# Urban Air Mobility (UAM) in Türkiye: Evaluating Existing Aviation Laws and International Practices[(*)]

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**Abstract**

Urban Air Mobility (UAM) has emerged as a solution to transport challenges such as traffic congestion, environmental impacts, and lack of adequate public transport systems in urban areas. As the interest in UAM objects such as electric vertical take-off and landing aircraft (eVTOL) is increasing, it is important to understand whether the current regulations are sufficient to address the sui generis difficulties of this brand new technology. This article examines the adequacy of Türkiye's current legal framework to ensure the safe, effective, and sustainable integration of UAM. This article analyses Türkiye's existing aviation legislation, in particular the Turkish Civil Aviation Law and the instructions issued by the Directorate General of Civil Aviation (DGCA) and examines their applicability to UAM. The article discusses various regulatory gaps such as the lack of standards specifically designed for UAM, inadequate safety, environmental and operational regulations, and unclear guidelines on airspace integration. The article also discusses various UAM regulations prepared by the International Civil Aviation Organisation (ICAO), the European Union Aviation Safety Agency (EASA), and the approaches of pioneer countries in this area, such as the US, Germany, and Japan. Through a comparative analysis, it demonstrates the key lessons learnt from these international practices and presents suggestions for

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improving Türkiye's regulatory environment. The study emphasises the need for targeted reforms, introduction of specific standards, and a new regulative framework to foster the successful integration of UAM. The findings aim to contribute to the establishment of a solid legal framework to ensure that Türkiye is prepared for the future of UAM.

**Keywords**

Urban Air Mobility, Turkish Civil Aviation Law, DGCA, ICAO, EASA.

# Türkiye'de Kentsel Hava Hareketliliği: Mevcut Havacılık Kurallarının ve Uluslararası Uygulamaların Değerlendirilmesi

**Öz**

Kentsel Hava Hareketliliği (*Urban Air Mobility*-UAM), trafik sıkışıklığı, çevresel etkiler ve kalabalık şehirlerde yeterli toplu taşıma sistemlerinin bulunmaması gibi ulaşım sorunlarına bir çözüm olarak ortaya çıkmıştır. Elektrikli dikey kalkış ve iniş yapan uçaklar (eVTOL) gibi UAM nesnelerine olan ilgi artarken, mevcut havacılık düzenlemelerinin bu yeni teknolojinin kendine has zorluklarını ele almak için yeterli olup olmadığını değerlendirmek önem taşımaktadır. Bu makale, Türkiye'nin mevcut yasal çerçevesinin UAM'nin güvenli, etkili ve sürdürülebilir entegrasyonunu desteklemek için yeterliliğini incelemektedir. Çalışma, başta Türk Sivil Havacılık Kanunu ve Sivil Havacılık Genel Müdürlüğü (SHGM) tarafından yayınlanan talimatlar olmak üzere Türkiye'nin mevcut havacılık mevzuatını analiz etmekte ve bunların UAM kavramıyla olan ilişkisini değerlendirmektedir. Çalışma, UAM için özel olarak hazırlanmış standartların eksikliği, yetersiz emniyet, çevre ve operasyonel düzenlemeler ve hava sahası entegrasyonuna ilişkin net olmayan yönergeler gibi çeşitli düzenleyici boşlukları tartışmaktadır. Makale ayrıca Uluslararası Sivil Havacılık Örgütü (ICAO), Avrupa Birliği Havacılık Güvenliği Ajansı (EASA) tarafından hazırlanan çeşitli UAM standartlarını ve ABD, Almanya ve Japonya gibi öncü ülkelerin yaklaşımlarını incelemektedir. Karşılaştırmalı bir analiz yoluyla, bu uluslararası uygulamalardan çıkarılan temel dersler ele alınmakta ve Türkiye'nin düzenleyici ortamının iyileştirilmesine yönelik tavsiyeler sunulmaktadır. Çalışma, UAM'nin başarılı bir şekilde entegrasyonunu desteklemek için hedeflenen reformlara, belirli standartların getirilmesine ve yeni düzenlemelere duyulan ihtiyacı vurgulamaktadır. Bulgular, Türkiye'nin kentsel hava hareketliliğinin geleceğine hazırlıklı olmasını sağlamak için sağlam bir yasal çerçevenin oluşturulmasına katkıda bulunmayı amaçlamaktadır.

**Anahtar Kelimeler**

Kentsel Hava Hareketliliği, Türk Sivil Havacılık Kanunu, SHGM, ICAO, EASA.

## Introduction

"They say the universe is expanding. That should help with the traffic." Even though comedian Steven Wright is making a joke, the traffic problem is one of the major problems that modern people face in their daily lives. According to the World Bank, 56%of the global population, or 4.4 billion people, now live in cities. By 2050, this proportion is expected to rise to nearly 70%[1]. The rapid pace of urbanisation is one of the main factors leading to traffic problems.

According to data from the Turkish Statistical Institute (TÜİK), the number of motor vehicles in traffic in Türkiye increased by 8.5%in 2023 compared to the previous year, while the total number of accidents increased by 6.6%, the number of accidents with fatal injuries by 19.2%, the number of accidents with fatal injuries by 19.2%, the number of accidents with material damage by 4.2%, the total number of deaths by 25.2%and the number of injured by 21.5%. In these traffic accidents, 55.3%of deaths and 77.3%of injuries were reported in residential areas[2]. Similarly, based on the data published by the Traffic Presidency of the General Directorate of Security (EGM), a total of 288,610 accidents occurred in the first half of 2024 and 86.4%of these accidents took place in residential areas[3].

In addition to the accidents, both fatal and material damage, traffic also causes great damage in terms of time, money and the environment. According to the traffic index prepared by the Netherlands-based technology company TomTom, Istanbul drivers spend a total of 25 workdays a year in traffic, 13 of which are due to congestion. Of the 986 kg of carbon dioxide emissions per year, 283 kg are caused by congestion[4].

Finding solutions to these detrimental consequences of traffic has become one of the primary objectives of many actors, from consumers and investors to businesses and municipalities[5]. With the development of aviation and artificial

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1 World Bank, 'Urban Development' (World Bank, 2023) <https://www.worldbank.org/en/topic/urbandevelopment/overview#1> accessed 30.09.2024.

2 Turkish Statistical Institute, 'Road Traffic Accident Statistics, 2023' *TÜİK* (16.05.2024) <https://data.tuik.gov.tr/Bulten/Index?p=Karayolu-Trafik-Kaza-Istatistikleri-2023-53479> accessed 1.08.2024.

3 Traffic Presidency of the General Directorate of Security, 'Traffic Statistics Bulletin' *EGM* (June 2024) <https://www.trafik.gov.tr/istatistikler37> accessed 1.08.2024.

4 TomTom Traffic Index, 'Istanbul Traffic' *TomTom* (last updated 2.08.2024) <https://www.tomtom.com/traffic-index/istanbul-traffic/> accessed 2.08.2024.

5 Jeffrey J Immel and Jonathan Alexander Langlinais, 'The Challenges to Urban Air Mobility' (2020) 33 Air & Space Law 16, 16.

intelligence technologies, Urban Air Mobility (UAM) is one of the solutions that is receiving growing attention. UAM represents a transformative and modern approach to urban transport, involving the use of airspace to alleviate traffic congestion on roads and its negative consequences, and as a rapid public transport solution, especially in metropolises[6]. This concept involves the use of electric vertical take-off and landing (eVTOL) aircraft and other innovative air technologies for the efficient and sustainable transport of passengers and goods[7]. These eVTOLs, essentially flying cars, are small electric aircraft capable of vertical take-off and landing from compact platforms like rooftops or barges, which have attracted significant investment in on-demand air transportation[8].

Investments and innovations in UAM technology have increased rapidly in recent years[9]. For example, with the Uber Elevate project launched in 2016, it is planned to offer flying taxi service in various cities and for this purpose, many eVTOL vehicles have started to be tested[10]. In 2019, Germany-based Volocopter successfully completed its first manned flight over Singapore's Marina Bay, marking a significant step towards bringing commercial air taxi services to the city[11]. In 2023, the Civil Aviation Administration of China (CAAC) issued a type certificate for EHang's EH216-S two-seat autonomous eVTOL aircraft, making it the first eVTOL vehicle in the world cleared for commercial use and allowing commercial passenger flights to begin in China[12]. Large companies such as Hyundai, Lilium and Airbus are also investing heavily in UAM technolo-

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6 Timothy M. Ravich, 'On-Demand Aviation: Governance Challenges of Urban Air Mobility ("UAM")' (2020) 124 Penn St L Rev 657, 659; Arif Tuncal and Suat Uslu, 'Kentsel Hava Hareketliliği Kavramının Gelişiminde İki Önemli Faktör: ATM ve Toplum' (2021) 23(41) KMU Journal of Social and Economic Research 564, 565.

7 Kevin Collareno, 'The Flight Path to Transportation Equity: How Legislators Can Ensure That Urban Air Mobility Delivers Inclusive Transportation Services' (2023) 2023 U Ill L Rev 639, 641; Ravich (n 6) 659; Tuncal and Uslu (n 6) 566.

8 Ravich (n 6) 659; Collareno (n 7) 644.

9 Collareno (n 7) 641.

10 Sneha Pandey and others, 'The Reality of Common Man's Dream of Air Lifting Uber Taxis' (2022) 7(7) International Journal of Mechanical Engineering 85, 86.

11 Editorial, 'Volocopter Air Taxi Flies Over Singapore's Marina Bay' *Volocopter* (22.10.2019) <https://www.volocopter.com/en/newsroom/volocopter-air-taxi-flies-over-singapores-marina-bay> accessed 2.08.2024.

12 Charles Alcock, 'China Issues the World's First eVTOL Aircraft Type Certificate to EHang's EH216-S Autonomous Vehicle' *Aviation International News* (13.10.2023) https://www.ainonline.com/news-article/2023-10-13/china-issues-worlds-first-evtol-aircraft-type-certificate-ehangs-eh216-s accessed 2.08.2024.

gies and working on innovative solutions that will revolutionise the urban transport of the future[13].

UAM has emerged as a result of advances in aviation technology, increased investment in the aerospace sector and growing demand for innovative mobility solutions[14]. Metropolitan cities are exploring UAM as an innovative solution to transportation-related urban problems such as traffic congestion, dependence on fossil fuel-dependent modes of transport, inefficient public transport systems, and air pollution[15]. In addition to the solutions to the problems mentioned above, positive externalities such as economic growth, creation of new employment opportunities and infrastructure development are also expected from UAM[16]. However, as with any technological development, these transformative innovations of aviation and urban transport require a robust legal and regulatory basis.

This study aims to reveal the adequacy of Türkiye's current regulations and the necessary areas of improvement for the safe, effective and sustainable integration of UAM. Therefore, the research question of this article is whether the existing aviation laws in Türkiye and international regulations are sufficient for UAM or whether new regulations are needed.

To answer this question, Chapter I analyses the existing aviation laws in Türkiye and their impact on UAM. Chapter II discusses international regulations and standards set by bodies such as the International Civil Aviation Organisation (ICAO) and the European Union Aviation Safety Agency (EASA). Chapter III analyses UAM regulations in pioneering countries on UAM. Chapter IV presents the lessons to be learned from international practices for Türkiye's UAM regulations, recommendations for improving existing regulations and strategies for developing new regulations.

By following the presented structure, this article aims to contribute towards identifying the current status and future needs of Türkiye's regulations

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13 Thom Patterson, '5 Ways eVTOL Got Bigger in 2021' *Flying* (last updated 9.02.2022) <https://www.flyingmag.com/5-ways-evtol-got-bigger-in-2021/> accessed 2.08.2024.

14 Volocopter GmbH, *The Roadmap to Scalable Urban Air Mobility, White Paper 2.0* (2020) 20 <https://static1.squarespace.com/static/5d27bb3e330ac30001dc14fd/t/6165c265c89c61365aa517f5/1634058869091/Volocopter+v2+Roadmap+to+Scalable+UAM.pdf> accessed 30.09.2024; Collareno (n 7) 647.

15 Collareno (n 7) 640; Immel and Langlinais (n 5) 16.

16 Ravich (n 6) 661.

regarding UAM and to shed light on the establishment of the necessary legal and regulatory frameworks for the successful integration of urban air mobility.

**Methodology and Research Limitations**

A comparative research methodology is primarily used in this article to assess Türkiye's ability to address the challenges that may arise under the UAM concept. It analyses existing Turkish aviation regulations and instructions, as well as the work and documents of organisations such as ICAO and EASA.

The article also includes secondary data from legal literature, official reports and best practices from the United States, Germany and Japan. The comparative analysis method is used to identify the regulatory gaps in Türkiye's aviation law framework on the addressed topic. This method helps to analyse the lessons learned from global pioneers in UAM governance and to provide practical recommendations that are relevant to Türkiye's legal and operational needs.

Although following a global comparative methodology, this study has several limitations. Firstly, although the article draws on international and various national legal regulations, studies and reports of international organisations, it may not fully reflect the practical challenges faced by industry stakeholders in the implementation of UAM. Field research, such as interviews with industry experts and legislative authority, has not been carried out in this sector which has yet to establish itself in Türkiye.

Secondly, the discussion in the article focuses on the regulatory aspect of UAM and does not address the equally important technical or economic feasibility studies for the sector.

Thirdly, as UAM is a field that is directly linked to technology and innovations, the recommendations presented in this article may become outdated over time. Future work should therefore take into account an approach to monitoring emerging technology and the associated evolving regulatory environment and assessing their short- and medium-term impact. Recognising these limitations, this study aims to provide a basic framework for understanding the current state of UAM regulation in Türkiye and to encourage further research to fill these gaps.

## I. Existing Aviation Law in Türkiye and UAM

### A. Overview of Aviation Law in Türkiye

Türkiye's aviation law is a synthesis of international standards and national regulations, aiming to ensure safety, order, and efficiency in the civil aviation sector. This structure is underpinned by a series of agreements and laws that define Türkiye's position and obligations within the international aviation community. One of Türkiye's main documents in the field of aviation law is the Chicago Convention[17]. Türkiye adopted Law No. 4749 on 5.06.1945[18], ratifying the International Civil Aviation Convention and the Interim Convention on Civil Aviation, which were signed in Chicago in 1944, along with their annexes[19]. By doing so, Türkiye committed to adhering to the regulations in the field of international civil aviation[20].

This convention, which was prepared to regulate international civil aviation in the aftermath of World War II, led to the establishment of ICAO and set out the basic principles to meet the need for inter-state cooperation and regulation in the field of civil aviation[21]. The Convention contains binding provisions for states on issues such as civil air transport, use of airspace, flight safety, air traffic management, and aviation safety[22]. Türkiye's being a party to this convention necessitates the harmonisation of national aviation policies with international standards[23].

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17 Convention on International Civil Aviation (signed 7.12.1944, entered into force 4.04.1947) 15 UNTS 295 (Chicago Convention).

18 Law on the Ratification of the International Civil Aviation Interim Agreement and Its Annexes, Concluded and Signed in Chicago on 7.12.1944, Official Gazette of the Republic of Türkiye, 7.10.1945/ 6029.

19 For further information on Chicago Convention and the development of international aviation law, see, Yaya Kareng, 'International Aviation/ Airspace Law An Overview' (2020) 4(1) International Journal of Law Reconstruction 56; S G Sreejith, Lakshmi Srinivasan and Vistasp Irani, 'The Philosophy of International Aviation Law' (2023) 33 Ind Int'l & Comp L Rev 169.

20 Şenol Kurt and Oğuzhan Ün, 'İnsansız Hava Araçları (İHA) Üzerine Hava Hukuku Açısından Bir Değerlendirme' (2015) 2 ERÜHFD 195, 200.

21 Kapila De Silva, 'Laws Governing Military Aircraft under International Aviation Law and International Humanitarian Law: A Critique' (2023) 3 KDU Law Journal 1, 10; Assad Kotaite, 'ICAO and the Development of Air Transport' (1980) 52 (2) Aircraft Engineering and Aerospace Technology 17, 18.

22 Charles S Rhyne, 'International Law and Air Transportation' (1948) 47 (1) Michigan Law Review 41, 46; Kotaite (n 21) 19.

23 Ayhan Sorgucu, *Hava ve Uzay Hukuku* (6th edn, Adalet 2024) 104.

In addition to the international regulations based on the Chicago Convention, Türkiye's aviation law system is also supported by various regulations at the national level. The Turkish Civil Aviation Law, which forms the basis of this framework, was adopted on 19.10.1983 and published in the Official Gazette as Law No. 2920[24]. The Turkish Civil Aviation Law was established to ensure the orderly, safe, and efficient conduct of civil air transport activities in Türkiye's airspace[25]. The Law emphasises Türkiye's full and exclusive sovereignty in its airspace and regulates matters such as the principles of internal line agreements, contracts for the use of aircraft, liability arising from the contract of carriage, penal provisions, and enforcement[26].

Aeronautical Information Publication (AIP) Türkiye is another important document created to regulate aviation activities in Türkiye and to ensure the flow of information[27]. AIP Türkiye is an official publication containing all the information required for civil aviation activities in Turkish airspace and provides comprehensive data on airports, air traffic services, flight operations, and other aviation-related information in Türkiye[28]. AIP Türkiye is prepared and continuously updated in accordance with the requirements set out in Annex 15 of ICAO[29]. This publication enables the provision of information necessary for the safe and efficient conduct of civil aviation operations and ensures harmonisation between national and international flight operations[30].

The Directorate General of Civil Aviation (DGCA) is the main authority implementing and supervising civil aviation regulations in Türkiye[31]. DGCA was

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24 Turkish Civil Aviation Law No: 2920, Official Gazette of the Republic of Türkiye, 19.10.1983/ 18196.

25 Kurt and Ün (n 20) 202.

26 ibid.

27 AIP is a key aviation document that is developed and issued by each country's aviation authorities in collaboration with ICAO. See, Sinan Sami Akkurt, 'Sivil Havayolu ile Yolcu Taşımacılığından Kaynaklanan Hukuki Sorumluluk' (PhD thesis, Selcuk University 2014) 127.

28 To access the website see, <https://www.dhmi.gov.tr/Sayfalar/aipturkey.aspx> accessed 19.09.2024.

29 International Civil Aviation Organization, *Annex 15 to the Convention on International Civil Aviation: Aeronautical Information Services* (16th edn, ICAO 2018).

30 Sorgucu (n 23) 106; Akkurt (n 27) 127.

31 Established in 1954 under the Ministry of Transport, the 'Department of Civil Aviation' was renamed as the 'Directorate General of Civil Aviation' in 1987. DGCA, 'History' (*DGCA*) <https://web.shgm.gov.tr/en/kurumsal/1-history> accessed 19.09.2024.

established in 1954, and its duties include ensuring that all civil aviation activities in Türkiye are carried out in accordance with national and international legislation, ensuring aviation safety and security, implementing environmental protection standards, and supporting the development of the sector[32]. The organisational structure, duties and powers, and service units of the DGCA are regulated in Section 31 of Presidential Decree No. 4[33]. DGCA is authorised in areas such as flight safety, air traffic management, airport management, aircraft registration and certification procedures, aviation training, and licensing in line with the Turkish Civil Aviation Law and related legislation[34].

Another important duty of DGCA is to ensure compliance with international agreements to which Türkiye is a party and to implement the regulations required by these agreements. In this context, DGCA is responsible for fulfilling Türkiye's obligations under other international aviation agreements, particularly the Chicago Convention[35]. Furthermore, DGCA works in cooperation with all parties operating in the sector and contributes to the development of aviation policies to ensure the sustainable development of the civil aviation sector in Türkiye[36].

As a result, Türkiye's aviation law is a comprehensive system combining compliance with international standards and national regulations to ensure the safe, orderly, and efficient operation of the civil aviation sector. Türkiye's accession to the Chicago Convention, the adoption of the Turkish Civil Aviation Law in 1983, the continuous updating of the Turkish AIP, and the effective inspection and regulatory activities of DGCA constitute the cornerstones of Türkiye's aviation law. These elements strengthen Türkiye's position in the international aviation community while at the same time ensuring the safe and efficient use of national airspace.

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32 Vildan Korul and Hatice Küçükönal, 'Türk Sivil Havacılık Sisteminin Yapısal Analizi' (2003) 3(1) Ege Academic Review 24, 27.

33 Presidential Decree on the Organization of Institutions and Organizations Affiliated, Related, or Associated with Ministries and Other Institutions and Organizations No: 4, Official Gazette of the Republic of Türkiye, 15.07.2018/ 30479.

34 Sorgucu (n 23) 107.

35 ibid.

36 Korul and Küçükönal (n 32) 27.

### B. Impact of Existing Regulations on UAM

As the concept of UAM gains attention, it becomes important to assess the impact of existing regulations on UAM operations. The existing regulatory framework, mainly shaped by the Turkish Civil Aviation Law and DGCA's instructions, forms the spine of aviation law in Türkiye. However, the extent to which the current system is able to meet the innovative demands of the UAM is a question mark. This section explores how existing regulations can address UAM and examines where they may intersect, emphasising the evolving needs of this innovative sector.

Article 3 of the Turkish Civil Aviation Law No. 2920 contains various definitions. In the article, the term 'aircraft' is defined as 'any vehicle capable of taking off and travelling in the air[37]'. In view of this definition, it can be argued that unmanned aircraft can also be considered within the scope of this Law, since the presence of a human being on the board of the aircraft is not required as a condition. Remote human supervision is similarly not specifically mentioned in the definition. Accordingly, unmanned aircraft, whether remotely controlled or autonomous, qualify as 'aircraft' within the scope of Law No. 2920.

Within the current regulations, the duties and authorities of two service units under DGCA are important for the concept of urban air mobility. These units are the Department of Airworthiness and the Department of Flight Operations. If the duties and authorities of the units are briefly explained;

- *Department of Airworthiness*[38]*:* Focuses on the technical suitability, maintenance, repair, design and production of aircraft. It undertakes technical tasks such as determining the airworthiness standards of aircraft and their parts, issuing, inspecting and, when necessary, cancelling documents and certificates in accordance with these standards. It determines the qualification certificates of technical personnel, and the training standards required by these personnel. It audits training organisations and assesses their international conformity.
- *Department of Flight Operations*[39]*:* Focuses on issues related to flight operations and operational regulations. It manages operational processes

[37] Turkish Civil Aviation Law (n 24) Art. 3/b.

[38] Presidential Decree No. 4 (n 33) Art. 441/a.

[39] ibid Art. 441/b.

such as inspecting aviation activities other than maintenance, repair, design and production, the operational compliance of civil aviation enterprises and airspaces open to civil air traffic and granting the necessary permits in these areas. Carries out licence and certification procedures of operational personnel. It determines the training and health standards of these personnel and authorises training institutions.

As described earlier, urban air mobility is a concept that recognises the use of advanced types of aircraft, such as unmanned aircraft, for air transport in and nearby urban areas. This innovative transport system requires novel additions to existing civil aviation organisations. Although the duties and powers of these two service units of DGCA do not directly refer to the UAM concept, some inferences can be drawn from the general framework and these units can fulfil various roles for UAM.

Considering the duties and authorities of the Department of Airworthiness, this department is expected to set technical conformity, airworthiness and safety standards for UAM vehicles. This department is expected to undertake tasks such as the inspection and certification of the conformity of the airframe, engine, battery systems, flight control software and other technical components of UAM vehicles with national and international standards.

This department also authorises institutions involved in the design, production, and maintenance of UAM vehicles, ensuring these processes adhere to appropriate standards. This department is also responsible for issuing, auditing and, if necessary, cancelling design approvals for new technologies and vehicles. In addition to these, the determination of the training standards required for the personnel maintaining UAM vehicles and the supervision of the organisations training these personnel are also within the competence of this department. The management of the certification processes of technical personnel requiring a certificate of competence is also included in this scope.

The Department of Flight Operations is responsible for the operational permits and licences required for the safe operation of UAM operations in urban airspace. This is because a proper determination of urban flight paths, airspace utilisation rules and flight safety requirements is critical to ensure that UAM aircraft operate in harmony with other aircraft. More precisely, the supervision of the flight safety of UAM vehicles and making the necessary arrangements to ensure the safe movement of these vehicles in the urban airspace, the integration of these vehicles with air traffic and the determination

of operational rules to prevent collisions fall within the scope of the duties and powers of this department.

Like the Department of Airworthiness, the Department of Flight Operations will be responsible for various training programmes. However, unlike the former, the latter manages the necessary training and certification processes for pilots and operators using UAM vehicles. It supervises the competence of the operators and ensures that operations are carried out in accordance with international standards.

It may also undertake the tasks of determining the take-off and landing areas to be used by UAM vehicles, taking security measures and regularly inspecting these areas. This task ensures that UAM vehicles take off and land safely from the designated points.

In order to minimise social disturbance while taking advantage of new technology, the Department of Flight Operations may also implement certain standards and restrictions to control noise and environmental impacts arising from the use of UAM vehicles in urban areas. It is important that noise and emission standards are set, and the necessary regulations are made to ensure more sustainable air transport within the urban area.

The Department of Flight Operations has also started to prepare various instructions in accordance with these duties and powers. The Instruction issued in April 2018 regulates flight and duty time limitations and rest requirements for air taxis[40]. Air taxis play a critical role in the future of urban mobility with their potential to reduce traffic congestion, shorten travel times and contribute to sustainable transport in urban transport within the scope of UAM. Therefore, it is appropriate that this Instruction has been introduced in order to safeguard the rights of the personnel who will serve in these vehicles.

In another Instruction issued in September 2024, the Department regulated the procedures and principles regarding the licensing and authorisation of persons who will operate as pilots in vertical take-off aircraft[41]. In this Instruction, a vertical take-off aircraft, which is an important concept for UAM, is de-

[40] DGCA, Instruction on Flight and Duty Time Limitations and Rest Requirements for Air Taxi and General Aviation Operators (SHT-FTL/HG) 13.04.2018.

[41] DGCA, Instruction on Licensing of Airplane, Helicopter, Vertical Take-off Aircraft, and Airship Pilots (SHT-FCL) 4.09.2024.

fined as ‘an aircraft capable of vertical take-off and travelling/elevating in the air by means of rotors with variable geometry or engines/propulsion devices on its fuselage or wings’.

### C. Gaps and Deficiencies in Existing Regulations

The comprehensive nature of Turkish aviation’s legal framework is regrettably inadequate to address the rapidly evolving concept of UAM. Significant gaps and deficiencies in the existing regulatory framework emphasise the need for targeted reforms and require the introduction of new standards that can adapt to the unique challenges of UAM operations. Although existing regulations, such as the laws and instructions discussed in the previous section, provide a basic legal structure, they do not sufficiently cover the specificities required for the UAM concept, leading to regulatory uncertainty and potential operational risks.

To start with, the lack of regulations specific to the UAM concept in Turkish aviation law is striking. Although Turkish Civil Aviation Law includes a broad definition of ‘aircraft’ which could theoretically include remotely controlled or autonomous unmanned aircraft, the technical and operational differences of UAM are not specifically addressed. Fundamental issues such as flight path planning in urban areas, integration with existing air traffic control systems, and lower airspace management are not regulated in depth. This leads to significant uncertainties in terms of the operations that can be authorised for UAM operators in the future and compliance standards.

Furthermore, the current regulatory framework does not address safety and certification standards specifically tailored for UAM vehicles to the extent required. Although the Department of Airworthiness monitors airworthiness and safety standards in broad terms, it should be noted that the current protocols are designed for conventional aircraft and not for new technologies of UAM vehicles such as eVTOL aircraft. The lack of specific design, manufacturing and maintenance criteria for UAM vehicles leaves regulatory gaps that could jeopardise not only safety but also public acceptance.

In addition, the regulatory scope for pilot and operator qualifications has limited applicability to UAM. Although there is an Instruction on the licensing of pilots of vertical take-off aircraft issued by the Department of Flight Operations, this Instruction also covers airplane and helicopter pilots. In other words, it is observed that the standards for UAM vehicles are not regulated in depth.

The existing instructions on pilot certification do not fully recognise the new roles and responsibilities introduced by UAM operations, particularly with regard to vertical take-off and landing in dense urban environments.

Moreover, environmental considerations also present a gap in the existing regulations. Although the Department of Airworthiness is authorised to set noise and emission standards, there is no specific guidance in the current regulations on mitigating the environmental impacts of UAM. The Department has prepared an Instruction covering the airworthiness and environmental certification of all types of civil aircraft and/or products, parts and devices in the first month of 2024[42], but more specific and targeted regulations are required for UAM operations. With the potential for intensive operations in heavily populated areas, UAM is likely to raise concerns about noise pollution, air quality and general environmental sustainability that are not comprehensively addressed in the current legal framework. The lack of stringent environmental standards is a barrier to the widespread adoption of UAM technologies in urban environments.

Furthermore, the integration of UAM into existing airspace management systems is not adequately regulated. Existing Turkish aviation laws and DGCA Instructions do not provide clear guidelines on how UAM vehicles should coexist with conventional aircraft in controlled and uncontrolled airspace. If issues such as collision avoidance and communication protocols are not properly regulated, the risk of operational conflicts and safety issues will increase.

Lastly, the regulatory framework should also be adapted to address the cyber security and data privacy issues specific to UAM. As UAM relies heavily on sophisticated software, communication networks and data exchange between vehicles and ground control, the lack of robust cyber security measures could expose these systems to potential threats. This has the potential to threaten the safety and security of UAM operations.

In conclusion, Türkiye's existing aviation regulations, while providing an adequate system for conventional aviation activities, are still insufficient to address the unconventional challenges posed by UAM. The lack of specific UAM standards, the paucity of existing safety, environmental and operational regulations, and the absence of clear guidelines on airspace integration and

[42] DGCA, Instruction on the Airworthiness and Environmental Certification of Aircraft and Related Products, Parts, and Appliances (SHT-21) 2.01.2024.

cyber security will undermine preparation for the UAM concept, which has a very high potential to become part of daily life in a highly populated country like Türkiye in the near future. Addressing these gaps is crucial to ensure that Türkiye's regulatory environment evolves with the technological developments shaping the future of urban air mobility.

## II. Work of International Aviation Organisations

International aviation organisations have an important role to play in shaping and internationally harmonising the regulatory frameworks governing emerging aviation technologies such as UAM. As this new form of air transport develops rapidly, organisations such as ICAO and EASA have begun to work on this new concept. Both organisations ultimately focus on harmonising national regulations, establishing airworthiness and safety standards and ensuring public acceptance of these new technologies. This section of the article examines the work of these organisations and their contribution to the global regulatory environment for UAM.

### A. ICAO

ICAO, the most important global authority in a highly internationalised sector such as aviation, has started to carry out various research studies on the UAM concept. As some of the member states have already started to develop their own regulations, guidance and standards in this area, ICAO's role has evolved more towards harmonisation. For capacity building and harmonisation of different national standards, ICAO has been making several efforts on UAM by prioritising information sharing.

UAM was discussed in detail at the 40th session of the ICAO Assembly in 2019[43], as it is recognised as a new mode of air transport to address traffic congestion in congested cities[44]. During the meeting, it was noted that this type of air transport lacks established regulations due to the lack of ICAO Standards and Recommended Practices (SARPS) for this type of air transport[45].

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[43] The ICAO Assembly is the supreme authority of the organization. It convenes at least once every three years, organized by ICAO's governing body, the Council. The 40th Session of Assembly of ICAO was held between 24.09.2019-4.10.2019.

[44] ICAO, *Assembly - 40th Session Executive Committee: Urban Air Mobility* (Working Paper No A40-WP/292, EX/122, 27.07.2019) 1, 1, <https://www.icao.int/Meetings/a40/Documents/WP/wp_292_en.pdf> accessed 2.10.2024.

[45] ibid 2.

Similarly, the different approaches to certification between different design situations was discussed as another issue that needs to be addressed[46]. The meeting also discussed the potential environmental concerns related to unmanned operation and noise levels, particularly due to the nature of the operation being close to public and urban areas[47].

In 2022, the 41st Assembly was convened[48]. At this Assembly, the UAM was discussed in much more detail than at the previous General Assembly and more effective conclusions were reached. It was stated that eVTOL vehicles and digitised air traffic management will provide future mobility for passengers and goods in cities[49]. The meeting emphasised that public acceptance of UAM operations is an important factor that will determine the future success or failure of this sector[50]. It was also highlighted that uncertainties in the management of low level airspace create a multi-level governance problem[51]. The session presented recommendations such as exploring the modernisation of the airspace legal framework for UAM services and integrated mobility, assessing the impact of existing ICAO annexes on low-level airspace management and developing an action plan[52].

At the Assembly meeting, it was suggested that a new expert group should be established to meet the demands of UAM/Advanced Air Mobility (AAM[53]) and that States should provide co-operative support[54]. Ultimately, these efforts led to the establishment of the Advanced Air Mobility Working Group (AAM

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46 ibid.

47 ibid.

48 The 41st Session of Assembly was organised between 27.09.2022-7.10.2022.

49 ICAO, *Assembly - 41st Session Executive Committee: Legal and Societal Stakes for the Emerging Air Mobility in Metropolitan Areas* (Working Paper No A41-WP/110, EX/50, 27.07.2022) 1, 1, <https://www.icao.int/Meetings/a41/Documents/WP/wp_110_rev_en.pdf> accessed 2.10.2024.

50 ibid 2.

51 ibid 3.

52 ibid 1-4.

53 Advanced air mobility is an extended version of UAM and includes air transport services to non-urban, rural and remote areas.

54 ICAO, *Assembly - 41st Session Technical Commission: Need for Guidelines and Regulatory Framework for Development of Urban Air Mobility/Advanced Air Mobility (UAM/AAM)* (Working Paper No A41-WP/292, TE/112, 5.08.2022) 1, <https://www.icao.int/Meetings/a41/Documents/WP/wp_292_en.pdf> accessed 2.10.2024.

SG) within ICAO[55]. Since the 41st ICAO Assembly recognised the need for a globally harmonised framework for AAM, ICAO's leadership in this effort was supported. The AAM SG has the mission to help develop a comprehensive vision and framework, working with other expert groups to ensure the safe, efficient and sustainable integration of AAM operations[56]. It also has the mandate and authority to advise ICAO on all AAM related activities[57].

Since this Assembly in 2022, ICAO has been inviting aviation experts on UAM and organising various scientific activities[58]. In the light of these activities and the work of the study group, ICAO is expected to provide SARPs with valuable insights on urban air transport in the near future.

**B. EASA**

One of the regions that has contributed most to the technological development of UAM is Europe. Various European-based manufacturers have applied for certification and EASA is working with these manufacturers on the airworthiness of the vehicles[59]. While realising these technological advances, the European Union, and EASA in particular, have also taken important steps in terms of both social expectations and regulations.

Since UAM, as its name suggests, represents a concept that is in direct contact with urban life and people, social trust is very important. While carrying out its regulatory work, EASA has also undertaken a comprehensive study to understand the public's view and expectations of this new concept and technological breakthrough[60]. The comprehensive study, conducted between

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55 ICAO, 'Advanced Air Mobility Study Group (AAM SG)' (ICAO, 2023) <https://www.icao.int/safety/UA/Pages/Advanced-Air-Mobility-Study-Group-(AAM-SG).aspx> accessed 2.10.2024.

56 ibid.

57 ibid.

58 See for examples, ICAO, 'Multi-level Governance of Urban Air Mobility (UAM)' (ICAO Innovation Series, 9.06.2024) <https://www.icao.int/Meetings/innovation-series/Pages/Multi-governance-of-UAM.aspx> accessed 2.10.2024; ICAO, 'First Advanced Air Mobility Symposium (AAM 2024)' (9-12 September 2024, Montréal, Canada) <https://www.icao.int/Meetings/AAM2024/Pages/default.aspx> accessed 2.10.2024.

59 EASA, 'Urban Air Mobility (UAM)' <https://www.easa.europa.eu/en/domains/drones-air-mobility/drones-air-mobility-landscape/urban-air-mobility-uam> accessed 12.08.2024.

60 EASA, 'Study on the Societal Acceptance of Urban Air Mobility in Europe - Full Study Report' (19.05.2021) <https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf> accessed 12.08.2024.

November 2020 and April 2021, used a literature review, local market analysis, surveys and interviews to investigate EU citizens' attitudes, expectations and concerns regarding UAM[61]. The study revealed information that will help EASA to shape its current and future regulatory framework.

The study found that public interest is one of the most important aspects affecting public acceptance[62]. Use cases that benefit the community, such as medical or emergency transport or connecting remote areas, are better supported[63]. Furthermore, the main benefits expected from UAM are faster, cleaner and extended benefits[64]. Regarding concerns, EU citizens stated that they would like to limit their exposure to safety, noise, security and environmental impacts[65]. The results also show that confidence in the security and cyber security of the UAM is limited, which will require further measures[66].

Based on the results of this study on social acceptance, EASA published a Special Condition to authorise small VTOL aircraft operations in June 2024[67]. This document, the first of its kind in the world to be published by EASA, details the specific technical requirements and airworthiness standards for the certification of small category vertical take-off and landing aircraft[68]. This condition is deemed necessary because VTOL-capable aircraft differ significantly from conventional rotorcraft or fixed-wing aircraft, which do not fully comply

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61 The study was conducted in collaboration with the consulting firm McKinsey & Company and the Arup Sound Lab. See for detailed survey results, EASA, 'Urban Air Mobility Survey Evaluation Report' (2021) <https://www.easa.europa.eu/sites/default/files/dfu/uam_detailed_survey_evaluation.pdf> accessed 12.08.2024.

62 EASA, 'Study on the Societal Acceptance of Urban Air Mobility in Europe - Summary Study Report' (May 2021) <https://www.easa.europa.eu/sites/default/files/dfu/uam-short-report.pdf> accessed 12.08.2024.

63 ibid 8.

64 ibid 9.

65 ibid 10.

66 ibid 15.

67 The term 'Special Condition' refers to additional requirements set by EASA for aircraft with new or innovative technologies that are not fully covered by existing certification standards. EASA, 'Special Condition for VTOL and Means of Compliance' (10.6.2024) <https://www.easa.europa.eu/en/document-library/product-certification-consultations/special-condition-vtol> accessed 12.08.2024.

68 Full text available here, EASA, 'Special Condition Vertical Take-Off and Landing (VTOL) Capable Aircraft' (Doc No SC VTOL 02, Issue 2, 10.06.2024) <https://www.easa.europa.eu/en/downloads/139946/en> accessed 12.08.2024.

with existing certification specifications[69]. Due to the unique design and operational characteristics of VTOL capable aircraft, they are assessed under these special conditions and their compliance with safety and performance criteria is ensured[70].

The Condition contains various technical standards for VTOL aircraft. For example, in accordance with VTOL.2130, landing performance should be determined taking into account critical flight parameters and landing area requirements should be calculated accordingly[71]. Furthermore, VTOL.2235-2265 defines the procedures that should be developed for structural resilience and emphasises that these procedures should prevent structural failures that could lead to serious injury or loss of the aircraft[72]. The Condition also mandates advanced technical requirements, such as VTOL.2520, which ensures that electrical and electronic systems are protected against high intensity radiation fields and that these systems can operate safely in such conditions[73]. These standards are intended to address the new challenges posed by the innovative design of VTOL aircraft and to ensure their safe and effective certification.

Apart from airworthiness, EASA has also developed an innovative regulatory package for the integration of drones into European airspace, known as U-Space/UTM (Unmanned Traffic Management). This package, which was adopted by the European Commission in April 2021, includes three key Commission Implementing Regulations:

- Commission Implementing Regulation (EU) 2021/664[74]: It sets out rules and procedures for the safe operation of these vehicles within U-Space, a specialised airspace designed specifically to manage drone traffic in urban environments. It focuses on the provision of U-Space services such as network identification, geographical awareness and traffic information to ensure the safe integration of drones as well as manned aircraft.

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69 ibid 1.

70 ibid 6.

71 ibid 9.

72 ibid 14-16.

73 ibid 25-26.

74 Commission Implementing Regulation (EU) 2021/664 on a regulatory framework for the U-space [2021] OJ L 139, 23.4.2021, 161-183.

- Commission Implementing Regulation (EU) 2021/665[75]: Amends the existing Air Traffic Management (ATM) and Air Navigation Services (ANS) regulations (EU 2017/373[76]) to accommodate the inclusion of drones in the airspace. It is a regulation for the safe and efficient coexistence of both manned aircraft and drones by harmonising the roles of traditional air traffic management with the emerging U-Space services.
- Commission Implementing Regulation (EU) 2021/666[77]: Amends Regulation EU 923/2012[78], which lays down the common rules of the air and operational provisions regarding services and procedures in air navigation, to include drone operations. This regulation aims to integrate drone operations into the wider aviation framework, ensuring consistency between regulations and improving the safety and operability of airspace missions.

This regulatory package is a world first in establishing a comprehensive framework for the safe and efficient integration of drones, especially in complex environments such as urban airspaces. This is an important clue and answer to the fact that drone operations will become widespread in Europe for commercial, private and official purposes. The Regulations aim to provide a clear legal and operational structure for this expanding use.

## III. UAM Regulations: Different Practices

Urban mobility is rapidly changing as a result of UAM, and various countries have put in place distinctive legal frameworks to encourage its expansion and integration. This chapter briefly reviews UAM developments and regulatory initiatives in three key countries: United States, Germany and Japan. These countries have been chosen for their leading roles and different approaches in shaping the future of UAM. This chapter aims to provide insights into other regulatory practices and innovations in UAM and to present good examples to assess and potentially improve Türkiye's UAM regulations.

The United States has established itself in UAM regulation both as a focal nation for technological developments and through the Federal Aviation Administra-

[75] Commission Implementing Regulation (EU) 2021/665 amending Regulation (EU) 2017/373 on air traffic management in U-space airspace [2021] OJ L 139, 184-186.

[76] Commission Implementing Regulation (EU) 2017/373 [2017] OJ L 62, 8.3.2017.

[77] Commission Implementing Regulation (EU) 2021/666 amending Regulation (EU) No 923/2012 on manned aviation in U-space airspace [2021] OJ L 139, 187-188.

[78] Commission Implementing Regulation (EU) No 923/2012 [2012] OJ L 281, 1-66.

tion (FAA), with comprehensive guidelines and a support system for innovation. Germany, as a central figure in the European Union, works closely with EASA to develop harmonised regulations affecting the wider European landscape. Japan represents the Asia-Pacific region with its proactive regulatory strategies and structured roadmap for integrating UAM into urban transport infrastructure.

Recent UAM regulatory developments in these three countries are analysed to gain insights into the lessons they offer for developing effective UAM frameworks worldwide. Similarly, Türkiye's initiatives in this area can be modelled on these good practices.

### A. United States

US aviation law regulates different certification options available to manufacturers of UAM vehicles, depending on the type, design and intended use of the vehicle. These certificates are based on criteria set by the FAA. The most appropriate certification option for the UAM category is the Part 21.17(b) Certificate for novel aircraft[79]. This 'special class' category provides a relatively favourable framework, especially for electric aircraft capable of vertical take-off and landing, such as eVTOL[80].

Another option is the Part 23 Certificate[81]. This certificate provides performance-based standards for fixed wing aircraft and has been adapted to new technologies with the latest regulations[82]. However, this type of certificate may not fully meet the characteristics of new generation UAM vehicles such as vertical take-off and landing, which may require additional exemptions or special conditions. Similarly, the Part 27 Certificate applies to rotorcraft and is issued for helicopters weighing up to 7,000 pounds and with a passenger capacity of less than nine[83]. Although UAM vehicles have some similar characteristics to fall into this category, there may be situations that require special exemptions[84].

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79 FAA 14 CFR Part 21.17(b).

80 ibid.

81 FAA 14 CFR Part 23.

82 ibid.

83 FAA 14 CFR Part 27.

84 Apart from the mentioned certification options, there is another type. Small drone deliveries are part of the UAM ecosystem, albeit a minor one. These drones generally operate under Part 107 regulation and perform commercial delivery tasks. See, FAA 14 CFR Part 107.

In addition to the certification required by manufacturers for aircraft, eVTOL operators are required to obtain certification for the operations they wish to conduct. Those wishing to operate with vehicles such as eVTOLs as part of the UAM must begin the 135 Certification process as prescribed by the FAA[85]. Operators wishing to obtain this certification from the FAA must carefully evaluate their operational intentions in three different categories: type, kind and scope. First, under type, applicants must decide whether to apply for an Air Carrier Certificate, which allows interstate or international operations, or an Operating Certificate, which allows operations only within the same state[86]. Secondly, under the kind category, applicants will choose either On-Demand[87], which allows unscheduled UAM flights[88], or Commuter, which allows both (unlimited) scheduled and on-demand operations[89]. Third and finally, the scope of operations is defined through the FAA's issuance of Operations Specifications (OpSpecs). The scope can vary significantly depending on whether the operator chooses to be a Single Pilot, Single Pilot-in-Command, Basic, or Standard Part 135 operator, each category offering different levels of operational flexibility[90].

American scholars have criticised the high costs and time-consuming nature of US UAM regulations[91]. Indeed, more flexible and up-to-date regulations are needed to meet the needs of the rapidly developing UAM sector, of which the US is a pioneer. However, even in its current form, Türkiye can learn important lessons from FAA regulations. These performance-based certification systems, adaptable to innovative technologies, contribute to the safe integra-

85 FAA 14 CFR Part 135 Air Carrier and Operator Certification: 1. General Information. Available at <https://www.faa.gov/licenses_certificates/airline_certification/135_certification/general_info> accessed 30 September 2024.

86 ibid, Types of 14 CFR 135 Operations.

87 On-demand operations can be carried out using airplanes with a seating capacity of 30 passengers or fewer, a maximum payload of 7,500 pounds, or any type of rotorcraft. See, ibid, Kinds of 14 CFR 135 Certificate Operating Authorities.

88 On-demand certificate holders may conduct limited scheduled operations but are restricted to fewer than five round trips per week on a single route, cannot use turbo-jet aircraft, and are limited to airplanes with a maximum of 9 passenger seats. See, ibid, Kinds of 14 CFR 135 Certificate Operating Authorities.

89 For operations such as air taxi, the On-Demand category may be sufficient, but for scheduled air transport, such as urban metro or bus transport, applicants are required to apply for the Commuter category.

90 FAA 14 CFR Part 135 Air Carrier and Operator Certification: Scope of Part 135 certificates.

91 According to Collareno, these costs also lead to social injustice in the form of transport inequity. See, Collareno (n 7) 649.

tion of UAM vehicles. Special class regulations, such as Part 21.17(b), provide airworthiness standards tailored to the characteristics of each vehicle, allowing emerging technologies to enter the market faster. It would be beneficial for Türkiye to adopt an adaptive structure to reduce the complexity of existing certification systems and pave the way for new technologies while establishing regulations for UAM. However, unlike in the US, accelerating processes and reducing costs are of great importance for a rapidly developing sector.

### B. Germany

Germany plays an important role in the advancement of UAM owing to its strong technological infrastructure and pioneering companies such as Volocopter and Lilium, which are leading the development of high-end eVTOL aircraft and setting new standards for urban air mobility. In order to integrate these technological developments, Germany is implementing various practical applications. In this framework, cities such as Aachen, Hamburg, Ingolstadt and North Hesse have been identified as model cities within the scope of UAM[92]. These cities have established their own visions, strategies and methods and regularly exchange information and carry out multidisciplinary projects[93]. The support programmes of the German Ministry of Digital and Transport (BMDV) also promote the development of UAM and provide financial support for various projects[94].

Projects in the context of integration are one of the approaches adopted by the German government. The BMDV has presented awards to seven innovative drone projects supported with funds worth EUR 4.3 million[95]. These projects cover topics such as air traffic safety, data availability, individual and sustainable mobility, life-saving and logistics of rural areas[96]. With a total budget

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92 The memorandum of understanding for cooperation with these model cities was signed by BMVI on 28.06.2021.

93 Editorial, 'German government signs cooperative UAM agreement with cities and regions' (*Unmanned Airspace*, 2.07.2021) <https://www.unmannedairspace.info/urban-air-mobility/german-government-signs-cooperative-uam-agreement-with-cities-and-regions/> accessed 7.08.2024.

94 ibid.

95 Press Release, 'BMDV fördert innovative Anwendungen mit Drohnen' (*BMDV*, 28.09.2022) <https://bmdv.bund.de/SharedDocs/DE/Pressemitteilungen/2022/074-wissing-drohnenfoerderung.html> accessed 7.08.2024.

96 The funded projects include AMICA for emergency drone use with real-time data (100,000 euros); DroLEx for rural goods delivery via drones and cargo bikes (430,000 euros); Liqui-Drone for extending drone flight with a hydrogen tank system (892,000 euros); CATS for fly-

of EUR 15 million, the *'Innovative Luftmobilität'* funding programme aims to enable UAM to offer practical solutions in various fields. Selected projects include innovative solutions such as the use of drones in emergency scenarios, fast and reliable delivery of daily essentials to rural areas, development of crash test standards for flying taxis, mobile measurement systems for the detection of air pollutants, automation of risk assessments of drone flights and digital twin-based airspace management for AAM[97].

In Germany, the legal basis of the UAM is created with the active participation of the BMDV. BMDV participates in legislative processes and prepares the necessary legal regulations for UAM[98]. These regulations cover urban air transport and the use of low-level airspace. In particular, legal arrangements are made to determine the urban infrastructure required for the integration of UAM, to meet legal and environmental requirements, safety requirements and to provide the necessary certifications.

The action plan *'Unbemannte Luftfahrtsysteme und innovative Luftfahrtkonzepte'* published by the BMDV aims to develop unmanned aircraft and innovative air transport concepts[99]. The plan also covers issues such as personal data protection, privacy and environmental protection and aims to make Germany a leading market in the drone economy[100].

### C. Japan

Japan is an outstanding candidate for UAM implementation due to an estimated 92%of its population being concentrated in urban areas and having

ing taxi safety and crash standards (99,000 euros); UnLuBW for air pollutant measurement drones (624,000 euros); AuRa for automating drone flight risk assessments (70,000 euros); and AMI-FlyingIN2Air for developing a drone and flying taxi airport (2.1 million euros). See, ibid.

97 ibid.

98 Memorandum für smarte Städte und Regionen zwischen den deutschen Modellstädten und -regionen für Urban Air Mobility (UIC²-DE), Stadt Aachen, Freie und Hansestadt Hamburg, Stadt Ingolstadt und Region Nordhessen sowie dem Bundesministerium für Verkehr und Digitale Infrastruktur (BMVI), 2. Available at <https://bmdv.bund.de/SharedDocs/DE/Anlage/DG/mou-drohneninnovationen-dokument.pdf?__blob=publicationFile> accessed 7.08.2024. The ministry was previously known as "*Bundesministerium für Verkehr und Digitale Infrastruktur*" (BMVI), but its name was changed to "*Bundesministerium für Digitales und Verkehr*" (BMDV).

99 ibid 2.

100 ibid.

the world's most populous metropolitan region, the Greater Tokyo area, with over 38 million residents[101]. In the first quarter of 2024, Japan established its first UAM centre. This centre was developed through a collaboration between AirX and Tsukuba Airlines. The UAM Centre is designed to meet the evolving needs of next-generation air mobility, encompassing pilotless eVTOL aircraft, helicopters, and private jets[102].

In response to this need and technological developments, Japan is working towards a regulatory framework that emphasises cooperation between the public and private sectors[103]. The Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) spearhead these efforts through the Public-Private Committee for Advanced Air Mobility[104]. This committee is responsible for overseeing the various working groups involved in the development of safety standards for aircraft and flight operations, pilot certification and operational regulations[105].

Japan's regulatory approach is based on existing aviation laws, including various adaptations to UAM technologies. The country seeks to develop its standards by taking into account Bilateral Aviation Agreements (BASA) with organisations such as FAA and EASA[106]. These standards include the classification of eVTOL aircraft under the Civil Aeronautics Law, which involves setting special conditions for type certifications based on aircraft performance, such as maximum take-off weights, number of seats, and intended use[107].

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101 Stephen Bridgewater, 'eVTOLs - set to be big in Japan?' *Royal Aeronautical Society* (Kyoto, 13.10.2023) <https://www.aerosociety.com/news/evtols-set-to-be-big-in-japan/> accessed 2.08.2024.

102 Joe Macey, 'Japan's First UAM Center Launched' *Advanced Air Mobility International* (22.03.2024) <https://www.aaminternational.com/2024/03/japans-first-uam-center-launched/> accessed 2.08.2024.

103 Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT), *Advanced Air Mobility in Japan 2021 -Our Development and Beyond* (2021) 1 <https://www.mlit.go.jp/koku/content/Advanced_Air_Mobility_in_JAPAN_2021.pdf> accessed 2.08.2024.

104 The Public-Private Committee on Enhanced Air Mobility was founded in 2018 to negotiate the development of a wide range of services such as passenger transport, scenic flights and air ambulance services within the country.

105 METI and MLIT (n 103) 1.

106 ibid 2.

107 ibid 13.

The AAM Roadmap in Japan includes short-term objectives for piloted eVTOL operations by 2025, with regulatory frameworks established for visual flight rules (VFR) operations and pilot certification requirements[108]. In the medium and long term, i.e. after 2025, the focus will shift to the development of regulations for remotely piloted and autonomous flights with improved levels of automation and increased flight route densities[109]. This structured and proactive approach aims to ensure the safe and efficient integration of UAM into Japanese society.

## IV. Lessons for Türkiye's UAM Regulations

### A. Key Lessons for Türkiye from International Regulations

As Türkiye develops its own UAM regulatory framework, the international standards examined in the previous chapters of this study and the practices of other states can be taken as examples. In the light of the experiences of pioneers in this field such as the USA, Germany, Japan and the work of international aviation authorities such as ICAO and EASA, Türkiye can be better prepared for the sui generis challenges that the UAM concept brings with it. Under this heading, before moving on to various recommendations, the main lessons that can be learnt from the practices examined in the study will be presented. These include the establishment of clearer safety standards, increasing public trust and acceptance of UAM technology, and the development of airspace management systems to facilitate and accelerate the integration of UAM operations with existing aviation operations.

The initial implication, as in almost every new technological field, is the need for specific regulations in this area. There is a strong need to establish specific safety and airworthiness standards for UAM vehicles. As observed in Europe, it is important to have certification requirements in line with the unique characteristics of eVTOLs and other UAM aircraft. EASA's Special Condition for VTOL aircraft, which describes new design and operational characteristics not covered by conventional aircraft standards, demonstrates the necessity for specialised regulatory criteria.

[108] ibid 10.

[109] ibid 10-12.

Another important lesson is to ensure public trust and acceptance of UAM technology. EASA's comprehensive study of social attitudes towards UAM has enabled regulatory authorities to better understand the public's concerns about safety, noise, environmental impact, privacy, etc. and to more accurately propose solutions. Turkish authorities can take these concerns into account and make them an early part of the regulatory process and facilitate a smoother integration of UAM technologies into urban environments.

Furthermore, the effective and safe management of low altitude airspace is another area that Türkiye needs to consider. Various applications such as Europe's U-Space framework and Japan's advanced air mobility initiatives can be considered as good practice examples for establishing airspace zones specialised for UAM vehicles and air traffic control systems that take into account these operations. Having such systems not only increases operational safety, but also enables manned and unmanned aircraft to operate seamlessly together in crowded urban areas. Türkiye can also benefit from digital solutions and advanced technology to effectively monitor and manage UAM traffic, which has a very high potential.

Finally, the proactive regulatory frameworks of the states modelled in this study emphasise the importance of strategies that are forward-thinking and responsive to the interests and needs of their society. Turkish regulatory authorities can start by creating guidelines for the integration of the UAM concept, such as Japan's Advanced Air Mobility Roadmap, and act as a pilot for the growth of the sector.

As a result, Türkiye's work on UAM regulations could be much more properly carried out by utilising international best practice recommendations and standards. Solidly established standards for safety and airworthiness, an approach that prioritises public acceptance, effective and efficient use of urban airspace are all vital for the proper integration of UAM into the Turkish urban transport system.

### B. Recommendations for New Standards and Regulation Enhancements

While Türkiye's existing regulatory framework is relatively adequate for aviation activities in the traditional sense, it appears inadequate to address the new and sui generis challenges of the new UAM concept. To fill this gap, both targeted changes to existing regulations and new standards and rules for UAM should be established. In this way, a country like Türkiye, with its large population and many metropolises, can meet the UAM concept that it will face in the near fu-

ture in a well-prepared form. In this section of the article, various suggestions on what strategies can be utilised to achieve these goals will be presented.

**1. Developing Specific Airworthiness and Safety Standards for UAM Vehicles**

One of the first and most critical steps to be taken for the UAM regulatory framework is the establishment of specific airworthiness and safety standards for new generation vehicles such as eVTOL aircraft. Many of the existing regulations are designed for conventional aircraft and do not address the different design, operational and technological characteristics of UAM vehicles. Standards such as EASA's Special Condition for VTOL aircraft or FAA's Part 21.17(b) should be developed to accommodate new innovations. This would provide clear regulatory guidance for the design, manufacture and operation of UAM vehicles in Türkiye and reduce uncertainties for both manufacturers and operators.

In developing requirements to cover technical features such as vertical take-off and landing capabilities, advanced propulsion systems and (semi/fully) autonomous operations, the DGCA may consider working in close liaison with technical experts and engineers with knowledge of the industry. Such co-operation would not only ensure that the standards introduced are in line with international best practice but would also provide a flexible framework for further developments in the future. The DGCA could even update its institutional legislation to add the preparation of UAM-related standards to the Department of Airworthiness' duties and powers.

**2. Enhancing Pilot and Operator Certification Processes for UAM**

Like airworthiness and safety standards, Türkiye's pilot and operator licensing process is generally designed for conventional aircraft and has limited suitability for UAM vehicles. What is required to overcome this deficiency is the establishment of licensing and training programmes tailored to the operators of these vehicles. This includes the creation of different categories for UAM specific licences, as well as training programmes addressing the operational differences of UAM vehicles, such as vertical take-off, landing in dense urban environments and integration with low altitude air traffic management systems.

The DGCA could start by revising the existing pilot certification instructions to include specific criteria for UAM pilots, such as flight simulation training for urban airspace, emergency response protocols and competence to operate autonomous or remotely piloted systems. Similar to Japan's approach to pilot certification, the development of comprehensive training standards for UAM

operators would ensure that personnel are adequately equipped to manage UAM operations. In this preparatory phase, DGCA could work with universities and private aviation training centres to develop UAM specific training modules. This will also fulfil the increasing demand for qualified personnel in the sector.

**3. Adopting a Phased Implementation and Testing Approach**

Considering the speed of technological developments in the UAM sector, although it is of great importance to close the regulatory gap, it will take time to create a solid structure. Legal borrowing of well-prepared foreign regulations may fill Türkiye's deficiency in this area in the short term, but it is likely to face other problems in the medium and long term. In order to avoid such an unfortunate outcome, Türkiye should adopt an approach based on real-world testing and feedback and develop a UAM regulatory framework with confident steps. Pilot projects and test flights in controlled areas can provide a safe operational environment for UAM technology with high public acceptance.

UAM test zones in well-defined urban areas will assist regulatory authorities with airspace governance strategies, safety protocols and public support. The knowledge gained from these trials will also help to face unexpected challenges earlier and allow for a dynamic regulatory environment.

In addition, a detailed survey could be carried out, similar to the one conducted by EASA, on the public attitude towards UAM operations and what the expectations and concerns of the public are. Since the UAM concept will be in close contact with crowded city life and therefore with people, this is very important for the public to accept this new technology and to find a place for it in their daily lives.

**4. Involving Stakeholder Collaboration and Public Consultation**

The drafting of UAM regulations should be inclusive, involving sector partners, aviation experts from both science and social sciences, industry representatives, aviation lawyers and, above all, the public. Methods such as inclusive surveys, periodic consultations, public hearings, etc. help to ensure that different perspectives on the issue can be shared and different concerns can be addressed. This ensures that Turkish UAM regulations are both technically sound and socially acceptable.

Furthermore, solid public-private co-operation will enable more effective sharing of knowledge and resources, stimulate innovation and accelerate the regulatory process. Collaboration with UAM technology developers, academic institutions and international regulatory authorities also helps to gain valuable

knowledge. In this way, it is more feasible for Türkiye to develop a future-proof regulatory framework that is flexible and adaptable to future innovations.

## Conclusion

In conclusion, this article has briefly introduced the concept of UAM and discussed whether Türkiye has an adequate aviation regulatory framework to ensure good operationalisation of this concept. Although the existing aviation regulations are relatively adequate for conventional air transport, they are not sufficient to address the sui generis problems created by UAM. Rapid developments in UAM technologies, such as eVTOL aircraft, make it necessary to have a legal framework that is both adaptable and far-sighted. As the concept is still new, it is not overdue for any action. Türkiye has the opportunity to develop a robust regulatory environment by learning from the work of international aviation organisations such as ICAO and EASA, and the approaches of leading countries in this field such as the US, Germany and Japan.

In developing the Turkish regulatory framework, it is a matter of debate whether existing regulations should be revised or whether a new industry orientated regulatory environment for UAM should be created from the ground up. Adapting and revising the existing aviation framework would allow for the gradual integration of UAM operations, and a practical solution could be achieved with established aviation rules. Another advantage of this approach could be a smoother and faster adoption of the UAM concept by stakeholders without the risks and disruptions of a completely new legal regime. On the other hand, if a separate and comprehensive regulatory environment centred on UAM is created, the sui generis difficulties of this new technological concept could be better addressed.

The decision ultimately depends on the sustainability and adaptability of the regulatory environment from a technological perspective as properly. A hybrid approach, i.e. both revising the existing framework as appropriate and creating new regulations for UAM, would offer the most appropriate way to proceed. By designing specific airworthiness and safety standards for UAM vehicles, improving the pilot and operator certification processes for these vehicles, and ensuring effective airspace management, Türkiye can make itself adequate to meet the demands of this emerging sector. Furthermore, a gradual and deliberate regulatory drafting process, active public participation and co-operation with a wide range of industry experts will ensure that the UAM is safely and sustainably integrated into Türkiye's urban transport infrastructure.

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