vehicle-to-vehicle potentially is provided in a different spectrum in lower airspace for small RPA operations.

Specifically within the current AMS Part 3 timeframe: ASUR-B2/2 Electronic conspicuity-based surveillance system for airborne aircraft (low and higher airspace).

ICAO GANP Operational thread CSEP

Cooperative Separation

Block 0 & 1 (2013 – 2024)

Enhanced traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations and visual separation on approach are enabled by the evolutions of ADS-B IN capabilities and associated applications.

In oceanic airspace, the use of Performance-Based Longitudinal Separation minima and Performance-Based Lateral Separation minima will enable the optimisation of trajectories.

Specifically within the current AMS Part 3 timeframe: CSEP-B1/1 Basic airborne situational awareness during flight operations (AIRB).

Block 2 (2025 – 2030)

The Interval Management (IM) procedure using distance or time will be implemented to improve traffic flow and aircraft spacing. Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. In the lower airspace, UTM separation rules apply based on vehicle-to-vehicle interaction. In the high upper airspace separation is provided strategically through sharing of operators' business and mission trajectories.

Specifically, within the current AMS Part 3 timeframe: CSEP-B2/2 Cooperative separation at low altitudes.

Focus area 4: Electronic conspicuity

The EC activities described here will deliver policy for the adoption of standards for EC along with FIS-B deployment. The EC work also includes policy for local and regional TIS-B deployment. These activities will support the integration of diverse airspace users and are due to deliver by the end of 2028, with most deliverables due before the end of 2026.

2.39 Electronic conspicuity (EC) is an umbrella term for the technology that can help pilots, unmanned aircraft users and air traffic services be more aware of what is operating in the surrounding airspace. Identifying an aircraft by electronic means involves the use of electronic devices such as ADS-B systems and other technologies to enhance aircraft visibility and situational awareness.

2.40 EC includes the devices fitted to or carried on aircraft, unmanned systems that send out the information, and the supporting infrastructure to help them work together. Airborne transponders, air traffic data displays, ground-based antennas and satellite surveillance services are all examples of EC.

2.41 EC strengthens the fundamental safety principle of 'see and avoid' by adding the ability to 'detect and be detected'. To be most effective it needs 100% of users operating in a designated block of airspace to use compatible EC devices that can be detected by others.

2.42 The AMS envisions greater connectivity between and among airspace users and those on the ground, enabling advanced aircraft-based navigation and airspace management capabilities. EC enables many aspects of the AMS delivery elements. It will form the foundation for enabling data services and achieving integration requirements. In particular it can play a vital role in four key areas to support AMS objectives:

- Enabling the ongoing modernisation of the UK's airspace structure and route network
- Helping to mitigate the risk of mid-air collisions in class G airspace and infringements of controlled airspace
- Enabling the safe and efficient integration of unmanned aircraft
- Providing the ability to share accurate navigation position data between airborne devices and ground (or indeed space-based) systems.

Traffic Information Service - Broadcast (TIS-B)

2.43 TIS-B will be deployed as a localised service which will rebroadcast a unified surveillance picture of multiple emission types for the benefit of all airspace users.

2.44 The EC capability is described in UK Element UK-ABN/4 (Integration) and utilises the ICAO GANP ASBU Thread CSEP to describe the evolution of EC.

ICAO GANP Operational thread CSEP

Cooperative Separation

Block 0 & 1 (2013 – 2024)

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Specifically, within the current AMS Part 3 timeframe: CSEP-B2/2 Cooperative separation at low altitudes.

2.45 It will be supported by enabling technology UK AM/7 (Future Surveillance and Spectrum) which utilises the GANP ASBU Thread ASUR.

ICAO GANP Technical thread ASUR

Advanced Surveillance

Block 0 & 1 (2013 – 2024)

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Specifically, within the current AMS Part 3 timeframe: ASUR-B2/2 Electronic Conspicuity-based surveillance system for airborne aircraft (low and higher airspace).

Focus area 5: Airspace systemisation and Performance Based Navigation

ATM system changes and optimisation of airspace designs will enable the benefits of Performance Based Navigation technology to be realised. The bulk of the navigation infrastructure and system development will occur between 2025 and 2028, with advanced concepts expected beyond 2030.

Work on enabling lateral application of PBN is due for delivery in 2024 and 2025. Other applications of PBN, such as reducing departure divergence at busy airports, are being investigated. Further advances in vertical navigation capabilities for PBN will be considered after 2030.

2.46 To deliver the strategic ambitions for airspace modernisation laid out in AMS Part 1, essential technical changes to the existing airspace system are necessary. With technological advancements comes the opportunity to optimise what is an inefficient distribution of CNS equipment and replace it with a minimum operational network (MON) of efficient, performance-based technologies. The performance-based approach is expected to favour possible operating synergies across CNS equipment, taking advantage of common system and common infrastructure capabilities. This cross-domain interaction will see the ATM system move towards an integrated digital framework.

2.47 Perhaps the most advanced example of UK airspace being systemised is the London TMA. Already hugely complex and busy airspace, technological advancements will see the TMA becoming even more systemised, leading to increased efficiency and demonstrably positive effects on environmental impact. UK AMS delivery element UK-ABN/2 (Terminal Airspace Redesign) uses the ICAO GANP ASBU Thread APTA (Improve arrival and departure operations) to describe the redesign of the route network in busy terminal airspace, taking account of advances in new technology, especially satellite navigation and alternative position navigation and timing (A-PNT) systems for resilience, and to realise the potential for system design optimisation to achieve greater systemisation in terminal airspace. Performance Based Navigation (PBN) is a key sub-element, providing a range of navigation specifications that can be scaled appropriately for use within airspace design, enabling effective systemisation and providing a tool to provide optimal noise mitigation solutions and minimise CO_2 in a local context around airports.

2.48 The AMS ambition is that approach procedures, as well as arrival and departure routes (collectively known as instrument flight procedures (IFP)), will be designed using PBN to provide more efficient and flexible route options that, in collaboration with community and environmental stakeholders, enable industry to better manage noise, fuel and CO_2 in accordance with government policy. Although it is worth noting that due to current ATM capabilities, it is likely that in certain locations, when the prevailing air traffic situation is dense and complex, a reversion to radar vectoring will still be required in order to maintain capacity. The deployment of PBN is therefore a key enabler of airspace modernisation.

ICAO GANP Operational thread APTA

Terminal Area Arrival and Departure Routes

Block 0 & 1 (2013 – 2024)

Procedures implemented as STARs in terminal airspace provide lateral path guidance to support improving the efficiency in the descent phase of flight by enabling near-idle power operations from top of descent to a point where the aircraft transitions to approach operations. For take-off, SIDs provide a lateral path that can support continuous climb operations to the top of climb where the cruise phase of flight starts.

Enhanced STARs and SIDs with altitude constraints along the lateral path improve ATC management, and further support operational efficiency by providing vertical profiles that all aircraft can follow.

Improvement in airspace management is brought by the utilisation of advanced capabilities such as standardised Baro-VNAV functionality and scalable RNP. These optimise descent phase and terminal airspace by providing vertical descent and climb corridors in combination with more precise lateral paths in the terminal area. Such advanced capabilities will reduce the amount of protected airspace vertically and laterally which will enhance the efficiency and flexibility of the terminal airspace design, allowing for optimum arrival and departure operations. These enhancements build on the achievements developed in Block 0.

Specifically, within the current AMS Part 3 timeframe: APTA B1/2 PBN SID and STAR procedures with advanced capabilities.

ICAO GANP Operational thread APTA

Approach Procedures

Block 0 & 1 (2013 – 2024)

Performance-based aerodrome operating minima (PB AOM) allows for implementation of vertically guided approaches at a wider range of aerodromes and facilitates a phased approach to improvement in approach capabilities. Advanced aircraft with technology such as Enhanced Vision Systems (EVS) benefit from operational credits to continue operations below normal minima.

APTA Improve arrival and departure operations: Operational Helicopter Point-in-Space procedures allow for access to landing locations other than heliports.

Further development of the PB AOM concept includes more options such as synthetic vision guidance systems (SVGS).

Specifically, within the current AMS Part 3 timeframe: APTA B1/1 PBN Approach (APCH) with advanced capabilities.

Block 2 (2025 – 2030)

Development of GBAS Cat II/III approaches allows for an alternative precision approach landing system to be used in low-visibility operations.

Specifically, within the current AMS Part 3 timeframe: APTA B2/1 GBAS CATII/III precision approach procedures; APTA UK B2/2 RNP approach to include three lines of minima (LNAV/ LNAV/VNAV, LPV).

2.49 The PBN concept determines a set of aircraft capabilities and system performance requirements utilising satellite-based navigation rather than relying solely on physical ground-based infrastructure. The introduction of this concept represents a paradigm shift in air navigation, moving away from traditional ground-based navigation to a more precise, accurate and efficient approach that leverages advances on-board aircraft technologies. The PBN concept does, however, permit the continued use of ground-based navigation aids in contingency scenarios to provide resilience when Global Navigation Satellite System (GNSS) is not available. For instance, due to GNSS interference.

2.50 The current framework requirements on service providers for the deployment of PBN can be broadly summarised as follows:

- Assimilated Regulation (EU) 716/2014 (UK Pilot Common Project (PCP)). There are requirements for air traffic service (ATS) providers at Heathrow, Gatwick, Stansted and Manchester airports to deploy PBN as from 31 December 2027 and implement the associated operational procedures, allowing their seamless operation in accordance with specified RNP operations.
- Assimilated Regulation (EU) 2018/1048 (UK PBN Implementing Rule). There are requirements for providers of Air Traffic Management (ATM) / Air Navigation Services (ANS) at aerodromes with instrument runway ends not served by precision-approach procedures to implement PBN in accordance with specified RNP operations, as well as associated transition plans, contingency measures and other procedures. Only those requirements applicable by 31 December 2020 were transposed into UK law.

2.51 Service providers in the UK outside the scope of these two regulations do not have obligations with respect to the deployment of PBN.

2.52 Revision of that framework, as well as the development of policies and guidance material, is considered necessary to ensure timeliness in line with ICAO GANP, consistency in application, and interoperability through standardisation of system performance.

2.53 Several CAA activities fall within the scope of PBN; one of which is the development and publication of revised PBN regulations. The first key milestone was completed in Q3 2023 with the submission and approval of a work mandate to the CAA's Aviation Legislation and Policy (ALP) Board for a new PBN rulemaking task that will include the development of new legislation and, where appropriate, acceptable means of compliance and guidance material. The next key milestone for this project is a public consultation on the PBN proposals; this is planned for Q2 2024.

2.54 Supporting navigation systems are required to enable the full benefits and to support navigation resilience of PBN deployment. The development is described in the ICAO GANP Navigation Systems (NAVS) element. The ASBU deployment is captured below:

ICAO GANP Technical thread NAVS

Navigation Systems

Block 0 & 1 (2013 – 2024)

Ground-Based Augmentation Systems (GBAS) is provided to support precision approach and landing operations at a specific airport, in particular NAVS Navigation systems Technology Category I operation utilising GBAS Approach Service Type C (GAST-C), with the improved accuracy, integrity and availability of satellite navigation.

Space-Based Augmentation System (SBAS) and Aircraft-Based Augmentation Systems (ABAS) are implemented as a mean to comply with ICAO Assembly Resolution A37-11 regarding Vertically Guided Approach. SBAS is provided to support PBN in all phases of flight with increased accuracy and integrity. ABAS is provided to support non-precision (LNAV) and vertically guided approach with Baro-VNAV as well as other terminal and en-route navigations.

Rationalisation of conventional navigation aid infrastructure through Minimal Operating Networks starts to happen and supports a reduction in the number of NDBs, VORs and, where appropriate, ILS. Complementary Positioning, Navigation and Timing is based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures.

With enhanced ionospheric monitoring and mitigation as well as enhanced VHF Data Broadcast receiver performance, extended GBAS is provided to support precision approach and landing operations at a specific airport, particularly Category II operation utilising GAST-C and Category II/III operation utilising GAST-D, with the improved accuracy, integrity and availability.

Within this Block 1 timeframe, new core constellations and new signals are available for civil aviation use (multi-constellation concept) – Galileo (Europe) and Beidou (China) – and support dual-frequency navigation signals. GPS (USA) and GLONASS (Russia) also evolve to support dual-frequency navigation signals.

Block 0 & 1 (2013 – 2024)

Rationalisation of the conventional infrastructure through Minimal Operating Networks continues to be implemented and supports a reduction in the number of NDBs, VORs and, where appropriate, ILS. Complementary Positioning, Navigation, Timing remains based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures. New CPNT infrastructure is being explored and evaluated.

Block 2 (2025 – 2030)

Dual-Frequency Multi-Constellation (DF/MC) GBAS, SBAS and ABAS start to be provided, improving the resolution of atmospheric propagation errors affecting navigation core constellation signals and supporting additional robustness, compared with single frequency interference.

2.55 Satellite-Based Augmentation System (SBAS) in the UK was once available through the European Geostationary Navigation Overlay Service (EGNOS); however, since the end of June 2021 this system is no longer available for the use of safety of life (SoL) services. The CAA is currently tasked with contributing to cross-government work led by the UK Space Agency (UKSA) to produce a project for SBAS provision in the UK. The UKSA have been directed by the Department for Science, Innovation and Technology and the Department for Transport to conduct this work to determine options to possibly reinstate a SoL capability for aviation, as well as providing services in support of a wide range of sectors. The availability of SBAS in the UK is an important enabler to the deployment of certain PBN capabilities, which includes the provision of RNP approaches to LPV minima using SBAS SoL provisions.

2.56 Further supporting the deployment of PBN, specifically the GNSS aspects, is the existence of a minimum operating network (MON) that is based on conventional navaids. A MON refers to the minimum navaid infrastructure needed to provide the required level of ATM/ANS for both normal and contingency operations. A MON is required to protect against interruption to satellite-based navigation systems where the only current alternative is terrestrial navigation. There is no extant policy regarding GNSS resilience and this will be developed, possibly alongside a GNSS reversion plan for the UK. The expectation of GNSS performance could impact multiple areas of the AMS, including AAM and UAS integration. The GNSS resilience provision needs to be aligned with the PBN rulemaking task outlined above. To this end there is an activity to develop an updated future strategy for the provision of terrestrial navigation infrastructure.

Focus area 6: System Wide Information Management (SWIM)

The introduction of SWIM – seamless information access and interchange between all providers and users of ATM information and services – enables delivery of the right data, at the right time, to the right user, in the right way. There are several key building blocks to achieving a UK SWIM capability starting at the end of 2024 and continuing, incrementally, as the performance evolves beyond 2030.

2.57 SWIM provides for a data exchange framework that enables interoperability and exchange of digital information between all ATM community stakeholders. SWIM aims to improve the efficiency and safety of airspace usage with the real-time exchange of pertinent aviation-related data.

2.58 The present-day model for information exchange is very limited and acts as a constraint on the forward-looking implementation of future, performance-enhancing operational improvements. Chief limitations are:

- Systems have not been designed and implemented to be globally interoperable within globally agreed parameters
- Many interfaces, which were designed to support point-to-point or application-to-application exchanges, have limited flexibility to accommodate new users, additional systems, new content or changed formats
- Message-size limitations and a non-scalable approach to information exchange with the present infrastructure
- The current infrastructure can make it difficult and costly for one stakeholder to access, on a timely basis, information originated by another stakeholder.

2.59 The current variety of systems and exchange models makes it challenging to devise security frameworks across systems and stakeholders to support the increasing need for open and timely data exchange while at the same time respecting the legitimate security concerns of all stakeholders. Currently most organisations manage their ATM information in partial isolation leading to duplication and inconsistencies.

2.60 SWIM contributes to achieving the following benefits:

- Improved 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 which minimises the impact of changes between information producers and consumers
  - Support of ATM Service Delivery Management (SDM).

2.61 UK Element UK-AM/6 (Data Services) utilises the ICAO GANP ASBU Thread SWIM to describe the intended development of SWIM.

ICAO GANP Information thread SWIM

Navigation Systems

Block 2 (2025 – 2030)

System Wide Information Management (SWIM) is a new way of managing and exchanging information. It replaces the current ground-ground point-to-point information exchange by an aviation intranet relying on internet technologies enabling information services to be provided to the ATM community. The aim is to facilitate a publish-subscribe and request-reply information exchange through SWIM-capable architecture. Operational standardised information services, provisions for the information service content and service overview are defined and appropriate SWIM governance established.

In addition, Air/Ground (A/G) SWIM is a capability that enables improved operational awareness and decision making by flight crews by exchanging information with the aircraft and its automation systems. A/G SWIM makes the aircraft a node in the network and supports the exchange of information such as trajectories, aeronautical, meteorological, and flight and flow information between ground-based ATM components and the flight deck. As a first step, A/G SWIM is supporting the exchange of non-safety-critical information.

SWIM governance ensures interoperability for global access to SWIM information by the ATM community.

This thread is an enabler to support all operational improvements that require information.

Specifically, within the current AMS Part 3 timeframe:

SWIM B2/1 Information Service Provision

B2/2 Information Service Consumption

B2/3 SWIM Registry

SWIM B2/4 Air/Ground SWIM for non-safety critical information.

2.62 ICAO provisions describe the standards, infrastructure and governance that are required to be addressed within a SWIM implementation framework. Establishing a UK SWIM implementation framework is the critical enabler for the implementation of the UK SWIM infrastructure that will be necessary for a modernised aviation environment. With a collaborative and digitised SWIM data backbone, suitably equipped airspace users, system operators and ATM managers will have access to relevant mission-critical data to support and execute their activities in all types of airspace classification cooperatively.

2.63 This underpinning digital data exchange capability will be the advancement that revolutionises UK aviation activity by supporting improvements in digitised ATM service delivery. In practical terms, the delivery of VOLMET[33] in the current aviation system could be replaced with Flight Information Service that is Broadcast. FIS-B is expected to offer users digitised and standardised data to enable users to plan activity accordingly.

2.64 The introduction of a digitised Traffic Information Service Broadcast (TIS-B) will complement the provision of ICAO Flight Information Services, enabling the integration of manned and unmanned systems, where technical fits and airspace classification allows.

[33]VOLMET is meteorological information for aircraft in flight, typically delivered via HF or VHF radio.

2.65 A real-time airspace picture will be supported using digitised flight intent data helping to build an ecosystem awareness that will be transmittable to all suitably equipped systems, offering a collaborative and integrated environment.

2.66 The scale and growth of aviation activity that is anticipated for the UK will necessitate technological support to the existing ATM processes to maintain the safe operating environment. An effective, regulated data exchange network will underpin that requirement.

Enabling programmes

NERL programmes

2.67 NATS (En Route) plc – NERL – is a certified ANSP and monopoly provider of UK en route air traffic services. As a monopoly, it is subject to economic regulation through its licence, issued by the Secretary of State, under the Transport Act 2000 (TA00). NERL plays a significant role in the development and deployment of airspace modernisation capabilities. The CAA is the safety and economic regulator of NERL, ensuring it provides safe and efficient services to both current and future users.

2.68 As part of its economic regulation of NERL, the CAA conducts periodic reviews and sets price controls for a five-year period, covering operating and capital allowances, incentives and service quality targets. The capital allowances are set in relation to NERL's investment plans for the price control period, which are developed in consultation with its airline customers. The current price control, NR23, covers the period January 2023 to December 2027. Under its licence, every six months NERL is required to report to, and consult with, stakeholders on its service performance, and delivery of its investment plans through the 'Service and Investment Plan' (SIP). NERL publishes its SIP through its NATS customer gateway website (a login is required).

Airspace change masterplan

2.69 As part of the price control arrangements covering 2020, NERL was required to establish and maintain an Airspace Change Organising Group (ACOG) function, charged with creating a single coordinated implementation plan for airspace changes in the UK (the masterplan). The masterplan must meet criteria set out by the CAA (CAP 2156a Airspace change masterplan – UK CAA acceptance criteria[34]).

2.70 Initially, the masterplan commission covered the scope of the 'FASI-South' programme, and in 2021 it was extended to cover all the UK. The ACOG function within NERL is required to follow commissions from the Department for Transport and CAA as airspace modernisation co-sponsors.

[34] http://www.caa.co.uk/cap2156a

2.71 The licence obligation to establish and maintain the ACOG function also provides for a Steering Committee, chaired by NERL, with other members drawn from the industry bodies responsible for delivering relevant elements and up to two independent members.

2.72 NERL's ACOG function is also required to report to the co-sponsors on progress related to work under the masterplan. More information on the ACOG function and the masterplan can be found on the CAA website.[35]

[35] https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-change-masterplan/about-the-masterplan/

Chapter 3: Technical look-ahead

Introduction

3.1 The structure of AMS Part 3 is designed to evolve and iterate as projects and their outcomes develop.

3.2 Chapter 3 is a less defined look-ahead, largely at the subsequent five-year period between 2026 and 2030, embracing ASBU Block 2 (which runs from 2025 to 2030), including information on possible nearer-term activities, concepts and challenges that the UK CAA needs to consider but where detail, clear deliverables and specific timeframes are not currently known. This initial description covers those areas of work where scoping activities are not mature enough to describe a specific deliverable or project and thus are not included in Chapter 2. This section provides an overview of those areas and/or topics that are under development.

Activities that are being scoped

3.3 For the purposes of this document, the additional AMS-related work being scoped by the CAA that does not appear in Chapter 2 or the appendices falls into three broad categories:

- **A** ATM systems and airspace
- **B** Aircraft operations
- **C** Communications, navigation and surveillance technologies.

A. ATM systems and airspace

3.4 Improvements in the capacity of ATM systems and airspace management techniques enable future concepts to be developed and realised.

3.5 Reduced Departure Divergence is enabled through UK Element UK-ABN/3 (Network Management) utilising the ICAO GANP ASBU Thread RSEQ.

ICAO GANP Operational thread RSEQ

Runway Sequencing

Block 0 & 1 (2013 – 2024)

Arriving flights are 'metered' and sequenced by arrival ATC based on inbound traffic predication information, optimising runway utilisation. Also improvements to departure sequencing, operational pushback clearances, reducing the taxi time and ground holding, delivering more efficient departure sequences and reduce surface congestion.

Extension of arrival metering and integration of surface management with departure sequencing to improve runway management.

Block 2 (2025 – 2030)

Integrated arrival management and departure management to enable dynamic scheduling and runway configuration to better accommodate arrival/departure patterns and integrate arrival and departure management. In addition, integrated arrival management and departure management expands scope from single airport operations to take into account multiple airports within the same terminal airspace.

Determine policy options for UK Reduced Departure Divergence

3.6 Current operational procedures originating from ICAO SARPs and PANS require that aircraft may depart from the same runway with a time-based spacing of no less than one minute, providing that the successive aircraft are on Standard Instrument Departures (SIDs) which diverge by no less than 45° immediately after departure. Reduced Departure Divergence (RDD) is a concept that intends to modify the provisions in ICAO PANS-ATM relating to course divergence for departing aircraft. The RDD concept has potential to improve operational efficiency and provide options for noise management. The CAA summarises the results of research into RDD in CAP 1385[36], and has recommended further R&D.

3.7 RDD could be an important contributor to TMA developments. The CAA recognises the need to consider the outputs of the ASF-funded research, formulate a view on the use of RDD in the UK, and determine next steps for policy development. RDD is a complex subject with separation implications and must therefore be carefully considered before any policy decisions are taken.

3.8 The CAA aims to:

- Determine a policy position on the use of RDD in the UK
- If required, determine a plan for RDD policy options development.

3.9 Subject to the outputs above and AMS Part 3 version schedule, a project will be incorporated into AMS Part 3 as a deliverable as and when appropriate.

[36] http://www.caa.co.uk/cap1385

ATM separation policies and flight procedures

3.10 ATM Separation Policies is enabled through UK Element UK-ABN/4 (Integration) and utilises the ICAO GANP ASBU Thread CSEP.

ICAO GANP Operational thread CSEP

Cooperative Separation

Block 0 & 1 (2013 – 2024)

Enhanced traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations and visual separation on approach are enabled by the evolutions of ADS-B IN capabilities and associated applications.

In Oceanic airspace, the use of Performance-Based Longitudinal Separation minima and Performance-Based Lateral Separation minima will enable the optimisation of trajectories.

Specifically, within the current AMS Part 3 timeframe: CSEP-B1/1 Basic airborne situational awareness during flight operations (AIRB).

Block 2 (2025 – 2030)

The Interval Management (IM) procedure using distance or time will be implemented to improve traffic flow and aircraft spacing. Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. In the lower airspace, UTM separation rules apply based on vehicle-to-vehicle interaction. In the high upper airspace separation is provided strategically through sharing of operators' business and mission trajectories.

Specifically, within the current AMS Part 3 timeframe: CSEP-B2/2 Cooperative separation at low altitudes.

3.11 Point-in-Space (PinS) operations are enabled through UK Element UK-ABN/2 (Terminal Airspace Redesign) utilising the ICAO GANP ASBU Thread APTA to describe PinS operations for helicopters. Future work will explore and, where necessary, develop policy for PinS approaches in support of vertiports[37] and AAM. AAM aircraft performance characteristics and vertiport policy requirements, such as safeguarding, are essential elements in the formulation of any future policy.

[37]The CAA defines a vertiport as a type of aerodrome or operating site that is used or intended to be used for the arrival, departure and surface movement of VTOL aircraft.

Airspace management

3.12 Variable Profile Areas and Dynamic Airspace Configurations is enabled through UK Element UK-AM/52 (Airspace Management) utilising the ICAO GANP ASBU Thread FRTO.

ICAO GANP Operational thread FRTO

Free Route Trajectory Operations

Block 0 & 1 (2013 – 2024)

En-route trajectories are enhanced by using more direct routings and collaborative airspace management process and tools.

ATCOs are assisted by tools for conflict identification and conformance monitoring.

Block 1 introduces the initial steps towards Trajectory-Based Operations by the enhancement of FRTO B0 processes and system support or the deployment of new processes and system support where necessary.

Free Route Airspace (FRA) as the continuation of direct routing introduced in FRTO B0. For airspace where FRA cannot be deployed, or for connectivity between FRA and terminal manoeuvring areas (TMAs), RNP routes should be considered to provide accurate and repeatable connectivity between TMA and FRA.

Collaborative airspace management is enhanced with new features such as real time airspace management (ASM) data exchanges. Additional system capabilities such as dynamic sectorisation intend to align the traffic demand to the available capacity.

Block 2 (2025 – 2030)

Block 2 includes further steps towards Trajectory-Based Operations by the enhancement of FRTO B1 processes and system support.

There is a need ensure a smooth transition between FRA and highly structured airspace based on Dynamic Airspace Configuration (DAC) principles.

All trajectories, planned and submitted/shared, are consistent with constraints and associated avoidance measures. This will be supported by Enhanced Collaborative Decision Making (ECDM) processes in the execution phase, enabling optimisation of trajectories in real time. Airspace users' participation in the ECDM will be extended to a higher level of integration between the decision support tools and it will be a major factor for the harmonisation of the competing goals.

Dynamic Sector Management will evolve into Dynamic Airspace Configuration (DAC), capable of accommodating traffic demand and air traffic flows in real time. DAC will be mainly executed at a network level. FRTO elements cover: the local DAC components to be provided as inputs (ATC sectorisation, airspace structure and restrictions), the application of dynamic airspace configuration identified at a network level and the local adaptation and fine-tuning of DAC according to local ATC needs of logical flows and individual trajectories.

3.13 The Advanced Flexible Use of Airspace may provide further options for future modernisation activities including the ability to further exploit Variable and Dynamically Activated Areas.

Establish safety assurance, operational procedures and tool support for Variable Profile Areas

3.14 Airspace performance will be improved by enhanced airspace management (ASM) concepts. These improvements go beyond flexible use of airspace and will use enhanced features such as variable profile areas (VPA) and dynamic mobile areas (DMA) to support the dynamic configuration of airspace. The CAA is defining its understanding of how VPA and DMA can be used and operated safely in UK airspace to maximise airspace performance.

Develop ATCO licensing policy to support dynamic sectorisation

3.15 There may be a future requirement to amend the extant or develop additional ATCO licensing policy to enable more flexible and dynamic sectorisation within the area control centres. This activity will be dependent on whether the ATCO licensing structure, specifically for unit endorsements, would need to be amended to enable dynamic sectorisation as envisaged. The need for these requirements will be monitored and given due consideration as and when appropriate.

B. Aircraft operations

3.16 Highlighting some areas of change for airspace users, UK Element UK-ABN/4 (Integration) utilises the ICAO GANP ASBU Thread NOPS to describe the development of airspace network operations planning and management for all users, incorporating ATM/UTM services.

ICAO GANP Operational thread NOPS

Network Operations

Block 0 & 1 (2013 – 2024)

Many ATFM processes are automated, while some elements are still managed procedurally. This module, NOPS Network Operations, introduces enhanced processes to manage flows or groups of flights to improve overall fluidity. It refines ATFM techniques, and integrates the management of airspace and traffic flows through a holistic network operational planning dynamic/rolling process to achieve greater efficiency and enhance network performance. It also increases the collaboration among stakeholders in real time to better know airspace user preferences, to inform on system capabilities and ATC capacity and further enhance Collaborative Decision Making (CDM).

Block 2 (2025 – 2030)

ATFM evolves to support Trajectory-Based Operations (TBO). There will be an improved trajectory forecast based on the qualification and quantification of uncertainties, probabilistic approaches and enriched en-route and airport information-sharing.

Enhanced Demand and Capacity Balancing (DCB) provides capabilities which create a paradigm shift with all stakeholders expressing dynamically and precisely their needs which must be accommodated within an agreed performance framework. The Collaborative Network Operations Planning will be further enhanced. Initial steps towards airspace users' driven priorities and the extended airports integration with the ATM Network Planning are envisaged.

Specifically, within the current AMS Part 3 timeframe: NOPS B2/7 UTM Network Operations and NOPS B2/8 High Upper Airspace Network operations.

3.17 The advent of a variety of use cases for Higher Airspace Operations (HAO) that transcend the current airspace limits, ATM technologies and global norms will precipitate the need for new standards. The expected demand from High Altitude Platform Systems (HAPS) will drive the AMS to develop requirements and policy relating to new airspace integration and operational challenges. In response to UK and international activities, a HAPS Delivery Group has been formed within the AMS governance structure, reporting to the Aircraft Capability Steering Group. The outputs of the delivery group will provide a fully informed and concordant response to relevant HAPS and HAO workstreams to support the direction of CAA and Department for Transport policy. While there are no agreed timescales for HAPS Delivery Group activity at this stage, in the near-term the group intends to focus on, in particular:

- Legislative and regulatory context for ATM and airspace that can enable HAO
- Vision of operational integration of HAPS as airspace users
- Baseline of expected aircraft performance and typical HAPS flight profiles; and
- Overarching technical components, such as CNS, needed to enable HAO within the short- and medium-term timeframes.

Flight intent and flight progress data

3.18 The submission of the planned intention of flight, more commonly referred to as a flight plan, is a critical component for the integration of new airspace users as well a fundamental tool in the management of airspace capacity and targeting of service provision for existing users.

3.19 A flight plan typically includes essential information about the flight, such as the aircraft's identification, proposed departure time, route, cruising altitudes and speeds, destination and estimated time en route. For new airspace users, this may also include specific operational details relevant to the type of aircraft or activity, such as UAV operational ceilings and trajectories.

3.20 The submission of flight plan data will remain voluntary in some cases. However, third-party functionality such as 'point and click' submission via Electronic Flight Bag applications will ease the process of submission in airspace requiring compulsory submission of flight plan data.

3.21 Flight progress data refers to the management and updating of flight plan data once the flight has started and is en route.

3.22 Modifications to the rules surrounding the reception, processing and distribution of some types of flight plan and flight progress data will be required, that is, route validation of VFR flight plans and the mandated distribution of low-level flight progress data between ANSPs. The national reception, processing and redistribution of flight intent as well as flight progress data will continue to form an intrinsic part of SWIM.

Evolution of ATM to enable scaled operations

3.23 The requirement for enhanced service provision and air traffic management in the lower airspace will increase with the need to integrate more aircraft and particularly new UAs such as BVLOS UA and AAM. Currently, most BVLOS operations and AAM movements are expected to operate in compliance with the extant international and national VFR ruleset.

3.24 The ability of any new airspace user to operate in low-level airspace under IFR will clearly place considerable demand on ATS provision within airspace classifications where separation is required to be delivered between IFR flights. Any change to those separation agreements or to the core requirements of the flight rules (such as the long-term digital flight rules concept) should be progressed internationally but contributed to and anticipated nationally. Additionally, the development of any specific requirements for equipage will be transparent and collaborative with industry.

3.25 Service provision will focus upon safe integration of new airspace users and may include national modifications to basic ICAO service requirements, such as specific traffic information availability via FIS provision when integrating BVLOS operations with other aircraft. ATM, including specific ATS, will develop and evolve through safe and structured trial deployment of Concepts of Operation for integration, referred to as the 'accommodation' phase.

Trajectory-Based Operations

3.26 The GANP anticipates increasing capabilities will emerge to support the exchange and synchronisation of individual trajectory intent and projections in many airspace environments, including low level. Protocols will enable the enhanced sharing of flight-centric information between aircraft and among ATM systems across airspace environments. This will allow more efficient and accurate flight planning and coordination of aircraft among an expected larger number of operations utilising lower levels of UK airspace (FICE-B2/8).

3.27 The AMS requires the effective integration of multiple user groups and airspace volumes to the largest possible extent. Trajectory-Based Operations (TBO) as envisaged for commercial air transport will provide a basis on which UAS and AAM can, in the future, be similarly enabled to link and synchronise various time advisories and flightpaths for individual aircraft. Flight segments can then be coordinated to provide equitable and efficient operations. This would help achieve an efficient coordination process across time-based capabilities leading to stable, consistent and robust local trajectory solutions. In turn this would improve individual flight efficiency while optimising the overall airspace performance. The development of enabling policies for the integration of flight plan and trajectory data, along with integration of UAS and AAM TBO in lower airspace, is dependent on progress in a number of areas such as, but not limited to, SWIM, output from BVLOS TRA trials, PNT developments and additional ATM services. Specific activities and deliverables will be added to AMS Part 3 when appropriate.

C. Communications, Navigation and Surveillance technologies

3.28 Aligned with international developments, performance-based CNS will take advantage of continued technological developments to support the AMS. The development is described in the ICAO GANP Navigation Systems (NAVS) element. The ASBU deployment is captured below:

ICAO GANP Technical thread NAVS

Navigation Systems

Block 0 & 1 (2013 – 2024)

Ground Based Augmentation Systems (GBAS) is provided to support precision approach and landing operations at a specific airport, in particular NAVS Navigation systems Technology Category I operation utilising GBAS Approach Service Type C (GAST-C), with the improved accuracy, integrity and availability of satellite navigation.

Space-Based Augmentation System (SBAS) and Aircraft-Based Augmentation Systems (ABAS) are implemented as a mean to comply with ICAO Assembly Resolution A37-11 regarding Vertically Guided Approach. SBAS is provided to support PBN in all phases of flight with increased accuracy and integrity. ABAS is provided to support non-precision (LNAV) and vertically guided approach with Baro-VNAV as well as other terminal and en-route navigations.

Rationalisation of conventional navigation aid infrastructure through Minimal Operating Networks starts to happen and supports a reduction in the number of NDBs, VORs and, where appropriate, ILS. Complementary Positioning, Navigation and Timing is based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures.

With enhanced ionospheric monitoring and mitigation as well as enhanced VHF Data Broadcast receiver performance, extended GBAS is provided to support precision approach and landing operations at a specific airport, particularly Category II operation utilising GAST-C and Category II/III operation utilising GAST-D, with the improved accuracy, integrity and availability.

Within this Block 1 timeframe, new core constellations and new signals are available for civil aviation use (multi-constellation concept) – Galileo (Europe) and Beidou (China) – and support dual-frequency navigation signals. GPS (USA) and GLONASS (Russia) also evolve to support dual-frequency navigation signals.

Rationalisation of the conventional infrastructure through Minimal Operating Networks continues to be implemented and supports a reduction in the number of NDBs, VORs and, where appropriate, ILS. Complementary Positioning, Navigation and Timing remains based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures. New CPNT infrastructure is being explored and evaluated.

Block 2 (2025 – 2030)

Dual-Frequency Multi-Constellation (DFMC) GBAS, SBAS and ABAS start to be provided, improving the resolution of atmospheric propagation errors affecting navigation core constellation signals and supporting additional robustness, compared with single frequency interference.

Future navigation infrastructure

3.29 Navigation infrastructure will continue to develop throughout the lifetime of the AMS. Providing the necessary resilience will require continued use of ground-based infrastructure and, with the increased use of satellite-based systems, further augmentation in addition to space-based augmentation. We are engaging with ANSPs, the Ministry of Defence and other stakeholders to better understand future navigation needs.

3.30 For example, Dual-Frequency Multi-Constellation (DFMC) GNSS-enabled GBAS and SBAS. This permits the combined leveraging of dual-frequency signals from up to four GNSS constellations simultaneously. The capability has been enabled through latest advances in aircraft-, satellite- and ground-based augmentation systems, and will become more prevalent as aircraft become increasingly equipped with DMFC-capable avionics.

3.31 Currently, global aviation GNSS capabilities rely mainly on just one constellation and one frequency via GPS L1, meaning that the new multi-constellation capability will assure greater system accuracy and redundancy, delivering important air network capacity and safety benefits.

3.32 The GBAS system provides several advantages such as increased coverage (all runways on an airport) and reduction of time between approaches. It can provide precision approaches where ILS cannot be used due to terrain constraints. The development of approach procedures with CAT II and III minima based on GBAS will allow approach procedures with lower minima even in challenging obstacle environments and reduce the limitations due to the infrastructure constraints.

Develop initial work programme for RPAS command and control (C2) links

3.33 Secure and timely communications between RPAS and operators is developing with the need for potential interoperability with other CNS systems. The development is described in the ICAO GANP COMI (Communications Infrastructure) element. The content to the end of Block 2 deployment is captured below:

ICAO GANP Technical thread COMI

Communication Infrastructure

Block 0 & 1 (2013 – 2024)

Air-Ground

VHF, HF and SATCOM Communications:

- VHF Voice Communications remains the primary means of information exchange in most regions.
- Continued use of the ACARS network to support the distribution of ATS message sets (FANS).
- Introduction of the ATN/OSI network to support B1.
- Continued use of VDL Mode 2 to support ATN/OSI and FANS.
- Continued use of SATCOM Class C, VDL Mode 0/A and VDL Mode 2 as datalinks to support Terrestrial, Oceanic and Remote Airspace, and as a complement to voice and in order to reduce voice channel congestion and increase capacity.
- Continued use of HFDL as the datalink to support Oceanic Airspace as a complement to voice and in order to reduce voice channel congestion and increase capacity.

Ground-Ground

Deployment of IP-based AMHS linked service:

- As an improvement over AFTN in term of bandwidth and length of the message
- As a means to enhance traffic transfer between ANSPs by expanding the use of ATS Inter-Facility Communication Data (AIDC) to improve efficiency of air traffic management by reducing the use of ATS voice service.

Air-Ground

Improved Terrestrial Data Communications:

- VHF Voice Communications remains the primary means of information exchange in most regions.
- Introduction of the VDL Mode 2 Multi-Frequency design to accommodate increased capacity and reduce interference.
- Introduction of the New SATCOM Class B Satellite Datalinks to increase performance and deliver increased ATN/OSI and ACARS network connectivity.

Ground-Ground

Introduction of IP-based network to replace point-to-point circuits:

- AMHS with extension service to support XML, FTBP (IWXMM).
- Expansion of AIDC to enhance efficiency and safety.
- Implement regional IP networks.
- AeroMACS circuits for airport local communications.

Block 2 (2025 – 2030)

Air-Ground

Improved Link Performance:

- VHF Voice Communications remains the primary means of information exchange in terminal areas, however a major shift toward greater use of Datalink in the en-route and surface domains is envisioned.
- Introduce Connectionless VDL Mode-2 design to improve performance and spectrum efficiency.
- Introduce new SATCOM Class B systems to support both voice and data operations with total global coverage.
- Introduction of the ATN/IPS Network technology to improve datalink performance, support message routing and multilink environments, improve system cyber-security and achieve cost reductions.
- AeroMACS for aircraft mobile connection.

Ground-Ground

Implement network services.

Implement AMHS/IP addressing gateway to support legacy services during transition.

Connect regional IP networks to provide for a federated aviation network for exchange of information.

Converged (both g/g and a/g) communications:

Make use of available link technologies meeting performance requirements to provide aviation communications for non-safety critical information.

Specifically, within the current AMS Part 3 timeframe: COMI B2/3 Links meeting requirements for non-safety critical communication.

3.34 The command and control (C2) link is the data link between the RPAS and the remote pilot station for the purpose of managing flight. There are a variety of possible architectures and considerations in the design, security and management of the C2 Link. Notwithstanding the development of ICAO SARPs for RPAS that will drive the need for RPAS C2 regulatory activities for certified RPAS operations, the CAA also recognises the need to progress a work programme in this area as it enables airspace modernisation to support BVLOS RPAS and in the longer term, AAM and HAPS operations. It is anticipated that RPAS C2 will be introduced into the ICAO GANP in due course, therefore the AMS is incorporating this activity.

3.35 An RPAS C2 Delivery Group was established at the end of 2023 and has commenced scoping activities in order to determine workstreams, resources and processes. It is expected that future regulation will need to cover C2 Link types, technical standards, MOPS, approvals and oversight of C2 Communications Service Providers (C2CSP), resilience, emergency recovery plans, service-quality monitoring, infrastructure audits, cyber security, physical security, internal audits and external audits.

3.36 The C2 Link work will be coordinated globally through ICAO; the COMI ASBU description will evolve to ensure a consistent approach to development of the capability.

Adoption of new ACAS, including interoperability of EC with new ACAS systems

3.37 Airborne Collision Avoidance System (ACAS) developments are needed to ensure interoperability with new cooperative surveillance capabilities. The development is described in the ICAO GANP ACAS element. The content to the end of Block 2 deployment is captured below:

ICAO GANP Technical thread ACAS

ACAS

Block 0 & 1 (2013 – 2024)

The traffic alert and collision avoidance system (TCAS) version 7.1 provides short-term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts as well as enhancing the logic for some geometries (for example, the Uberlingen accident). This will reduce trajectory deviations and increase safety in cases where there is a breakdown of separation.

Block 2 (2025 – 2030)

Implementation of a new airborne collision avoidance system will support more efficient operations and ACAS Airborne Collision Avoidance System (ACAS) operational airspace procedures while complying with safety regulations. Fewer 'nuisance' alerts will reduce pilot and controller workload as personnel spend less time responding to such alerts, increasing safety. Aircraft systems such as UAS will be provided with a new collision avoidance function.

3.38 Planned for ASBU Block 2, 2025–2030 is implementation of an airborne collision avoidance system (ACAS) adapted to trajectory-based operations, with improved surveillance function supported by ADS-B and adaptive collision avoidance logic aimed at reducing 'nuisance' alerts and minimising deviations. Additionally, ACAS-B2/1 describes new collision avoidance capability as part of an overall detect and avoid system for UAS. The implementation of a new airborne collision warning system will enable more efficient operations and airspace procedures while complying with safety regulations. Fewer 'nuisance' alerts means personnel spend less time responding to them and hence reduced pilot and controller workload. This will result in a reduction in the probability of a near mid-air collision. While this area is expected to be driven by international developments, there may be rulemaking activities required along with policy decisions relating to equipment requirements for volumes of airspace. The outputs from the CAA EC activities may feed additional considerations for longer term ACAS requirements.

3.39 People will remain at the heart of air traffic management systems. While AMS Part 3 addresses technological developments, we recognise these changes will require careful consideration of human performance. New systems, methods of operation, design and development of Human-Machine Interfaces all require consideration through research and development, licensing and training. As the airborne and ground elements of ATM become ever more connected and interoperable, there are likely to be similar implications for aircraft manufacturers, engineers and flight crews.

3.40 The foundational SWIM services that will be delivered in the earlier stages of the AMS (aligned to ASBU Block 2) will be progressively enhanced with the addition of an ability to share a greater amount of non-safety-critical information between the aircraft (SWIM-B2/4) and the ATM system, moving beyond the constraints of voice communications. Extension of the capability to enable the exchange of safety-critical information in later Blocks will further improve operational awareness and efficiency; these are wholly dependent on creating a UK national SWIM infrastructure including standards, policies and processes. Such connectivity between air- and ground-based systems could be transformational in meeting future objectives, such as enhancing the UK contributions to the Global Aeronautical Distress and Safety System.

Areas of work outside the current UK CAA programme

3.41 The CAA recognises that there are future activities not necessarily captured or presented with associated detail.

3.42 Many airspace modernisation activities are based on technologies and/or operational concepts that have been industrialised and are mature; therefore, the deployment of these technologies and operational concepts is not captured within AMS Part 3.

3.43 There are also future aspects of airspace modernisation whereby there is a dependency on international policy development that is not currently being undertaken. As described in Chapter 1, AMS Part 3 will be subject to ongoing amendment and future versions will be published at various intervals. Each version will endeavour to incorporate more detail as certain activities mature and introduce new activities as they become evident.

Appendix A: Timelines

2024	2025	2026	2027-30	2030+	
	●				Develop and publish new legislation and AMC/GM for PBN
	●				Publish update to CAP 1385, PBN: Enhanced route spacing requirements
	●				Publish update to CAP 1378, PBN: Airspace design guidance
	●				Produce an updated UK PBN Implementation Plan
				●	Produce a UK concept for the future use of vertical navigation utilising a satellite-based navigation system
				●	PBN implementation: RNP approaches at airports with approach control
●					PBN implementation: RNP approaches at airports without approach control
	●				PBN implementation: point in space (PinS) procedures for heliports
		●			Requirements and policy for determining the areas where air traffic services are provided
			●		Develop updated policy on the airspace structures to support aerodromes operating in uncontrolled airspace
				●	Develop requirements and policy relating to the integration of high altitude operations
	●				Review airspace design and classification to ensure that it is fit for purpose and maintains a high standard of safety
●					Publish updated safety buffer policy for Special Use Airspace design
	●				Publish EC standards for the integration of airspace users
	●				Publish guidance on the application of EC standards for different operations and volumes of airspace
	●				Complete human factors review and update pilot training guidance to accommodate EC standards
	●				Examine options to encourage or compel the adoption of EC equipage in the required timeframes
			●		Onward roadmap to full adoption of airborne EC creating known and complete traffic picture
	●				Complete trial(s) of FIS-B installations in a managed environment to guide standards development
	●				Publish FIS-B requirements specifications and performance standards
		●			Set commercial framework for the provision of local and regional TIS-B services
			●		Deployment concept for delivery of improved UK alignment with ICAO FIS provisions

Appendix A: Timelines

2024	2025	2026	2027-30	2030+	
				●	Deployment of a digitised Lower Airspace Service
			●		Enable the use of enhanced functions of a flight information display by FISOs
			●		Develop and publish traffic management concept and policy for new and diverse airspace users
	●				Review rules of the air (SERA) right-of-way
	●				UK SORA Air Risk (Model) Classes (ARCs) for RPAS integration with crewed aircraft
●					Develop and publish Detect and Avoid (DAA) policy
	●				Expand DAA policy to cover non-aircraft threats
●					Publish policy concept on RAS BVLOS operation in Atypical Air Environments
	●				Publish policy on RPAS BVLOS operations in Atypical Air Environments
			●		Input of results from BVLOS sandbox trials utilising a TRA (+ TMZ) in non-segregated airspace (Class D, E & G) to inform policy updates
●					Develop UK SWIM Implementation Framework
	●				Implement a national UK SWIM infrastructure
				●	Introduce Flight and Flow Information for a Collaborative Environment
			●		Air/Ground SWIM for non-safety Critical Information
				●	Air/Ground SWIM for safety Critical Information
	●				Updated rationalisation programme for existing ground infrastructure to provide GNSS failure resilience to suitably equipped aircraft (development of MON)
	●				Provide input into UK Space Agency (UKSA) outline business case for a UK SBAS
				●	Develop a UK framework for dual-frequency multi-constellation SBAS
	●				Policy decision and Ofcom endorsement for allocation of 978MHz to provide additional ADS-B capacity
				●	Establish common infrastructure requirements for the provision of LAS

Appendix B: Deployment plan dashboards

B1 Using a dashboard format, this appendix sets out the activities that are ongoing or planned as of March 2024, including the focus areas described in Chapter 2. The dashboards detail the deliverable, a summary of the activity required, and a target date for completion. The dashboards also show how the activities link to GANP elements, UK sub-elements and a delivery element in the AMS.

B2 The scope and scale of each deliverable varies depending on the nature of the task. An overview is provided for each deliverable giving an indication of the overall aim and any additional explanatory information.

How to interpret this appendix

B3 The content and purpose of the boxes and headings on each dashboard in this appendix are described below under the following headings:

- GANP and UK AMS sub-element alignment
- Most relevant UK AMS delivery element
- Themed outcome or headline area
- Table of individual activities or deliverables showing what is being delivered and by when.

GANP Alignment – UK: Lists the individual ICAO GANP elements and/or UK AMS sub-elements from AMS Part 2 – i.e. the outcomes and tangible deliverables – that are fully or partly enabled by the CAA projects listed in the 'Outcome' box.

AMS Delivery Element: under which the projects listed are considered to be best placed, and as described and organised in AMS Part 2. That is, they service this AMS element to a greater extent than they service other AMS elements. (Many projects will enable or deliver against several different AMS elements.) This provides a consistent link between the AMS Part 2 'ends and ways' and the AMS Part 3 projects.

Outcome: The expected overall high-level outcome or headline area relating to the set of projects. As explained in Chapter 1, projects have been grouped by outcome.

Deliverable and Overview: This is the title of the project or a sentence stating the deliverable. Each individual project will vary in scope, size, complexity and maturity; however, the purpose will be evident from the title and the overview.

Delivery Date: This is the latest planned year for completion of the project, with a specific quarter of the calendar year shown where appropriate. (In general, where there are multiple internal and/or external dependencies, we show only the year.)

Appendix B: Dashboards

GANP Alignment – UK

> GANP APTA – Improve arrival and departure operations
> FRTO-B1/2 Required Navigation Performance (RNP) routes
> APTA-B0/1 PBN Approaches (with basic capabilities)
> APTA-B0/2 PBN SID and STAR procedures (with basic capabilities)
> APTA-B0/6 PBN Helicopter Point in Space (PinS) Operations
> APTA-B1/1 PBN Approaches (with advanced RNP capabilities)
> APTA-B1/2 PBN SID and STAR procedures (with advanced capabilities)
> APTA-B1/5 CDO (Advanced), APTA-B1/4 CDO (Advanced)

Principal Element #2

Terminal airspace redesign

Outcome: Performance-Based Navigation (PBN) policy and regulation

Deliverable

Develop and publish new legislation and AMC/GM for PBN.

Overview

Performance-Based Navigation (PBN) provides the basis to enable modernised airspace utilising the aircraft navigation capabilities to provide route design opportunities that contribute to the industry sustainability ambitions. The milestones capture (as at June 2023), the existing PBN requirements in UK legislation. The rulemaking activity will include regulation and associated AMC.

Delivered

Q3-2025

Deliverable

Publish update to CAP 1385, PBN: Enhanced Route Spacing Requirements.

Overview

CAP 1385 provides the industry guidance on route-spacing methodologies and analysis using PBN as the basis for navigation performance. This element represents the use of advanced features of PBN in design of arrival procedures to provide more flexibility in airspace design, leading to greater efficiency in the terminal area and increased capacity.

Advanced RNP is the navigation specification which encompasses all elements of PBN (but excluding RNP AR APCH). It requires an FMS based on a TSO-C115d.

Delivered

Q1-2025

Deliverable

Publish update to CAP 1378, PBN: Airspace Design Guidance.

Overview

CAP 1378 provides guidance on a range of design options for PBN arrival and departure procedures, outlining the potential benefits and impacts certain solutions may have on noise for local communities.

Delivered

Q1-2025

Deliverable

Produce an updated UK PBN implementation plan.

Overview

Following consultation on the revised PBN legislation, an updated national PBN implementation plan will be published, informed by industry plans for deployment in accordance with the proposed legislation.

Delivered

Q1-2025

Deliverable

Produce a UK concept for the future use of vertical navigation utilising a satellite-based navigation system.

Overview

Develop a CONOPS in association with PBN to redefine airspace containment criteria to protect ATS routes.

Delivered

2030+

GANP Alignment – UK

> GANP APTA – Improve arrival and departure operations

Principal Element #2

Terminal airspace redesign

Outcome: Non-Masterplan ACPs for PBN Implementation

Deliverable

PBN implementation: RNP approaches at airports with approach control.

Overview

UK(EU)2018/1048 requires RNP APCH (3 lines of minima) to be deployed at all runways with instrument runway ends served by non-precision approach by 3 December 2020. This is not currently possible due to lack of UK SBAS solution. Work towards identifying a credible UK SBAS solution will enable this outcome.

Delivered

2030+

Deliverable

PBN implementation: RNP approaches at airports without approach control.

Overview

UK state-funded programme to deploy RNP APCH lines of minima at runway ends not serviced by an approach control function to enhance safety of flight in the approach phase.

Delivered

Q4-2024

Deliverable

PBN implementation: point in space (PinS) procedures for heliports.

Overview

PBN PinS procedures provide a published flight procedure for helicopters to regularly used landing sites (such as hospitals, offshore platforms etc).

Delivered

Q1-2025

GANP Alignment – UK

> UK-ABN/3 Network Management; GANP NOPS
> UK-ABN/4 Integration; GANP CSEP
> UK-AM/5 Airspace Management; UK FA

Principal Element #5

Airspace management

Outcome: Integrated airspace structures – policy and regulatory framework

Deliverable

Requirements and policy for determining the areas where ATS are provided.

Overview

ICAO airspace classifications are used to support the right air traffic services to deliver a safely managed operation. The right-sized airspace volume with appropriate classification supports existing and new users but is fixed and notified through aeronautical information management. The long-term ambition is to deliver the right airspace volumes in a more flexible and real-time way. This activity will deliver requirements and policy for determining the areas where air traffic services are provided and the designation and design of airspace to support that provision.

Delivered

Q4-2026

Deliverable

Develop updated policy on the airspace structures to support aerodromes operating in uncontrolled airspace.

Overview

Policy to assist aerodrome operators in ensuring the safe operation at aerodromes operating in uncontrolled airspace e.g. through the use of a Radio Mandatory Zone.

Delivered

2027

Deliverable

Develop requirements and policy relating to the integration of High-Altitude Operations.

Overview

High-Altitude Operations aim to utilise airspace above the traditional airspace volume to date with a potential mix of operations. Work to develop policy and requirements in this area will initially be coordinated by the HAPS Delivery Group, although it is anticipated that this activity will produce policy and requirements by the beginning of ASBU Block 3.

Delivered

2031

GANP Alignment – UK

> UK-ABN/4 Integration
> UK-AM/5 Airspace Management
> UK FA-B1/1 – Concept for lower level flexible airspace access developed

Principal Element #5

Airspace management

Outcome: Airspace classification review

Deliverable

Review airspace design and classification to ensure that it is fit for purpose and maintains a high standard of safety.

Overview

In accordance with The CAA (Air Navigation) Directions 2023, and in support of the AMS strategic objectives, the CAA will regularly review volumes of airspace using the process described in CAP 1991. The recent and immediate focus for the CAA is the Manchester Low Level Route (MLLR). CAP 2564 (the MLLR report) was published in Q3 2023; the CAP 1991 submission to CAA Airspace Regulation is planned for Q3 2024 with implementation planned for Q1 2025. Full details of the review including CAA recommendations can be found in CAP 2564.

Delivered

Q1-2025

GANP Alignment - UK

> FRTO-B1/3 Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
> FRTO-B2/2 Local components of Dynamic Airspace Configurations (DAC)

Principal Element #5

Airspace management

Outcome: Regulatory enablers for Advanced Flexible Use Airspace

Deliverable

Publish updated safety buffer policy for Special Use Airspace design.

Overview

Special Use Airspace (SUA) is a generic term used for airspace volumes that are designated for specific operations which, because of their nature, may require limitations on airspace access to be imposed upon other aircraft not participating in those operations / activities. SUA can be permanent or temporary. This task will review and, if necessary, refine extant policy considering all types of SUA.

Delivered

Q1-2024

GANP Alignment – UK

> ALP Mandate Task 0169 aligns with ICAO Global Air Navigation Plan (GANP)
> Align UK B1/1: Agree alignment with ICAO PANSOP & SARPS

Principal Element #5

Airspace management

Outcome: Deployment of a simplified flight information service and Lower Airspace Service

Deliverable

Deployment concept for delivery of improved UK alignment with ICAO FIS provisions.

Overview

UK Flight Information Services are based upon ICAO provisions on the flight information service and the requirements detailed within the Standardised European Rules of the Air (SERA). We intend to improve our alignment with ICAO, adopting the type of service provision arrangements seen elsewhere in the world; i.e. provision of a state-wide flight information service (including surveillance-based traffic information and traffic avoidance advice) and alerting service. The core deliverable of this project will be the publication of policy. The implementation of the policy will require an appropriate transition period to be determined in due course, but not before at least the public consultation on policy proposals has been conducted.

Delivered

2027

Deliverable

Deployment of a digitised Lower Airspace Service.

Overview

The integration of existing and new users in UK airspace is fundamental to modernisation to ensure all operators can be safely accommodated in the limited airspace volumes available; the most pressing volume is the lower airspace with rapidly increasing demand. A consistent and resourced UK Lower Airspace Service delivering air traffic services supported by digital data and EC data will create a safer operating environment for airspace users. The deployment of LAS will follow the ASBU-aligned path contained within AMS Part 2. The project to deploy LAS is currently being scoped with many key activities to follow, such as a concept of operations and possible funding models. Project scoping, including milestones and associated timelines is currently underway.

Delivered

2030+

Deliverable

Enable the use of enhanced functions of a flight information display by FISOs.

Overview

ICAO Doc 4444 PANS-ATM describes the functions of ATS surveillance systems in the flight information service and, in relation to AFIS, the CAA considers these to be 'enhanced functions'. At present, the technical specification developed by the CAA for the FID supports only the use of ATS surveillance systems to provide basic functions. The performance of enhanced functions is dependent upon wider developments including, inter alia: more widespread use of ADS-B technology, development of CAA proposals on FISO training, qualification and licensing etc and would be considered to be an ATS surveillance service. The CAA will develop requirements relating to the enhanced functions as operational requirements mature and are identified by industry.

Delivered

2027

GANP Alignment – UK

> UK Align-B2/5: Determine use of automated services (FIS/TIS-B Type)
> UK Align-B2/6: Implement Automated services (Basic)

Principal Element #4

Integration

Outcome: Flight Information Service Broadcast (FIS-B) Deployment

Deliverable

Complete trial(s) and investigation of FIS-B installations in a managed environment to guide standards development.

Overview

FIS-B will automatically transmit a range of national and regionally focussed aeronautical and meteorological information products as specified by the CAA and sourced from the UK aeronautical and meteorological information service providers, including METARs, TAFs, SIGMET and NOTAM. The products will be available to aircraft that can receive data over 978 MHz (UAT). Having current weather and aeronautical information in the cockpit will help pilots plan more safe and efficient flight paths, as well as make strategic decisions during flight to avoid potentially hazardous developing weather (although it should be noted that, given service limitations and potential quality assurance issues, FIS-B will not be for use as a primary means of navigation or for tactical decision-making and the approved sources of authoritative information remains the UK Aeronautical and Meteorological Service Providers).

Technical trial has already been completed. Further investigation into the operation of FIS-B to be completed.

Delivered

Q4-2024

Deliverable

Publish FIS-B requirements specifications and performance standards.

Overview

Minimum performance standards and specifications will be required for FIS-B data link systems and equipment/aircraft equipment (avionics) intended to display (non-air traffic control related) aeronautical and meteorological information to pilots to enhance their situational awareness. An approval process for display equipment/avionics (hardware/software) will need to be established.

Delivered

Q4-2025

Deliverable

Complete service tender, award and licensing process for a national FIS-B provider.

Overview

The UK FIS-B technical infrastructure (e.g. ground stations and datalink) is intended to be a State service provided through a third party provider, which will require a suitable funding mechanism and licensing process to be established. The third party will be required to make the necessary arrangements with the UK Aeronautical and Meteorological Service Providers for the supply of Aeronautical and Meteorological Information as specified by the CAA, and with applicable aircraft equipment manufacturers for the display of information disseminated via the FIS-B service.

Delivered

Q2-2026

GANP Alignment – UK

> UK Align-B2/5: Determine use of automated services (FIS/TIS-B Type)
> UK Align-B2/6: Implement Automated services (Basic)

Principal Element #4

Integration

Outcome: Traffic Information Service Broadcast (TIS-B) Deployment

Deliverable

Complete trial(s) of TIS-B installations in a managed environment to guide standards development.

Overview

The UK dual-frequency strategy for EC will be supported through the provision of local, timely and accurate traffic information that enhances in-flight situational awareness and provides this traffic information across the necessary spectrum to ensure all recipients receive the relevant information. Technical trial already completed (2023); further investigation into the operation of TIS-B to be completed, which will be informed by the EC Ground Infrastructure study.

Delivered

Q1-2025

Deliverable

Publish TIS-B requirements specifications and performance standards.

Overview

The integrity and accuracy of the EC position data to be broadcast and the timeliness of the ground system re-broadcast are fundamental to the provision of the right data at the right time to the airspace user. EC integrity and accuracy standards, ground infrastructure latency, recording and redundancy standards are required.

Delivered

Q4-2025

Deliverable

Set commercial framework for the provision of local and regional TIS-B services.

Overview

The localised nature and technical integrity requirements mean the service may be delivered through a centralised or distributed model or mix; that choice may depend on the trial outputs and standards required. The aim being to enable an ANSP to partially/fully discharge their responsibilities for the provision of surveillance enhanced traffic information via the option to transmit an integrated surveillance picture via TIS-B. The working assumption is that there will be no economic regulatory requirement.

Delivered

Q2-2026

GANP Alignment – UK

Principal Element #4

Integration

Outcome: Air traffic management requirement for integration

Deliverable

Develop and publish traffic management concept and policy for new and diverse airspace users.

Overview

Develop the UK's service provision concept and create policy. This will require the identification of the ATM services and supplementary services that will be necessary to enable the integration of diverse airspace users in existing UK airspace. Those services applicable in the UK will be identified in the Technical Requirements (TR). The Authority Requirements (AR) and the Organisational Requirements (OR) of any service provider will be identified by the CAA using a sandbox activity. Key near-term milestones are:

- Policy concept for TR for services – Q2-2024
- Sandbox to assess AR and OR – Q4-2024
- Policy concept for AR for service providers – 2025
- Policy concept for OR for service providers – 2025

This area of work is maturing, and further development is required (AMS Part 3 Chapter 3 refers) which will be dependent on the CAA sandbox activity. More detail will be included in future iterations of the AMS Part 3.

Delivered

2028

Deliverable

Review rules of the air (SERA) right-of-way

Overview

Review and recommend amendments to SERA.3205 (proximity) and SERA.3210 (right-of-way) to accommodate UAS.

Delivered

Q4-2025

GANP Alignment – UK

Principal Element #4

Integration

Outcome: Ground-Air / Air-Air Detect & Avoid (Cooperative and Non-Cooperative Solutions)

Deliverable

UK SORA Air Risk (Model) Classes (ARCs) for RPAS integration with crewed aircraft.

Overview

Define UK framework to allow integration of crewed and uncrewed air systems in UK airspace classifications.

Delivered

Q1-2025

Deliverable

Develop and publish Detect and Avoid (DAA) policy.

Overview

A DAA policy is one of the foundational policies required to enable RPAS BVLOS within the UK Air Risk Model. The DAA Delivery Group is drafting a policy that covers all classes of airspace and RPAS categories. The initial priority of the DAA DG is lower risk airspace and specific category RPAS, but this will be expanded to larger RPAS and higher risk airspace.

Delivered

Q4-2024

Deliverable

Expand DAA policy to cover non-aircraft threats

Overview

Expand the DAA policy to cover non-aircraft threats to RPAS BVLOS operations e.g. wildlife.

Delivered

Q4-2025

GANP Alignment – UK

Principal Element #4

Integration

Outcome: RPAS BVLOS Operations in Atypical Air Environment

Deliverable

Publish policy concept on RPAS BVLOS operations in Atypical Air Environments.

Overview

Operating within an Atypical Air Environment should reduce the likelihood of a mid-air collision between an UA and other conventionally piloted aircraft. The adoption and recognition of an Atypical Air Environment is an innovative concept in the UK. The initial policy position will evolve as understanding of how Atypical Air Environments are used matures. The policy is to be considered in addition to any Regulation and AMC/GM that is applicable to UAS operations.

Delivered

Q2-2024

Deliverable

Publish policy on RPAS BVLOS operations in Atypical Air Environments.

Overview

Updated policy based on lessons learned from initial publication of the Atypical Air Environment policy concept to enable scaled operations within an Atypical Air Environment.

Delivered

2025

GANP Alignment – UK

> UK-ABN/4 Integration
> UK-AM/5 Airspace Management
> UK-AM/6 Data services
> UK-AM/7 Future Surveillance and Spectrum

Principal Element #4

Integration

Outcome: RPAS BVLOS Operations in segregated and non-segregated airspace

Deliverable

Input of results from BVLOS sandbox trials utilising a TRA (+ TMZ) in non-segregated airspace (Class D, E and G) to inform policy updates.

Overview

Delivery of a coordinated programme (commenced in 2024) of demonstrators that conducted RPAS BVLOS operations in a TRA supported by a TMZ, including defined requirements and success criteria that has enabled clear definition of the outputs required to achieve scalable RPAS BVLOS. Sandbox trials commence in 2024 and learnings input of results on a rolling basis. The following key milestones are applicable to this activity:

- Commence BVLOS sandbox trials and reporting – Q1-2024
- Publish tailored safety reporting and lessons-learning data collection process to support trials – Q2-2024
- Commence input of results from trials into, where appropriate, updates to relevant policy – Q4-2024
- Conclude BVLOS sandbox trials – 2027

Outputs from BVLOS sandbox trials will provide evidence and operational lessons to support development of future ATM/ANS requirements for integration, including that of AAM operations. Policy development will remain dependent on outputs from other activities such as EC and DAA.

Delivered

2027

GANP Alignment – UK

> NAVS-B0/1 Ground Based Augmentation Systems (GBAS)
> NAVS-B2/1 Dual Frequency Multi Constellation (DF MC) GBAS
> NAVS-B0/2 Satellite Based Augmentation Systems (SBAS)
> NAVS-B2/2 Dual Frequency Multi Constellation (DF MC) SBAS
> NAVS UK/2 SBAS solution implementation for the UK
> NAVS-B0/3 Aircraft Based Augmentation Systems (ABAS)
> NAVS-B2/3 Dual Frequency Multi Constellation (DF MC) ABAS

Principal Element #8

Integration of CNS & Spectrum

Outcome: Future Navigation Infrastructure

Deliverable

Updated rationalisation programme for existing ground infrastructure to provide GNSS failure resilience to suitably equipped aircraft (development of Minimal Operating Networks).

Overview

The GNSS resilience provision needs to be aligned with the PBN mandate. A complementary PNT MON is required to protect against failure or degradation of satellite-based navigation systems. To achieve this the only current alternative for crewed aviation is a terrestrial navigation provision such as DME-DME. Currently there is no policy regarding GNSS resilience and this would need to be developed, possibly alongside a GNSS reversion plan for the UK.

The expectation of GNSS performance and resilience could impact multiple areas of the AMS, including AAM and RPAS integration. Currently the core terrestrial navigation provision is DME-DME and further down the line (2030+) this could incorporate some elements of LDACS, which may have a terrestrial navigation component. Under various workstreams, the CAA will consider the navigation and surveillance PNT (Position, Navigation and Timing) requirements for new airspace users. This is likely to include contributions to UK Government work on complementary PNT systems through the DfT PNT office.

Delivered

Q4-2025

Deliverable

Provide input into UK Space Agency (UKSA) outline business case for a UK SBAS.

Overview

To identify and promote the requirement for UK SBAS and contribute to the UK Government business case. Establish timescales for project and develop plans for approval of service if required (including independent certification of EGNOS). To support efforts within government to explore options to remedy the current absence of a SBAS SoL in the UK. To support the test bed programme and help develop UK overarching business case requirements.

Delivered

Q1-2025

Deliverable

Develop a UK framework for Dual-Frequency Multi-Constellation SBAS

Overview

To influence the development of international standards and to develop the UK framework for implementation of DFMC SBAS.

Delivered

2030+

GANP Alignment – UK

- ASUR-B2/1 Evolution of ADS-B and Mode S
- ASUR-B2/2 Electronic conspicuity based surveillance system for airborne aircraft (low and higher airspace) EVLOS, BVLOS surveillance Urban Air Mobility requirements HAPS surveillance requirements
- UK ASUR-B2/2 Establish use of EC & MLAT data in the provision of ATS separation services
- ASUR-B3/1 New non-cooperative surveillance system for airborne aircraft (medium altitude)
- ASUR-B4/1 Further evolution of ADS-B and MLAT
- UK ASUR-B2/1 Integration of EC sources to provide a comprehensive surveillance source with integrity and accuracy

Principal Element #7

Future surveillance and spectrum

Outcome: Future Surveillance Infrastructure

Deliverable

Policy decision and Ofcom endorsement for allocation of 978MHz to provide additional ADS-B capacity.

Overview

To progress the adoption of 978MHz (airborne) and execute work to support rollout, the spectrum allocation needs to be secured. The CAA is working with Ofcom to enact changes to associated spectrum management rules and licensing frameworks. There are also a number of workstreams underway with a specialist contractor to deconflict with existing services; these include JTIDS, DME and PMSE.

978MHz allocation will support additional airborne ADS-B capacity but may also provide a FIS-B or TIS-B provision. Currently ground infrastructure requirements are being investigated internally, and the delivery of such services will be dependent on the technical approach agreed.

Delivered

Q1-2025

Deliverable

Establish common infrastructure requirements for the provision of LAS.

Overview

To establish the ground-based infrastructure requirements to provide an ICAO FIS service. Likely to focus on traditional CNS requirements in parallel with electronic conspicuity and utilisation of 978MHz for the provision of ADS-B and TIS/FIS-B. A review of the current CAP 670 requirements under supplementary amendment 2021/02 also needs to be conducted. This work will be dependent on progress of the LAS concept.

Delivered

2030+

Appendix C: Abbreviations

Abbreviation	Description
A/G	Air/Ground
AAE	Atypical Air Environment
AAM	Advanced Air Mobility
ABAS	Aircraft-based augmentation system
ACARS	Aircraft Communications, Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACOG	Airspace Change Organising Group
ADS-B	Automatic Dependent Surveillance–Broadcast
ADS-C	Automatic Dependent Surveillance–Contract
AeroMACS	Aeronautical Mobile Airport Communications System
AFIS	Aerodrome Flight Information Service
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATS Inter-Facility Communication Data
AIM	Aeronautical Information Management
AIRB	Airborne situational awareness during flight operations
AIS	Aeronautical Information Service
AISG	Airspace Integration Steering Group
ALP	Aviation Legislation and Policy
AMAN	Arrival Manager
AMC	Acceptable Means of Compliance
AMHS	Air Traffic Service Message Handling System
AMS	Airspace Modernisation Strategy
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider

Abbreviation	Description
AOP	Airport Operating Plan
APCH	Approach Phase of Flight
APTA	Approach Procedures
AR	Authority Requirements
ARC	Air Risk Class
ASBU	Aviation System Block Upgrade
ASF	Airspace Modernisation Strategy Support Fund
ASM	Airspace Management
ASUR	Advanced Surveillance
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATN/IPS	Aeronautical Telecommunication Network/Internet Protocol Suite
ATN/OSI	Aeronautical Telecommunication Network/Open Systems Interconnect
ATS	Air Traffic Services
Baro-VNAV	Barometric Vertical Navigation
BVLOS	Beyond Visual Line of Sight
C2	Command and Control
CAP	Civil Aviation Publication
CCO	Continuous Climb Operations
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
CFIT	Controlled Flight into Terrain
CNS	Communications Navigation and Surveillance
CONOPS	Concept of Operations
CPDLC	Controller–Pilot Datalink Communications
CPNT	Complementary Position Navigation and Timing

Abbreviation	Description
CTR	Control Zone
DAA	Detect and Avoid
DAC	Dynamic Airspace Configuration
DCB	Demand and Capacity Balancing
DFMC	Dual-Frequency Multi-Constellation
DfT	Department for Transport
DL	Data Link
DMA	Dynamic Mobile Area
DME	Distance Measuring Equipment
EASA	European Union Aviation Safety Agency
EC	Electronic Conspicuity
ECAC	European Civil Aviation Conference
ECDM	Enhanced Collaborative Decision Making
ECTRL	EUROCONTROL
EGNOS	European Geostationary Navigation Overlay Service
EVS	Enhanced Vision Systems
FANS	Future Air Navigation System
FDPS	Flight Data Processing System
FF-ICE	Flight and Flow Information for a Collaborative Environment
FIR	Flight Information Region
FIS	Flight Information Service
FIS-B	Flight Information Service–Broadcast
FISO	Flight Information Service Officer
FL	Flight Level
FMS	Flight Management System
FRA	Free Route Airspace
FRTO	Free Route Trajectory Operations

Abbreviation	Description
FTBP	File Transfer Body Part
FUA	Flexible Use Airspace
GADSS	Global Aeronautical Distress and Safety System
GANP	Global Air Navigation Plan
GAST-C	Ground Based Augmentation System Approach Service Type C
GBAS	Ground Based Augmentation System
GLONASS	Global Navigation Satellite System (Russia)
GM	Guidance Material
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAO	Higher Airspace Operations
HAPS	High Altitude Platform System
HF	High Frequency
HFDL	High Frequency Data Link
ICAO	International Civil Aviation Organization
IFP	Instrument Flight Procedures
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Interval Management
IP	Internet Protocol
IWXXM	ICAO Meteorological Exchange Model
LAS	Lower Airspace Service
LDACS	L-band Digital Aeronautical Communications System
LNAV	Lateral Navigation
LPV	Localiser Performance with Vertical Guidance
LSSIP	Local Single Sky Implementation
LTMA	London Terminal Control Area

Abbreviation	Description
J&I	Joint and Integrated
MAC	Mid-Air Collision
MLAT	Multilateration
MLLR	Manchester Lower-Level Route
MOD	Ministry of Defence
MON	Minimum Operational Network
MOPS	Minimum Operational Performance Standards
MTMA	Manchester Terminal Control Area
NDB	Non-Directional Beacon
NERL	NATS (En Route) plc
NM	Nautical Mile
NMOC	Network Manager Operations Centre
NOPs	Network Operations
OFCOM	The Office of Communications
OR	Organisational Requirements
PANS	Procedures for Air Navigation Services
PANS-ATM	Procedures for Air Navigation Services – Air Traffic Management
PANSOP	Procedures for Air Navigation Services – Aircraft Operations
PB AOM	Performance-Based Aerodrome Operating Minimal
PBCS	Performance-Based Communication and Surveillance
PBN	Performance-Based Navigation
PCP	Pilot Common Project
PinS	Point-in-Space
PNT	Position Navigation and Timing
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communication Performance
RDD	Reduced Departure Divergence

Abbreviation	Description
RMZ	Radio Mandatory Zone
RNAV	Area Navigation
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft System
RSEQS	Runway Sequencing
RSP	Required Surveillance Performance
RTCA	Radio Technical Commission for Aeronautics
SARPS	Standards and Recommended Practices
SATCOM	Satellite Communication
SBAS	Space-Based Augmentation System
SERA	Standardised European Rules of the Air
SES	Single European Sky
SESAR	Single European Sky Air Traffic Management Research
SID	Standard Instrument Departure
SIP	Service and Investment Plan (NERL)
SoL	Safety of Life
SORA	Specific Operating Risk Assessment
STAR	Standard Instrument Arrival
STMA	Scottish Terminal Control Area
SUA	Special Use Airspace
SVGS	Synthetic Vision Guidance Systems
SWIM	System Wide Information Management
TBO	Trajectory-Based Operations
TBS	Time-Based Separation
TCAS	Traffic Alert and Collision Avoidance System
TIS-B	Traffic Information Service–Broadcast
TMA	Terminal Control Area

Abbreviation	Description
TMZ	Transponder Mandatory Zone
TOS	Trajectory Operations Set
TR	Technical Requirements
TRA	Temporary Reserved Area
TSO	Technical Standard Orders
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UIR	Upper Information Region
UKADS	UK Airspace Design Service
UKSA	UK Space Agency
UTM	Unmanned Aircraft Systems Traffic Management
VDL	Very High Frequency Data Link
VFR	Visual Flight Rules
VHF	Very High Frequency
VNAV	Vertical Navigation
VOLMET	Meteorological information for aircraft in flight
VOR	Very High Frequency Omni-Directional Range
VPA	Variable Profile Area
VTOL	Vertical Take-Off and Landing
WRC	World Radio Conference
XMAN	Extended Arrival Management
XML	Extensible Mark-Up Language

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