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THE MARKET FOR UAV TRAFFIC MANAGEMENT SERVICES 2024-2028

BY PHILIP BUTTERWORTH-HAYES

EDITION 6.2 DECEMBER 2023

www.unmannedairspace.info

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Contents – V6.02

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Tables

Images

1.2 The race to launch operational UTM/U-space areas in Europe

At the end of 2023, Belgium was on course to win the race to launch the first **national** operational UTM system, which it planned to do in the first quarter of 2024, while Rotterdam Port had initiated the most advanced UTM **ecosystem**. In March 2023, Unifly and SkeyDrone announced a Strategic Partnership Agreement in which Unifly will provide its automated, interoperable UTM platform, which is fully compliant with the newest U-space regulation, to SkeyDrone. SkeyDrone will leverage Unifly's platform to add its aviation-grade traffic data and value-added services to help drone operators with all required regulated services, delivering end-to-end solutions that enable them to operate drones safely and securely.

But most other European countries are lagging somewhat behind. The coordinator of the SESAR's U-ELCOME project – based in Spain and coordinated by Eurocontrol and involving 51 European partners - Ludovic Legros said "U-ELCOME bridges the gap between innovation and real life," adding "We can make commercial drone operations possible on a daily basis BVLOS/VLOS by 2026".

Many operators, whose long-term plans rely on member states implementing the European Union's U-space regulation for automated BVLOS flights at scale, remain frustrated.

On 26 January 2023 the European Union's U-space regulation came into effect. EU Member States are now identifying U-space airspace areas where drones will be able to fly increasingly complex operations – BVLOS, over people, autonomously and at night – supported by air traffic services provided by certified U-space service providers (USSP). USSPs will coordinate drone operations with the air navigation service providers (ANSPs) and operational data exchanges between USSPs, ANSPs and drone operators will be ensured by the Common Information Service Provider (CISP).

The technology hurdles to implementing a fully operational U-space system seem to be most resolved (see table two: Maturity levels of U-space). Rotterdam port has developed a prototype operational system to handle flights from over 40 drone operators working at the port.

The current system features the following functions:

- Flight authorisations
- Geo awareness
- Tracking and monitoring
- Conflict detection and resolution
- Conformance monitoring
- Dynamic airspace reconfiguration

The UTM system connects directly to the drone operator's command and control network, server to server.

The system has been designed and developed by Airwayz and the system interface is via APIs or a Web App – the system does not discriminate against either type of user and authorisations are selected on a first-come first-serve basis, unless a high priority service flight is suddenly planned. Aeret has integrated the flight authorization process for area zones and SkyOps has completed the integration and is providing real-time positions and managing all the services and alerts.

The drone operator submits a flight request for a space and time reservation, which the airspace manager marks as a future flight. Time and flight reservations are mapped on a large digital display of the port. In case of a conflicting flight authorisation request the Web App Operator DDC rejects the flight and offers and alternative area/time which does not overlap are asks for another submission. The API then submits an area authorization request for immediate takeoff and the UTM system checks and approves the request. In case of a conflicting request the airspace manager gets an alert, sends a rejection and offers the drone operator a choice between adjusting the flight are or changing the flight time. Once the authorisation has been given the operator submits a trajectory request for immediate take off and the UTM system checks and approves the request.

Image one: View of the UTM display in Rotterdam port

The airspace manager has allocated area and time reservations for drone operators in green. The no-fly zone is in red.

The current system is hosted in the Port Authority building and six airspace managers have been trained to use the equipment. The basic system is now operational and over the next few weeks will be adding some important new functions – replacing the current manual flight authorisation requests with a faster digital interface, enhancing the dynamic airspace integration function and connecting to the crewed air traffic management system, among other elements.

One of the key issues which has yet to be resolved – and which will be critical to the evolution of the U-space market in Europe – is whether the common core Common Information System (CIS)/Flight Information Management System (FIMS) will be centrally located or distributed in each city or port eco-system.

In October 2023 AirHub Consultancy, in collaboration with partners Ordina and MovingDot, conducted a study on behalf of the Dutch Ministry of Infrastructure and Water Management to advise on an optimised U-space architecture,

According to the study, when designing the CIS, one can choose between a single national CIS for all U-space airspace or one CIS per U-space airspace. In both scenarios, information can be supplied by a single organization or through a distributed system where information is relayed directly from the provider to the users. However, the common information will have

Section two: A growing demand for services

2.1 The market for commercial drones

The September 2023 "forecasts of forecasts" by *Unmanned Airspace* shows a sharp fall in commercial drone market growth estimates, with compound annual growth rates (CAGR) for the global drone sector over the next few years averaging 17.9%, down from 24% in the January 2023 forecast of forecasts.

While this is still a very robust figure for annual growth rates, the wide variations in market values (from USD 3.99 billion to USD 54 billion) and CAGR forecasts for the next few years (a low of 3.24% and a high of 50%) show that this remains a highly complex market, subject to many contradictory drivers, according to *Unmanned Airspace* editorial director Philip Butterworth-Hayes.

"Market forecasters are divided over whether China or the USA is the biggest market in the world," said Butterworth-Hayes. "There is little, or no reference, in these forecasts to the widespread use of commercial drones in the war Ukraine – where losses on both sides are running at more than 10,000 a month – and whether these are commercial or military assets. In the USA, the Federal Aviation Administration is forecasting commercial market growth will drop away substantially towards the end of the decade – at a time when commercial industry forecasts show the market rapidly accelerating following the introduction of rules which will allow for more commercially beneficial beyond visual line of sight (BVLOS) and complex operations."

"Despite this, the one clear trend, however, is that, in general, all market forecast companies and consultants are reducing their previous highly optimistic expectations of growth in the commercial drone sector to 2030," he said.

According to a May 2023 report from *Markets and Markets*, the overall drone market is projected to grow from USD26.2 billion in 2022 to USD 38.3 Billion by 2027, at a CAGR of 7.9% from 2022 to 2027. This is a considerable decrease on its 2022 forecast, which predicted a 16.4% CAGR between 2021 to 2026.

"Rising demand for military C4ISR capabilities is driving the demand for UAVs," said the company. "Drones are used to gather data about ongoing and life-threatening military missions with the help of their command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities which are used to reinforce, boost, or implement command and control strategies and directives within military and intelligence frameworks. C4ISR powered by AI uses machine learning to identify and classify tanks and other vehicles, improves image feeds, and also provides driving assistance by giving early warning on obstacles and changing ground conditions. Governments are also quickly adopting these technologies to improve their defense arsenal…. The rising number of UAV manufacturers in China and India and increased procurement of military drones is the major factor driving the market growth in Asia Pacific.

Table three: Drone industry forecasts in 2022/2023

Forecaster	Market value	Years	Market	Growth rate
ABI Research	USD92 billion by 2030	2020-2030	Small UAS	CAGR 25%
Analysys Mason	USD8 billion in 2030	2022-2030	Cellular connected drones	–
China Daily	USD14.8 billion	2022	All drones	CAGR 30%
FACT MR	USD24.147 billion in 2023 rising to USD94.34 by 2033	2023-2033	Quadcopter market	CAGR 14.3%
FAA	805,000 registered drones in 2023 and 955,000 in 2027	2023-2027	Commercial sUAS fleet	CAGR 4.6%
Fortune Business Insights	USD10.98 billion in 2023 to USD54.81 billion by 2030	2023-2030	Commercial drone market	–
Frost & Sullivan	–	2019-2023	Global commercial UAS fleet	CAGR 4.3%
DRONEII	USD54.6 billion by 2023	2023-2030	Global commercial UAS fleet	CAGR 7.7%
Gartner	–	2019-2020	Global commercial UAS fleet	CAGR 50%
GAI	USD58.5 billion by 2026	2022-2026	Global UAV fleet	CAGR13.9%
Grand View	USD19.8 billion in 2023	2023-2030	Commercial drone market size	CAGR 13.9%
International Data Corporation (IDC)	–	2020-2025	Global drone industry (including software)	CAGR 33.3%
MarketsandMarkets	USD26.2 billion in 2022 and USD38.3 billion in 2027	2022-2022	Civil and military drone industry forecasts	CAGR 7.9%
Statistica	USD3.99 billion in 2023	2023-2028	Civil drones	CAGR 3.24%
Teal	USD19.8 billion by 2030	2022-2031	Global civil UAS fleet	CAGR 9.1%
Technavio	–	2021-2025	Commercial drones	CAGR 36.73%

3.1 Australasia

In November 2023 the Civil Aviation Safety Authority (CASA) and Airservices **Australia** announced new airspace, around Sydney Airport and Sydney Harbour, will be added in the automated airspace authorisations trial for certified commercial drone operators from mid-November 2023. Coinciding with this announcement is the extension of the automated airspace authorisations trial for a further 12-months.

The expansion of the trial means more remotely piloted aircraft operator's certificate (ReOC) holders will be able to use a participating CASA-verified drone safety app to apply to fly:

- within 5.5 km (3 nm) of Adelaide, Canberra, Perth and Sydney Airports
- in Restricted Areas near Sydney Harbour.

The automated authorisations reduce approval times from weeks to minutes, allowing ReOC holders to secure more business, in new locations, faster – saving time and money.

Automated airspace authorisations were launched in 2021 by CASA in partnership with Airservices Australia. It uses historical flight data from crewed aircraft operations to identify locations at the selected trial sites where it's safe for licensed and certified commercial drone operators to fly. Since the trial began in 2021, more than 1,275 automated airspace authorisations have been issued in Adelaide, Canberra and Perth.

Also in November 2023, Australia's Department of Infrastructure, Transport, Regional Development, Communications and the Arts developed infrastructure planning guidelines to support the safe, secure and environmentally-considerate integration of drones and electric vertical take-off and landing (eVTOL) vehicles into communities and broader transport networks.

The guidelines are available here

CASA published its remotely piloted aircraft system (RPAS) and advanced air mobility (AAM) roadmap (https://www.casa.gov.au/rpas-aam-roadmap) in July 2022 and has been widely welcomed by industry. The report outlines CASA's plans for developing a national UAS traffic management system.

"The Australian Association for Uncrewed Systems welcomes the release of CASA's RPAS and AAM Strategic Regulatory Roadmap," said AAUS Executive Director, Greg Tyrrell. "For many years AAUS has been advocating for greater certainty to industry through the development of a roadmap and we see the release of this document as an important milestone for the RPAS and AAM sectors, giving them direction to investment and development as we move towards an uncrewed aviation future."

Under the new Roadmap clear timelines are set out for: Aircraft and aircraft systems; Operations; Airspace and traffic management; Infrastructure; People; Safety and security.

In the immediate term (2022 to 2023) CASA plans to (inter alia)

- Publish acceptable industry consensus standards for piloted AAM.
- Review applicable maintenance policies for AAM.
- Review international frameworks, standards and methods for certification and assurance of RPAS.
- Develop a transparent, consistent, and scalable method to manage Australian airspace that supports RPAS and AAM integration.

- Research how existing separation standards may apply to RPAS and AAM. Identify future changes required including conspicuity and equipage considerations.
- Review existing flight rules against the future needs for RPAS and AAM.
- Work with DITRDC and Airservices Australia to develop a regulatory oversight framework for UTM.
- Conduct a gap analysis of CASR parts to identify regulatory changes required to support RPAS and AAM operations.
- Publish more standard scenarios and SORA guidance for low risk RPAS operations and emergency services.
- Work with DITRDC to set up the National drone detection network and support all safety aspects of the infrastructure planning framework.

In June 2022 Airservices Australia selected OneSky to continue to Phase 3 in the development a working prototype of a Flight Information Management System (FIMS) for Australia's UTM ecosystem. OneSky is partnered with AAM Group, Airbus, and Resilienx to deliver a full system.

The Airservices tender called for providers to build out a concept for FIMS tailored to the needs of the Australian aviation industry. While FIMS can refer to an interface between an Air Traffic Management System and UTM for the transfer of data, OneSky aims is to collaborate with Airservices to create a platform for a wide variety of services: one that will ensure that drones operate safely within regulations and have minimum impact on other aircraft and the communities they fly over, and ensure "efficient, fair, and competitive access to airspace."

According to the OneSky press release, building a system that meets global standards presents a challenge. Integrating this system with the wide variety of aircraft, communications systems, and services that comprise a cooperative system is an even greater difficulty. OneSky's integration framework is designed to make it easy for new users to access the system. OneSky will deliver a fully functioning FIMS prototype that allows for qualified USS providers to participate, forming the bridge between the actual drone operator and the UTM system. Based on the prototype, the ASA concept could be used around the world to advance uncrewed systems.

In September 2022 Airservices moved onto Phase 4 of its Flight Information Management System (FIMS) working prototype project. Three companies continue to work with Airservices to develop a system that will support the safe and efficient integration of emerging airspace users, including drone operators and air taxis, into Australia's low-altitude airspace. The down-selection process sees Altitude Angel, Frequentis Australasia and OneSky Systems pursuing the development of a FIMS prototype tailored to the needs of Australia's aviation industry, with in-field trials expected later this year.

According to a OneSky press release, the FIMS solution will allow qualified U-space service providers to participate in an integrated airspace, forming the bridge between the actual drone operator and the Uncrewed Traffic Management (UTM) system. OneSky is working with AAM, Airbus, ResilienX and TruWeather Solutions.

Meanwhile in April 2022 Thales reported its ScaleFlyt Platform, which enables large-scale drone operations through planning, record keeping, risk assessment and corporate fleet management, had been approved by CASA. "Subsequent to being green-lighted by CASA, the ScaleFlyt Platform will be deployed from April 2022, offering operators access to all the information they need to safely and lawfully fly their drones fleet through a simple and intuitive tool. From planning the missions, creating flight plans according to local safety requirements, and managing the fleet, everything can now be easily managed in a single platform powered by Thales," said the company. "The ScaleFlyt Platform grants access to all

EU funded U-space research programmes – complete and underway

U-space projects were among five new Digital Sky Demonstrators officially kicked off on 24 November, 2022. With combined funding to the tune of EUR 45 million from the Connecting Europe Facility between now and 2025, the selected projects aim to accelerate the market uptake of SESAR Solutions for greener aviation and urban air mobility (UAM).

The projects were selected following a call issued in September 2021 by the European Climate, Infrastructure and Environment Executive Agency (CINEA) under the Connecting Europe Facility. The demonstrators are a key tool to support the SESAR JUs vision of delivering the Digital European Sky, matching the ambitions of the European Green Deal and the 'Europe fit for the digital age' initiatives. The two SESAR-related topics covered by the call, 'U-space and urban air mobility' and 'aviation Green Deal', were selected from among nine flagships outlined in the work programme of the new SESAR 3 Joint Undertaking.

The Digital Sky Demonstrators will take place in live operational environments and will put to the test (on a very large scale) the technological solutions necessary to deliver the Digital European Sky. The demonstrators are part of an innovation pipeline designed by the SESAR Joint Undertaking to bridge the gap between applied/industrial research and industrialisation, and to accelerate market uptake. Critical to their success will be the involvement of early movers, as well as a strong and close connection with relevant standardisation and regulatory activities and bodies.

SESAR researchers at the end of 2022 took stock of the lessons learnt during the year.

SESAR research projects developed to validate different elements of edition four of the CORUS-XUAM ConOps resulted in some important findings. A very large-scale demonstration in September at Grottaglie-Taranto civil experimental airport in Italy confirmed that the tested U-space services are mainly ready for emergency transport. Earlier flight tests held at Pontoise airfield in France simulating avoidance manoeuvres in three different real-world scenarios, have "proved that safe flight with urban air mobility (UAM) aircraft is possible". But the demonstrations also showed many technological issues were still unresolved.

- The PODIUM project concluded that U-space services for the pre-flight phase are practically ready for deployment, but that significant action is needed to ensure that U-space services can really take off in the flight execution phase.

- The ICARUS project proposed the introduction of Common Altitude Reference Areas (CARA) based on Article 15 of Commission Implementing Regulation 2019/947.

- The DACUS project concluded the dynamic capacity management in UTM is now much better defined. Open questions impacting DACUS include how likely are contingencies; how uncertain / dynamic are U-plans? And How (well) does U-space tactical conflict resolution work?

- BUBBLES proposed a new tactical Separation Minima Service, where separation is calculated as a function of target level of safety, CNS performance and previous separation performance

- URclearED concluded deconfliction depends on predictability - either the manoeuvre is coordinated as TCAS or under ATC, or the manoeuvre follows pre-agreed rules e.g. give way to the right. Sharing intent as part of DAA would be

beneficial and having models of flight characteristics is a valuable step in designing tactical conflict resolutions.

- USEPE identified 13 separation methods and nine performance criteria; from these it downsleteced five methods and four criteria for more serious hybrid separation scheme : "Dynamic Density Corridor Concept" D2-C2

- SAFIR Med SAFIR-MED validated the CORUS CONOPs and where problems were found, suggested fixes.

- U-space 4UAM looked at how controllers might interact with drone flights and concluded special procedures are needed to control remotely piloted IFR as remote pilots might not be able to follow some ATCO instructions due to vehicle handling & control limits. Outstanding issues included the effects and eVTOLs and defining U-space corridors for eVTOLs.

- ASPID concluded U-space airspace design has to take into account neighbouring drone detection systems & processes; U-space airspace, surveillance and flight data should be exchanged with drone detection systems, including non-conformance.

- AMULED found no big discrepancies found with respect to CORUS-XUAM ConOps Ed4 but suggested further research/discussions are required in airspace structure (AMU-LED argued layered segregation), architecture, vertiport flow management and flight rules.

- Metropolis 2 looked at centralised and decentralised UTM architectures and recommended the best concept was a hybrid of the two.

- AURA concluded a more nuanced view of the ATC-U-space boundary is needed with more use cases considered.

- GOF2.0 demonstrated a unified air operation traffic management with high levels of automation serving both manned and unmanned aircraft in a safe, interconnected, distributed, interoperable, efficient, scalable and environmentally optimized manner. The new systems devised by developers as part of the GOF 2.0 project enabled drone operators to use the airspace in a flexible manner and already issued flight plans can be altered from the moment a request is made.

The SESAR ERICA project team demonstrated detect and avoid capabilities by manned and unmanned aircraft in live flight demonstration led by Saab and featuring UMS Skeldar and Trafikverket. The flight involving a manned aircraft and an unmanned SKELDAR V-200 UA showed that Detect and Avoid (DAA) technology is capable of mitigating the risks that have so far prevented manned aircraft from sharing airspace with unmanned aircraft.

Other European UTM/U-space research programmes made substantial progress. "Mobile telephony is the answer to aircraft conspicuity – with conditions," according to Vladimir Foltin, European Aviation Safety Agency (EASA) Certification Manager and ATM Expert at the Drone Enable webinar hosted by ICAO on 14 September 2022. He said mobile telephony uses existing infrastructure and is affordable to new users. "Although aerial use is not explicitly forbidden, neither is it explicitly legal. Therefore, it still needs to be legalised by telephone coordinators and their regional regulators."

Meanwhile, from March until September 2022, High Tech Campus Eindhoven (HTCE) became the first Flying Forward 2020 (FF2020) living lab to successfully conduct demonstrations of

4.2 How the UTM market is really evolving – revenue streams for UTM infrastructure and service providers.

Even though the initial stages of the commercialisation of the global UTM market is not expected before early 2024 there are eight current and potential revenue streams for UTM infrastructure and service providers:

1. Developing a national UTM programme in a commercial contract with a regulator/ANSP
2. National government and inter-governmental funded research
3. Prototype UTM service within a defined drone eco-system (eg a port)
4. Income from operational UTM infrastructure provision
5. Income from operational UTM service provision
6. UTM-as-a-service for drone and eVTOL operators/OEMs
7. UTM partnership in vertiport-focused AAM eco-system
8. Consultancy and other revenue streams – from defence contracts, private landowners, airports etc.

For most independent (that is, non-ANSP funded) UTM companies their business plans rely on government funded research in the short term – they hope that this funding will last long enough to bridge the gap before commercial revenue starts to flow from eVTOL operators or drone operators flying autonomous BVLOS missions requiring complex, specialist, paid-for UTM services. The good news is that although more complex drone missions have been delayed as a result of complexities in the regulatory and standards development processes, eVTOL operations are still being fast tracked. No wonder so many UTM companies have embraced the AAM/UAM market with such gusto.

While 2023 was meant to be the year that States around the world launched their national UTM programmes, the number of large scale commercial UTM eco-system development contracts has been relatively small – compared with 2019 for example (see table below).

Table seven: UTM service providers and commercial contracts with ANSPs, civil aviation and military authorities for operational UTM systems

Date	UTM service supplier	Client	Country	Contract details
April 2016	Exponent/Astra UTM	Dubai Civil Aviation Administration	Dubai	Public launch of the Exponent Portal software which allows DCAA officials and other local authorities to track the location, speed and height of drones.
2017				
July	Unifly	DFS	Germany	UTM deployment with mobile app in July 2017
August	AirMap (nowDroneUp)	Kansas Department of Transportation (KDOT)	USA	The AirMap (nowDroneUp) UTM platform is deployed in Kansas where drones will be mobilised for disaster recovery, search-and-rescue, agriculture, construction, package delivery, and more.
August/ September	AirMap (nowDroneUp)	States of Texas and Florida	USA	Temporary UTM set up in wake of hurricanes Harvey and Irma

HUB, a new capability to combine multiple connectivity sources. AirborneRF HUB analyzes cellular and satellite data from several providers, and enables the users, such as drone operators and UTM systems the best possible real-life connectivity path for BVLOS drone flights. The platform also provides the user with all relevant information about ground and air risks, aggregated and available through a single, programmable interface.

This means that MNOs can, theoretically, provide many of the functions in the UTM service arena that until today have been the exclusive preserve of aviation organisations (see table below).

Table eleven: Potential UTM roles for ANSPs, USSPs, CAAs, MNOs and others

Who provides what services in a U-space eco system – how USS see the future	Who provides what services in a U-space eco system – how MNOs see the future
U1 e-Registration - CAA Electronic chip – MNO/ANSP/USSP Drone operator online registration - CAA Drone online registration - CAA Registration enforcement - CAA Registration Authority -CAA e-Identification – MNO/ANSP/USSP Drone Identification - MNO/ANSP/USSP e-identification enforcement – CAA/ANSP Identification Authority - CAA Pre-tactical geo-fencing – USSP/ANSP Geo-limitation database – CAA/USSP/ANSP Drone operator authentication and authorisation – CAA/ANSP	**U1** e-Registration - CAA Electronic chip – MNO Drone operator online registration - CAA Drone online registration - CAA Registration enforcement - CAA Registration Authority -CAA e-Identification – MNO Drone Identification - MNO e-identification enforcement – CAA/ANSP Identification Authority - CAA Pre-tactical geo-fencing – MNO Geo-limitation database – ANSP/MNO Drone operator authentication and authorisation – CAA/ANSP
U2 Tactical geo-fencing – USSP/ANSP/MNO? Live airspace data feed – USSP/ANSP/MNO? Area infringement notification – USSP/ANSP/MNO? Flight planning management – USSP/ANSP Automated FPL validation – USSP/ANSP Operations digital authorisation – USSP/ANSP Digital NOTAM – USSP/ANSP/SDSP Weather information – USSP/SDSP Low-altitude wind forecast – USSP/SDSP Actual low-altitude wind info - SDSP Weather info collection - USSP Weather hazard alerts – SDSP/USSP Tracking – MNO/USSP Radio Positioning infrastructure – MNO/USSP Real-time tracking -MNO/USSP Tracking data recording - USSP Monitoring -USSP Air situation monitoring - USSP Flight non-conformance detection - USSP Area infringement detection - USSP Traffic info multicast- USSP Alert/Report line - USSP Drone aeronautical information management - USSP/SDSP/ANSP UTM-relevant static aeronautical data - USSP/SDSP/ANSP	**U2** Tactical geo-fencing – MNO Live airspace data feed – USSP/ANSP/MNO Area infringement notification – USSP/ANSP/MNO Flight planning management – USSP/ANSP/MNO Automated FPL validation – USSP/MNO Operations digital authorisation – USSP/MNO Digital NOTAM – USSP/ANSP/SDSP/MNO Weather information – SDSP/MNO Low-altitude wind forecast – SDSP/MNO Actual low-altitude wind info – SDSP/MNO Weather info collection – USSP/MNO Weather hazard alerts – SDSP/USSP/MNO Tracking – MNO/USSP Radio Positioning infrastructure – MNO/USSP Real-time tracking -MNO/USSP Tracking data recording – USSP/MNO Monitoring -USSP/MNO Air situation monitoring – USSP/MNO Flight non-conformance detection – USSP/other Area infringement detection – USSP/other Traffic info multicast- USSP/MNO Alert/Report line – USSP/MNO Drone aeronautical information management - USSP/SDSP/ANSP/MNO UTM-relevant static aeronautical data - USSP/SDSP/ANSP UTM-relevant dynamic aeronautical data- USSP/SDSP/ANSP/MNO

UTM-relevant dynamic aeronautical data-USSP/SDSP/ANSP Procedural interface with ATC -USSP/ANSP ATC/UAS coordination procedures – USSP/ANSP Flight notification procedures -USSP Emergency and contingency procedures – USSP/ANSP Emergency management -USSP/ANSP Emergency alert line – USSP/ANSP Emergency assistance information -USSP/ANSP Strategic de-confliction - USSP Strategic de-confliction - USSP **U3** Dynamic geo-fencing - USSP Dynamic geo-fencing – ANSP/USSP Collaborative Interface with ATC – ANSP/USSP Global air situation monitoring - USSP ATC alert notification -USSP/ANSP Tactical de-confliction -DO/USSP Dynamic capacity management - USSP Airspace capacity monitoring - USSP UAS traffic complexity assessment USSP/ANSP Demand/capacity imbalance detection – USSP/ANSP UTM measures implementation – USSP/ANSP	Procedural interface with ATC -USSP/ANSP/MNO ATC/UAS coordination procedures – USSP/ANSP/MNO Flight notification procedures -USSP Emergency and contingency procedures – USSP/ANSP/MNO Emergency management -USSP/ANSP/MNO Emergency alert line – USSP/ANSP/MNO Emergency assistance information - USSP/ANSP/MNO Strategic de-confliction – USSP/MNO Strategic de-confliction – USSP/MNO **U3** Dynamic geo-fencing – USSP/MNO Dynamic geo-fencing – USSP/MNO Collaborative Interface with ATC – ANSP/USSP/MNO Global air situation monitoring – USSP/MNO ATC alert notification -USSP/ANSP/MNO Tactical de-confliction -DO/USSP/MNO Dynamic capacity management – USSP/MNO Airspace capacity monitoring – USSP/MNO UAS traffic complexity assessment USSP/ANSP/MNO Demand/capacity imbalance detection – USSP/ANSP/MNO UTM measures implementation – USSP/ANSP
Notes: Based on the SESAR U-space service level definitions *Key:* *CAA – civil aviation authority DO – drone operator MNO – mobile network operator* *ANSP – air navigation service provider SDSP – Supplemental data service provider USSP - UTM/U-Space service provider ND - Not decided*	

MNOs are gearing up their networks to play a major role in both infrastructure and service provision. In May 2023 Belgian's telco operator Citymesh introduced a network of 70 safety drones built to support the company's emergency services in a programme called SENSE.

"In a world's first, police stations and fire stations across Belgium will have a Drones-in-a-Box (DiaB) solution at their disposal," says a company press release. "When emergency services receive a call, depending on the type of call, the Safety Drone will take off to gather critical information in the first 15 minutes. Thanks to 4K high definition & thermal images enriched with AI, the emergency services get a lot more info on the situation and can thus make better and faster decisions… Crucial minutes for a human life.

The system is built on a Nokia Drone Networks platform with 70 Drone-in-a-Box (DiaB) units. Nationwide availability of SENSE follows pilot projects in the Fluvia fire brigade in Kortrijk, Brussels Airport Company, Port of Antwerp-Bruges, and the city of Genk, with the support of the Federal Public Service Economy.

In June 2023 BT Group and SkyLift, a provider of turnkey UAS solutions for logistical and time-critical operations, conducted demonstration flights using uAvionix's SkyLine cloud-based command and control (C2) system communicating over C-Band and LTE. The flights achieve two UK firsts for UAS operations; operational Command and Non-Payload Communications (CNPC) C2 systems using C-Band and LTE via BT's Drone SIM and secondly the transmission of ADS-B OUT on 978 MHz for detect and avoid (DAA) operations. Operators

In August 2023 the **Drone Operator Requirements Aero Initiative (DORAI)** published the first requirements to support and help drone manufacturers focus their development efforts. These requirements are the result of a half year intensive collaboration and alignment effort done by drone operators on a pan-European level, representing France, Italy, The Netherlands, Belgium, Greece and Switzerland.

The requirements cover both hardware development (incl. packaging sizes, payload handling automation) as well as software development (incl. interfaces towards operator BVLOS Ground Control, enabling U-Space operator responsibilities).

The DORAI members request their technology suppliers to use the DORAI minimum requirements in their drone platform developments going forward.

All drone related actors are invited to provide input that can be included in additional future (periodic) requirement publications. DORAI targets the next publication for 1 February 2024. DORAI is furthermore open to operators who wish to collaborate on industry requirements. Any operator can join DORAI if they subscribe to a modular drone industry setup and do themselves not manufacture drones.

This effort runs in parallel to the European SESAR **SAFIR-Ready**, **SAFIR-Med project**s where the 34 partners and advisory members adhere to the same requirements to support EU legislation and U-Space.

DORAI created in 2022 with the objective to ensure efficient and effective technology development for the unmanned aviation sector. Drone operators align on use case-based requirements to provide economically viable and robust services.

DORAI forms a platform for drone operators to align and communicate their requirements towards drone Original Equipment Manufacturers (OEMs) and unmanned aviation related technological providers. DORAI statements provide a clear, publicly referenceable basis for future development. These statements give guidelines for drone design choices towards a viable, scalable and modular drone eco-system.

In June 2021 the **European Committee for Standardization** (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI) announced that CEN and ASD-STAN, the dedicated body for standardization in the aerospace sector, have launched the public enquiry for prEN 4709-001 'Aerospace series – Unmanned Aircraft Systems – Part 001: Product requirements and verification'.

According to a CENELEC press release:

"This document provides technical specification and verification method to support compliance with Commission Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems (UAS, popularly known as 'drones') and on third-country operators of UAS. This includes compliance with product requirements for all UAS authorised to operate in the 'open' category (class C0, C1, C2, C3 and C4 UAS).prEN 4709-001, prepared by ASD-STAN, is the fourth standard on UAS to go through a public enquiry this year. It lays down technical specifications and verification methods ensuring the compliance with the requirements set by EU Regulation 2019/945.

"The development of this series of standards takes place in the context of a specific focus by the European Commission to develop a framework for the safe development of a drone ecosystem in Europe: as part of its Sustainable and Smart Mobility strategy, the Commission expects to adopt a Drone strategy 2.0 in 2022 to develop drones into a vector for the smart and sustainable mobility of the future. For this reason, standards on drones developed by

Appendix one: Cities planning UAM/AAM ecosystems in the next three-five years

The following data is sourced from the Global AAM/UAM Market Map

Australia

Melbourne, Victoria

Timeline
Planned – *to be launched within two to five years; funds have been committed and key industry partners identified*

Programme description
In August 2022, at the Australian Association for Uncrewed Systems (AAUS) annual Advanced Air Mobility summit in Melbourne, Skyportz announced it would develop the first vertiport in Australia at Caribbean Park in Melbourne's east, in conjunction with Contreras Earl Architects, to70 aviation, Arup and Microflite.

At the end of August 2022, the Victoria government also published its Advanced Air Mobility Vision report. According to the report:

"Victoria's regional centres, such as Traralgon, Geelong, Ballarat and Bendigo, have growing commuter markets, thriving commercial centres and strong tourism opportunities. AAM has the potential to provide fast, cost-effective methods for connecting city/town pairs, especially where the cost and complication of scaling traditional aviation, or constructing fixed infrastructure, do not justify the likely demand."

Melbourne was originally chosen as a launch city for Uber's UAM services but since the takeover by Joby of Uber, these plans have been delayed. The city is still listed as one of Joby's list of target cities and the company has been reported as working towards launching its first commercial services there as early as 2024.

In March 2022 Skyportz and planning group Arup announced they were jointly developing specifications to support property developers wanting to prepare their buildings for UAM and eVTOL aircraft, in anticipation of the launch of Uber Elevate services.

Advancing UAM services has the support of the Victorian Government and Invest Victoria. Meanwhile, the partnership between Eve Urban Air Mobility and Microflite, an Australia-based helicopter operator, foresees the introduction of eVTOL flights to the city as early as 2026.

In October 2023 Skyportz, Contreras Earl Architecture and Pascall+Watson Architects released a concept for an Australian waterfront e-mobility hub at the World Air Taxi Congress in San Francisco.

"The proposal will replace an existing heliport on the Yarra River in Melbourne, with a new purpose built vertiport to accommodate the introduction of clean, quiet, electric air taxis" according to the press release.

"Under this plan the site would also be a multi modal hub for electric scooters, bikes, ferries and hire boats. A cafe would provide an area for people to view the action."