

Airspace Modernisation Strategy 2023–2040

Part 2: Delivery elements

CAP 1711a



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Chapter 1 Overview

Airspace Modernisation Strategy

- 1.1 This document forms **Part 2** to the 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.¹ 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 As explained in more detail in Part 1, the AMS is a refresh of the original 2018 AMS:
- to extend the strategy's focus from 2024 out to 2040, as required by the Air Navigation Directions²
 - to take account of the latest developments in innovation and technology, placing integration of all airspace users at the core of the strategy, including accommodating new types of aerial craft like remotely piloted aircraft systems³, advanced air mobility⁴ and spacecraft
 - to aim for simpler airspace design and supporting regulations

¹ www.caa.co.uk/cap1711

² <https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Legislative-framework-to-airspace-change/>

³ Remotely piloted aircraft systems (RPAS) may be referred to as unmanned aircraft systems (UAS), unmanned aerial vehicles (UAV), uncrewed aircraft, drones, model aircraft or radio-controlled aircraft. This terminology may change as aircraft capability evolves through technological development such as autonomy. For more information see <https://www.caa.co.uk/drones/>.

⁴ References in the AMS to the advanced air mobility concept generally mean eVTOL (electric vertical take-off and landing) aircraft i.e. aerial taxis, but this terminology may change.

- to treat environmental sustainability as an overarching principle to be applied through all modernisation activities, taking account of the latest government policy and environmental guidance
- to meet the UK's international obligations, aligning delivery of the AMS with the ICAO⁵ Global Air Navigation Plan (GANP) and ensuring interoperability of the UK network with neighbouring air traffic management areas
- to make the AMS the single roadmap to guide the CAA's approach to its policy development on airspace modernisation and related legislation (otherwise known as rulemaking), now that the UK has left the European Union and the European Union Aviation Safety Agency (EASA)

all without undermining the initiatives from the 2018 AMS, delivery of which continues and which are subsumed into the refreshed AMS.

- 1.3 The refreshed AMS therefore pulls together the ICAO GANP, the 2018 AMS initiatives and also new requirements that the CAA has identified through extensive stakeholder engagement in 2021–2022. It also now provides a clear strategic path for rulemaking activities.

Structure of the AMS – ends, ways and means for modernising airspace

- 1.4 The AMS sets out the **ends**, **ways** and **means** of modernising airspace:
- the **ends** are the policy objectives for achieving the shared vision for airspace modernisation
 - having explained those ends, the strategy describes the **ways** of achieving them (the enablers) – such as new airspace design, new operational concepts and implementable new technologies
 - to establish the **means** of delivering modernised airspace, such as the resources needed, this strategy requires organised project teams, led by industry and other entities, to draw up delivery plans, with delivery overseen by the CAA.

⁵ The International Civil Aviation Organization, a specialist agency of the United Nations responsible for international standards for civil aviation which the UK has by international treaty agreed to implement. ICAO's strategic objectives (in respect of global aviation, not just airspace) can be read here <https://www.icao.int/about-icao/Council/Pages/Strategic-Objectives.aspx>.

Content of each part of the strategy

1.5 The AMS 2023–2040 is split into three parts (see Figure 1.1 below).

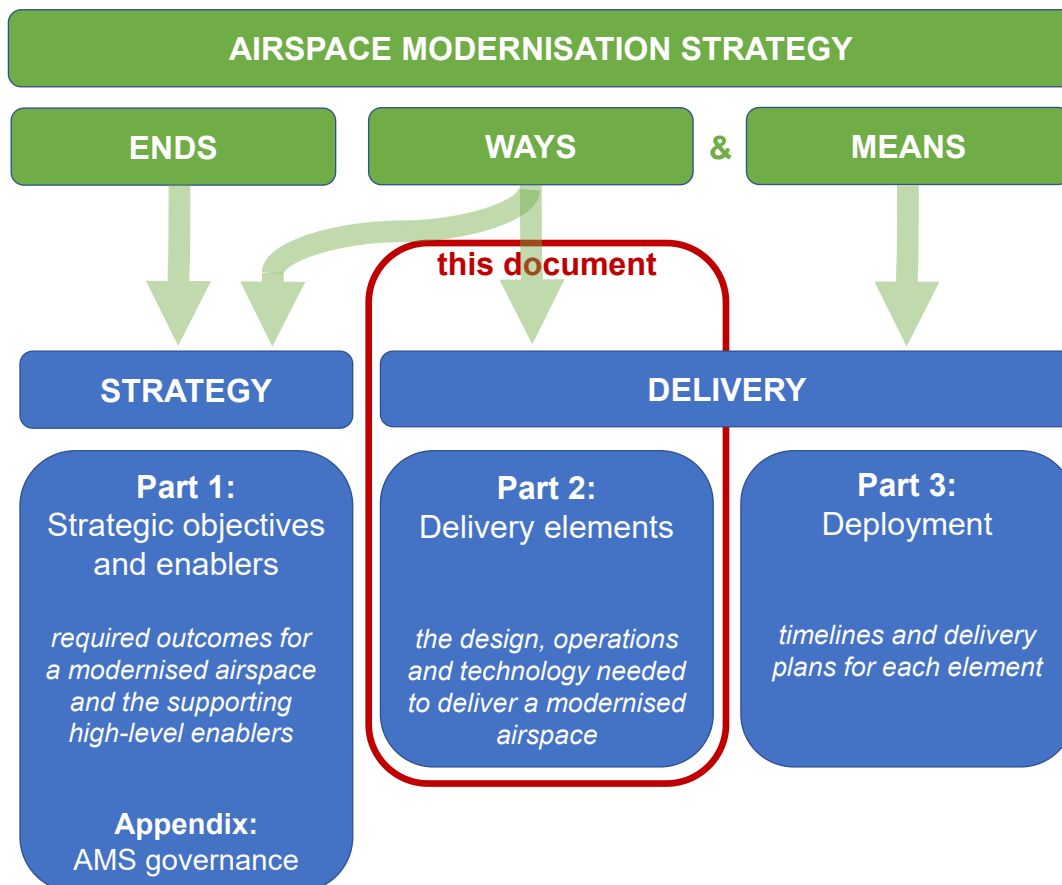


Figure 1.1 Structure of the AMS

- 1.6 **Part 1 (Strategic objectives and enablers)** explains the strategy’s objectives (the **ends**), a high-level overview of what will enable those objectives to be fulfilled (the enablers or **ways**), and governance arrangements for overseeing delivery. Part 1 does not specify detailed solutions, allowing space for innovation. Part 1 is published separately as [CAP 1711](#).
- 1.7 **Part 2 (Delivery elements)** and **Part 3 (Deployment)** describe the short-term ambition and explain how the strategy is being delivered. Parts 2 and 3 are likely to be updated more frequently than Part 1 as the elements evolve and mature for delivery. You are reading **Part 2**, which explains the different **delivery elements** that make up the AMS (the **ways**, in more detail, including a linked **Part 2 online database**.⁶ **Part 3** sets out progress with **deployment** and related activities for

⁶ The Part 2 database can be downloaded at www.caa.co.uk/cap1711X.

those elements (the **means**). We have yet to determine the form of Part 3, which is still being developed. Because it will be an online collection of plans that is constantly evolving, we envisage that it will not form a single document.⁷

- 1.8 Our intent is for stakeholders to be able to readily identify the modernisation themes that are most relevant to them and which will help to deliver their ambitions. Key to delivering airspace modernisation successfully is **AMS governance**: ensuring that each of the entities involved has the right role, powers and/or incentives, underpinned by appropriate governance and enforcement (see Appendix A to Part 1).
- 1.9 The AMS will guide the delivery of relevant and timely policy and regulation across the whole CAA that supports the delivery of airspace modernisation goals. In particular, it will be used to assist in the prioritisation of UK airspace rulemaking activity to help ensure its timely and coordinated implementation.

Updating the AMS

- 1.10 Bearing in mind the 2040 timescale specified by the Government, the CAA will keep the context for the AMS under review and update it where necessary, drawing on appropriate work through the AMS governance structure. This particularly applies to AMS Parts 2 and 3 containing the delivery elements, as technological innovations are forthcoming or become ubiquitous, gaps in the policy or regulatory framework emerge that are affecting delivery, or where the Government has signalled upcoming or widescale policy developments. Part 1 of the AMS also sets out strategic areas where more work is needed.
- 1.11 As the deployment plans in Part 3 of the AMS are developed, we will, where necessary, strengthen relevant requirements or detail as to how the elements should be delivered, and with what aim. The means of delivering some of the ends required for airspace modernisation are still being developed in detail – for example, the approach to integrating operations of new types of airspace user. The CAA will develop or implement a solution or enabler to better respond to a change or gap where it is within our remit and appropriate for us to do so.
- 1.12 The pace of change may mean that for practical reasons we review and update the AMS in stages. In other words, some developments aligned with the AMS Part 1 vision may move on before the CAA is able to review and update the other parts of the strategy.
- 1.13 Where appropriate, the CAA may seek stakeholder comments on these updates before implementing them, but we will not necessarily do so in every case.

⁷ Please see <https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy/> for the latest position.

Chapter 2

Delivery elements – overview

Introduction

2.1 AMS Part 1 sets out the ‘ends’ or objectives for airspace modernisation, and gives an overview of the enablers or ‘ways’ that structure the delivery plans set out in Parts 2 and 3. This is summarised in Figure 2.1 below, which is taken from and explained in more detail in Part 1.

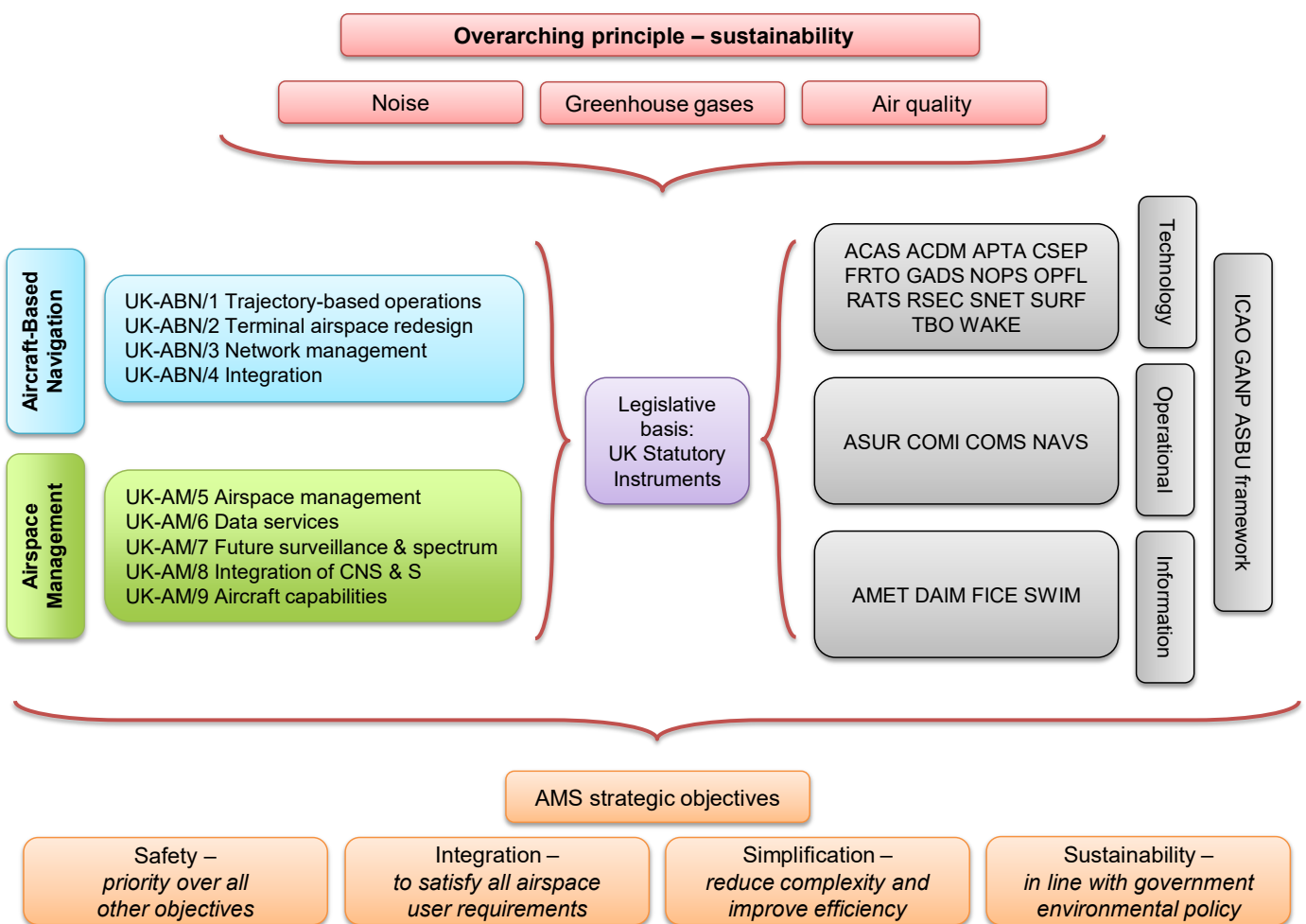


Figure 2.1: Overall summary of the delivery elements aligned with the ICAO ASBU framework in pursuit of the AMS strategic objectives

2.2 This document, Part 2, is more focused on the near term, and will evolve over time, aligned with the ICAO GANP programme. 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 Part 1). Part 2 expands on the ASBU threads to provide the essential detail of

the development activities – known as ‘delivery elements’– making up the strategy.

- 2.3 While the ASBU threads have extensive operational and technical descriptions, not everything will be wholly applicable to the UK, while some activities necessary for modernisation of UK airspace will be specific to the UK. The delivery elements in the strategy are therefore based on ICAO operational and technical descriptions but tailored to the needs of UK airspace.
- 2.4 The delivery elements form the basis of research and development activities over the near term in support of deployment, including how those activities are funded. The delivery elements also identify legislative, policy or regulatory gaps that need to be addressed, for example how to accommodate new types of aircraft in UK airspace like remotely piloted aircraft systems or spacecraft, or trade-offs between increased capacity, greenhouse-gas emissions, noise, or other factors.

The nine delivery elements

- 2.5 As shown in Table 2.1 below, there are nine delivery elements arranged under two headings:

- **aircraft-based navigation**
- **airspace management.**

These nine elements pull together the ICAO GANP, the 2018 AMS initiatives and new requirements identified through extensive stakeholder engagement.



- 2.6 These elements identify the areas for development by the UK aviation industry and other entities (including the CAA and Department for Transport as co-sponsors of airspace modernisation) over the period to the end of ASBU Block 3 in 2033.
- 2.7 Work carried out through the Future Airspace Strategy (which preceded the 2018 AMS) and the 15 initiatives from the 2018 AMS was all in service of the ICAO GANP and related to ASBU Block 0 and Block 1. Some of this work will carry on into Block 2 and 3 due to delayed development and delivery.










ASBU series of system upgrades designed to meet GANP objectives

- Block 0 2013 – 2018
- Block 1 2018 – 2023
- Block 2 2023 – 2028
- Block 3 2028 – 2033
- Block 4 2033 +

ASBU threads:

- Information
- Operational
- CNS Technology and Services

Table 2.1: Structure for AMS delivery elements ('ways')

Category	AMS delivery elements	2018 AMS initiatives further developed through these elements	
Aircraft-Based Navigation	 UK-ABN/1. Trajectory-based operations	2, 7, 8, 11, 14	Overarching principle: implementing government policy on minimising the environmental impacts of aviation within the context of supporting a strong and sustainable aviation sector
	 UK-ABN/2. Terminal airspace redesign	4, 5, 14	
	 UK-ABN/3. Network management	3, 6	
	 UK-ABN/4. Integration	3, 9, 10, 11	
Airspace Management	 UK-AM/5. Airspace management		
	 UK-AM/6. Data services	13, 15	
	 UK-AM/7. Future surveillance and spectrum	11, 12	
	 UK-AM/8. Integration of communications, navigation, surveillance & spectrum	12, 13, 14, 15	
	 UK-AM/9. Aircraft capabilities	New	

Notes: Initiative 1 (Direct Route Airspace) in the 2018 AMS is complete.

More detail on the 15 initiatives from the 2018 AMS is in the annual AMS [progress reports](#).

Chapter 3

Description of each element



Introduction

- 3.1 The nine UK elements described in Table 2.1 above contain a number of ICAO elements that support their development and delivery. The intent of this AMS Part 2 is to capture all the relevant elements and sub-elements in their respective ASBU delivery blocks along with any specific delivery timescales required through UK law (in the form of Statutory Instruments).
- 3.2 In this chapter, we summarise each of the elements and sub-elements in the form of a ‘swim-lane’ diagram. Full information in respect of each element and sub-element can be downloaded in the form of the **AMS Part 2 database** at www.caa.co.uk/cap1711a. The summaries should be read in conjunction with the database.

Summary of each element

- 3.3 A summary of each of the nine elements is described below under the two headings, aircraft-based navigation and airspace management. For each element, a swim-lane diagram shows the sequence of capability development and delivery to the end of ASBU Block 3 (2033), and also captures links and dependencies across all the individual sub-elements required to achieve the required UK element outcome.⁸
- 3.4 For the purpose of this overview, the specific ICAO work elements and combined ICAO and UK sub-elements are shown in plain English, to avoid having to explain each ICAO ASBU abbreviation.

Environmental sustainability as an overarching principle

- 3.5 In preparing and maintaining the AMS, the CAA is bound by the legal and policy framework (see Appendix B to AMS Part 1), in particular section 70 of the Transport Act 2000, the Air Navigation Directions and the Air Navigation Guidance. As noted in Table 2.1 in Chapter 2, all the delivery elements must adhere to the overarching principle of government policy on minimising the environmental impacts of aviation within the context of supporting a strong and

⁸ In due course, we intend to highlight through the swim-lane diagrams the steps relevant to individual stakeholder groups, whether UK industry or those impacted by airspace modernisation.

sustainable aviation sector (in accordance with the Government's Air Navigation Guidance). In addition, the delivery elements should align with the aim to deliver quicker, quieter and cleaner journeys for those who use and are affected by UK airspace, as set out in the Jet Zero Strategy.

Part 2 database

- 3.6 The database linked to AMS Part 2 (www.caa.co.uk/cap1711x) is intended to be the working tool to help manage industry planning of activities and distribution of available funding, and to support tracking and reporting of deployment activities.⁹
- 3.7 The database contains a front page ('Part 2 summary') that provides an overview of the relationship between the nine UK elements and the ICAO elements. The Initiatives identified in the 2018 AMS are captured against the nine new UK elements along with feedback gleaned from the AMS refresh engagement sessions against each UK element.
- 3.8 The nine UK elements are then described individually, using the 'ends, ways and means' methodology described in AMS Part 1:
- 'end' is the UK Element
 - 'ways' are the steps described against the ICAO ASBU Blocks 1 to 4 (the current Part 2 only covers the period to the end of Block 3)
 - 'means' captures the sub-elements by ICAO Block needed to achieve the 'ways'.
- 3.9 The 'means' form the main driver for development and deployment activities. The ICAO elements will link directly to the existing live ICAO GANP portal¹⁰ where the intent behind each of the ICAO elements is explained. The UK-specific elements will be expanded to explain their intent and a link provided to the relevant UK legislative requirements (in the form of Statutory Instruments).

⁹ The database linked to AMS Part 2 is still under development, but is sufficiently complete to demonstrate the intent. We are hoping to make the database as easy to access and to interpret as we can, within the constraints of the content being primarily of a technical nature.

¹⁰ <https://www4.icao.int/ganportal/>


Aircraft-Based Navigation (elements UK-ABN/1 to UK-ABN/4)

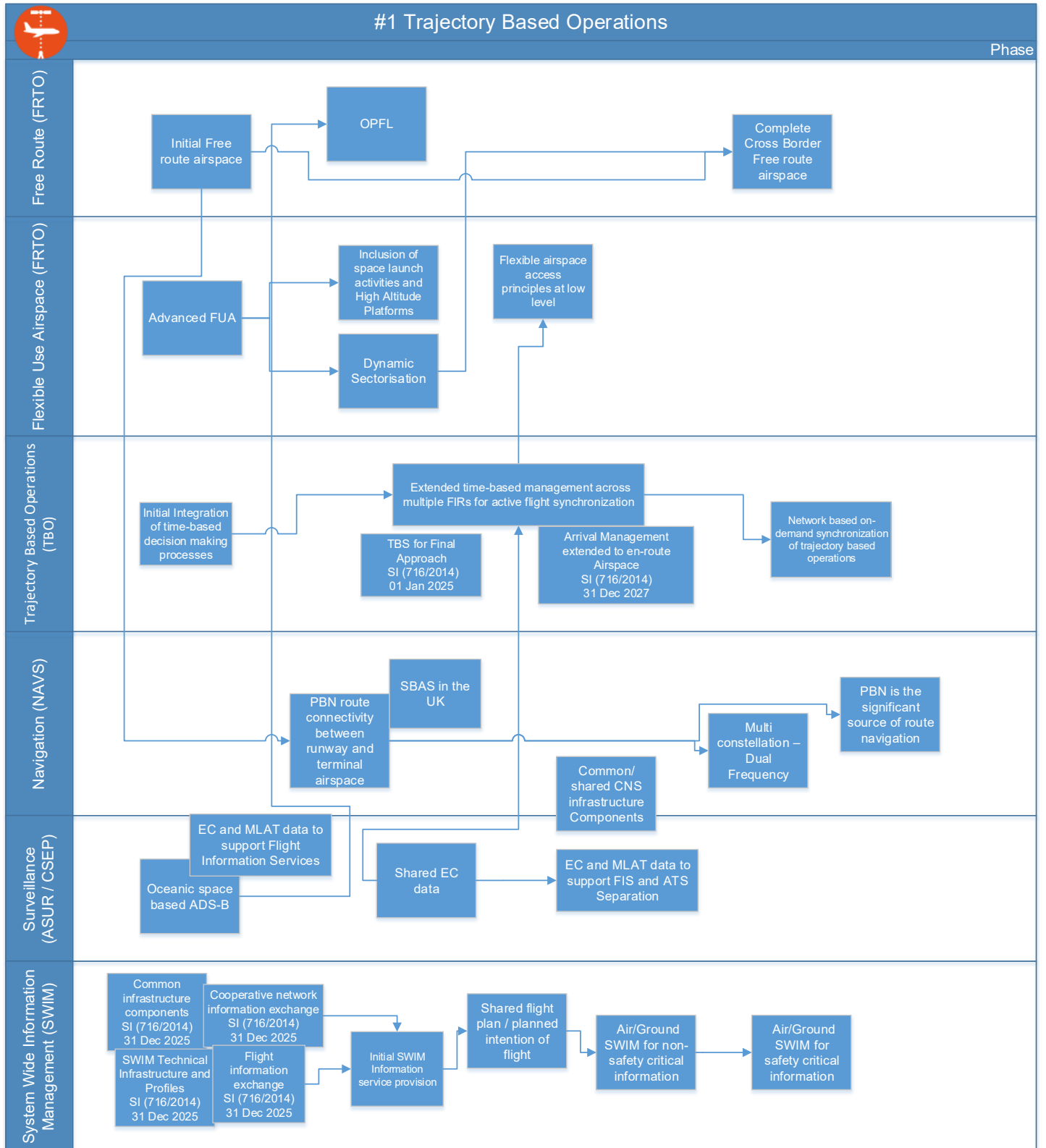
UK-ABN/1. Trajectory-based operations

Trajectory-based operations implements the flexibility for airspace operators to plan their operations around their need. This is enabled through:

- structured performance-based navigation routes at lower levels
- flexible access airspace structures that allow for low-level integration of different users
- removal of high-level route structures supported by flexible use of airspace management techniques that segregate operations where necessary, such as military operations and training, and space launches
- air traffic management support tools.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033), along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>1. Trajectory-based operations</p>	<p>Airspace management and planning will be trajectory-centric. Shared information will enable optimised mission and business trajectories for all types of air operation, commercial and non-commercial. Users will be able to optimise their planned and current operations, facilitated by a flexible and dynamic upper airspace, with a structured but sufficiently contained lower-level network of routes. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Consolidation and extension of en-route time-based trajectory management. • Deployment of time-based separations on approach to support network and airport efficiency.




UK-ABN/2. Terminal airspace redesign

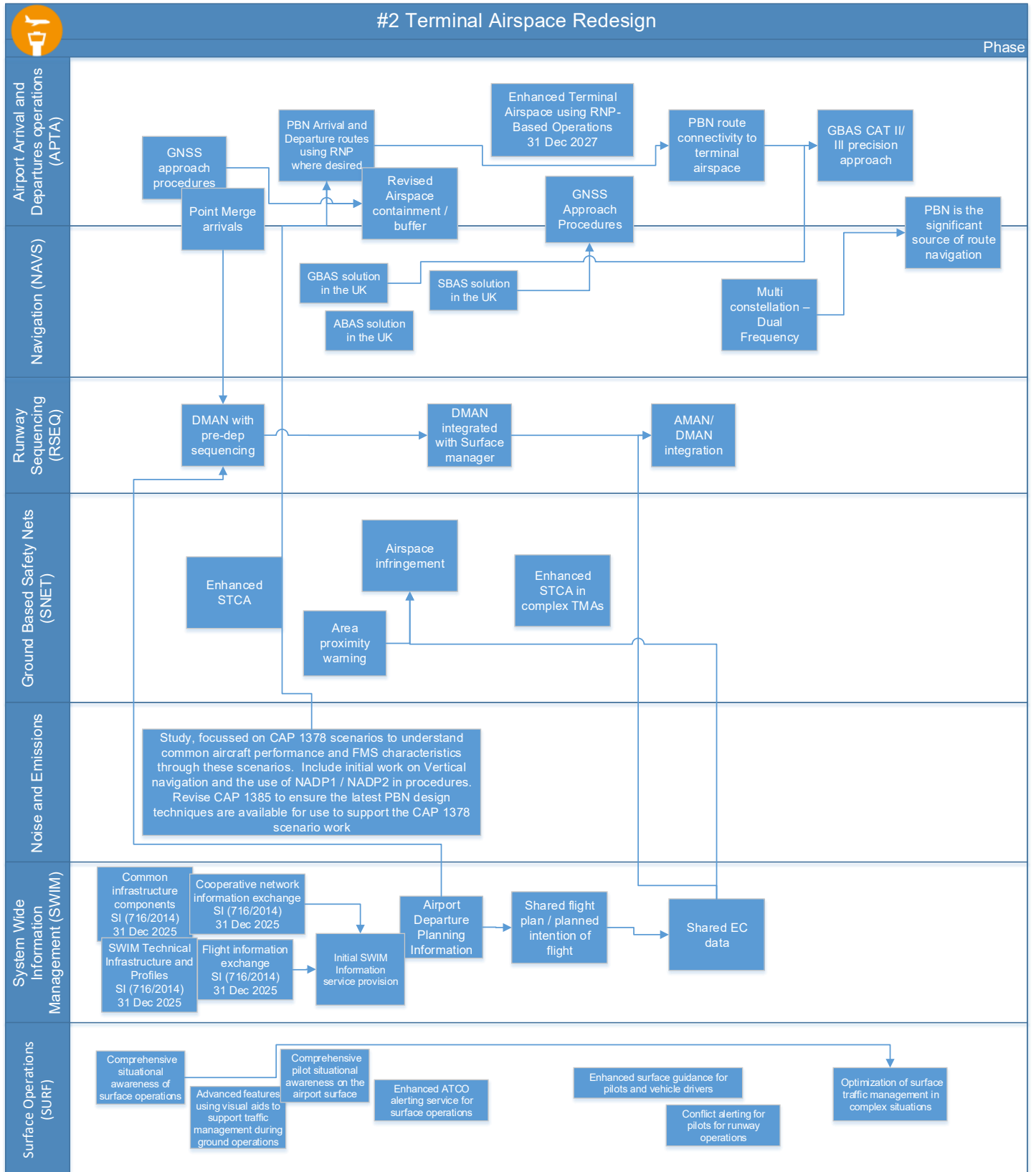
Terminal airspace development includes the arrival and departure operations to individual airports (i.e. it does not need to be captured within a terminal operation that covers multiple airports) and aims to provide a predictable and repeatable arrival and departure route that connects airports to the Free Route Airspace environment.

This organised structure provides the basis for determining the need for controlled airspace around airports and enables high-performing modern aircraft to deliver sustainable emission reductions through better climb and descent performance. This is enabled through:

- structured performance-based navigation routes at lower levels, initially focussed on lateral performance but ultimately including vertical navigation performance
- flexible access airspace structures that allow for low-level integration of different users
- electronic conspicuity sharing accurate navigation position data between airborne devices and with ground systems
- airport management of runway sequencing of traffic and positive links to the network route management through the sharing of the Airport Operations Plan.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>2. Terminal airspace redesign</p>	<p>The lower network of routes will make full use of modern aircraft capabilities, optimised to limit noise impacts and contribute to Jet Zero targets. Airspace structures will safely contain high density and complex areas of the operation, with flexible access (wherever possible) enabling effective integration. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Noise respite – PBN (performance-based navigation) dispersal vs concentration; vertical profiles – developing a ‘playbook’ of procedure options. • PBN (performance-based navigation) procedures in terminal airspace to ensure the right-sized controlled airspace providing suitable containment. • Developing airspace-sharing (flexible access) processes and procedures. • Establishing relevant Jet Zero targets in relation to airspace change. • FASI programme (Future Airspace Strategy Implementation) – FASI deployment plan being delivered through the airspace change masterplan, coordinated by ACOG (Airspace Change Organising Group).




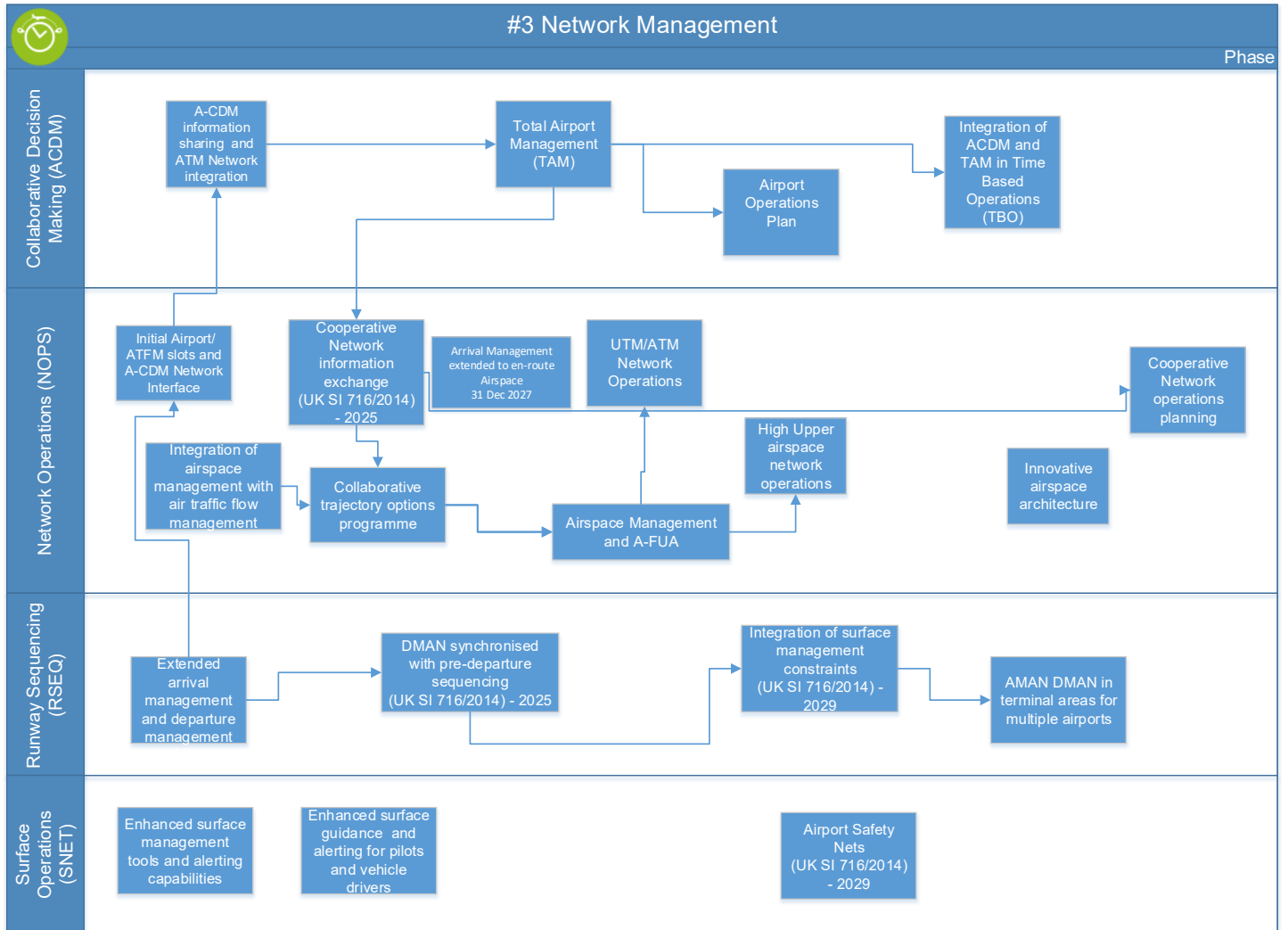
UK-ABN/3. Network management

Network Management aims to balance the capacity of the operational network with the demand from users through the sharing of accurate plan information. Importantly the airport operational decisions and planning information is a key component. This is enabled through:

- airport management of runway sequencing of traffic and positive links to the network route management through the sharing of the Airport Operations Plan
- arrival and departure management techniques that can utilise the runway capacity efficiently while reducing the need for airborne holding of aircraft.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>3. Network management</p>	<p>All relevant aviation operational stakeholders are fully connected. All tactical decisions are synchronized and operations are managed by trajectory. All ground processes including aircraft turnaround operations and the landside processes are agreed on the en-route to en-route view of flight operations. Expected ground event times are managed with known impacts to the air traffic management system, to ensure that the agreed trajectory is consistent with the Airport Operations Plan. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Queue management (arrival and departure management).




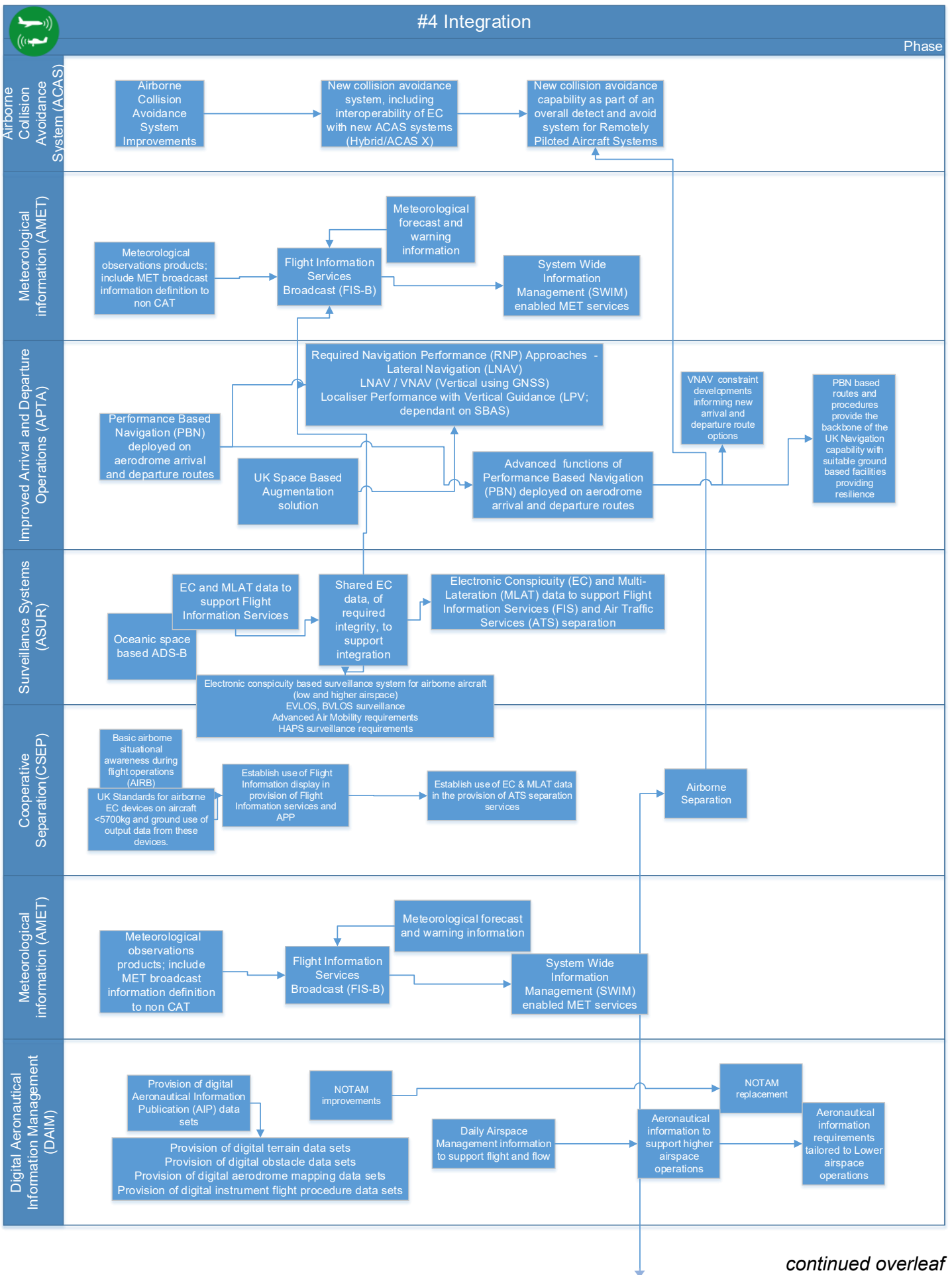
UK-ABN/4. Integration

The demand from existing and new types of aviation operations for access to UK airspace is not purely about the numbers but also the complexity of the interactions created through different performance capabilities. This means we must be more innovative and flexible in our approach to the structures and procedures we put in place to ensure the safe integration of these different operations. This is enabled through:

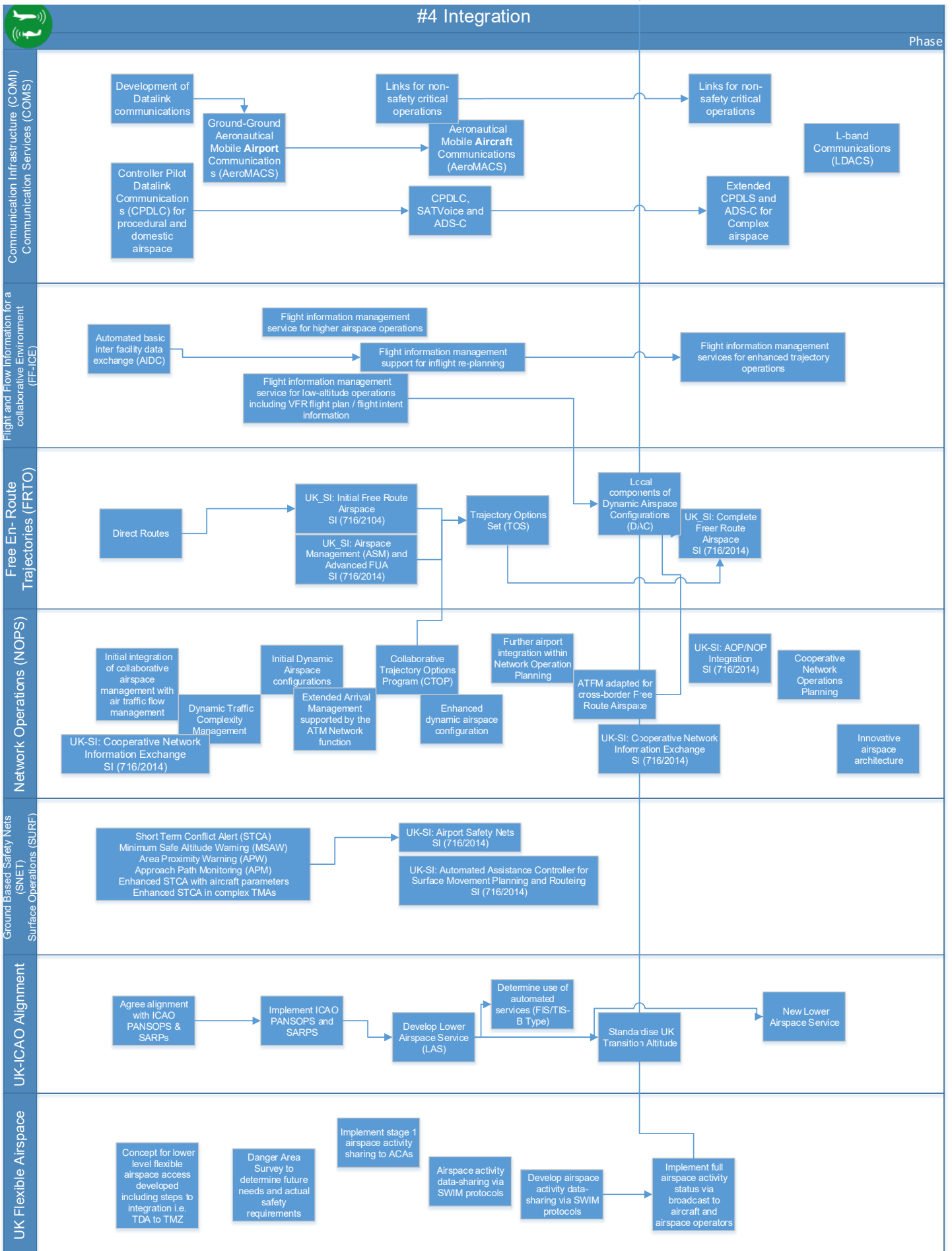
- flexible access airspace structures that allow for low-level integration of different users
- electronic conspicuity sharing accurate navigation position data between airborne devices and with ground systems
- sharing of digitised airspace availability information and broadcast of relevant operational information such as meteorological information
- delivery of a new ICAO-aligned Lower Airspace Service to deliver services that enable more flexible and efficient operations for users such as General Aviation, Ministry of Defence, remotely piloted aircraft systems and advanced air mobility.
- procedures and processes to manage high-altitude airspace for integration of high-altitude platform systems and supersonic/hypersonic passenger operations.

The summary below is further developed in the two swim-lane diagrams overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p data-bbox="164 1216 336 1245">4. Integration</p>	<p data-bbox="387 405 1455 584">Demand from all types of aviation operation and the complex interactions this creates will be integrated and flexibly managed at all levels. In areas of high demand (particularly low-level airspace), aircraft and air systems will be equipped to navigate safely according to surrounding airspace users and the live airspace picture. Initial areas of work focus on:</p> <ul style="list-style-type: none"> <li data-bbox="387 607 1455 703">• Access for remotely piloted aircraft systems (BVLOS – beyond visual line of sight), advanced air mobility, high-altitude platform systems (HAPS) and spacecraft. <li data-bbox="387 725 1342 757">• Lower airspace flexible access (airspace switched on when required). <li data-bbox="387 779 1401 810">• Development of the AFUA (Advanced Flexible Use of Airspace) concepts. <li data-bbox="387 833 1455 1012">• Lower Airspace Service concept aligned with ICAO-specified flight information services to deliver a 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. <ul style="list-style-type: none"> <li data-bbox="464 1012 1353 1088">– Radio mandatory zones in lieu of aerodrome traffic zones where appropriate, regardless of the licensed status of that aerodrome. <li data-bbox="464 1088 1455 1258">– Transponder mandatory zones, utilising electronic conspicuity capabilities, in support of flight information services provision for operations in Class G airspace, including required navigation performance (RNP) approaches and beyond visual line of sight (BVLOS) remotely piloted aircraft system integration. <li data-bbox="464 1258 1445 1290">– Enhanced airspace-sharing arrangements through switchable airspace. <li data-bbox="464 1290 1358 1366">– FIS-B (Flight Information Service – Broadcast) and TIS-B (Traffic Information Service – Broadcast) deployment. <li data-bbox="464 1366 1075 1397">– UK Flight Information Service replacement. <ul style="list-style-type: none"> <li data-bbox="523 1397 1382 1473">– The intention is to adopt ICAO flight Information services (FIS) with/without surveillance in lieu of the current suite of UK FIS. <li data-bbox="523 1473 1455 1697">– The CAA does not automatically equate the adoption of ICAO FIS with the need for every air navigation service provider currently providing UK Flight Information Services Deconfliction Services and Procedural Service to IFR traffic in Class G airspace to require a control zone (CTR). The expectation as a starting assumption is that air navigation service providers will manage their traffic in Class G using ICAO FIS. Any perceived need for the provision of air traffic control service and the associated notification of a CTR will require an airspace change proposal in accordance with CAP 1616. <li data-bbox="464 1697 1422 1774">– Flight plan data – voluntary submission and sharing of the intention of flight data. <ul style="list-style-type: none"> <li data-bbox="523 1774 1455 1886">– ‘Flight plan’ means specified information provided to air traffic services relative to an intended flight or portion of a flight of an aircraft (SERA.4001). The methods for submitting this information include traditional ‘booking in/out’ via telephone or radiotelephony and digital submission of flight intention data. <li data-bbox="464 1886 922 1917">– Electronic obstruction beacons. <ul style="list-style-type: none"> <li data-bbox="523 1917 1455 2078">– These electronic beacons notify the activation of cluster-based activities such as large model sites, paragliding and hang-gliding activity, where electronic conspicuity of individual air systems is not practicable or desirable. The emissions from these beacons can be received via the reception of a broadcast in the cockpit and depicted on existing avionics or electronic flight bag applications.



continued overleaf




Airspace Management (elements UK-AM/5 to UK-AM/9)

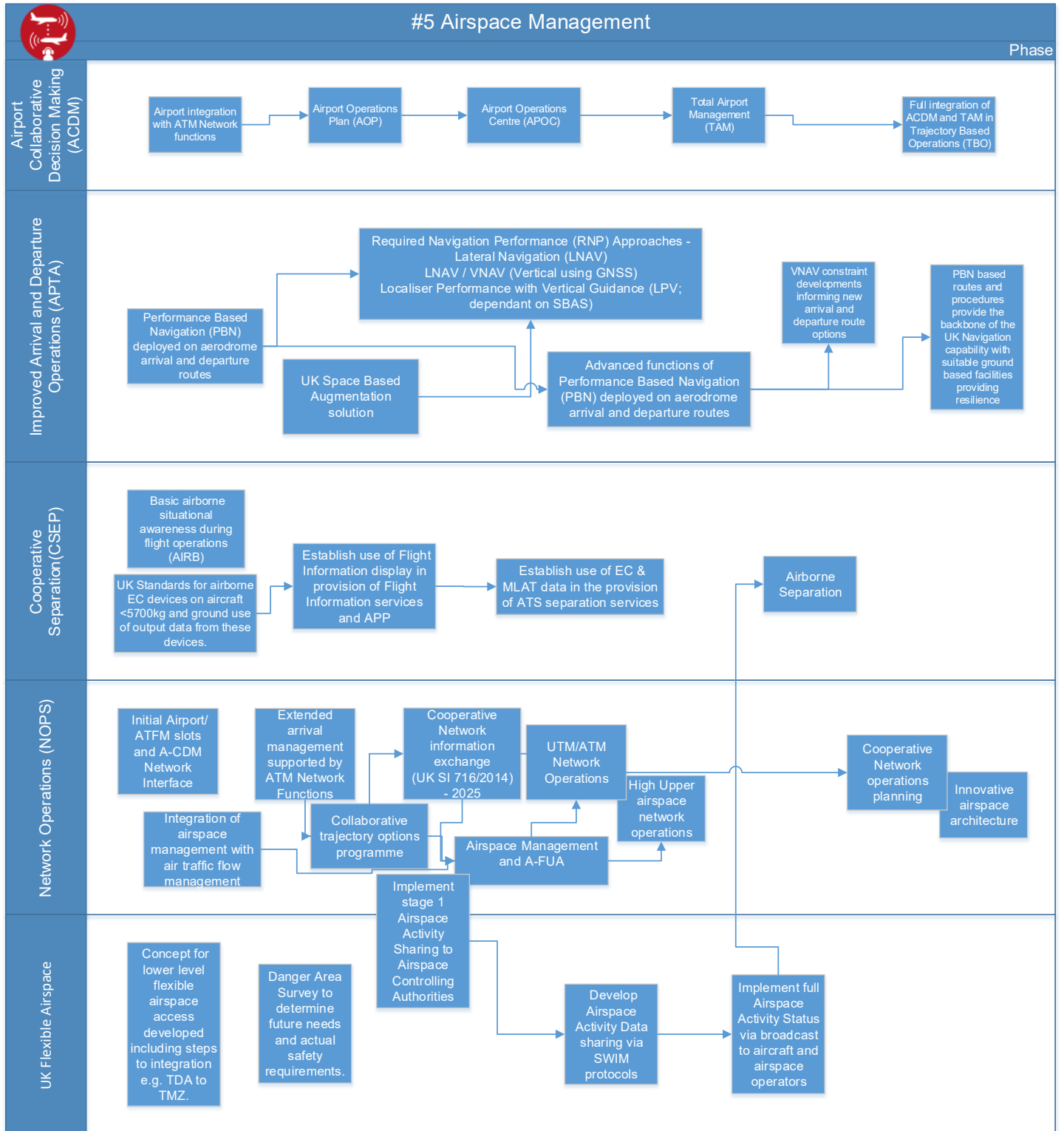
UK-AM/5. Airspace management

Airspace management brings together a combination of the above elements to allow a more efficient use of UK airspace, from high-altitude to low-level operations. This is enabled through:

- flexible access airspace structures that allow for low-level integration of different users procedures and processes to manage high altitude airspace
- flexible use of airspace management techniques that safely segregate operations where necessary such as military operations and training, and space launches
- electronic conspicuity sharing accurate navigation position data between airborne devices and with ground systems
- sharing of digitised airspace availability information and broadcast of relevant operational information such as meteorological information.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>5. Airspace management</p>	<p>A modernised suite of traffic management tools and capabilities, including procedures for space activity, will bring together all elements to enable flexible management of UK airspace. Safe and necessary segregation will be digitally notified to all users and services. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Air and space management – traffic management system for the UK combining ATM (air traffic management), UTM (UAS traffic management) and developing procedures for space activity. • New Lower Airspace Service – replace LARS (Lower Airspace Radar Service) and London/Scottish Information Service with a bespoke, surveillance-based flight information service. This is planned to be the service delivery and enabler for flexible access to airspace – intermediate service until technology and equipment update allows autonomous flight. • Airspace management cell – lower airspace management through Lower Airspace Service aligned with existing airspace management cell. • Air traffic services use of electronic conspicuity information for service provision and airspace management. • Ongoing review of airspace classifications through the CAA published procedure.




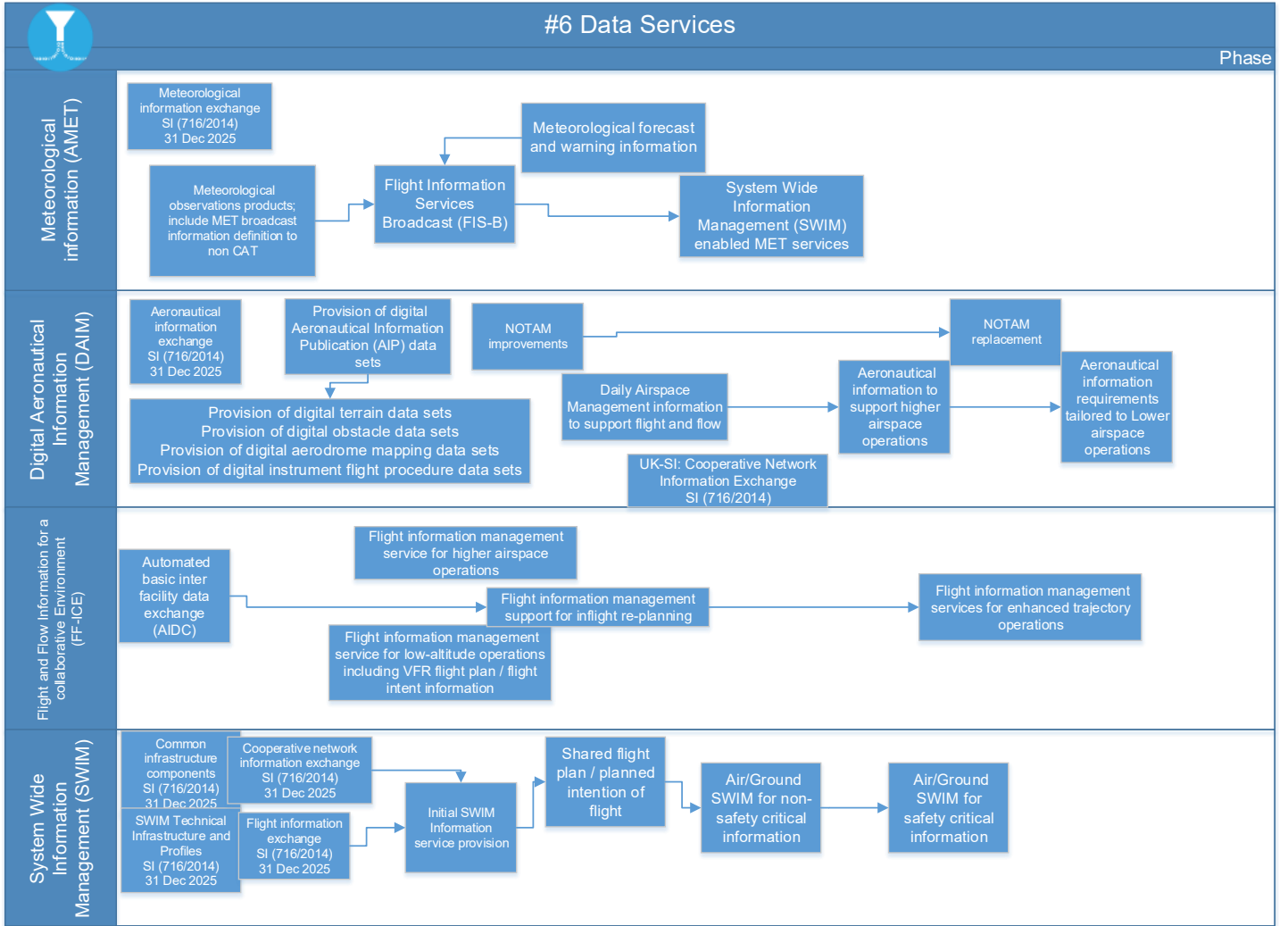
UK-AM/6. Data services

Accurate data delivered to the right operation at the right time is key to enabling much of the modernisation ambition. This is enabled through:

- digitised aeronautical data that can be consumed by users through various market-developed tools and applications
- meteorological products that allow inflight updates of information that help with re-planning
- timely and accurate broadcast and re-broadcast from the ground services
- a system that supports the exchange of aviation data in a secure way while allowing access across a wide range of operational resources.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p data-bbox="162 1444 306 1512">6. Data services</p>	<p data-bbox="387 1169 1390 1310">All airspace users will have access to the digital aeronautical and meteorological data required to enable continually optimised trajectories and the effective integration of air operations (including autonomous flight). Initial areas of work focus on:</p> <ul style="list-style-type: none"> <li data-bbox="387 1332 1390 1747">• Developing the SWIM (System-Wide Information Management) context and concept of operations for the UK, enabling the 'one truth' (AIM/MET/NOTAM etc) and cyber considerations available across all users and service providers. <ul style="list-style-type: none"> <li data-bbox="459 1478 1390 1556">– Digitised AIM to enable products and services to be developed that simplifies operational planning and support inflight data services <li data-bbox="459 1563 1390 1668">– MET services that are timely and relevant to support ground operations planning and decision-making and relevant inflight services <li data-bbox="459 1675 1390 1747">– NOTAM service that supports timely dissemination of relevant information. <li data-bbox="387 1758 1390 1803">• Autonomous flight including remotely piloted aircraft systems.




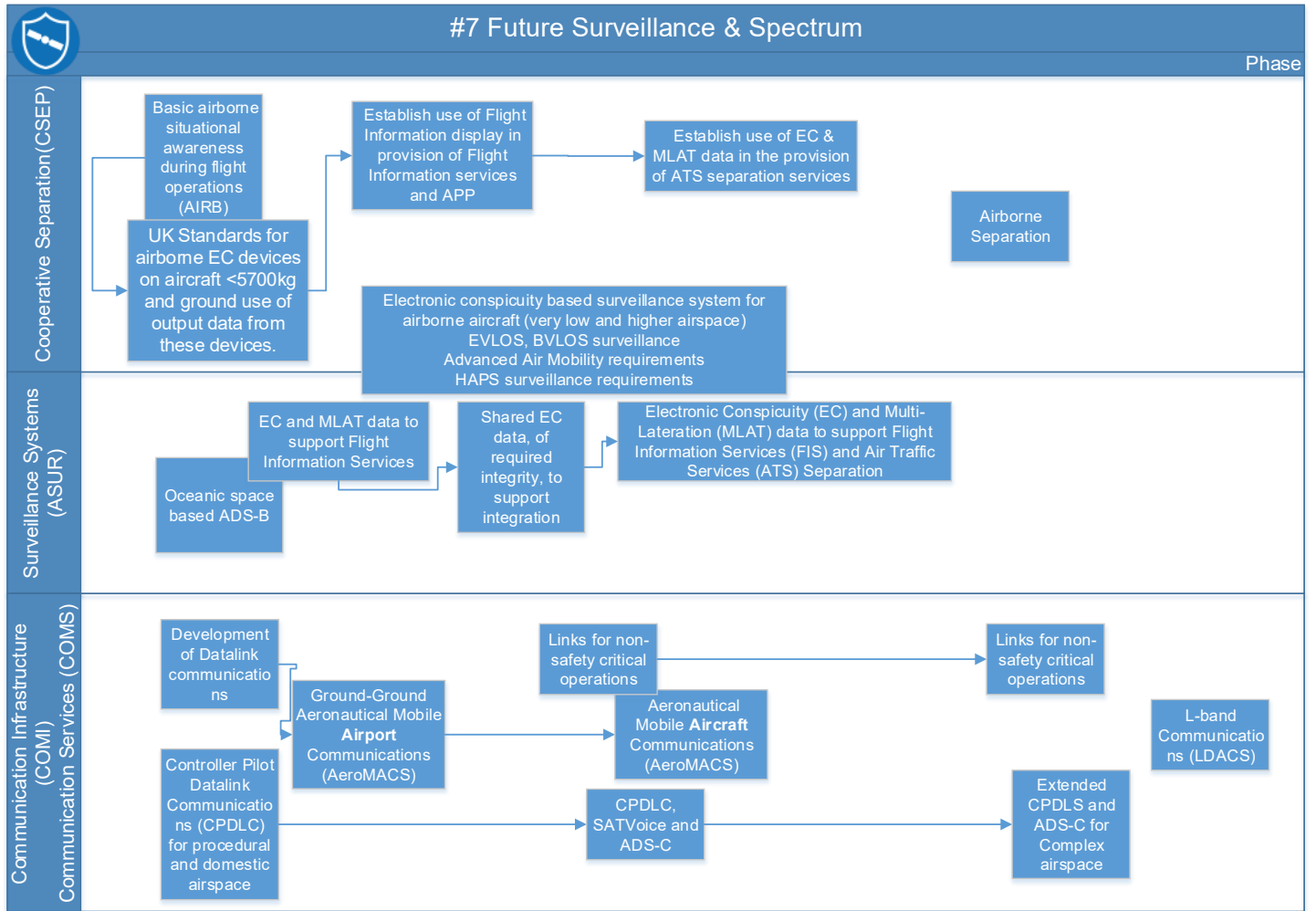
UK-AM/7. Future surveillance and spectrum

Future surveillance and spectrum focussed on enabling the replacement of traditional, non-cooperative surveillance with more cost-effective and safe solutions that greatly reduce the need for extensive ground-based surveillance infrastructure. Greater emphasis will need to be placed on the security of the spectrum to protect it from interference, but the newer solutions will require a smaller footprint overall. Options are:

- wider use of cooperative surveillance, including low-cost solutions to provide an accurate air picture
- better spectrum management and increased security to reduce interference in respect of cyber and GNSS (global navigation satellite system) issues
- increased use of data link services to pass time-critical aeronautical information.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>7. Future surveillance and spectrum</p>	<p>A safe, secure, and cooperative system of ground- and space-based surveillance and data services will enable cost-effective integration of flight operations. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Cooperative surveillance including low-cost solutions. • Spectrum management and spectrum interference. • Security needs – cyber, GNSS (global navigation satellite system) issues and system resilience. • Datalink applications reducing the demand for voice communications. • Long-term future surveillance (ground- and space-based).




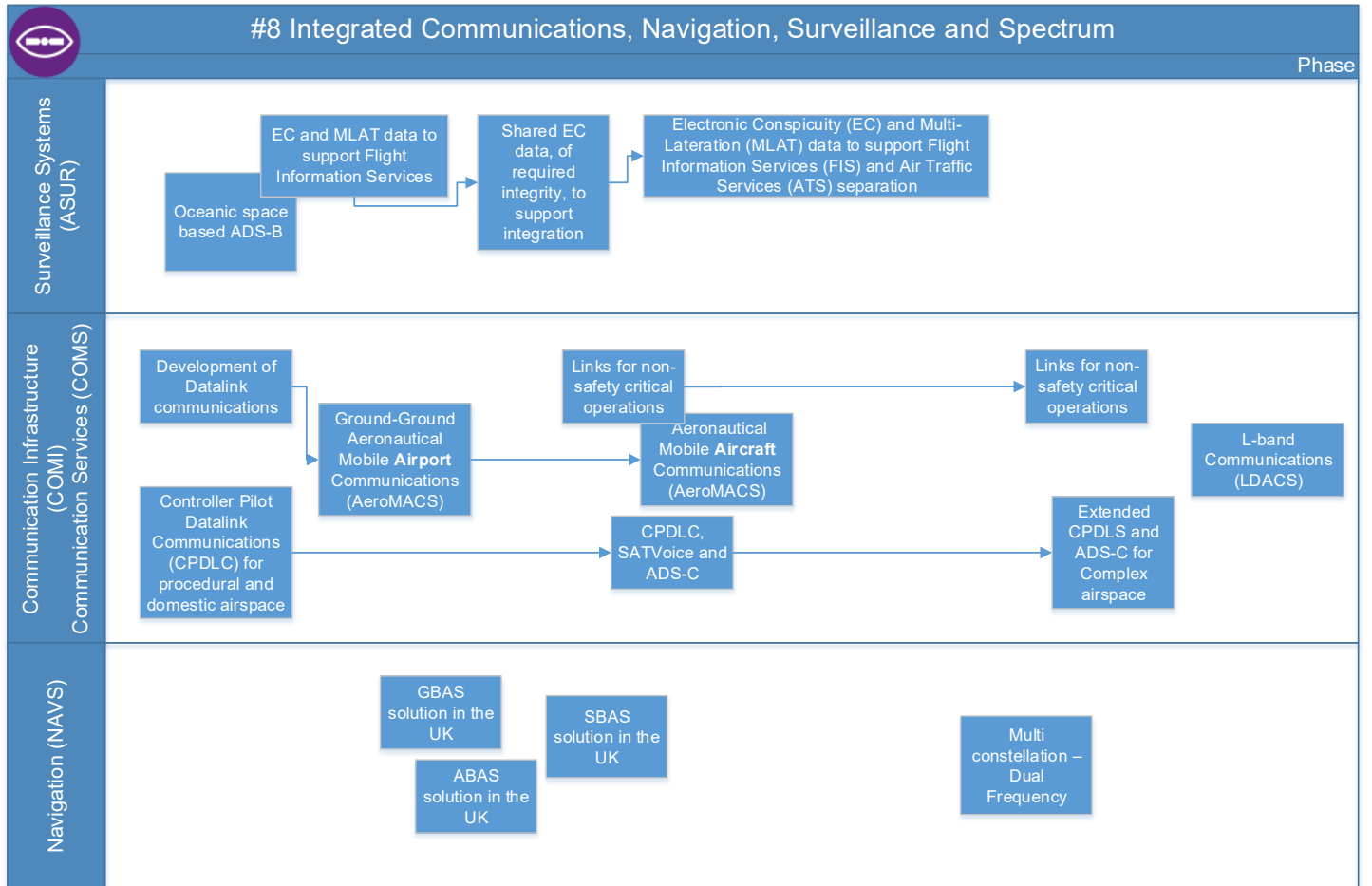
UK-AM/8. Integration of communications, navigation, surveillance & spectrum

Integration of communications, navigation, surveillance (CNS) and spectrum to introduce new and integrated CNS technologies while utilising the available spectrum both securely and efficiently. These changes will be enabled through:

- modernisation of the CNS infrastructure to allow greater use of space-based technologies
- alternate technologies provided through core ground-based systems
- introduction of a UK space-based augmentation system.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>8. Integration of communications, navigation, surveillance & spectrum</p>	<p>A secure suite of performance-based Integrated Communications, Navigation and Surveillance (CNS) technologies will be delivered and supported through efficient management of the available spectrum. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Modernisation of CNS infrastructure to support the migration to space-based technology and provide contingency through multi-frequency multi-constellation capabilities as well as A-PNT (alternative position, navigation and timing) and a core ground-based infrastructure to provide resilience across CNS. • Identify the need and process to achieve a UK space-based augmentation system.




UK-AM/9. Aircraft capabilities

This element implements the necessary changes to aircraft capabilities that are not necessarily captured through other changes. Capabilities such as:

- carriage of electronic conspicuity on aircraft <5700kg
- updates to the airborne collision avoidance system to include electronic conspicuity data
- equipment necessary to receive autonomous aeronautical information through datalink connectivity.

The summary below is further developed in the swim-lane diagram overleaf summarising the sequence of significant capability deployments to the end of ICAO Block 3 (2033) along with relevant links and dependencies across the delivery elements.

AMS element	Sub-elements
 <p>9. Aircraft capabilities</p>	<p>Aircraft will be sufficiently equipped to manage their preferred trajectories and airspace interactions without any adverse constraints exerted on them by the airspace system due to a lack of capability or compatibility. Initial areas of work focus on:</p> <ul style="list-style-type: none"> • Electronic conspicuity on aircraft <5700kg (including remotely piloted aircraft systems, advanced air mobility and high-altitude platform systems). • Airborne collision avoidance system updates to integrate electronic conspicuity data. • MFMC (multi-frequency multi-constellation) capabilities to improve PNT (position, navigation and timing) resilience. • Datalink equipage to reduce the need for voice communication. • Performance-based navigation capabilities.

