URBAN AIR MOBILITY DEVELOPMENT IN WESTERN BALKAN (WB6) REGIONAL PARTNERS

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ABSTRACT

The air transport sector is the fastest growing sector in Europe and the world. The planned establishment of new routes in Europe until 2050 is based on the increase of city pair routes. Therefore, air traffic demand will cause an increase in the number of aircraft operations, the number of passengers, the required number of new pilots, etc., and on the other hand, the (re)construction of infrastructure in accordance with the requirements of decarbonization, alternative fuels, new types of aircraft (HEPA), etc. Also, urban air mobility strategies will lead to the integration of drones into the air traffic system and the development of U-space. Regional partners are strongly forced by international institutions to follow set targets and to adopt requested regulations (ICAO, EASA, etc.). Based on the abovementioned it is expected that the development of air traffic in the Western Balkan (WB6) Regional Partners will meet the goals stated in the action scenarios and BAU with over 85%. Demands for decarbonization, digitization and U-space development are priority areas of umbrella international institutions of which WB6 Regional Partners are members and thus obliged to implement the required programs and initiatives.

KEYWORDS _ *U-Space, Aviation, Urban Air Mobility*

Introduction

U-space is a set of new services relying on a high level of digitalization and automation of functions and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones. As such, U-space is an enabling framework designed to facilitate any kind of routine mission, in all classes of airspace and all types of environments –even the most congested – while addressing an appropriate interface with manned aviation and air traffic control / ATC (SESAR, 2018).

Table 1 shows projections gathered from the contemporary researches under SESAR Joint Undertaking. Moreover, three major issues are focused on necessary infrastructure (ground, airborne and human resources); safety issues, both regulatory and operational and decarbonization issues. Ground infrastructure, airborne infrastructure and human resources represent a group of primary investment requirements.

Table 1: Summary of drone & conventional air fleet volumes (000s); Source: (SESAR, 2018)

	2015	2018	2020	2025	2030	2035	2040	2045	2050
Open category	1,000	5,000	6,000	7,000	7,000	7,000	7,000	7,000	7,000
Certified category (excl. Military)	-	-	-	-	-	-	2	6	13
Specific category	9	45	86	200	373	386	384	390	396
Military	1	1	1	1	1	2	2	2	3
Urban air mobility	-	-	-	-	2	4	4	4	4
Scheduled airline fleet	11	12	13	15	17	20	22	25	25
Business aviation fleet	7	7	8	8	8	9	8	7	4
Rotorcraft fleet	2	2	2	3	3	3	3	2	1
VFR	59	61	63	67	71	75	79	83	87
IFR	13	14	15	17	20	22	25	27	29

PRIMARY INVESTMENT REQUIREMENTS

Table 2: Business view - Primary investment requirements; Source: (SESAR, 2018)

Category	Sub-category
Ground infrastructure	ATC interface and airport adaptations
	Drone traffic management (DTM)
	Protection sensitive sites
	Telecommunications & satellite communications
	Geo-fencing database
	Enhanced data provision and information sharing
	Drone traffic management oversight
	e-registration and e-identification
Airborne infrastructure	On-drone capabilities
	On other aircraft capabilities
Human resources	Procedure development
	ATC personnel training

Key underlying investment assumptions for WB6 are presented below:

- The focus of effort was to determine the minimum ATM-related infrastructure investment required to support a safe drone ecosystem in WB. In scope investments include: ground and airborne infrastructure investments and select human resources directly related to deployment and safety. Out of scope elements include, but are not limited to: operating costs, investments to develop and establish U-space services, drone design and certification investment, and insurance related costs.
- The timeframe for the business view is 2018-2050, with most achievements depicting the timeframe to 2035, by which time the majority of investment (~70%) is anticipated to have been spent.
- Other relevant sectors (e.g., connected cars, advanced metering infrastructure, etc.) are assumed to allow for meaningful comparisons to the drone landscape in particular areas. Where appropriate, they are leveraged as proxies to support assumptions.
- Open, specific, and certified drone categories; It is assumed that open category drones are impacted by e-registration, e-identification, and tracking requirements only on the basis of likely safety regulations.
- For this assessment, it is assumed that the U-space will follow a federated model in WB6 given the necessity for highly automated systems to handle the anticipated scale of operations; a volume of 15 certified drone traffic management (DTM) providers is assumed for Europe.
- Existing communication infrastructure will be leveraged and no dedicated communication layer is required; similarly, a new satellite constellation that would be shared both with non-European users and for non-drone applications (e.g. connected trains) is envisaged.
- Airborne investment requirements for urban air mobility are included, but due to lack of available data at time of publishing, airport modification and landing pad investments to accommodate this are not included.
- It is assumed that ground infrastructure solutions include facility, build-out, and necessary hardware and software to serve the indicated function; the actual end-state solution could also be cloud-based or hybrid, however, this is not accounted for in this assessment.
- The evolution of the drone ecosystem will materialize with minimal impact on civil aviation fleets; however, it is foreseen some equipment for general aviation may be needed to accommodate the safe operation of drones in uncontrolled airspace.

Critical components of drone infrastructure could also be susceptible to monopolies – in particular, ground-based equipment (such as drone charging stations or vertiports) and UTM systems and the data they collect.

ADOPT THE REGULATORY FRAMEWORK FOR DRONES AND UNMANNED AIRCRAFT

The WB6 needs to ensure the safe and efficient development of a drone ecosystem within the framework of EU regulations and future Drone strategy (EC, 2022b). Within Europe, two regulations came into force in 2019 and are applicable since 31st December 2020 in all EU Member States, replacing the 2008 legislative framework. The new regulations are as follows:

- Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; and
- Commission Delegation Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems.

Regulation (EU) 2019/947 defines three categories of civil drone operations: the 'open', the 'specific' and the 'certified' category. The 'open' category addresses the low-risk commercial activities regarding drone operations, where safety is ensured by providing the civil drone operator complies with the relevant requirements for its intended operation. This category is subdivided into three subcategories, namely A1, A2 and A3 (applicable until 31 December 2023). Starting from 1 January 2024 operations in the open category must be conducted either with a drone bearing a C0 to C4 class identification label, or being privately built or even without class identification label but only if purchased before 31 December 2023. Operational risks in the 'open' category are considered low and, therefore, no operational authorization is required before starting a flight. The 'specific' category covers riskier civil drone operations, where safety is ensured by the drone operator by obtaining an operational authorization from the national civil aviation authority before starting the operation. To obtain the operational authorization, the drone operator is required to conduct a risk assessment, which should determine the requirements necessary for the safe operation of the civil drone(s). In the 'certified' category, the safety risk is considerably high; therefore, the certification of the drone operator and its drone, as well as the licensing of the remote pilot(s), is always required to ensure safety.

HARMONIZATION OF NATIONAL REGULATORY FRAMEWORK OF WB6 REGIONAL PARTNERS WITH EU REGULATION

The need for globally harmonized rules for the operation of unmanned aircraft is requested even by operators of very small unmanned aircraft. ICAO and JARUS are the international bodies for discussions on unmanned aircraft regulations. ICAO has now set up a Remotely Piloted Aircraft Systems Panel (RPASP), which shall produce draft standards and recommended practices (SARPs) for unmanned aircraft by 2018 focusing its work on international operations. JARUS is a cooperation of 40 CAAs worldwide and its aim is to develop harmonized rules for unmanned aircraft. JARUS has been recognized by the European Commission and the European Parliament as the 'working engine' to develop the necessary rules for unmanned aircraft. This will ensure harmonization worldwide and JARUS is expected to contribute to the ICAO work. The Agency is, therefore, fully engaged in JARUS and provides significant resources. The framework should enable unmanned aircraft system (UAS) operations in urban environment categorized as medium risk in the specific category.

The management of drone traffic will be ensured through the U-space: a set of services that will be deployed in airspace where heavier traffic is expected, such as in urban areas. The U-space regulation establishes and harmonizes the necessary requirements for manned and unmanned aircraft to operate safely in the U-space airspace, so as to prevent collisions between aircraft and to mitigate air and ground risks. The U-space regulatory framework should ensure safe aircraft operations in all areas and for all types of unmanned aircraft operations.

SAFETY ISSUES

There are numerous approaches to evaluating safety risks in drone operations (Cokorilo, 2020). However, it is important to systematically approach safety risks in accordance with the growing trend of drone use. One of the key approaches is the application of the Backcasting approach (Tomić et al., 2023).

Backcasting is holistic approach, focusing on targets and desirable future (Mihajlović et al., 2020). It starts with defining a desirable future and then works backwards to identify strategies - policies and 3 technologies that will connect that specified future to the present. Backcasting methodology includes four steps (Mihajlović et al., 2020): (1) Identification of problem and targets; (2) Definition of a baseline scenario; (3) Design of future scenarios; (4) Analysis and assessment of technologies and policy packages (strategies) that could serve as pathways from the present to the targeted period.

CO_2 IMPACTS AND DECARBONIZATION

Decarbonizing transport remains a major challenge for mitigating climate change in the decades ahead (ITF, 2021). Fuel combustion from transport is responsible for around one-quarter of greenhouse gas (GHG) emissions globally; the sector remains dependent on oil for 92% of its energy demand. The ITF's (ITF, 2021) "current ambition" scenario projects that the sector's CO_2 emissions, the main GHG in transport, will grow by 60% between 2015 and 2050. Drones, a new means of transport that has the potential to reduce the use of more conventional vehicles, may be able to reduce CO_2 emissions from transport. This will, however, depend on many factors. Most currently available drones run on electricity. As such, they do not emit any tailpipe emissions. A meaningful comparison of the CO_2 impact of drones with that of other means of transport should therefore rely on a so-called "well-to-wheel" analysis (or "generator-to-propeller" analysis in the case of drones) – regardless of their energy supply or the service they provide. This type of analysis accounts for both the emissions caused during the vehicle-use phase and those caused by the production, transportation and distribution of the electricity or transport fuels. A full life-cycle assessment (LCA) for a drone, from "cradle" to "grave", is also required to account for the emissions impacts of the vehicle itself. An LCA accounts for CO_2 emissions that stem from the extraction of resources required for manufacturing the vehicle; for CO_2 emissions from producing, recycling (or disposing of) and transporting the vehicle (and its battery, where applicable); and for CO_2 emissions caused by vehicle maintenance and service activities. Also, the emissions resulting from the construction and use of enabling drone infrastructure, or from the potential need to replace a battery during the life cycle of a drone, need to be accounted for (ITF, 2021). To improve the CO_2 efficiency of drones and their operations, policy makers can revert to measures that have been put in place for more traditional means of transport and for other industries.

DEVELOPING URBAN AIR MOBILITY AND REGIONAL AIR MOBILITY; INCLUDING GROUND INFRASTRUCTURE

Air taxis using eVTOL aircraft and smaller UAS used for cargo delivery operations are the core of Innovative Air Mobility (IAM) (EC, 2022a). Although first air taxi operations are expected to be conducted with manned eVTOL capable aircraft, such operations will likely be in the future performed on the similar platforms but remotely piloted and then fully autonomous. Therefore, it is necessary to support the transitioning phase and ensure a smooth integration of these new operational concepts in the current aviation domain as well as the future multimodal transportation system. Until such times as more citizens get to experience real IAM operations, efforts will be needed to counter misapprehensions about their potential impact (noise, visual pollution, etc.). There is a need to better define and communicate on IAM opportunities, and create a modus operandi to ensure collaboration between European, national, and local authorities to manage societal and environmental impacts. The societal impact of IAM operations must be recognized and should be tackled upfront with a set of EU-developed instruments. IAM services should be promoted on the basis of inclusivity and sustainability, and not be restricted to upper-class services. Indeed, multiple eVTOL developers are targeting passenger operations built on economic efficiencies of electric power, nodal networks, and scalability to achieve competitive pricing and provide more sustainable alternatives to existing travel services. IAM should systematically be considered as part of sustainable urban mobility plans (SUMPs), and should contribute to address its objectives:

- Ensure all citizens are offered transport options that enable access to key destinations and services;
- Improve safety and security;
- Reduce air and noise pollution, greenhouse gas emissions and energy consumption;
- Improve the efficiency and cost-effectiveness of the transportation of persons and goods;
- Contribute to enhancing the attractiveness and quality of the urban environment and urban design for the benefits of citizens, the economy and society as a whole.

Competition within the IAM market and with other modes of transport requires a strong framework to deal with external costs and will make IAM operations affordable to a wide range of service providers:

- The logic of the pragmatic, operation-centric policy should systematically be applied to keep safety requirements proportionate to the risk;
- The roll-out of IAM will need public policy support and adequate private investments;
- Public R&D funding should support projects that are geared towards further automation and sustainability;
- Infrastructure associated with U-space and IAM implementation, including the landing site and charging infrastructure, should be considered for eligibility within traditional Europe and WB6 infrastructure funding pathways. Funding should also focus on multi-mode infrastructures where aviation could benefit from energy and telecom cross-fertilization;
- Eligibility requirements for public funding should be adapted to the new competitive market framework and should include a robust business plan.

The siting of vertiports, which will enable eVTOLs and autonomous parcel delivery drones to operate from sites that are physically close to citizens, must be a holistic process that includes stakeholders beyond the traditional aviation community. Not all vertiports will need to be new sites but may reuse existing helipads or airports (including small aerodromes). The location of the required new enabling infrastructure (e.g., vertiports, telecommunication and energy distribution equipment) in the urban environment should be systematically analyzed, finding a balance between location requirements, affordability and other aspects such as nuisance to neighbors and visual pollution to avoid jeopardizing social acceptance. Connectivity to local airports and other modal hubs, including with public means of transport, should be prioritized. Further research could be conducted on operations limiting factors, which may hinder IAM development, such as battery technology development. Finally, a harmonized and synchronized roadmap should be established at European and WB6 level for the development and deployment of IAM. Such a roadmap should set out the objectives, tasks and responsibilities of the multiple actors involved, as well as a timeline for its development. It would improve the investment climate, as well as, societal acceptance, particularly if essential aspects of urban transport decarbonization in urban areas are included.

CONCLUSIONS

The future development of urban air mobility in WB6 Regional Partners must follow the development and implementation of appropriate technical and infrastructure systems within the EU. Harmonization of the regulatory framework of the civil aviation authorities, which should ensure safety and security measures implementation, is of exceptional importance. Future trends until 2050 require the systematic integration of drones into the air traffic system (within the space of maned-aircraft operations). This paper provides general guidelines for the development of drone operations in WB6, as a basis for defining pilot actions within each individual regional partner.

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