UK Civil Aviation Authority

UK Unmanned Aircraft Systems Traffic Management (UTM) Concept of Operations

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This document uses the term “Unmanned” throughout rather than “uncrewed”. Unmanned is the terminology currently used within legislation and regulation; given this, the term has continued to be used for these documents. There is work ongoing at the CAA to review the correct use of these terms, and this will be reflected in any further iterations of this document.

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The latest version of this document is available in electronic format at: www.caa.co.uk/CAPXXXX

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Abbreviations and References

Abbreviation	Item
AIS	Aeronautical Information Service
AISP	Aeronautical Information Service Provider
AIM	Aeronautical Information Management
AMS	Airspace Modernisation Strategy
ANSP	Air Navigation Service Provider
API	Application Programming Interface
ATM	Air Traffic Management
BVLOS	Beyond Visual Line of Sight
C2	Command and Control
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CISP	Common Information Service Provider
ConOps	Concept of Operations
DAA	Detect and Avoid
DMARES	Drone and Model Aircraft Registration and Education System
EC	Electronic Conspicuity
Future-ATM/ANS	Future Air Traffic Management/Air Navigation Service
FUA	Flexible Use of Airspace
GA	General Aviation
GI	Ground Infrastructure

Abbreviation	Item
NOTAM	Notice to Airmen
RP	Remote Pilot
RATE	Recognised Air Traffic Environment
SUA	Special Use Airspace
SWIM	System-Wide Information Management
TRA	Temporary Reserved Airspace
TMZ	Transponder Mandatory Zone
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UDSP	Unmanned Aircraft System Data Service Provider
UTM	Unmanned Aircraft System Traffic Management
UTMSP	UTM Service Provider

Executive Summary

The increasing use of Unmanned Aircraft Systems (UAS) across commercial, government, and recreational domains represents a transformative shift in the aviation landscape. This growth brings with it multiple opportunities yet also presents significant challenges. Notably, how to integrate these novel airspace users safely, efficiently, and at scale into the existing aviation system.

One of the strategic elements of the Civil Aviation Authority's (CAA) Airspace Modernisation Strategy (AMS) clearly articulated the UK's vision for incorporating emerging airspace users. The AMS recognises that traditional Air Traffic Management/Air Navigation Services (ATM/ANS) frameworks will require updating and modernising to accommodate the unique characteristics of high-density and often autonomous UAS operations. To address this gap, a dedicated UAS Traffic Management (UTM) framework has been developed.

This Concept of Operations (ConOps) sets out a structured and risk-informed framework for the progressive integration of Unmanned Aircraft (UA) operations within UK airspace. UTM, whilst currently considered as a separate entity in the current ATM/ANS framework it will be considered as an integrated entity in the Future-ATM/ANS framework. This approach prioritises safety whilst delivering scalability, and regulatory coherence.

The ConOps adopts a phased, scenario-based approach to UTM implementation following the roadmap for Beyond Visual Line of Sight (BVLOS) operational scenarios into the UK's airspace (CAP3182). Described by a series of scenarios, UTM progressively delivers service-based air risk mitigation, initially enhancing and complementing existing mitigation measures, to evolving into a traffic management system that enables UAS operations to integrate with all air users without the need for Special Use Airspace (SUA). As operational capability and technology improves, subsequent scenarios progressively introduce more complex UTM capabilities and greater levels of interoperability between UTM Service Providers (UTMSPs) and Air Navigation Service Providers (ANSPs). This controlled evolution reflects a planned transition from early accommodation of UA operations towards a safe, integrated and scalable traffic management arrangements. As UTM becomes part of routine unmanned aircraft operations, its design will address the issue of fair and equitable access to airspace and will facilitate operations at scale.

This document establishes a reference point for the implementation and development of UTM services throughout the UK, which are key enablers for strategic and tactical mitigations in alignment with UK Specific Operations Risk Assessment (UK SORA) principles and future regulatory decision-making.

This ConOps is not intended to serve as a regulatory document; instead, it presents the current thinking on UTM implementation in the UK and will continue to evolve, informed by

feedback from trials, industry engagement, and collaboration with relevant standards organisations.

UK SORA within the Future-ATM/ANS Programme

The Strategic Role of UK SORA within Future-ATM/ANS

UK SORA as the Safety Backbone of Future-ATM/ANS

Within the Future-ATM/ANS programme, UK SORA functions as the primary safety and architectural driver. It provides the common reference framework through which technologies, services, and policies are coherently aligned.

UK SORA underpins the programme in three key ways:

- Safety Baseline for All ConOps: UK SORA establishes a common safety baseline, requiring all project-level ConOps to explain how air and ground risks are identified and mitigated, ensuring consistency, traceability, and regulatory credibility across Future-ATM/ANS.
- Performance Driver for Enabling Technologies: UK SORA defines the integrity levels rather than prescribing solutions, directly informing the expected behaviour and maturity of UTM, Electronic Conspicuity (EC), Command and Control Link (C2 Link), Detect and Avoid (DAA), and Ground Infrastructure (GI).
- Regulatory Pathway to Integrated BVLOS Operations: Through risk-based airspace characterisation, UK SORA enables the progressive transition from segregated to integrated BVLOS operations, supporting the objectives of the UK Airspace Modernisation Strategy.

What This Means for This Document

For the purposes of this ConOps, the UK SORA framework is used to demonstrate how UTM services can contribute to mitigating air risk, without replicating the formal assessment process. This document assumes a risk-based approach to airspace characterisation, targeting a residual Air Risk Class (ARC) no higher than ARC-b[1], and supporting a transition towards integrated operations without permanent segregation. Within this framework, UTM is positioned as a key enabler of both strategic and tactical mitigations — supporting airspace characterisation, strategic deconfliction, traffic information provision, and system interoperability — in alignment with UK SORA principles and future regulatory decision-making.

[1] Refer to UK Regulation (EU) 2019/947 Annex 11

This document does not intend to replace the existing UK SORA framework but to link the UTM workstream within Future ATM/ANS programme to the UK SORA methodology in supporting UAS operators in the flight authorisation process and flight execution phases.

Revision History

Revision	Affected Pages	Change
First Edition	All	Initial Concept of Operations Publication

Chapter 1

Introduction

Context

1.1 This ConOps is framed within a strategic vision aimed at the progressive integration of Unmanned Aircraft (UA) into the UK's airspace, while avoiding unnecessary airspace fragmentation and preserving the integrity of existing Air Traffic Management (ATM) systems and structures. The approach is inherently risk-based, with an initial focus on the application of UK SORA as the primary mechanism to characterise and mitigate air risk associated with UA operations.

1.2 The operational environment is grounded in the established ICAO airspace classification system and is implemented in the UK through Standardised European Rules of the Air (SERA), specifically SERA.6001. Building upon this baseline, UK SORA introduces the Air Risk Class (ARC) construct, enabling a more granular, risk-based characterisation of operational volumes. ARC complements traditional airspace classes by describing the collision risk of UAS operations, thereby allowing operational constraints and mitigations to be proportionate to actual air risk rather than airspace design alone.

Purpose

1.3 The purpose of this ConOps is to focus on:

Validation of UTM Capabilities in Controlled and Uncontrolled Airspace

1.4 This ConOps establishes a strategic and operational framework for validating the performance and maturity of Unmanned Traffic Management (UTM) capabilities within both controlled and uncontrolled airspace.

1.5 It defines the approach through which risk-based integration of UAS can be achieved in line with the CAA's Airspace Modernisation Strategy (AMS – CAP1711 series) and the Future-ATM/ANS programme.

1.6 It also provides the foundation to build evidence supporting an iterative transition from segregated to integrated operations, supporting the aim for all airspace users, manned and unmanned, to benefit from equitable and proportionate access.

Integration of UK SORA Methodology for Air Risk Classification and Mitigation Validation

1.7 The integration of UTM Services into the UK SORA process provides a mechanism for linking regulatory intent with operational implementation. UTM

services deliver the digital service provision required to ensure that air risk mitigation measures can be applied, monitored, and validated in real time, contributing directly to the integrated airspace.

Support to AMS Objectives through Progressive, Test-Based Implementation

1.8 This ConOps directly supports both the CAP1711 and Future of Flight BVLOS Roadmap (CAP3182). It defines how UTM, working with ATM, ANSPs, and System Wide Information Management (SWIM) compliant data services, will be validated through a structured programme of scenario-based testing, progressively increasing technical capability and operational complexity.

Objectives

1.9 The primary objectives of the ConOps are to:

a) Define the UTM Operational Concept: Establish the foundational principles, conceptual architecture, and key traffic management services required to support safe and scalable UAS operations, by providing a common framework for UTM, including a standardised operational model and terminology to ensure alignment across the aviation industry, government, and commercial stakeholders.

b) Clarify Roles and Responsibilities: Identify the key stakeholders involved in UTM, including CAA, ANSPs, UTMSPs and UAS operators.

c) Delivery of UTM Mandatory Services: The management and organisation of airspace through the delivery by UTMSPs of one or more of the mandatory services, which include geo consciousness, flight authorisation, and conflict management, in line with the UK UTM Policy Concept.

d) Integration of Manned and Unmanned Aircraft: The safe coexistence of manned and unmanned aviation operations within the UK's airspace.

e) Conformance with SWIM principles: The provision and exchange of assured digital data between systems (e.g. ATM, CISP, DSS, UTMSPs and UAS operators' systems) is accomplished through services that comply with SWIM requirements on data assurance.

f) Inclusion of Unmanned Aircraft System Data Service Providers (UDSPs): The integration and validation of assured data sources providing real-time operational information such as meteorological data, aeronautical information (e.g. terrain and obstacle data), and communications network status, in support of SORA mitigations and performance assessment.

g) Encourage Industry to Provide Innovative Solutions: Provide a technology-neutral framework that promotes industry innovation while ensuring regulatory alignment.

Scope

1.10 This ConOps guides the regulatory requirements and operational framework for UTM service provision in the UK, and where a UTM element is being tested to deliver UTM services. The scope includes:

- The operation of Specific category beyond visual line of sight (BVLOS) UAS safely in volumes of SUA with a focus on operations at scale.
- The management and organisation of airspace through the delivery of UTM mandatory services that include flight authorisation, geo-consciousness and conflict management services.
- The safe accommodation/integration of manned aircraft into volumes of SUA established for use by UA. This SUA can be established in controlled airspace, uncontrolled airspace, or a combination of both.
- The provision of digital data and services that address safety-critical requirements for UAS and the sharing of assured data between stakeholders such as UAS operators, UTMSPs, and ANSPs.
- The provision of assured data from UDSPs.
- The implementation of data exchange mechanisms between UTM and ATM systems via the Common Information Service Provider (CISP).

Application and Evolution

1.11 This ConOps focuses on testing representative use cases to validate the performance of UTM within selected operational environments aligned with the proposed scenarios under Future of Flight BVLOS Roadmap (CAP3182).

1.12 These trials should demonstrate how strategic and tactical mitigations, supported by UTM services provision, can collectively achieve acceptable residual risk without permanent segregation.

1.13 Future iterations will expand the scope to incorporate additional stakeholders and will also include regulatory and technical developments such as SORA3.0.

Approach to the Testing Environment

1.14 The holistic testing project will provide detailed testing characteristics and documentation, including all testing activities related to the Future-ATM/ANS programme workstreams.

1.15 The aim of the testing is to validate interoperability, data assurance, and risk-based performance, providing the evidence base required for scalable and repeatable authorisations under the UK SORA.

1.16 The outcomes of these tests will inform future policy, technical standards, and the regulatory pathways required to support the progressive transition toward integrated, data-driven UAS operations across UK airspace.

Key Challenges for UAS Integration

Several key challenges must be addressed to facilitate UAS integration into the UK's airspace environment:

1.17 Alignment within the UK Airspace Modernisation Strategy (AMS) – Ensuring a consistent approach together with the other workstreams, from Airspace to SWIM, including C2 Link, DAA, EC, and GI.

1.18 Airspace Complexity and Congestion – UK airspace is amongst the most complex and constrained in the world, requiring a structured approach to integrating new airspace users without compromising the operations of commercial airliners, general aviation, military or emergency services.

1.19 Safety and Risk Mitigation – The risk of mid-air collisions between UAS and other UAS and UAS and manned aviation must be minimised through a combination of strategic deconfliction, electronic conspicuity, DAA technologies, C2 link, and airspace management, under the umbrella of the UK SORA risk-based framework.

1.20 Regulatory and Operational Harmonisation – UTM must align with existing UK CAA frameworks (e.g. UK Regulation (EU) 2019/947 Article 11 (UK SORA)), ICAO standards (including guidance material), and future regulatory developments.

1.21 Scalability and Interoperability – UTM must support growing UAS demand for service provision that addresses both simple and complex BVLOS operations, while ensuring seamless interoperability with ATM/ANS services.

1.22 Cybersecurity and Data Integrity – UTM must be built on secure, resilient, and trustworthy digital infrastructure to protect against cyber threats, data corruption, and unauthorised system access.

Question 1: *Do you agree with how the UTM Services have been integrated into the UK SORA process? If you disagree, please provide an explanation.*

Question 2: *Are there any missing objectives that you were expecting the ConOps to deliver on?*

Question 3: *Are there any other key challenges that you would like to highlight to the CAA relating to the challenges of integrating UAS operations into UK airspace environment?*

Responding to this consultation

1.23 The consultation process is an integral part of CAA and government's policy development approach, allowing us to understand the impact of possible policy changes on stakeholders. We welcome responses to the consultation from any stakeholder impacted by these proposals, including recreational and commercial UAS remote pilots/operators, potential UTMSPs, external data providers, and UAS service providers, amongst others.

1.24 The consultation is open until 23:59 28 August 2026. Responses can be provided via Citizen Space.

1.25 Our strong preference is that you complete the online consultation. We understand that some stakeholders prefer not to be constrained by the questions alone and will want to send a self-contained response. While we will accept these submissions, we ask that they are structured around our questions. Otherwise, we will not be able to analyse the submissions in the same way that we analyse the online responses.

1.26 We will assume that all responses can be published on our website. When you complete the online consultation, there will be an option for you to hide your identity or refuse publication. (In any event, your email address will not be published.) In the interests of transparency, we hope people will not refuse publication. If you do send us a separate submission and it includes any material that you do not want us to publish, please also send us a redacted version that we can publish. You should be aware that information sent to and therefore held by the CAA is subject to legislation that may require us to disclose it, even if you have asked us not to (such as the Freedom of Information Act and Environmental Information Regulations). Therefore, if you do decide to send information to the CAA but ask that this be withheld from publication via redacted material, please explain why, as this will help us to consider our obligations to disclose or withhold this information should the need arise.

1.27 If you would like to discuss anything about how to respond to the consultation, please email airspacemodernisationdelivery@caa.co.uk .

1.28 Once the consultation has closed and we have considered feedback, we will publish our consultation reply document. This will summarise the feedback and set out our proposed updates.

Chapter 2

UTM Target Concept

Introduction to UTM Target Concept

2.1 The Target Concept for UAS operations utilising UTM services establishes the requirements for the safe, efficient, and scalable integration of UAS into UK airspace. It establishes a progressive pathway towards full integration with ATM and ANS infrastructures, whilst maintaining regulatory oversight throughout the safe introduction of capabilities such as automation and digital assurance.

2.2 The UTM concept aims to define the architecture and constraints applicable to this domain and the stakeholders involved in deploying and operating UTM within UK airspace.

Key Elements of the Target Concept

Airspace Integration

2.3 The target concept aims to ensure that UAS can safely operate with manned and unmanned aviation in both controlled and uncontrolled airspace without the requirement for Special Use Airspace.

2.4 Where SUA is required, preferably TRAs, they will only be activated when necessary, thus aligning with the Flexible Use of Airspace (FUA) concept within the AMS Part 3 (CAP1711b).

Digital and Automated UTM Framework

2.5 Automation is central to the UTM architecture, significantly reducing human involvement in managing UAS traffic. Through digital services – including automated flight authorisations, real-time compliance monitoring, and strategic and tactical deconfliction – large-scale and complex UAS operations are anticipated to be managed effectively, safely, and efficiently, facilitating operational scalability.

Risk-Based and Scalable Operations

2.6 UTM operations will adopt a risk-based framework, ensuring operational requirements are proportionate to the complexity and risk profile of each flight.

2.7 UTMSPs provide services that serve as strategic (SM4-SM8) and tactical (TM2; TM3; TM5 and TM7) mitigations within the UK SORA framework. These services can be provided for all UAS operations conducted, regardless of the Air Risk Class (ARC) level.

Advanced Operational Capabilities

2.8 The Target Concept supports advanced capabilities, including routine BVLOS operations.

2.9 These rely on resilient command-and-control links, electronic conspicuity (CAP3140), and dynamic airspace management integrated through UTM, ensuring continuous responsiveness to real-time airspace constraints and dynamic airspace changes that can be promulgated by NOTAMs.

Safety and Compliance by Design

2.10 Safety and compliance remain at the heart of UTM systems development. The architecture is fundamentally designed to mitigate risks such as mid-air collision, controlled flight into terrain, inadvertent airspace infringement and operations not in compliance with their notified flight plan. Transparent regulatory oversight mechanisms ensure UAS operators and UTMSPs adhere to stringent safety and performance standards, thus safeguarding all airspace users.

Data-Driven Decision Making

2.11 Operational decision-making within UTM is underpinned by real-time, assured data exchange consistent with the SWIM model.

2.12 Access to reliable aeronautical, surveillance, and meteorological information supports quantitative ARC assessment and evidence-based operational decisions across all users.

UAS Operator Responsibility and Awareness

2.13 When utilising UTM services UAS operators may have access to information and data to assist in maintaining compliance with flight authorisation.

2.14 Autonomous and semi-autonomous UAS platforms will utilise DAA technologies (onboard, ground-based or provided by UTM) and geo-awareness systems to operate safely, particularly within complex and dynamically managed airspace.

Operational Framework for the Target Concept

2.15 The operational framework supporting the UK´s Target Concept is structured around three operational phases, ensuring comprehensive oversight, safety, and continuous improvement throughout every stage of UAS missions.

Pre-Flight Operations

2.16 The pre-flight operational phase consists of several steps following the order presented hereafter:

- Before flight, UAS operators submit flight plans through a UTMSP.

- Each plan is validated against airspace restrictions, potential conflicts, and adherence to operational rules. UAS operator registration is verified through DMARES (Drone and Model Aircraft Registration and Education System), ensuring accountability from the outset.
- The flight plan is shared with other UTMSPs to ensure strategic deconfliction is conducted where multiple UTMSPs are operating.
- Once approved, an authorisation of the flight plan is issued to the UAS operator.

In-Flight Operations

2.17 The in-flight phase is built on the following actions, but the list below is not exhaustive:

- Throughout the duration of each flight, UTMSPs continuously monitor UAS operations via real-time compliance monitoring (using data from the ground infrastructure and/or data from the UA relayed over the C2 link to the CU for onward transmission), to verify compliance with the approved flight plans.
- If deviations from the flight plan are detected, the UAS operator is notified. If these deviations result in a conflict, conflict management services are provided and tactical deconfliction mechanisms are activated. UTMSPs may be able accept alternative flight plans to maintain safety.
- UAS operators and involved stakeholders receive additional data (weather updates, assured terrain, surveillance) from UDSPs, facilitating adaptation to changing flight conditions.

Post-Flight Operations

2.18 On completion of the flight, the flight plan is closed, and all operational data is archived for analysis. This comprehensive data logging supports ongoing performance assessment, compliance verification, and identifies areas for system refinement.

2.19 Regular feedback mechanisms are built into the operational cycle, ensuring continuous improvement of UTM services, regulatory oversight processes, and the enhancement of overall airspace safety and efficiency.

Supporting Functionalities

2.20 The effectiveness of the UTM Target Concept relies on a set of key supporting functions that enable interoperability, scalability, and regulatory assurance across the system architecture. These functions form the operational backbone of the UTM system, ensuring that services are delivered with the necessary levels of data integrity, reliability, and transparency.

2.21 Each function, ranging from data management and registration to information exchange and oversight, underpins the performance of UTM services. Collectively, they provide the digital infrastructure that connects UTM to the wider aviation system, supporting safe, efficient, and proportionate unmanned operations within the modernised UK airspace environment.

Data

2.22 Real-time, assured data is fundamental to UTM performance.

2.23 Dynamic integration of aeronautical, surveillance, and constraint data ensures that all stakeholders, UTMSPs, UDSPs, ANSPs, and the regulator share a single operational picture, supporting consistent decision-making and compliance.

Scalability

2.24 The federated, service-oriented UTM architecture allows progressive scaling aligned with demand. Discovery and Synchronisation Service (DSS) facilitates the interoperability of multiple UTMSPs and ensures that operational data can be securely exchanged.

2.25 This phased approach mirrors the AMS modernisation roadmap and supports the Future-ATM/ANS programme's end-to-end testing strategy.

Registration

2.26 UTM system integrates seamlessly with the CAA Drone and Model Aircraft Registration and Education System (DMARES) for UAS operator validation and compliance.

2.27 To ensure secure and verifiable UAS operations, most operators are required to be registered and validated through DMARES. The UTM system can be integrated with DMARES, allowing UTMSPs to verify UAS operator credentials and to confirm compliance before authorising flight plans. This tight coupling of registration and flight authorisation will prevent unauthorised operations, improve accountability, and strengthen regulatory enforcement.

Common Information

2.28 This ConOps has been developed on the working assumption that the CISP will act as the primary technical and operational connector between ATM and UTM in controlled airspace. It is acknowledged that the role, architecture, and governance of the CISP are currently under discussion and subject to development within parallel workstreams. The arrangements described in this ConOps may be adapted as national policy, regulatory decisions, and technical architectures evolve.

2.29 The Common Information Service Provider (CISP) will act as the central data exchange hub between UTMSPs and ATM in controlled airspace, ensuring seamless interoperability.

2.30 It is the provider of digital common information through a SWIM-compliant network to all UTMSPs and ANSPs supporting the exchange of information for operations in controlled airspace. This approach removes the need for bespoke data relationships between UTMSPs and ANSPs, establishing the CISP as the single source of assured data.

UAS Data Service Providers

2.31 UDSPs will provide critical operational data, such as weather, terrain, and surveillance data, to UTMSPs and UAS operators, enhancing situational awareness and decision-making.

2.32 UTMSPs will rely on UDSPs to supply additional airspace information to UAS operations that do not fall under the mandatory services. This integration ensures timely, evidence-based tactical responses and supports safe scaling of BVLOS and high-density UAS operations.

Regulatory Oversight

2.33 The focus upon digital data in a UTM system allows the CAA to actively monitor compliance, ensuring that all UAS operations meet national safety and regulatory requirements, and performance analysis. This regulatory oversight mechanism will facilitate real-time auditing of UTM activities, reducing the likelihood of non-compliance or unsafe operations. By leveraging data-driven regulatory tools, the UK UTM framework will remain adaptable and responsive to emerging aviation challenges.

Processes

2.34 UTM operations will follow a structured, end-to-end workflow encompassing pre-flight, in-flight, and post-flight phases. UTMSPs will ensure UAS operations are conducted safely, expeditiously, and with full regulatory compliance throughout all the phases of flight.

Question 4: *Do you agree with the supporting functionalities that have been identified and are there any additional ones that you would suggest and why?*

Chapter 3

UTM Operational Concept & Architecture

Description of the Operational Environment

3.1 The classification of airspace remains a foundational element for ensuring safe and efficient aviation operations. As defined by the International Civil Aviation Organisation (ICAO), States determine the need for the provision of Air Traffic Services (ATS) – e.g. Air Traffic Control (ATC) service, Flight Information Service (FIS), and alerting service – and then classify and designate the airspace accordingly. These classifications support airspace design decisions by accounting for mixed traffic, operational complexity, and acceptable safety margins. The United Kingdom has implemented the ICAO airspace classification framework through the Standardised European Rules of the Air (SERA), providing a stable and internationally harmonised baseline for both manned and unmanned aviation.

3.2 In addition to this established framework, for UA operations the UK has adopted the UK SORA air risk model. This introduces the Air Risk Class (ARC), which characterises the likelihood of encounters between UA and manned aircraft within a defined operational volume, categorised from ARC-a (lowest air risk) to ARC-d (highest air risk). This risk-centric approach enables a more granular understanding of the operational environment than airspace class alone, particularly in low-level and mixed-traffic contexts where UA operations are expected to scale, supplementing existing ICAO airspace classifications by introducing a risk-based lens that quantifies airspace user risk exposure according to the density and nature of surrounding traffic.

3.3 Within this operational environment, UTM services may contribute to risk management by supporting strategic coordination, information exchange, and operational compliance; however, their relevance to air risk mitigation is assessed strictly in accordance with UK SORA principles. In particular, UTM services are only considered to influence ARC where they demonstrably reduce the encounter rate between UA and manned aircraft within the operational volume. Encounters between UA-UA are treated separately and are not considered within the air risk model[2].

3.4 The operational scenarios developed later in this ConOps build upon this framework, illustrating how different combinations of airspace classification,

[2] The current version of the ConOps is aligned with the UK SORA framework. JARUS SORA 3.0 will be taken into consideration when publicly available and assessed by UK CAA.

ARC, and UTM service provision can be applied to support safe and efficient UA operations across both controlled and uncontrolled airspace.

Overview of the UK SORA Framework

3.5 The UK SORA provides a framework for evaluating the risk of unmanned aircraft operations conducted within the Specific category. It defines a structured, step-by-step methodology for identifying operational risks, determining appropriate levels of robustness, and applying proportionate mitigations to ensure that UAS can operate safely alongside existing airspace users.

3.6 At its core, the UK SORA seeks to balance innovation and safety by enabling a risk-based, performance-driven approach. Rather than defining prescriptive airspace restrictions or rigid operational limits, the framework allows UAS operators to demonstrate equivalent levels of safety through evidence-based application of both strategic (pre-flight) and tactical (in-flight) mitigations.

3.7 ARC determination is conducted by qualitative assessments or quantitative airspace characterisation studies. Airspace characterisation allows operational constraints and mitigations to be defined based on actual risk exposure, rather than relying solely on static airspace designations. This provides a structured pathway to progressively enable more complex UA operations, including BVLOS, while maintaining acceptable levels of safety.

UK SORA Alignment and Integration of UTM Services

3.8 The integration of UTM Services into the UK SORA process provides a mechanism for linking regulatory intent with operational implementation. UTM Services delivers the digital infrastructure required to ensure that risk mitigation measures can be applied, monitored, and validated in real time.

3.9 The alignment between the UK SORA and the Future-ATM/ANS programme ensures that the deployment of UTM Services supports both CAP1711 and the broader goal of transitioning from segregated to integrated operations.

3.10 Rather than duplicating the SORA framework, the UTM ConOps explains how UTM functions deliver or support the mitigations defined within SORA steps 4 to 11, providing a clear operational linkage between digital services, regulatory requirements, and safety assurance.

UTM Contribution to the UK SORA Steps

3.11 At Step 4 – Determination of the Initial ARC, UTM contributes to transforming what has historically been a qualitative classification into a quantitative, data-driven assessment. The encounter-rate modelling can be used to estimate initial risk based on actual traffic density and airspace characteristics. By integrating EC, C2 Link, and Ground Infrastructure data within the UTM framework,

encounter probabilities can be calculated dynamically, supporting evidence-based ARC determination.

3.12 Residual risk estimates can be used to hypothesise and test future mitigations, such as new UTM services or shared avoidance responsibilities between manned and unmanned aircraft.

3.13 This approach aligns with ongoing developments under JARUS SORA 3.0, which aims to formalise the use of quantitative data and statistical encounter modelling for risk classification. The UK CAA intends to ensure that future updates to the UK SORA reflect these international advancements while allowing UTM implementation to progress independently of regulatory maturity constraints.

Strategic and Tactical Mitigations

3.14 UTM supports strategic mitigations (SM4–SM8) by providing digital mechanisms for airspace design, coordination, and data assurance:

- SM4–SM5: Facilitate digital establishment of airspace structures.
- SM6–SM7: Enable pre-flight coordination and pre-agreement of UTM service use with ANSPs through integrated data exchange; These may be merged into a single UTM-supported mitigation layer.
- SM8 (optional): Automate promulgation of operational intent via digital NOTAM or geo-consciousness functions.

3.15 The UTM capabilities that support tactical mitigations TM2, TM3, TM5 and TM7 are:

- TM2: Providing detect capability and avoidance information (real-time conflict resolution) through service and data provision in accordance with the UTM policy concept and CAP3015.
- TM3: Utilise EC out data to provide a real time recognised air traffic environment (RATE) that supports the provision of geo-consciousness traffic information and conflict management services.
- TM5: Integrates multiple surveillance data sources creating a situational awareness picture in real-time through the provision of its services.
- TM7: Provides real time assured Met and AIS data to assist tactical risk mitigation.

3.16 This combination allows operations to safely achieve Residual ARC-b status without reliance on segregation, supporting the transition towards scalable BVLOS operations.

Scenario Alignment and Forward Coordination

3.17 The set of scenarios described in Chapter 5 aligns with the Future of Flight BVLOS Roadmap (CAP3182), and they progress from low complexity operational environments, where UTM services such as a flight authorisation service that includes strategic deconfliction will primarily be used, to more complex scenarios where conflict management services provided by a UTMSP will be required.

3.18 As operational maturity increases, there will be a requirement for increased levels of coordination and interoperability between UTMSPs and ANSPs. This phased expansion reflects a deliberate, iterative growth towards more integrated and scalable traffic management capabilities.

3.19 The scenarios will progress in accordance with the UK Concept of Operations – Future Air Traffic Management and Air Navigation Service document, ensuring that the evolution of the UTM services, operational assumptions, and system interfaces remain synchronised with CAP3182 operational scenarios.

UTM Architecture and Infrastructure

3.20 The technical airspace architecture for the UK Concept of Operations - Future Air Traffic Management & Air Navigation Service (UK ConOps) document progresses along with the CAP3182 pathway towards full integration of unmanned aircraft systems within the UK's airspace. This approach considers not only an architecture example applicable to current UAS operations but also envisions possible architectures for this future integration. The pathway considered is structured into three time periods, starting from now towards a full integration concept beyond 2028. The considered time periods are catalogued as:

- Period 0 is now;
- Period 1 captures the vision of 2027 and 2028; and
- Period 2 beyond 2028.

3.21 The time periods align with the scenarios captured in CAP3182 that range from Atypical Air Environment (AAE) scenario (A0) through to Fully Integrated scenario in both controlled and uncontrolled airspace (FI3), allowing:

- Phased Integration Approach: It facilitates a gradual transition from less complex environments, such as AAE, to full integration with traditional ATM systems, where the validation of new technologies and operational concepts, such as providing UTM services, minimises the risks and ensures continuous compliance with the AMS.

- Risk-Based Management using SORA: A core feature of the architecture proposed is its alignment with the UK SORA methodology, which provides a risk-based approach to UAS operations. The use of UTM services supports this risk-based management with the strong attachment of them to both strategic and tactical mitigations described in the UK SORA methodology.
- Interoperability and Standardisation: Interoperability between UTM and traditional ATM systems is a cornerstone of the architecture. The combined CISP and DSS architecture facilitates efficient and secure information sharing across multiple service providers and airspace users using standardised SWIM compliance interfaces.

3.22 UK Concept of Operations considers specific examples for each scenario CAP3182 describes, highlighting the elements that would be utilised in that particular scenario. On the other hand, the present ConOps focuses on the full UTM domain architectural elements proposed as part of an example architecture.

CONCEPTUAL UTM FRAMEWORK

Multi-UTMSP in Controlled Airspace Architecture Diagram

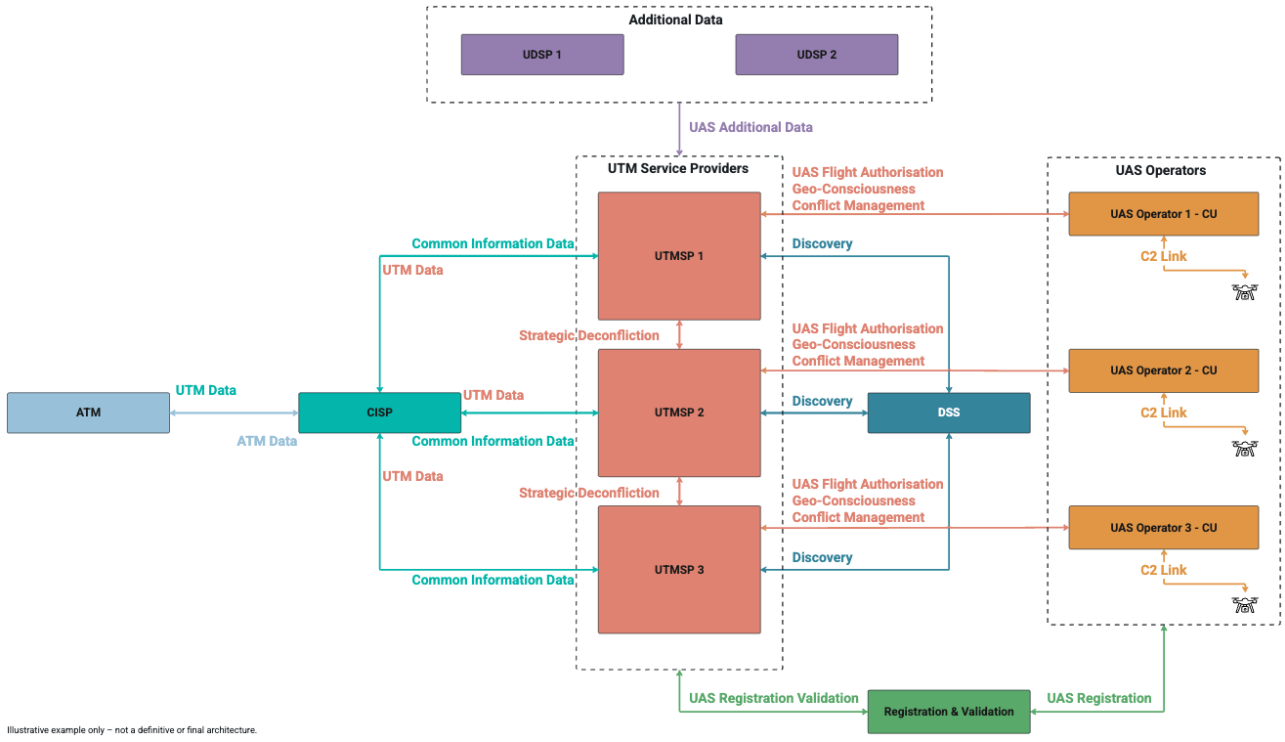

Figure 1 - Conceptual UTM Architecture

3.23 The architecture presented in Figure 1 proposes the architecture in a controlled airspace environment with multiple UTM service providers. Nonetheless, according to UK ConOps, the UTM domain would also require integration with Ground Infrastructure (GI) for Electronic Conspicuity (EC) reception and for the

provision of the detect capability and conflict resolution for multiple UAS that complement the onboard DAA system.

3.24 This integration proposed is further described hereafter and linked to the services that the UTM providers may provide to UAS operators.

Key Architectural Elements for UTMSPs Integration

3.25 UTM and ATM Integration

- Use of SWIM-compliant requirements for secure and efficient data exchange between UTM and ATM (possibly via a CISP or other assured method of data exchange).
- Multiple UTMSPs are established with standardised data exchange protocols, which are SWIM-compliant, enabling real-time coordination of UAS operations. This interoperability is supported by the Discovery and Synchronisation Service (DSS).

3.26 Airspace Management and Notifications

- Airspace management and notifications are delivered following SWIM standard requirements for secure and efficient data exchange between UTM and ATM regarding constraints applicable to the airspace. This integration enables UTMSPs to provide geo-consciousness service.

3.27 Electronic Conspicuity (EC)

- Use of ADS-B In/Out across dual frequencies will increase the visibility likelihood of UAS by all airspace users.
- Real-time data sharing of EC information with multiple UTM service providers for enhanced situational awareness. This allows the UTMSPs to provide Traffic Information Service as part of the conflict management service.

3.28 Advanced Surveillance and Data Fusion

- Data received from ADS-B, MLAT, PSR/SSR (Primary/Secondary Surveillance Radar), and obstruction beacons for real-time traffic management.
- Use of standardised protocols for comprehensive surveillance and data interoperability.
- Fusing real-time traffic data to create a RATE may support UTMSPs in providing conflict management service.

3.29 DAA for Integrated Airspace

- Full DAA capabilities, not only to provide situational awareness but also to include the use of predictive conflict detection and automated avoidance manoeuvres.

3.30 C2 Link Infrastructure

- Sufficiently robust C2 links to support BVLOS operations within various classes of airspace.
- Use of authenticated, secure, and redundant C2 Link connections using satellite and/or terrestrial means may be required.

3.31 In summary, the architecture implementation proposal enables UAS to operate safely in all airspace environments, achieving full integration with traditional manned aviation systems. The architecture supports high-density UAS operations through advanced automation, real-time data exchange, and predictive conflict management capabilities.

Infrastructure

3.32 The proposal for a UK UTM service provision model is anticipated to be a federated model in which multiple UTMSPs deliver services, such as UAS flight authorisation, geo-consciousness, and conflict management, rather than relying on a single centralised entity. This approach is expected to encourage competition and choice for UTM service provision, drive technological innovation, and prevent dependency on a sole supplier. While the CAA retains overall regulatory authority, UTMSPs will be responsible for managing their own service provision, ensuring compliance with aviation regulations. This distributed architecture increases efficient use of airspace, supports scalable operations, and provides a resilient framework for managing growing UAS traffic volumes.

3.33 The UTM architecture, while operating in controlled airspace, also relies on a central node: CISP, to support UTMSPs to provide conflict management mitigation with manned aircraft and dynamic airspace data to address geo consciousness requirements that mitigate the unsafe operation of the UAS.

Question 5*: Is it useful for industry to include how UTM services integrate with the SORA process? If you do not agree with this approach, why not?*

Question 6: *Have the right strategic and tactical mitigations been identified?*

Chapter 4

UTM Services

Overview of the UTM Services

4.1 The current ATM/ANS system was not designed to control automated and/or pilotless aircraft now operating in UK airspace, and therefore, the addition of a UTM system – an ATM/ANS capability that addresses the specific requirements of a UAS service provision – is required to support safe, efficient, and scalable integration. The provision of any of the services identified in the UTM policy concept shall be undertaken either by a certified UTM Service Provider (UTMSP) or by an existing ATM/ATS ANSP appropriately certified under UK Regulation (EU) 2017/373.

4.2 This chapter will focus on:

- Defining operational flows for planning, execution, and post-flight phases;
- Identifying stakeholders, including the CAA, ANSPs, UTMSPs, CISP(s), UDSPs and UAS operators; and,
- Building the relationship of UTM Services' contributions to the mitigations defined within UK SORA.

4.3 One or more of the following services will be provided by a certified UTMSP to ensure safe and efficient UAS integration into UK airspace:

- Flight Authorisation Services, consisting of:
  - Airspace Authorisation
  - Flight Planning
- Geo-Consciousness Services, consisting of:
  - Compliance Monitoring
  - Aeronautical Data (terrain and obstacle data / information
  - Accessing Aeronautical Information Services / Aeronautical Information Management (AIS/AIM)
- Conflict Management Services, consisting of:
  - Traffic Information Service
  - Traffic Separation Service

4.4 To facilitate the safe and efficient integration of UAS into UK airspace, all UTMSPs will be required to provide one or more of the UTM services identified in the UTM policy concept to ensure operational awareness, regulatory compliance, and airspace safety.

4.5 A set of additional data services may be provided by UTMSPs or UDSPs to enhance safety, scalability, and efficiency, including meteorology, common altitude reference, registration and validation, SWIM-based information exchange, and data logging and analytics.

UTM Services

Flight Authorisation Services

4.6 The flight authorisation services are required to validate and to authorise flight requests against airspace structure, geo-zones, other UAS trajectories, and manned traffic constraints, issuing a unique UAS Flight Authorisation ID and defining the allowable 4D operational volume.

4.7 This set of services comprises the following:

- Airspace Authorisation capability provides airspace authorisation from the delegated State authority to the UTMSP to establish and promulgate airspace restrictions for UAS, either to:
  - Restrict access to geofenced areas (geofencing); or
  - Restrict the UAS to a geographically defined area (geo-caging).
- Flight Planning is a process that, prior to the flight of an UAS, arranges and optimises intended operational volumes, routes, and trajectories utilising the information provided by the UAS operator as part of a flight plan.

4.8 This set is related to a strategic deconfliction function for UAS interactions in the same area of conflicting flight plans.

4.9 The provision and exchange of real-time flight plan data will be used in the Compliance Monitoring Service, allowing much better tactical management by UTMSPs. Moreover, sharing information will enable optimised operations for multiple UAS operations conducted in the same airspace.

OPERATIONAL FLOW

UAS Flight Authorisation Service Operational Flow Diagram

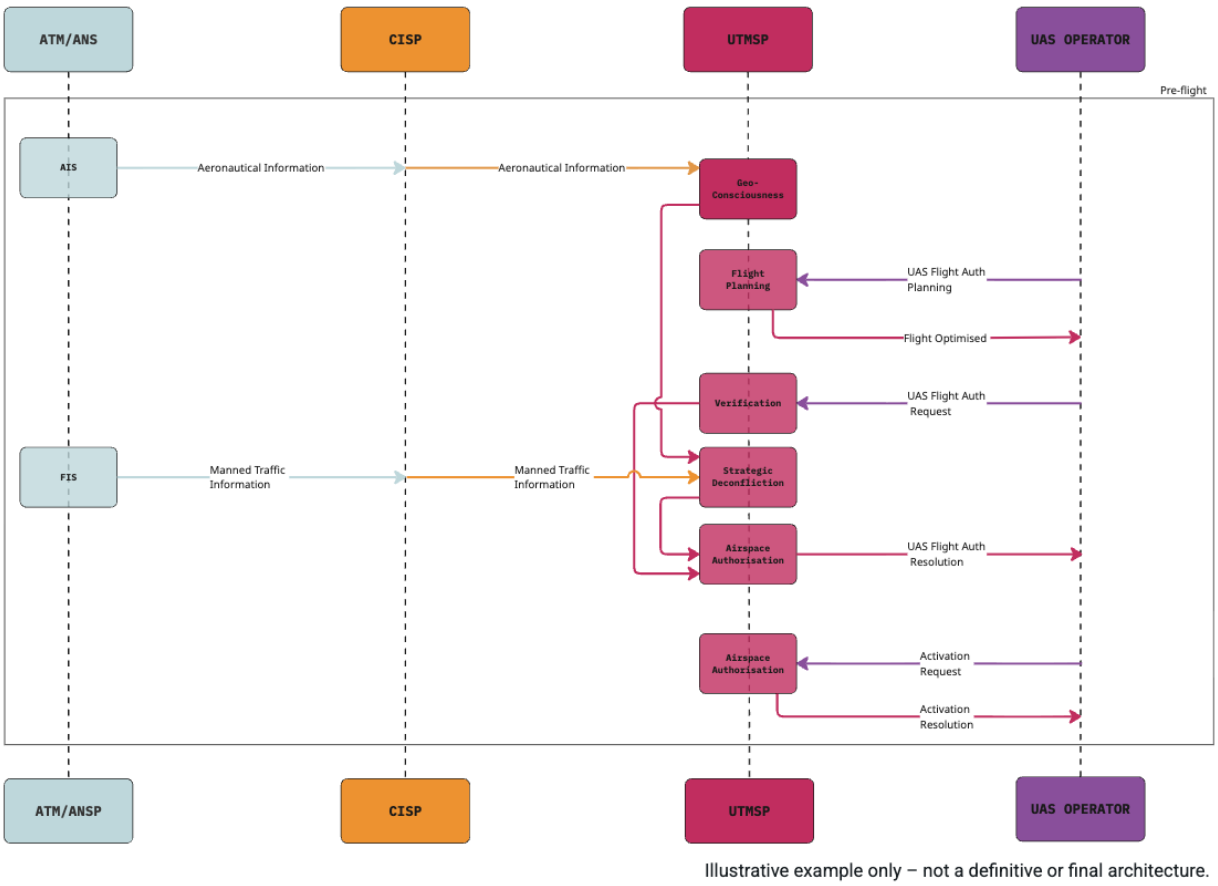

Figure 2 – Operational Flow for UAS Flight Authorisation Service Pre-flight Phase

Flight Plan Submission

4.10 The UAS operator submits an electronic flight authorisation request to the UTMSP, including operational intent, 4D trajectory, performance characteristics, SORA outcomes (including ARC), equipage, and contingency procedures.

Data Gathering

4.11 The UTMSP queries data about the current airspace design, geo-zones, aeronautical data, weather information, and manned traffic constraints within the relevant volume.

Verification

4.12 The UTMSP verifies that the authorisation request is complete, correct, and free from inconsistencies (e.g. overlapping segments, non-flyable altitudes) and the UAS operator details align with DMARES.

Airspace Authorisation / Strategic Deconfliction

4.13 The UTMSP assesses the proposed trajectory against other known or authorised UAS trajectories and structural constraints.

4.14 Where conflicts are identified, the UTMSP negotiates alternative trajectories or volumes with the UAS operator, seeking an acceptable strategic solution without infringing manned aviation operations or ARC-related risk limits.

4.15 For operations in controlled airspace, the UTMSP coordinates with ATC/ANSP through agreed ATM/UTM interfaces before granting airspace authorisation.

Decision and Notification

4.16 If the UTMSP accepts the flight plan, a unique UAS Flight Authorisation ID is issued, and the authorisation is recorded for data logging purposes.

4.17 If the UTMSP rejects the flight plan, structured reasons (e.g. incompatible with geo-zones, capacity, priority or safety constraints) are provided to support the UAS operator re-planning.

Activation and Deactivation

4.18 Immediately prior to take-off, the UAS operator requests activation of the authorisation; the UTMSP confirms that conditions have not materially changed (e.g. new restrictions, updated weather, ANSP instructions) and activates the authorisation, sharing the active 4D volume to other UTMSPs.

4.19 Upon landing or mission termination, the authorisation is deactivated, and the final operational record is closed and archived.

Geo-Consciousness Services

4.20 The geo-consciousness service is a service where the UTMSP monitors the UAS flight path against the corresponding flight plan that has been filed and provides information and/or alerts to the UAS operator when the UA is in the proximity to the boundary of airspace volumes it cannot enter or leave. This is done by either:

- Geofencing function, which restricts access to geofenced areas; or
- Geocaging function, which restricts the UA to a geographically defined area.

4.21 Geo-consciousness consists of three components:

- Compliance Monitoring is the function providing real-time monitoring and alerting of non-compliance to flight plans to the UAS operator, remote pilot, other UTMSPs, and, where required, ATC.

- Aeronautical Data and information will need to be accessed to provide terrain and obstacle data / information appropriate and necessary for meeting the UK SORA requirements of individual UAS operations, or for supporting UTM system needs for the provision of deconfliction or flight planning services.
- Aeronautical Information Services / Aeronautical Information Management (AIS/AIM) will also need to be accessed to enable the flow of aeronautical information necessary for the safe, expeditious, and orderly operation of aircraft using the service.

OPERATIONAL FLOW

Geo-Consciousness Service Operational Flow Diagram

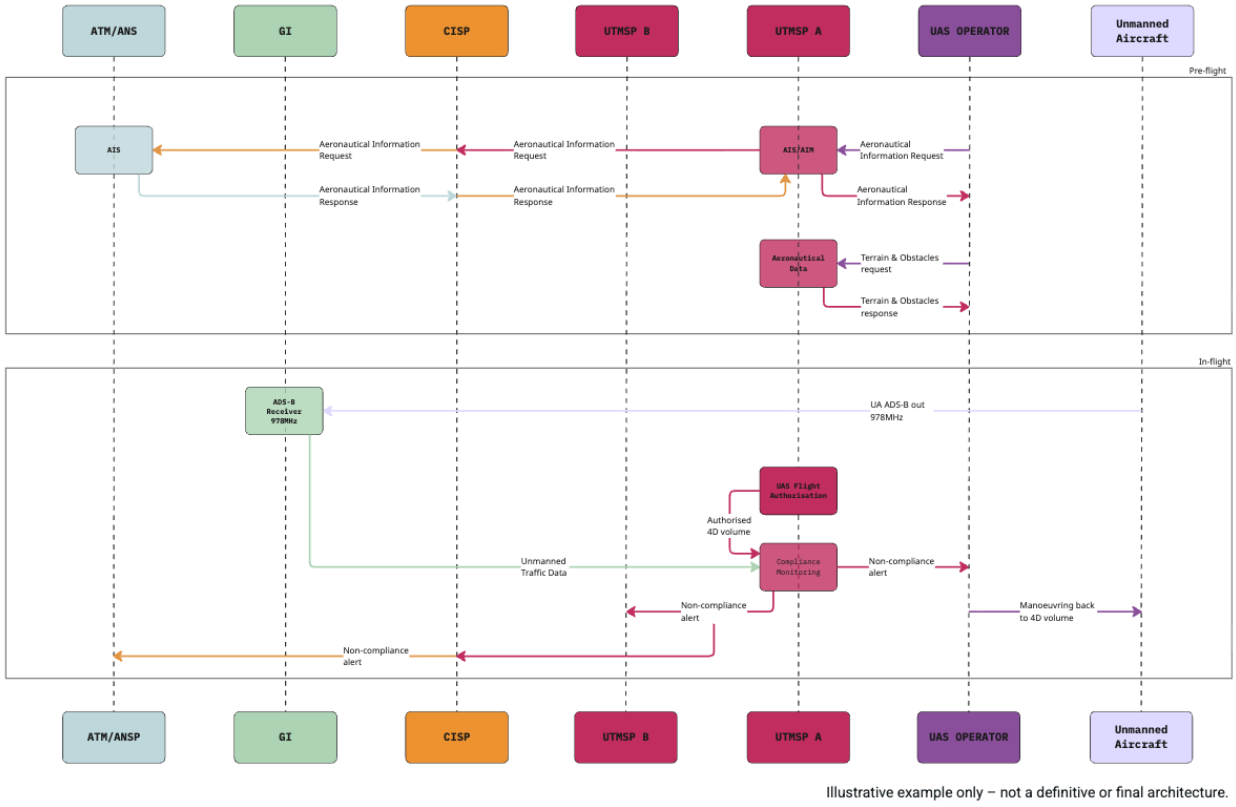

Figure 3 - Operational for Geo-Consciousness Service both Pre and In-flight Phases

Data Aggregation and Validation

4.22 The CAA and ANSPs will provide aeronautical information, geographical zones, NOTAMs, and temporary restrictions to an Aeronautical Information Service Provider (AISP).

4.23 Mapping and obstacle data are ingested from UDSPs and/or AISP and are quality-assured in accordance with aeronautical data quality requirements[3].

Geo-layer Generation

4.24 A CISP consolidates aeronautical, obstacle, and restriction data into machine-readable geo-layers (e.g. static and dynamic geographical zones, altitude limits, TRA/TMZ where applicable). The UTMSPs consume these geo-layers via standardised digital interfaces to build their internal geo-awareness models.

Pre-flight Use

4.25 During flight planning, the UTMSP checks the requested operational volume and trajectory against the current geo-layer set (e.g. restricted geographical zones, critical infrastructure, noise-sensitive areas).

4.26 Where an overlap with the geo-layer set occurs, the UTMSP rejects the plan or proposes route/volume adjustments consistent with applicable restrictions.

4.27 At authorisation time, the UTMSP registers the planned 4D trajectory/volume.

In-flight Use

4.28 UTMSPs and/or onboard systems provide continuous geo-awareness information to the remote pilot or UAS automation (e.g. proximity to boundaries, dynamic restrictions, temporary danger areas).

4.29 If the current position of the UAS is reaching the limit of its authorised 4D volume (e.g. lateral, vertical, or temporal), a pre-configured warning threshold triggers an alert to the UAS operator, UTMSP and, where applicable, any other UTMSPs or ANSP through the Compliance Monitoring Service.

4.30 Depending on severity and context, follow-up may include instructions provided by conflict management services.

4.31 Non-compliance events are recorded in the operational record to support safety occurrence reporting, investigation, and oversight by competent authorities.

Conflict Management Services

4.32 UTMSPs will need to safely demonstrate a conflict management capability to tactically separate aircraft through the provision of appropriate Air Traffic Services (ATS) comparable services. This will provide real-time information about other aircraft so that UAS can apply the relevant requirements of SERA when interacting with them.

4.33 The service comprises:

[3] CAP1054

- Traffic Information Service, which is a surveillance-based service where information is provided to the UAS regarding other air traffic that may be in proximity to the position or intended route of the flight. It helps UAS to avoid a collision by making the UAS situationally aware of known traffic through a Recognised Air Traffic Environment (RATE); and
- Traffic Separation Service, which is a surveillance-based service providing specific surveillance-derived traffic information and issues instructions to the UAS to achieve planned deconfliction minima against all known aircraft.

4.34 The conflict management services build upon EC and DAA capabilities described both in CAP3140 and CAP3015 and complement SERA responsibilities for collision avoidance.

OPERATIONAL FLOW

Conflict Management Operational Flow Diagram

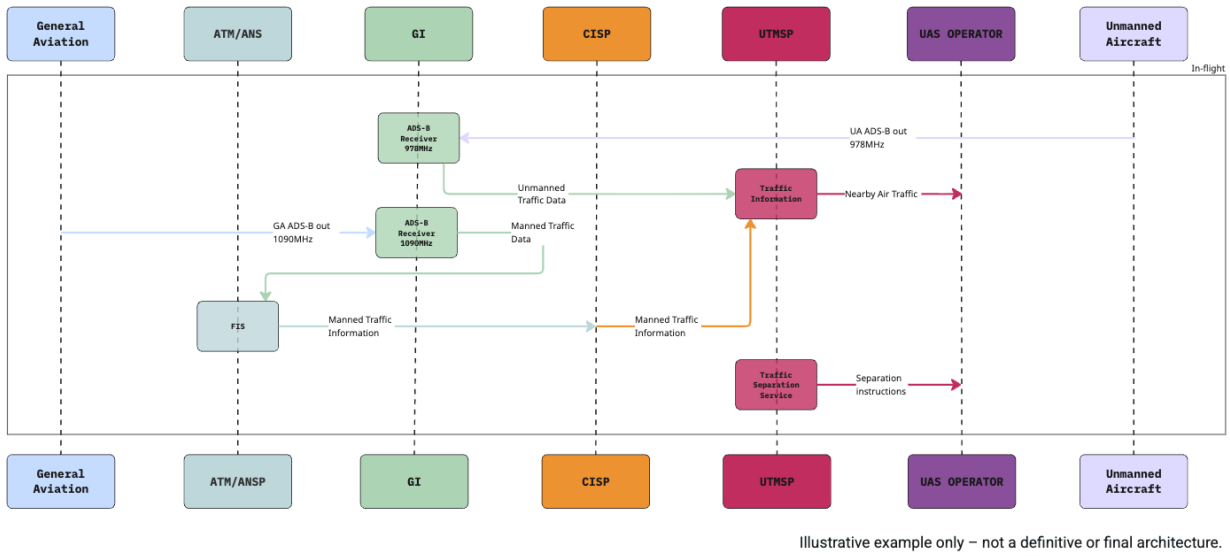

Figure 2 - Operational Flow for Conflict Management Service In-flight Phase

Surveillance and Traffic Information

4.35 In flight, UTMSPs receive live UAS position data (typically via EC, or ground-based surveillance) and manned traffic information through EC, radar, MLAT, TIS-B, and related feeds, as described in CAP3140.

4.36 A Recognised Air Traffic Environment (RATE) for the relevant volume is created, either centrally by an ANSP or CISP, or locally by UTMSPs using UDSP data where applicable or required.

Conflict Detection

4.37 The UTMSP continuously predicts trajectory evolution for all participating aircraft within its area of responsibility.

4.38 When predicted trajectories infringe defined well-clear or separation thresholds, a conflict is raised and passed either to the tactical deconfliction logic or to a ATS provider where appropriate.

Tactical Deconfliction – Information and Guidance

4.39 Where the UTMSP provides a Traffic Information Service, it issues timely alerts to the operator or onboard automation regarding proximate traffic, including type (manned/unmanned), relative position, and closing rate.

4.40 Where a Traffic Separation Service is provided, the UTMSP or ANSP issues explicit instructions (e.g. turn, climb/descend, speed change) designed to maintain separation minima consistent with DAA performance requirements.

Integration with DAA and SERA

4.41 Conflict management services complement, but do not replace, DAA systems and SERA responsibilities. DAA provides the airborne surveillance, decision, and manoeuvre execution capability direct to the UAS operator, whereas UTM conflict management can provide detection of the conflict to the UAS operator and if required, avoidance instructions provided if required. Further to that capability UTM can recognise the impact of tactical manoeuvres upon other UAS and apply traffic management through cooperative measures to multiple UAS, especially where the UAS has no avoidance, nor detect capability (at the system/service level).

Additional Data/Information

4.42 The additional services hereafter described are not required for UTM compliance but are expected to enhance safety, scalability and resilience. They may be provided to UAS operators directly or via a UTMSP, UDSPs or possibly via a CISP.

4.43 These services enable iterative refinement of UTM policies and architectures through testing phases, as foreseen in the UK UTM ConOps and Airspace Modernisation Strategy.

Meteorological Data/Information

4.44 To meet the UAS-tailored operational requirements, the provision of digital meteorological information to UTMSPs or UAS operators can be provided by certified or uncertified Met providers , adding to the safe conduct of UAS operations.

4.45 This comprises of the following functions:

- Provision of real-time and forecasted wind, visibility, precipitation, cloud base, and turbulence;
- Generation of mission-specific weather briefings for planning; and

- Provision of in-flight weather updates and alerts to support dynamic rerouting and contingency management.

Common Altitude Reference Data

4.46 The common altitude reference provides harmonised altitude/level information compatible with existing manned aviation practices (e.g. QNH, QFE, SAS), ensuring consistent vertical separation management between manned and unmanned aircraft.

4.47 This is recognised as a critical enabler for integrated operations and is expected to evolve in parallel with wider surveillance and EC work (CAP3140).

Registration and Validation Services

4.48 Registration and Validation Services interface with the UK's UAS and Drone & Model Aircraft Registration and Education System (DMARES) to verify operator identities, competency, and organisational approvals before flight.

Data Logging and Analysis Services

4.49 Data Logging and Analysis Services captures, stores, and processes operational data to support safety assurance, regulatory oversight, and performance optimisation.

4.50 This enables the retrieval of post-flight reports for operators providing evidence for conformance and occurrence reporting. They also provide aggregated performance indicators supporting airspace design and AMS implementation.

UTM Services Supporting UK SORA

4.51 UTM services either provided by a UTMSP or a UDSP are not explicitly considered within the UK SORA methodology. Nonetheless, these services presented in the chapter have an implicit impact on the air risk classification assessment.

4.52 UTM services impact both strategic and tactical mitigations, providing UAS operators with the means to reduce the associated ARC of the operation. The link between the services and the mitigations is described in the table presented hereafter:

Linking UTM Services to UK SORA

Table 1 - Strategic and Tactical Mitigations

Service	Capability	Mitigation	Rationale
All	-	SM7	As part of the pre-agreement of the UTM services to be used in-flight.

Service	Capability	Mitigation	Rationale
Geo-Consciousness	AIS/AIM	SM4	Geo-Consciousness service provides the aeronautical data related to these kinds of special use of airspace (SUA).
		SM5	This service provides the geographical limits associated to the TMZ.
		SM8	When a NOTAM of the intended operation is required, geo-consciousness service provides the geographical limits of the constraint to any other UAS operator.
UAS Flight Authorisation	Flight Planning	SM6	Strategic based segregation, deconflicting UAS BVLOS operational volumes.
	Airspace Authorisation	SM6	Procedure based segregation reserving the UAS BVLOS operational volume.
Conflict Management	Traffic Information	SM6	Traffic information to assist the remote pilot in command in avoiding other traffic.
		TM5	Monitoring local cooperative traffic through the provision of a RATE provided by ground -based surveillance.
	Traffic Separation	SM6	Issuing headings and/or levels aimed at achieving planned deconfliction minima.
UDSP	Meteorological	SM6	Basic service providing advice and information useful for the safe and efficient conduct of flights.
		TM7	Local area real-time weather monitoring helping to anticipate likelihood of unusual aircraft traffic patterns.

Chapter 5

Scenarios and Holistic Testing

Introduction

5.1 This chapter defines a structured set of operational scenarios intended to exemplify realistic and progressively complex unmanned aircraft operations in line with the integration pathways described in CAP3182.

5.2 Rather than describing isolated use cases, the scenarios represent coherent operational steps along two complementary integration pathways: the Low-Level pathway and the Fully Integrated pathway. Each pathway reflects a distinct integration logic, airspace context, and maturity level, while sharing common design principles related to safety, scalability, and operational predictability.

5.3 From a UTM perspective, the scenarios have been deliberately structured to show how UTM services are progressively introduced, expanded, and delegated as operational complexity and unmanned aircraft traffic density increase. This graduated approach ensures that the role of UTM remains proportionate, risk-based, and aligned with UK SORA principles. It is recognised that UTM requires other workstreams, such as EC, DAA, C2 link, and GI, to help UTMSPs provide the services that support UK SORA mitigations as proposed in Chapter 4.

5.4 The scenarios are also explicitly designed to be technology-agnostic. They do not prescribe specific implementations; instead, they identify the functional behaviours and service expectations that must be met to enable each operational step. In this sense, the scenarios act as drivers for technical architecture definition, regulatory alignment, and validation activities.

5.5 Each scenario has been analysed not only in terms of its nominal operational context, but also in relation to unmanned aircraft traffic density[4], recognising that scalability is a critical determinant of both risk and service requirements. However, it is foreseeable that this traffic density increment will take place along with the UTM requirements for the safe access of UA in the UK's airspace. Within these scenarios, these future steps are suggested but not prescribed as mandatory requirements.

[4] Traffic density definition is to be developed since data from trials is yet to be analysed.

Scenario A0 – Atypical Single Operation

Scenario Introduction

5.6 Scenario A0 is the current environment under CAP3040 Third Edition, where UAS operators conduct their BVLOS flights in an Atypical Air Environment (AAE). The UTM role is considered optional and limited to informational use only, not forming part of the air risk mitigation strategy. Therefore, Scenario A0 serves as a testing environment for UTM services to illustrate how they could be used to improve situational awareness for UAS operators.

UTM Services Approach Based on UA Traffic Density

5.7 In scenario A0, the traffic density does not vary since it is a single UAS operator conducting a single mission. Hence, the UTM approach is static in this scenario, providing informational services to UAS operators.

UTM Workflow for Scenario A0

A0 WORKFLOW DIAGRAM

Operational Workflow for Scenario A0

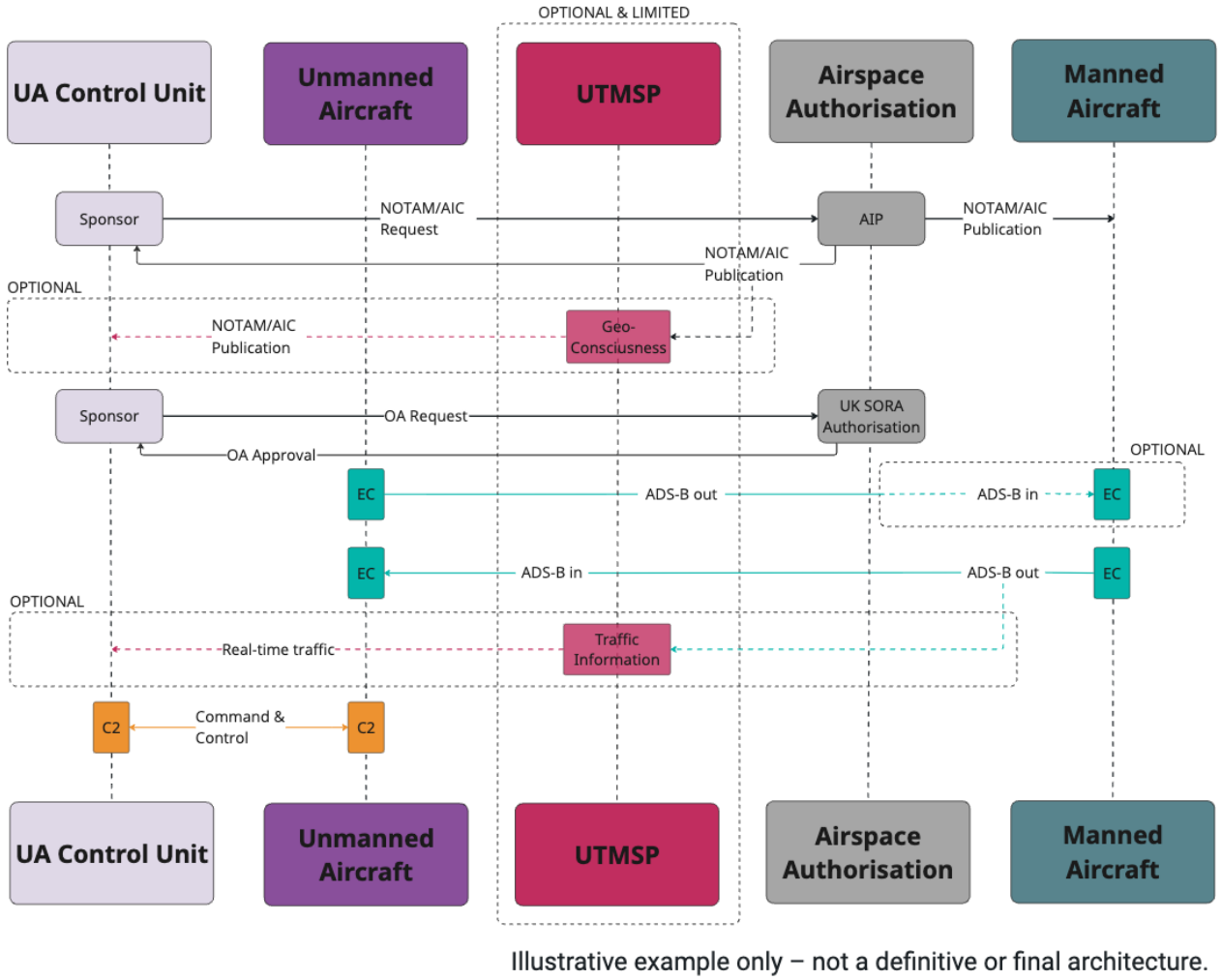

Figure 3 - Workflow and Timeline Event Diagram for Scenario A0

Planning Phase

5.8 Flight Authorisation Request

- UAS Operation conducted in Atypical Air Environment (AAE) submit a NOTAM as required in CAP3040. No requirement for flight authorisation or strategic 4D trajectory submission.
- UAS operator obtains the Operational Authorisation under UK SORA, which will define the operational volume and contingency procedures applicable. Operation based on procedural planning and pre-defined airspace constraints.

5.9 Geo-Consciousness Check (AIS/AIM information/data)

- UTMSP may provide aeronautical data/information as part of the geo-consciousness service supporting basic situational awareness. This service is not part of the air risk mitigation strategy, but they may provide UTM services for testing purposes.

5.10 **ANSP / ATM Coordination**

- Atypical Air Environment requires a NOTAM or AIC surrounding the operational volume and thus, it does not require further coordination.

5.11 **Authorisation Output**

- Operational Authorisation relies on UK SORA authorisation.

Execution Phase

5.12 **Flight Activation**

- Operation can start once the OA is valid and the airspace conditions are met.

5.13 **Operational Environment**

- Limited interaction with manned aviation is expected, with no interaction with other UA as operating as a single operation within AAE.

5.14 **Surveillance and Situational Awareness**

- Basic cooperative awareness via ADS-B IN/OUT as per CAP3040 Third Edition, providing local situational awareness.

5.15 **UTM Services (Active)**

- If UTMSP is providing services, it provides geo-consciousness services, including airspace awareness and restrictions.

5.16 **Tactical Behaviour (ARC-a context)**

- The likelihood of encounters with other airspace users is reduced primarily through airspace characterisation and operational proximity to infrastructure.
- The only tactical mitigation in place is TM3 – EC Out.

Post-Flight Phase

5.17 **Flight Closure**

- Operation ends under operator’s responsibility.

5.18 **Data Logging**

- UAS Operator records flight execution telemetry and compares it with the operational authorisation to obtain compliance metrics. To provide the authority with those metrics to oversee the execution based on UK SORA approval conditions.

5.19 **UTM Role**

- UTM services are not required in the present scenario. Nevertheless, they could be used as optional services.

Scenario A1 – Atypical Operations with Multiple Operators

Scenario Introduction

5.20 Scenario A1 represents an early but scalable example of multiple operators within AAE, aligned with CAP3040 (3rd Edition) and enabled through a combination of coordination with ANSP, electronic conspicuity, and UTM services. The scenario demonstrates how multiple operators can conduct consecutive and concurrent BVLOS flights within a shared operational volume, without the use of segregated airspace structures, relying instead on cooperative surveillance and structured operational design.

5.21 From a UTM perspective, this scenario acts as a reference case for the progressive introduction of UTM services as strategic mitigations under UK SORA, supporting predictable, repeatable operations while maintaining an initial and residual ARC-a classification. The scenario also illustrates how UTM services are progressively suggested based on UA traffic density, in accordance with the Future-ATM/ANS framework and the UTM Services Approach described in this ConOps.

UTM Services Approach Based on UA Traffic Density

5.22 In Scenario A1, the same operational concept may be exercised under different UA traffic density conditions over time. The UTM approach is therefore not static, but adaptive, with services activated progressively as density and complexity increase.

UTM Services by UA Traffic Density

Table 2 - UTM Requirements per Traffic Density Increment in Scenario A1

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Limited number of operators ▪ Non-overlapping or loosely coupled flights within the same operational volume ▪ Predictable time separation	▪ No mandatory UTM services ▪ Optional operator coordination	▪ UTM services not required as a SORA mitigation ▪ Human/operator-level coordination sufficient

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Medium UA Traffic Density	▪ Multiple operators ▪ Consecutive or partially overlapping operations ▪ Shared operational volume	**Flight Authorisation Services** ▪ Airspace Authorisation ▪ Flight Planning **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Strategic deconfliction at planning stage ▪ Assurance of compliance with agreed 4D volumes ▪ Reduction of encounter likelihood through airspace structure
High UA Traffic Density	▪ Multiple operators simultaneously active ▪ High interaction rate ▪ Increased temporal and spatial coupling	**Flight Authorisation Services** ▪ Airspace Authorisation ▪ Flight Planning **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Tactical risk management ▪ Active resolution of UA-UA conflicts ▪ Scalability without airspace segregation

UTM Workflow for Scenario A1

SCENARIO WORKFLOW DIAGRAM (A1)

Operational Workflow for Scenario A1

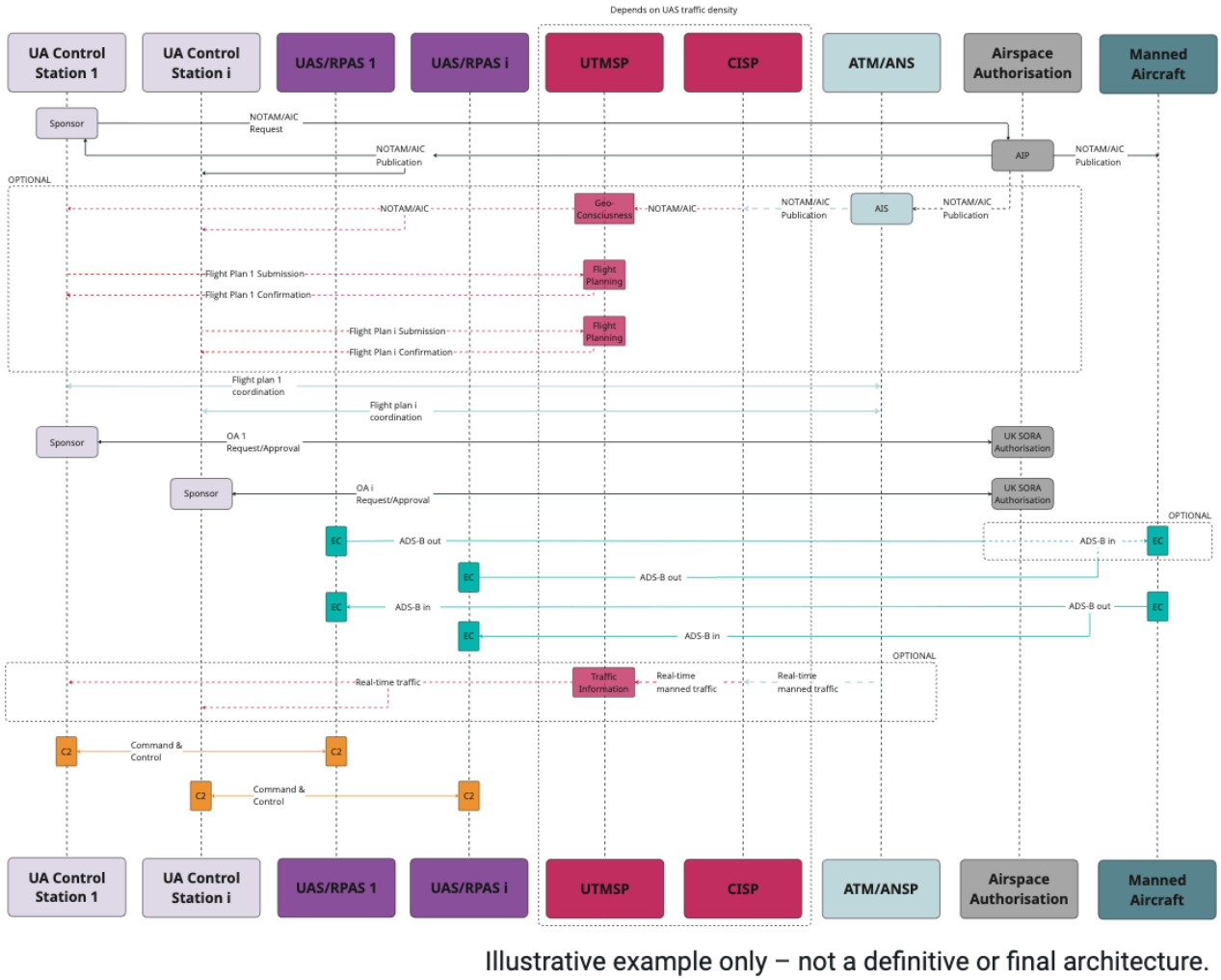

Figure 4 - Workflow and Timeline Event Diagram for Scenario A1

Planning Phase

5.23 Flight Authorisation Request

- UAS operator submits its 4D trajectory or operational volume, including SORA outputs (residual ARC-a), equipage and contingency procedures.

5.24 Geo-Consciousness Check (AIS/AIM information/data)

- The UTMSP validates the intended flight plan against the airspace structures, including the geo-zones, restrictions (potentially received via CISP or AIS, including NOTAM) and the pre-defined operational boundaries.

5.25 **Strategic Deconfliction**

- The intended UAS 4D trajectory is compared against other UAS trajectories, airspace constraints, and capacity limits for conflict detection.
- If a conflict is detected, the UAS 4D trajectory is adjusted as required. This can be done iteratively.

5.26 **ANSP / ATM Coordination**

- Coordination with ANSP/ATM is required for validation of altitude limits (≤500 ft AMSL), lateral boundaries, and safe interaction with manned traffic.
- Coordination with ANSP/ATM through NOTAM or AIC as required per CAP3040.

5.27 **Authorisation Output**

- UTMSP issues the approved flight plan, including its operational conditions.

Execution Phase

5.28 **Flight Activation**

- The UAS operator activates its authorised flight plan prior to take-off. Then, the UTMSP confirms if the conditions under which the operation has been approved are still valid.

5.29 **Operational Environment**

- Multiple UA operations strategically deconflicted, ensuring procedural coordination between UAS operators.

5.30 **Surveillance and Situational Awareness**

EC-based cooperative environment, dual frequency ADS-B IN and ADS-B OUT required for UA and ADS-B OUT required for manned aviation entering the AAE environment.

5.31 **UTM Services (Active)**

- Geo-Consciousness services in place providing airspace constraints updates through AIS/AIM, including the use of NOTAMs; and compliance monitoring service providing continuous monitoring of the current position and the authorised 4D volume, alerting the UAS operator when a non-conformity occurs.
- Conflict management services to be used in high-traffic density environments, providing Traffic Information Service for situational awareness and potential Traffic Separation Service.

5.32 **Tactical Behaviour (in residual ARC-a context)**

- UTM role is limited to monitoring unmanned traffic, alerting UAS operators when a conflict arises, and coordinating these UA operations with ANSP/ATM.

Post-Flight Phase

5.33 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.34 **Data Logging**

- After the flight plan has been deactivated, the authorised operational data, deviations and alerts raised during the operation, and the overall system performance are recorded in a data log.

5.35 **Oversight & Performance Monitoring**

- Data is shared with the ANSP or aviation authority if required. Data sharing supports safety analysis and the continuous improvement of operations.

Scenario Low Level LL0 – Single Operator Ground Surveillance

Scenario Introduction

5.36 Scenario Low Level LL0 represents an early-stage BVLOS operational model in Class G airspace, characterised by single-operator activity, supported by a dedicated TDA/TRA that ensures predictable access and reduces the encounter likelihood with other airspace users. This scenario reflects current and near-term operational realities (now to 2027), where scalability is achieved primarily through segregation rather than dynamic traffic management.

5.37 From a UTM perspective, LL0 illustrates a baseline case where UTM is not a primary enabler but may act as a supporting or optional layer depending on traffic density and local coordination arrangements.

UTM Services Approach Based on UA Traffic Density

5.38 Although Scenario LL0 is nominally a single-operator scenario, the UTM approach is still assessed generically against the three UA traffic density levels to ensure consistency across the ConOps.

UTM Services by UA Traffic Density

Table 3 - UTM Requirements per Traffic Density Increment in Scenario LL0

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Single operator ▪ Segregated volume (TDA/TRA) ▪ No UA-UA interaction	▪ No UTM services required ▪ Operator coordination only	▪ UTM services not used as an ARC mitigation ▪ Safety achieved through segregation
Medium UA Traffic Density	▪ Potential nearby activity ▪ Still segregated	**Flight Authorisation Services** **Conflict Management Services** ▪ Traffic Information **Geo-Consciousness Services** ▪ Aeronautical Information	▪ UTM services enhance situational awareness ▪ Early exposure to UTM processes
High UA Traffic Density	▪ Unlikely in LL0 context	▪ Not applicable	▪ Not applicable

UTM Workflow Assessment for Scenario LL0

SCENARIO WORKFLOW DIAGRAM (LL0)

Operational Workflow for Scenario LL0

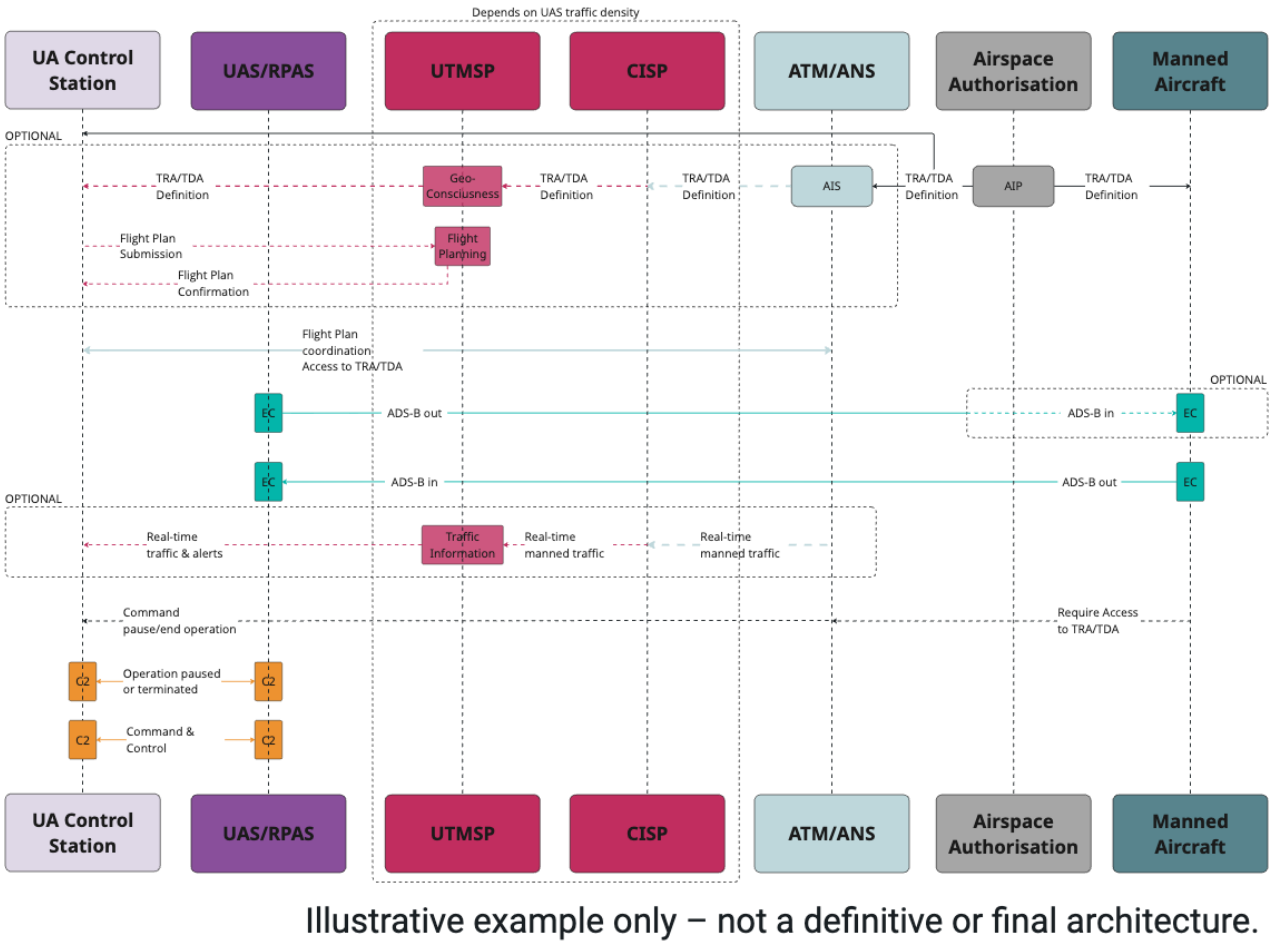

Figure 5 - Workflow and Timeline Event for Scenario LL0

Planning Phase

5.39 Flight Authorisation Request

- Operations are conducted within Special Use Airspace (SUA) and NOTAM'ed accordingly. The operation authorisation relies on UK SORA Operational Authorisation (OA) and compliance with TDA/TRA entry conditions. Hence, flight plan submission is not required since flight authorisation services are optional.

5.40 Geo-Consciousness Check (AIS/AIM information/data)

- UTMSP may receive TDA/TRA status (potentially via CISP), specifying the entry conditions.

5.41 **ANSP / ATM Coordination**

- ANSP manages the entry conditions to the TDA/TRA, activating and deactivating the airspace structure when it is required.

Execution Phase

5.42 **Flight Activation**

- Operation starts once the TDA/TRA is active, and the entry conditions are met.

5.43 **Operational Environment**

- Fully segregated airspace (active TDA/TRA) without interaction with other UA or manned aircraft since they are excluded or procedurally managed.

5.44 **Surveillance and Situational Awareness**

- EC-based cooperative environment, dual frequency ADS-B IN and ADS-B OUT required for UA.

5.45 **UTM Services (Active)**

- UTM Service is optional.
- Geo-consciousness services may provide TDA/TRA status updates through AIS/AIM.
- Conflict management services may provide Traffic Information Service for basic traffic awareness.

5.46 **Tactical Behaviour (ARC-a context)**

- Separation ensured through airspace segregation (TDA/TRA).
- Tactical mitigations in place are TM2 on DAA, TM3 on EC OUT, and TM5 on Local traffic monitoring.

Post-Flight Phase

5.47 **Flight Closure**

- Operation ends when the UA has landed. Hence, TDA/TRA is deactivated by ANSP.

5.48 **Data Logging**

- ANSP records TDA/TRA usage and activation.
- Operator records flight logs and compliance with authorisation.
- UTMSP, if present, records the overall system performance metrics.

5.49 **Oversight & Performance Monitoring**

- Data supports operational traceability, regulatory oversight, and optimisation of operations.

Scenario Low Level LL1 – Specific Volumes with Bespoke Entry Conditions

Scenario Introduction

5.50 Scenario Low Level LL1 represents a step change from segregated to integrated operations at low level, introducing multiple BVLOS operators conducting routine medical delivery flights in a Class D environment, without relying on temporary segregated airspace structures. Operations are conducted in airspace characterised by higher complexity, demand, and interaction with manned aviation. The initial ARC of the operation within the scope of UK SORA is ARC-b.

5.51 From a UTM perspective, LL1 marks the transition where UTM becomes an essential operational enabler, rather than an optional support function. Safety and scalability are achieved through cooperative surveillance, structured access conditions, and UTM-based coordination with the ANSP, with services progressively applied based on UA traffic density.

UTM Services Approach Based on UA Traffic Density

5.52 According to CAP3182, in the LL1 scenario, UA traffic density is expected to increase over time, driven by routine operations and multiple operators. The UTM services approach is therefore foundational to the scenario.

UTM Services by UA Traffic Density

Table 4 - UTM Requirements per Traffic Density Increment in Scenario LL1

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Limited number of operators ▪ Predictable schedules • Minimal interaction	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information **Geo-Consciousness Services** ▪ Compliance Monitoring	▪ Early coordination support ▪ Situational awareness

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
		▪ Terrain and obstacle data ▪ Aeronautical Information	
Medium UA Traffic Density	▪ Multiple operators ▪ Overlapping delivery windows ▪ Shared low-level volumes	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Strategic deconfliction ▪ Assurance of compliance with agreed 4D volumes
High UA Traffic Density	▪ High frequency medical deliveries ▪ Concurrent operations	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Service** ▪ Traffic Information **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Tactical conflict resolution ▪ Scalability without segregation

UTM Workflow Assessment for Scenario LL1

SCENARIO WORKFLOW DIAGRAM (LL1)

Operational Workflow for Scenario LL1

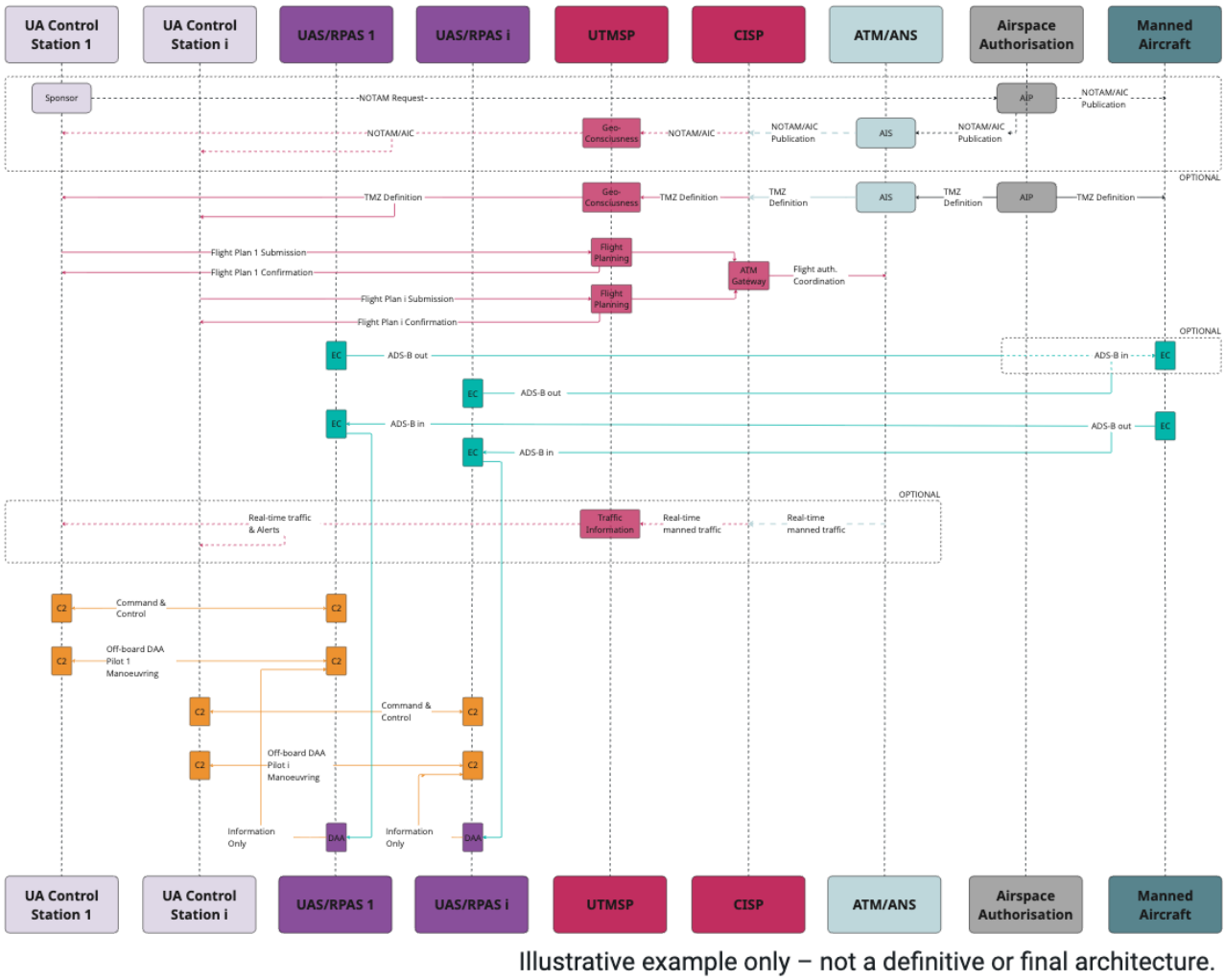

Figure 6 - Workflow and Timeline Event Diagram for Scenario LL1

Planning Phase

5.53 Flight Authorisation Request

- UAS operators submit 4D trajectory / operational volume, including the flight profile, SORA outputs (residual ARC-b), and the equipage and contingency procedures managed through UTM/ATM coordination.

5.54 Geo-Consciousness Check (AIS/AIM information/data)

- Validation against the controlled airspace constraints, geo-zones, restrictions (provided potentially via CISP/AIS, including NOTAM), and the pre-agreed operational conditions with ANSP.

5.55 **Strategic Deconfliction**

- Conflict detection against other UAS trajectories, airspace constraints and capacity limits.
- Resolution proposed through temporal separation and/or spatial structuring of routes and agreed with the remote pilot ensuring compliance with the applicable residual ARC.

5.56 **ANSP / ATM Coordination**

- Procedural coordination with ANSP, ensuring separation between UAS and manned routes. An increment in coordination requirements to maintain predictability as traffic density increases.
- Validation of altitude limits (≤500 ft AMSL), lateral boundaries, and the interaction with manned aviation.
- Pre-agreed use of UTM services, increasing the UTM requirements while traffic density increases (SM6 / SM7).

5.57 **Authorisation Output**

- UTMSP issues the approved flight plan, including its corresponding operational conditions.

Execution Phase

5.58 **Flight Activation**

- Operator activates the flight plan prior to take-off. UTMSP confirms that the authorisation still applies since no new restrictions have arisen.

5.59 **Operational Environment**

- Controlled airspace is progressing towards 2028 without the use of SUA.
- Multiple UAS operators are simultaneously active with potential interaction with manned aviation at low level.

5.60 **Surveillance and Situational Awareness**

- EC-based cooperative environment, ADS-B IN on both 978MHz and 1090MHz and ADS-B OUT on 978 MHz required for UA and ADS-B OUT 1090MHz required for manned aviation.
- Shared situational awareness across UAS operators and ANSP, potentially through a CISP.

5.61 **UTM Services (Active)**

- Geo-Consciousness services in place providing airspace constraints updates through AIS/AIM, and compliance monitoring service providing continuous monitoring of the current position and the authorised 4D volume, alerting the UAS operator when a non-conformity occurs.
- Conflict management services to be used in high-traffic density environments, providing Traffic Information Service for situational awareness and potential Traffic Separation Service solving UAS encounters.

5.62 **Tactical Behaviour (ARC-b context)**

- Cooperative surveillance through ADS-B IN/OUT for UA and Traffic Information Service in high-traffic density environments.
- Tactical mitigations in place are TM3 – EC out and TM5 – Local traffic monitoring. UTMSPs support these mitigations with the conflict management service in high-traffic density environments.

Post-Flight Phase

5.63 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.64 **Data Logging**

- UTM systems record the flight trajectories, deviations, alerts, and the overall system performance metrics.

5.65 **Oversight & Performance Monitoring**

- Data supports operational traceability, regulatory oversight, and scaling and optimisation of operations.

Scenario Low Level LL2 – Multiple Operators in Uncontrolled Airspace

Scenario Introduction

5.66 **DISCLAIMER**: This scenario is only possible in the future (beyond 2028). This is outside of the medium-term objective of enabling more BVLOS operations in UK airspace.

5.67 Scenario Low Level LL2 represents a multi-operator BVLOS delivery model in uncontrolled airspace, enabled by UTM services and Detect and Avoid capabilities. The scenario addresses last-mile delivery operations conducted by multiple operators in Class G airspace without reliance on temporary or permanent segregated airspace structures.

5.68 From a UTM perspective, LL2 marks a fundamental shift from segregation, providing a layer of mitigation to where predictability, scalability, and risk mitigation are achieved through cooperative surveillance, automated DAA, and UTM-driven coordination mechanisms.

UTM Services Approach Based on UA Traffic Density

UTM Services by UA Traffic Density

Table 5 - UTM Requirements per Traffic Density Increment in Scenario LL2

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Limited operators ▪ Low interaction rate	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Situational awareness ▪ Proactive coordination
Medium UA Traffic Density	▪ Multiple operators ▪ Shared delivery areas ▪ Overlapping operations	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Strategic deconfliction ▪ Predictable volume management

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
High UA Traffic Density	▪ High-frequency deliveries ▪ Dense shared volumes	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Tactical conflict resolution ▪ Scalability without segregation

UTM Workflow Assessment for Scenario LL2

SCENARIO WORKFLOW DIAGRAM (LL2)

Operational Workflow for Scenario LL2

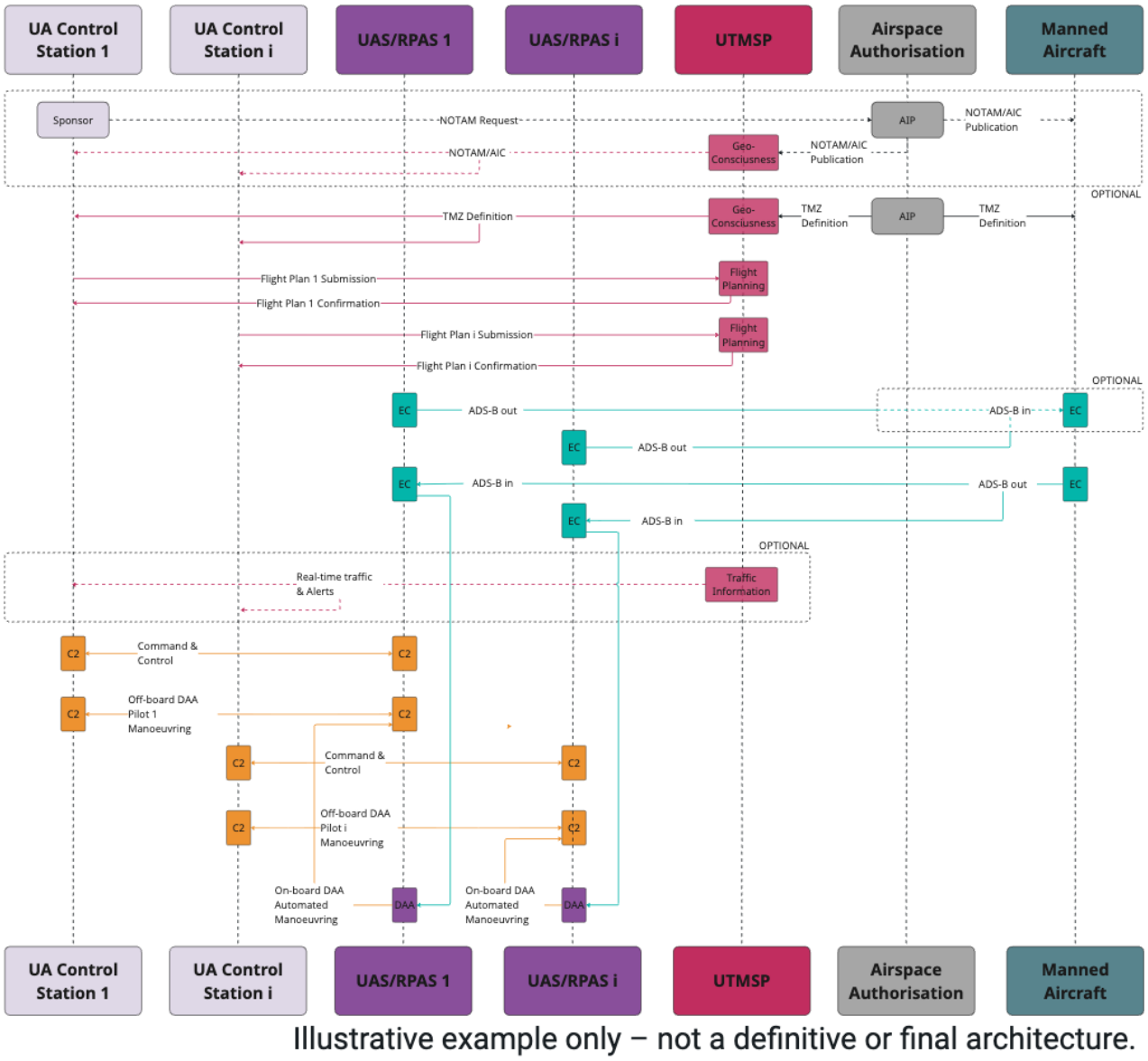

Figure 7 - Workflow and Timeline Event Diagram for Scenario LL2

Planning Phase

5.69 Flight Authorisation Request

- UAS operators submit flight plan requests, including the last-mile delivery profile, the SORA outputs (residual ARC-c), the equipage and automated DAA capabilities, and the contingency procedures applicable to the operation.

5.70 **Geo-Consciousness Check (AIS/AIM information/data)**

- Validation against geo-zones and restrictions provided via AIS, including NOTAMs, the applicable operational rules for the Class G environment, and the local constraints, including environmental limitations.

5.71 **Strategic Deconfliction**

- Core planning function consists of conflict detection against other approved UA trajectories. The resolution process proposes routes based on temporal separation and/or spatial structuring in agreement with the remote pilot, ensuring compliance with the applicable residual ARC.

5.72 **Authorisation Output**

- UTMSP issues the approved flight plan, including the operational conditions, validating the altitude limits (≤500 ft AMSL).

Execution Phase

5.73 **Flight Activation**

- Operator activates the flight plan prior to take-off. UTMSP confirms that the authorisation still applies since no new restrictions have arisen.

5.74 **Operational Environment**

- Uncontrolled airspace progressing towards 2028 without the use of SUA. If EC is mandated, the establishment of a TMZ will not be required.
- Multiple UAS operators are conducting their flights simultaneously.

5.75 **Surveillance and Situational Awareness**

- EC-based cooperative surveillance environment, dual frequency ADS-B IN and ADS-B OUT required for UA, and ADS-B OUT required for manned aviation.
- Shared situational awareness across UAS operators.

5.76 **UTM Services (Active)**

- Geo-Consciousness services in place providing airspace constraints updates through AIS/AIM; and compliance monitoring performing the continuous tracking of the current position and the authorised 4D volume, including the deviation thresholds to alert UAS operator of non-compliance events.

- Conflict management services are provided in high-traffic density environments, on the one hand, Traffic Information Service for situational awareness; and on the other hand, Traffic Separation Service detecting potential UA-UA encounters and supporting UAS operators in solving the tactical loss of separation.

5.77 **Tactical Behaviour (ARC-c context)**

- Separation is achieved either through air-based DAA or UTM coordination layer provided via Traffic Separation Service. Cooperative surveillance through ADS-B IN/OUT for UA and Traffic Information Service in high-traffic density environments.
- Tactical mitigations in place are TM2 – automated DAA, TM3 – EC OUT, and TM5 – Local traffic monitoring. UTMSPs support these mitigations with conflict management services in high-traffic density environments.

Post-Flight Phase

5.78 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.79 **Data Logging**

- UTM system records the trajectory data, including deviations, conflicts and resolutions, and the overall system performance metrics.

5.80 **Oversight & Performance Monitoring**

- Data supports the safety performance analysis, optimisation of delivery networks, and the scalability of operations.

Scenario Fully Integrated FI0 – Segregated Operations

5.81 Scenario Fully Integrated FI0 describes the initial step towards UTM integration, where unmanned aircraft begin to operate routinely within Class G airspace, conducting flights such as inspection over territorial waters, while UA traffic volumes remain low. The activity is protected by a Temporary Danger Area (TDA) separating the flights from other airspace users.

5.82 From a UTM perspective, FI0 is characterised by low UA traffic density, where UTM services act primarily as an information layer. Nearby ANSP supports the operation by providing information on TDA status and coordinating possible crossings for other kinds of traffic when the TDA is inactive.

UTM Services Approach Based on UA Traffic Density

5.83 In FI0, the setup enables simple, safe, and predictable UAS BVLOS inspection flights where UTM services are just informative due to the very low traffic density.

Nevertheless, the scenario is analysed in terms of its operational characteristics and the presence of these informative UTM services supporting UAS operators in conducting their flights.

UTM Services by UA Traffic Density

5.84 FI0 scenario is characterised by low UA traffic density operations, where UTM, besides providing the flight authorisation services and geo-consciousness services (AIS/AIM for TDA status), plays a role in providing conflict management services. Particularly, Traffic Information Service for UAS operators to maintain situational awareness of existing traffic.

UTM Workflow Assessment for Scenario FI0

SCENARIO WORKFLOW DIAGRAM (FI0)

Operational Workflow for Scenario FI0

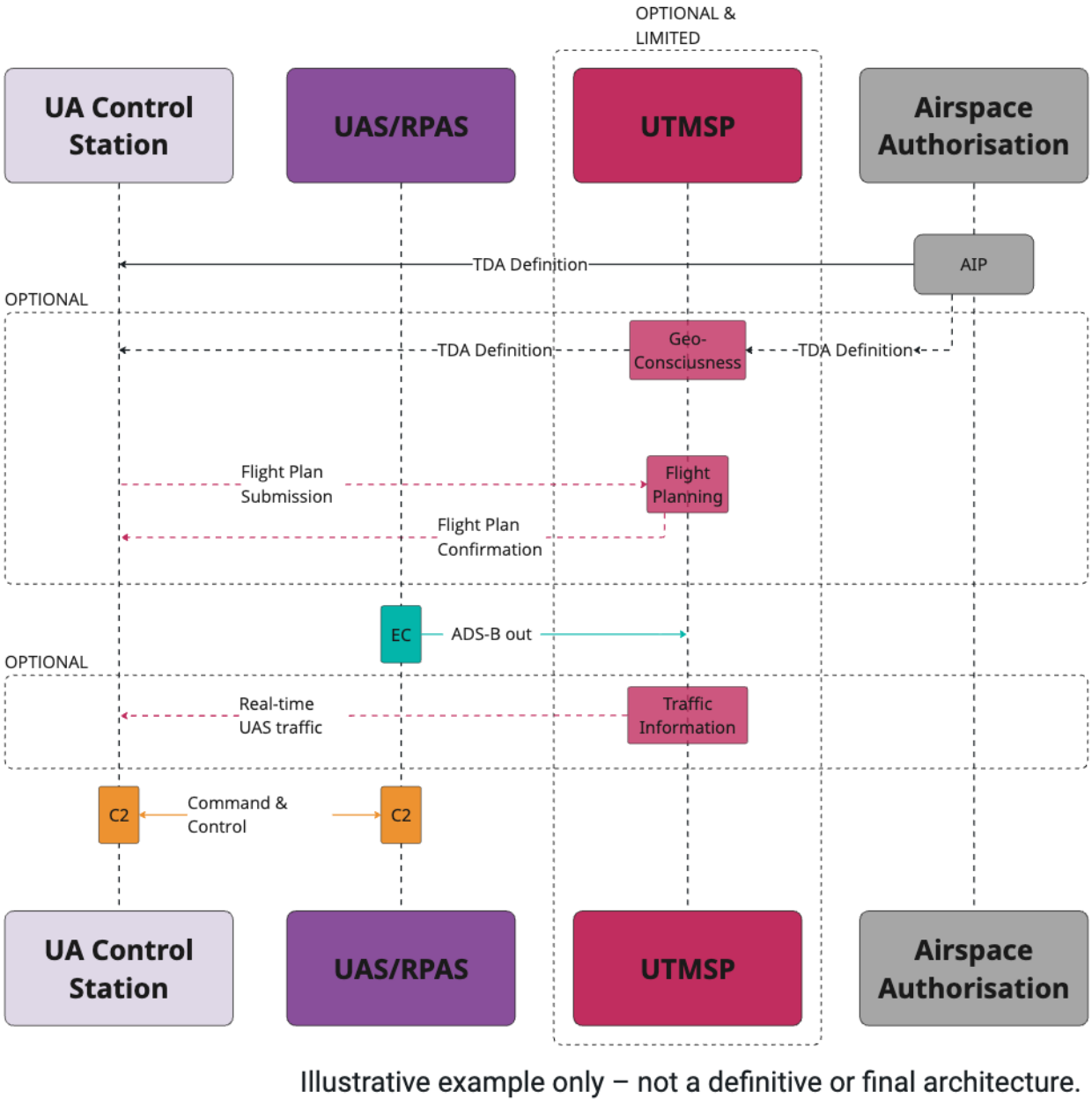

Figure 8 - Workflow and Timeline Event Diagram for Scenario FI0

Planning Phase

5.85 **Flight Plan Notification**

- UAS operator submits flight plan, including the mission profile, the SORA outputs (residual ARC-a), and the equipage and contingency procedures managed within the segregated framework.

5.86 **Geo-Consciousness Check (AIS/AIM information/data)**

- AIS/AIM will provide airspace restrictions (e.g. via NOTAM), and where applicable, additional data restrictions are in the AIP dataset/AIP or in the AIP Supplements/AICs and may be sourced via UDSP.

Execution Phase

5.87 **Flight Activation**

- Operation starts under ATS clearance and defined operational conditions (TDA status).

5.88 **Operational Environment**

- Uncontrolled airspace segregated via TDA. Low UA traffic density expected.

5.89 **Surveillance and Situational Awareness**

- EC-based cooperative surveillance through dual frequency ADS-B IN and ADS-B OUT is required for UA. Situational awareness between the UAS operator and UTMSP when TDA is active.

5.90 **UTM Services (Informative only)**

- Geo-Consciousness services is updating TDA status and supporting Compliance Monitoring Services tracking the adherence of the current position of the UA with respect to the flight plan.

5.91 **Tactical Behaviour (ARC-b context)**

- ATC is responsible for ensuring that manned aircraft remain outside of the TDA.
- Supporting mitigations as TM3 on EC OUT and TM5 on Local Traffic Monitoring.

Post-Flight Phase

5.92 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.93 **Data Logging**

- UTM system, if used records the trajectory data, including deviations and alerts and the overall system performance metrics.

5.94 Oversight & Feedback

- Data supports the safety assessment of integrated operations and incremental evolution towards higher integration levels.

Scenario Fully Integrated FI1 – Specific Volumes with Bespoke Entry Conditions

Scenario Introduction

5.95 Scenario Fully Integrated FI1 represents the transition from bespoke integration to regular, repeatable unmanned operations in controlled airspace, involving multiple operators and a moderate increase in UA traffic density. Operations are conducted in Class D airspace in environments where manned traffic remains predominant.

5.96 From a UTM perspective, FI1 is characterised by a shared operational responsibility model, where UTM evolves from a passive coordination layer (FI0) into an active traffic coordination and compliance management system, while ATM retains tactical separation responsibility for manned aircraft. This scenario is critical to demonstrate that routine UA operations can be accommodated without increasing ATC workload, provided that UTM services are appropriately scoped and integrated.

UTM Services Approach Based on UA Traffic Density

UTM Services by UA Traffic Density

Table 6 - UTM Requirements per Traffic Density Increment in Scenario FI1

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Few operators ▪ Regular but sparse operations	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Geo-Consciousness Services** ▪ Terrain and obstacle data ▪ Aeronautical Information **Conflict Management Services** ▪ Traffic Information	▪ Structured access to CAS ▪ Situational awareness for ATC

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Medium UA Traffic Density	▪ Multiple operators ▪ Overlapping UA operations	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information **Conflict Management Services** ▪ Traffic Information	▪ Strategic deconfliction among UA ▪ Protection of ATC capacity
High UA Traffic Density	▪ Not permitted in FI1	▪ Not applicable	▪ Operational limits prevent scaling

UTM Workflow Assessment for Scenario FI1

SCENARIO WORKFLOW DIAGRAM (FI1)

Operational Workflow for Scenario FI1

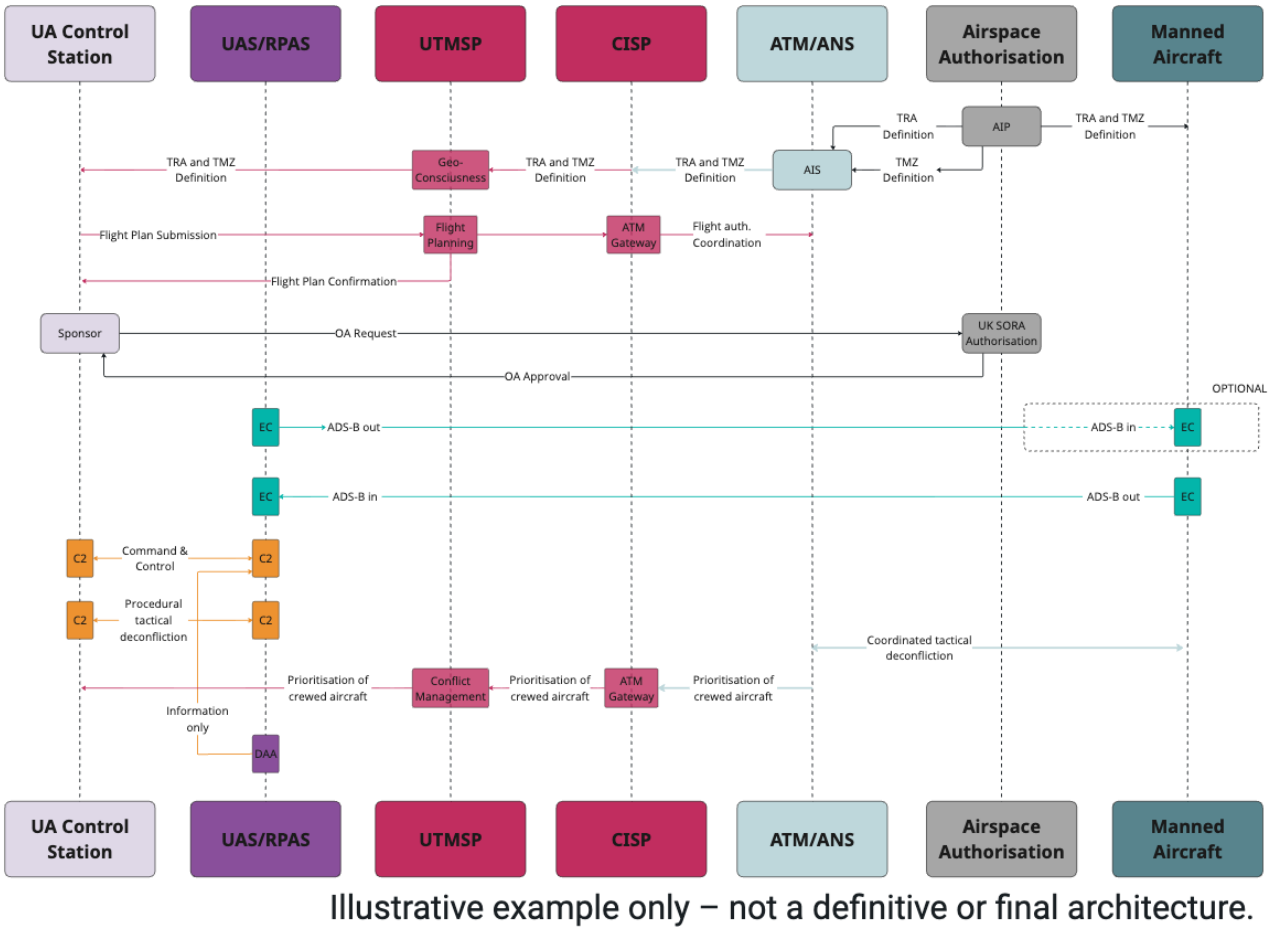

Figure 9 - Workflow and Timeline Event Diagram for Scenario FI1

Planning Phase

5.97 **Flight Authorisation Request**

- Multiple UAS operators submit flight plan requests, including the routine BVLOS flights, the SORA outputs (residual ARC-b), and the equipage and contingency procedures coordinated procedurally with the ANSP.

5.98 **Geo-Consciousness Check**

- Validation against controlled airspace restrictions, geo-zones, and any other constraint provided (potentially via CISP/AISP, including NOTAM) and the pre-agreed operational conditions with ANSP.

5.99 **Strategic Deconfliction (UA–UA)**

- Conflict detection against other UAS trajectories and airspace constraints, ensuring UA operations are strategically deconflicted.

- Resolution proposed through temporal separation and/or spatial structuring of routes and agreed with the remote pilot, ensuring compliance with the applicable residual ARC.

5.100 **ANSP / ATM Coordination**

- UTMSP provides ATC with approved flight plans, ensuring they are aware of the UA trajectories and planned traffic level to assist in integrating manned aircraft where required. ATC retains the authority over integrated operations.

5.101 **Authorisation Output**

- UTMSP issues the approved flight plan, including the corresponding operational conditions aligned with ATC constraints.

Execution Phase

5.102 **Flight Activation**

- Operator activates the flight prior to take-off. UTMSP confirms that the authorisation still applies and ensures no new restrictions have arisen.

5.103 **Operational Environment**

- Controlled airspace subject to bespoke entry conditions enabling coexistence between unmanned and manned aircraft.
- Temporary airspace structures may be used to support early integrated operations.

5.104 **Surveillance and Situational Awareness**

- EC-based cooperative environment, ADS-B IN on both 978MHz and 1090MHz and ADS-B OUT on 978 MHz required for UA and ADS-B OUT 1090MHz required for manned aviation.
- Shared situational awareness provided by UTMSP across UAS operators and ANSP, potentially through a CISP.

5.105 **UTM Services (Active)**

- Geo-Consciousness services in place, disseminating the airspace constraints and updates through AIS/AIM; and compliance monitoring service providing the continuous monitoring of the current position with regards to the authorised 4D volume, alerting the UAS operator and the ANSP when a non-conformity occurs.
- Conflict management services, specifically the Traffic Information Service, provides situational awareness to UAS operators and UAS traffic information to ANSP, potentially through a CISP.

5.106 **Separation Responsibility**

- ATM retains a supervisory role over integrated operations, coordinating manned traffic access as part of the bespoke entry conditions.
- UTM manages UA predictability and compliance, reducing ATC workload.

5.107 **Tactical Behaviour (ARC-b context)**

- Separation is ensured through a combination of procedural responses and emerging technical support from ATC.
- Tactical mitigations in place are TM2 – DAA, TM3 – EC OUT, and TM5 – local traffic monitoring. UTMSPs support these mitigations with the conflict management services providing the Traffic Information Service.

Post-Flight Phase

5.108 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.109 **Data Logging**

- UTM systems record the flight trajectories, including the deviations and alerts raised, and the overall system performance metrics.

5.110 **Oversight & Performance Monitoring**

- Data supports routine operational reporting, compliance verification, and evidence for progression towards the Full Integrated 2 scenario.

Scenario Fully Integrated FI2 – Operations in Controlled Airspace

Scenario Introduction

5.111 **DISCLAIMER**: This scenario is only possible in the future (beyond 2028). This is outside of the medium-term objective of enabling more BVLOS operations in UK airspace.

5.112 Scenario Fully Integrated FI2 represents the first mature ATM–UTM integrated operational model, enabling medium-to-high density UA operations in controlled airspace without a proportional increase in ATC workload. Multiple unmanned operators conduct routine BVLOS flights—such as point-to-point logistics, infrastructure inspection, and priority services—within Class D and selected Class C airspace in proximity to manned aviation.

5.113 From a UTM perspective, FI2 marks the transition where UTM becomes an active tactical enabler, supporting separation assurance and conflict resolution for UA traffic, while ATM retains responsibility for manned aircraft separation. This scenario demonstrates how trajectory-centric UTM services, combined with

advanced surveillance and DAA capabilities, allow controlled airspace to safely accommodate increased UA traffic volumes.

UTM Services Approach Based on UA Traffic Density

5.114 FI2 is explicitly designed to operate in the medium-to-high UA traffic density regime, making advanced UTM services mandatory rather than optional.

UTM Services by UA Traffic Density

Table 7 - UTM Requirements per Traffic Density Increment in Scenario FI2

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Sparse UA activity	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Baseline integration and awareness
Medium UA Traffic Density	▪ Multiple operators ▪ Concurrent UA activity	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring	▪ Predictable UA flows ▪ Protection of ATM capacity

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
		▪ Terrain and obstacle data ▪ Aeronautical Information	
High UA Traffic Density	▪ High-frequency UA operations ▪ Dense shared volumes	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Tactical conflict resolution ▪ Safe scalability in CAS

UTM Workflow Assessment for Scenario FI2

SCENARIO WORKFLOW DIAGRAM (FI2)

Operational Workflow for Scenario FI2

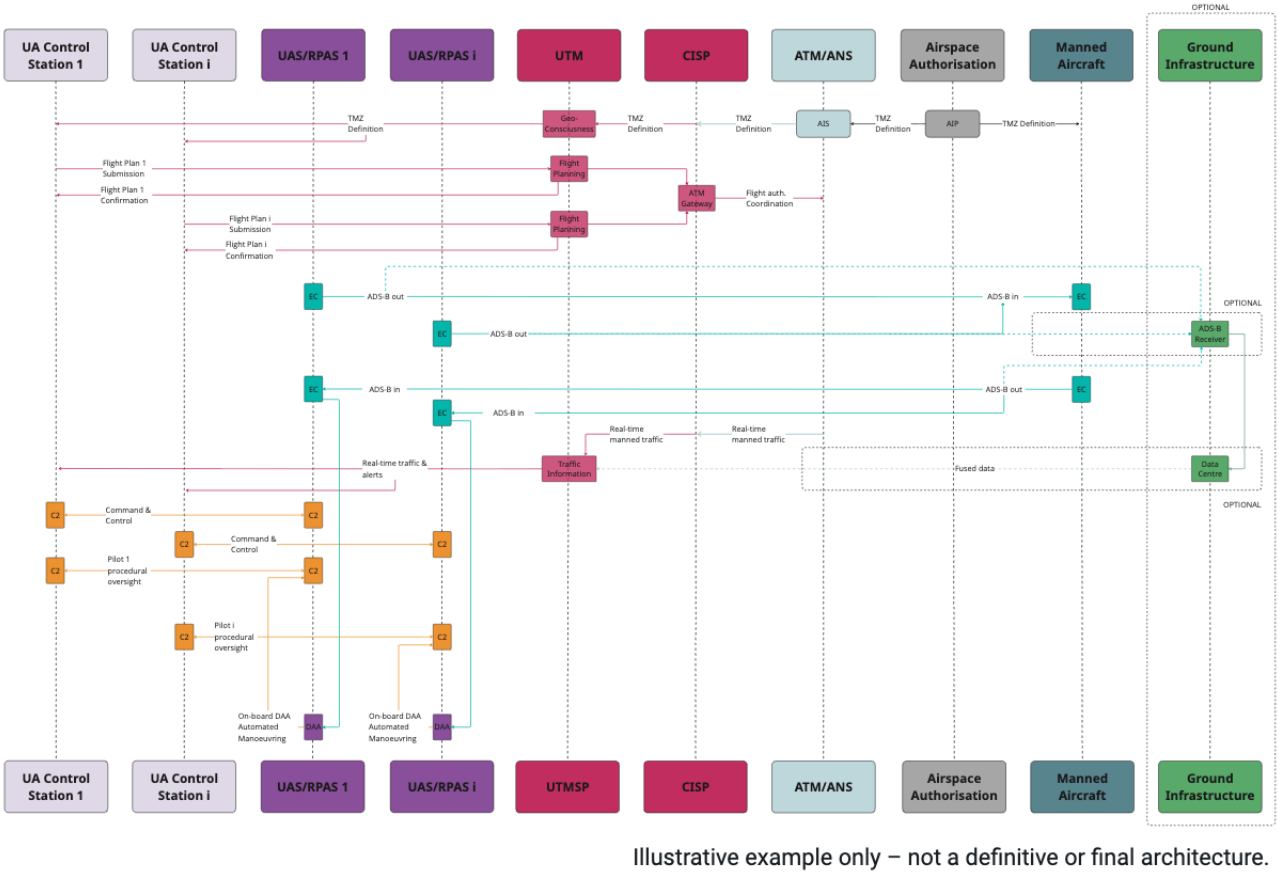

Figure 10 - Workflow and Timeline Event Diagram for Scenario FI2

Planning Phase

5.115 Flight Authorisation Request

- UAS operators submit 4D trajectory / operational volume, including routine BVLOS flights, SORA outputs (residual ARC-b), and the equipage and the contingency procedures managed through UTM/ATM coordination, including DAA capabilities as the primary tactical mitigation for MAC risk.

5.116 Geo-Consciousness Check (AIS/AIM information/data)

- Validation against controlled airspace constraints, geo-zones, restrictions (potentially provided via CISP/AISP, including NOTAMs) and the pre-agreed operational conditions with ANSP.

5.117 Strategic Deconfliction

- Conflict detection across all UA trajectories and the applicable airspace constraints.

- Resolution proposed through temporal separation and/or spatial structuring of routes and agreed with the remote pilot, ensuring compliance with the applicable residual ARC.

5.118 **ATM–UTM Coordination**

- Procedural coordination with ANSP providing the authorised flight plans, which ensure separation between UAS and manned aircraft routes. This coordination requires sharing approved flight plans between UTM and ATM, ensuring common situational awareness.
- Validation of altitude limits (≤500 ft AMSL), lateral boundaries, and the interaction with manned aviation.
- UTM enables coordinated management of mixed traffic with ATM by sharing traffic situational awareness.

5.119 **Authorisation Output**

- UTMSP issues the authorised 4D volumes, including its operational conditions aligned with ATM constraints.

Execution Phase

5.120 **Flight Activation**

- Operator activates the flight plan prior to take-off. UTMSP confirms that the authorisation still applies based on airspace restrictions and manned traffic context.

5.121 **Operational Environment**

- Controlled airspace is progressing towards 2028 without the use of SUA.
- Multiple UAS operations simultaneously active with continuous interaction with manned aviation.

5.122 **Surveillance and Situational Awareness**

- Enhanced cooperative environment, ADS-B IN/OUT, and optional multi-source surveillance inputs via ground infrastructure.
- Shared situational awareness across UAS operators and ANSP, potentially through a CISP.

5.123 **UTM Services (Active & Tactical)**

- Geo-Consciousness services in place providing airspace constraints updates through AIS/AIM; and compliance monitoring service providing continuous monitoring of the current position and the authorised 4D volume, alerting the UAS operator and ANSP when a non-conformity occurs.

- Conflict management services provide a Traffic Information Service for situational awareness and Traffic Separation Service detecting emerging UA-UA encounters and provides tactical resolution where applicable.

5.124 **Separation Responsibility**

- UA to UA separation relies on UTMSPs providing Traffic Separation Service.
- Manned traffic separation is retained by the ATM with an active supervisory role.

5.125 **Tactical Behaviour (ARC-c context)**

- Separation procedurally supported by UTM/ATM coordination enhanced through onboard DAA capabilities based on ADS-B IN/OUT situational awareness and UTMSP conflict management services.
- Tactical mitigations in place are TM2 – DAA, TM3 – EC OUT, and TM5 – local traffic monitoring. UTMSPs support these mitigations with the conflict management services.

Post-Flight Phase

5.126 **Flight Closure**

- Deactivation of the flight plan once the UA has landed, finalising the operation.

5.127 **Data Logging**

- UTM systems record the flight trajectories, including conflict resolutions and deviations. They also record the overall system performance metrics.

5.128 **Oversight & Performance Monitoring**

Data supports operational traceability, regulatory oversight, and optimisation of traffic management.

Scenario Fully Integrated FI3 – Operations in Controlled and Uncontrolled Airspace

Scenario Introduction

5.129 **DISCLAIMER**: This scenario is only possible in the future (beyond 2028). This is outside of the medium-term objective of enabling more BVLOS operations in UK airspace.

5.130 Scenario Fully Integrated FI3 represents the target end-state for ATM–UTM integration, enabling very high-density unmanned aircraft operations across controlled and uncontrolled airspace, with routine interactions between unmanned and manned aviation. Operations may include middle-mile logistics

between distribution centres, high-frequency point-to-point services and scalable logistics movements across mixed airspace environments.

5.131 From a UTM perspective, FI3 is characterised by a high degree of functional delegation to UTM, where automated, trajectory-centric services provide traffic separation support and airspace management, while ATM transitions towards a supervisory and exception-handling role. This scenario demonstrates how UTM becomes an integral component of the overall air traffic management system.

UTM Services Approach Based on UA Traffic Density

UTM Services by UA Traffic Density

Table 8 - UTM Requirements per Traffic Density Increment in Scenario FI3

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
Low UA Traffic Density	▪ Transitional or off-peak periods	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Service** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Baseline compliance and awareness
Medium UA Traffic Density	▪ Routine operations	**Flight Authorisation Services** ▪ Flight Planning ▪ Airspace Authorisation **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation	▪ Predictable flow management

UA Traffic Density	Operational Characteristics	UTM Services Applied	Purpose from a UTM Perspective
		Geo-Consciousness Services ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	
High UA Traffic Density	▪ Continuous, dense UA traffic ▪ Frequent UA–UA and UA–manned interactions	**Flight Authorisation Services** ▪ Airspace Authorisation ▪ Flight Planning **Conflict Management Services** ▪ Traffic Information ▪ Traffic Separation **Geo-Consciousness Services** ▪ Compliance Monitoring ▪ Terrain and obstacle data ▪ Aeronautical Information	▪ Tactical separation assurance ▪ System-wide scalability

UTM Workflow Assessment for Scenario FI3

SCENARIO WORKFLOW DIAGRAM (FI3)

Operational Workflow for Scenario FI3

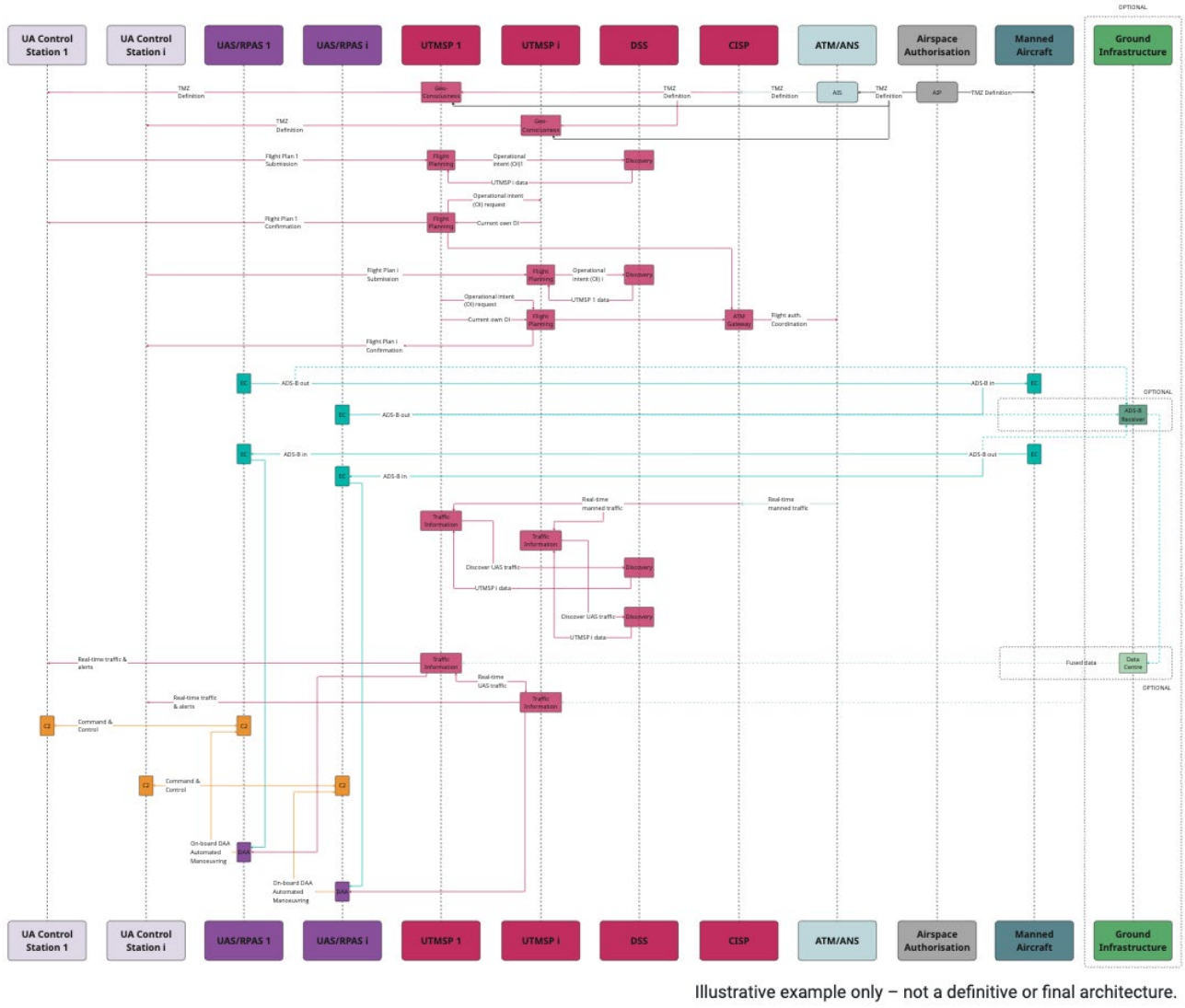

Figure 11 - Workflow and Timeline Event Diagram for Scenario FI3

Planning Phase

5.132 Flight Authorisation Request

- UAS operators submit 4D trajectory / operational volume, including the flight profiles (logistics, inspection, persistent ops), SORA outputs (residual ARC-c), the equipage, and the contingency procedures, including DAA capabilities as the primary tactical mitigation for MAC risk.

5.133 Geo-Consciousness Check (AIS/AIM information/data)

- Validation against controlled and uncontrolled airspace constraints, geo-zones, restrictions (potentially provided via CISP / AISP, including NOTAMs), and pre-agreed operational conditions with ANSP under controlled airspace.

5.134 **Strategic Deconfliction**

- Conflict detection across all UA trajectories and the applicable airspace constraints.
- Resolution proposed through temporal separation and/or spatial structuring of routes and agreed with the remote pilot, ensuring compliance with the applicable residual ARC.

5.135 **ATM–UTM Coordination**

- Procedural coordination with ANSP in controlled airspace, providing the authorised flight plans, which ensure separation between UA and manned routes.
- Validation of altitude limits (≤1200 ft AGL), lateral boundaries, and the interaction with manned aviation in both controlled and uncontrolled airspace.
- UTM enables coordinated management of mixed traffic with ATM by sharing traffic situational awareness.

5.136 **Authorisation Output**

- UTMSP issues the authorised 4D volumes, including its operational conditions.

Execution Phase

5.137 **Flight Activation**

- Operator activates the flight plan prior to take-off. UTMSP confirms that the authorisation still applies based on airspace restrictions and traffic context.

5.138 **Operational Environment**

- Fully integrated, controlled, and uncontrolled airspace without the use of SUA.
- Altitude constraints are dynamically managed through flight planning and in-flight updates.
- Multiple UAS operations are managed through different UTMSPs operating simultaneously, with continuous interaction between UA and manned aviation.

5.139 **Surveillance and Situational Awareness**

- Enhanced cooperative environment, ADS-B OUT / IN, and optional multi-sensor surveillance fusion via ground infrastructure.
- Shared real-time situational awareness across UAS operators and ANSP (potentially through CISP), in controlled airspace and between UTMSPs based on DSS.

5.140 **UTM Services**

- Geo-Consciousness services in place providing airspace constraints updated through AIS/AIM; and compliance monitoring service providing continuous monitoring of the current position and the authorised 4D volume, alerting the UAS operator, other UTMSPs, and ANSP when a non-compliance occurs.
- Conflict management services provide a Traffic Information Service for situational awareness and/or Traffic Separation Service detecting emerging UA-UA encounters and providing tactical resolution.

5.141 **Separation Responsibility**

- UA to UA separation relies on UTMSPs providing Traffic Separation Service.
- Where an ANSP (not also certified as a UTMSP) is providing an ATS (where separation or deconfliction minima are applicable) to manned aircraft, the responsibility for the deconfliction/separation of manned traffic remains the responsibility of the ATS ANSP.

5.142 **Tactical Behaviour (ARC-c context)**

- Separation supported by UTM/ATM coordination enhanced through onboard DAA capabilities based on ADS-B IN/OUT situational awareness and UTMSP conflict management services.
- Tactical mitigations in place are TM2 – DAA, TM3 – EC OUT, and TM5 – local traffic monitoring. UTMSPs support these mitigations with the conflict management services.

Post-Flight Phase

5.143 **Flight Closure**

- Deactivation of the flight plan once UA has landed, finalising the operation.

5.144 **Data Logging**

- UTM systems record the flight trajectories, including conflict resolutions and deviations. They also record the overall system performance metrics.

5.145 **Oversight & Performance Monitoring**

- Data supports operational traceability, regulatory oversight and optimisation of traffic management.

Question 7: *Is it beneficial for the UTM ConOps to align with the scenarios in CAP 3182? If you do not agree, please provide your alternative proposal?*

Question 8: *Is the structure of this Chapter of use to industry? If not, please provide constructive feedback on the changes required to made in the next version of the Conops.*

Chapter 6

Conclusions

6.1 This Concept of Operations establishes a coherent and proportionate framework for the integration of unmanned aircraft operations within UK airspace, grounded in existing ATM/ANS principles and extended through a risk-based application of UK SORA. By combining traditional airspace classification with the Air Risk Class (ARC) construct, the ConOps enables a safety-driven decision-making that is responsive to actual risk exposure rather than static airspace structures alone.

6.2 UTM is positioned deliberately as an enabling component within the wider airspace system, supporting safe and scalable UA operations without displacing established ATM responsibilities or introducing unnecessary airspace segregation. The ConOps clarifies that UTM services contribute to air risk mitigation, preserving conceptual separation between air risk management and UA traffic density management. This distinction is essential to maintain regulatory clarity and consistency with UK SORA.

6.3 The phased, scenario-based approach presented in this document provides a pragmatic pathway from early, lower-complexity operations towards progressively more integrated and capable UTM-supported environments. Initial scenarios validate foundational services and governance arrangements, while later stages introduce enhanced functionality, interoperability, and closer coordination between UTM Service Providers and ANSP systems. This incremental evolution supports scalability while maintaining proportionality in both technical complexity and regulatory oversight.

6.4 Alignment with ongoing CAA activities and compatibility with Future-ATM/ANS trial environments ensures that this ConOps remains anchored in the UK Airspace Modernisation Strategy and the BVLOS roadmap. The approach promotes regulatory predictability, facilitates iterative validation through trials and demonstrations, and reduces integration risk for both industry and the regulator.

6.5 Overall, this ConOps provides a structured foundation for the continued maturation of UTM in the UK, supporting a controlled transition from accommodation to integration of UA operations. It enables innovation while safeguarding safety, ensures coherence across regulatory and operational domains, and establishes a clear basis for future refinement as operational experience, technology, and policy continue to evolve.

APPENDIX A

Definitions

Definitions

A1 All Definitions and terminology contained within this document are taken from regulatory and authoritative sources (E.g. UK Reg Assimilated (EU) 2017/373 and 2027/947 or CAA CAP's 1430 and 722.). Other terms are drawn from the ICAO Unmanned Aircraft Systems Traffic Management (UTM) – A Common Framework with Core Principles for Global Harmonization and other ICAO Annexes. Where no term is defined then the source is the Oxford English Dictionary. Other terminology, please, see below:

Note. The definitions used in this document are those set down in UK regulation and UK Civil Aeronautical Publications and are aligned with ICAO (unless otherwise stated). This list is not exhaustive. Where a definition is not contained above and is required in this document the definition and its source are stated.

- Aeronautical Information Service (AIS): A service established within the defined area of coverage, responsible for the provision of aeronautical data and aeronautical information necessary for the safety, regularity, and efficiency of air navigation. (UK Reg (EC) No 549/2004 Article 2 (3)).
- Aeronautical Information Management (AIM): The dynamic integrated management of aeronautical information through the provision and exchange of quality-assured digital aeronautical data in collaboration with other parties. (DOC 10066 PANS-AIM).
- Aeronautical Information Products: Aeronautical data and aeronautical information are provided either as digital data sets or as a standardized presentation in paper or electronic media. These include Aeronautical Information Publications (AIP), including Amendments and Supplements; Aeronautical Information Circulars (AIC); aeronautical charts; NOTAMs; and digital data sets. (DOC 10066 PANS-AIM).

- Air Traffic Management (ATM)[5]: The aggregation of the airborne and ground-based functions (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations (UK Reg (EC) No 549/2004 Article 2(10)).
- Air Navigation Services (ANS): Air Traffic Services; communication, navigation, and surveillance services; meteorological services for air navigation; and aeronautical information services. (UK Reg (EC) No 549/2004 Article 2 (4)).:
- Air Traffic Service (ATS): A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service) (UK Reg (EU) No 923/2012 Article 2(32).
- Beyond Visual Line of Sight Operation (BVLOS): A type of UAS operation which is not conducted in VLOS (UK Reg (EU) 2019/947 Article 2(8)).
- Common information elements: Information elements that assure safety, regularity, and efficiency of air navigation (generic).
- Common Information Service Provider (CISP): The provider of digital common information through a network or platform in which the common information elements (data) that support the implementation and proper functioning of the airspace are provided/exchanged but does not have active operational roles and responsibilities. (ICAO UTM-A common framework with core principles for global harmonisation. Edition 4)
- Concept of Operations (ConOps): Describes the characteristics of the organisation, system, operations, and the objectives of the user. CAP 722D
- Controlled Airspace: Airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification (UK Reg (EU) No 923/2012 Article 2(58)). Note: Controlled airspace is a generic term which covers ATS airspace *Classes A, B, C, D and E (UK Reg (EU) No 923/2012 Article 2(58) GM1).*
- Detect and Avoid (DAA): The capability to see, sense, or detect conflicting traffic or other hazards and take the appropriate action. (ICAO Doc 10019: Manual on Remotely Piloted Aircraft Systems).

[5] The use of the term 'aircraft' above includes UAS; thus ATM includes the management of these aircraft which has been referred to as 'UAS traffic management (UTM)'. ICAO describes UTM as "a specific aspect of ATM which manages UAS operations safely, economically and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions".

- Drone and Model Aircraft Registration and Education System (DMARES): The UK CAA's online platform for registering UAS and their operators.
- Discovery and Synchronisation Service (DSS): A federated information service that enables UTMSPs to discover each other and synchronise operational data, such as flight intents and traffic information, ensuring a consistent and shared operational picture across distributed service providers.
- Electronic Conspicuity: An umbrella term for the technology that can help pilots, remotely piloted aircraft systems, and air traffic service providers be more aware of what is operating in the surrounding airspace. Electronic conspicuity includes the devices fitted to aircraft that send out the information, and the supporting infrastructure to enable the position of the aircraft to be shared[6]. (CAP 1711 chapter 2).
- Filed Flight Plan (FPL): The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. (UK Reg (EU) No 923/2012 Article 2(73)).
- Flight information service (FIS): A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. (UK Reg (EU) No 923/2012 Article 2(77)).
- Flight Information Region (FIR): Airspace of defined dimensions within which flight information service and alerting service are provided. (UK Reg (EU) No 923/2012 Article 2(76)).
- Geofence.[7]: A virtual three-dimensional perimeter around a geographic point, either fixed or moving, that can be predefined or dynamically generated, and that enables software to trigger a response when a device approaches the perimeter (also referred to as geo-awareness or geocaging). *Note: High seas airspace. Airspace beyond land territory and territorial seas, as specified in the United Nations Convention on the Law of the Sea (Montego Bay, 1982). (UK Reg (EU) No 923/2012 Article 2(86)).*
- NOTAM: A notice distributed by means of telecommunication containing information concerning the establishment, condition, or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. (ICAO PANS-ATM (Doc 4444)).

[6] The UK position for UAS is ADSB (1090 MHz for manned aircraft and 978 MHz for UAS)

[7] In the context of unmanned aircraft, an aircraft operation includes the unmanned aircraft system.

- Recognised Air Traffic Environment (RATE):The situation which results from the deployment of a transponder mandatory zone (TMZ) where all air traffic within a defined volume of airspace is conspicuous to air traffic services through the carriage and operation of a Mode S SSR transponder (unless operating in compliance with alternative provisions prescribed for that particular airspace by the TMZ Controlling authority that will achieve a cooperative electronic conspicuity environment), but where there is no requirement for air traffic to maintain continuous air-ground voice communication watch. (CAP 1430).
- Situational Awareness: The ability to keep track of the prioritised significant events and conditions in the environments of the subject.
- SWIM: A global air traffic management initiative to harmonise the exchange of aeronautical, weather, and flight information for airspace users, civil and military air navigation service providers, airport operators, meteorological service providers, and the European Network Manager. SWIM is the standards, infrastructure and governance, enabling the management of ATM/ANS information and its exchange between qualified parties via interoperable information services. The effective implementation of SWIM is the foundation of the UK's transition to a digital data driven ATM system.
- Trajectory-based Operations: Defined in four dimensions (4D) – latitude, longitude, altitude, and time. The trajectory represents a common reference for where an aircraft is expected to be, and when, at key points along its route. The trajectory is defined prior to departure, updated in response to emerging conditions and operator inputs, and shared between stakeholders and systems.
- Traffic Information: Information issued by an air traffic services unit to alert a pilot to other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision. (UK Reg (EU) No 923/2012 Article 2(132)).
- Unmanned Aircraft System Traffic Management (UTM): A specific aspect of air traffic management that manages UAS operations safely, economically, and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions.
- Unmanned Aircraft System Traffic Management Service Provider (UTMSP): An organisation that provides digital services to support the safe, efficient, and scalable operations of unmanned aircraft. These services include, but are not limited to, flight authorisation, geo-consciousness and conflict management, enabling the coordination and organisation of UAS operations in real-time within the UK's airspace.

- Unmanned Aircraft System (UAS) Operator: Any legal or natural person operating or intending to operate one or more UAS. (UK Regulation (EU) 2019/947).
- Unmanned Aircraft System (UAS): Comprises individual 'System Elements' consisting of the Unmanned Aircraft (UA) and any other Communication Link and Launch and Recovery Element. There may be multiple UAs, RPS, or Launch and Recovery Elements within a UAS. (CAP 722D).
- UAS Data Provider (UDSP): A certified entity responsible for providing assured data services to support UTM operations, supplying accurate and timely information to UTM Service Providers (UTMSPs) and UAS operators, in order to enhance situational awareness and support safe and efficient UAS operations across the UK’s airspace.

APPENDIX B

Summary of Questions

Question 1: Do you agree with how the UTM Services have been integrated into the UK SORA process? If you disagree, please provide an explanation.

Question 2: Are there any missing objectives that you were expecting the ConOps to deliver on?

Question 3: Are there any other key challenges that you would like to highlight to the CAA relating to the challenges of integrating UAS operations into UK airspace environment?

Question 4: Do you agree with the supporting functionalities that have been identified and are there any additional ones that you would suggest and why?

Question 5: Is it useful for industry to include how UTM services integrate with the SORA process? If you do not agree with this approach, why not?

Question 6: Have the right strategic and tactical mitigations been identified?

Question 7: Is it beneficial for the UTM ConOps to align with the scenarios in CAP 3182? If you do not agree, please provide your alternative proposal?

Question 8: Is the structure of this Chapter of use to industry? If not, please provide constructive feedback on the changes required to made in the next version of the Conops.