Report of the Drone Leaders' Group

in support of the preparation of
'A Drone Strategy 2.0 for a Smart and Sustainable
Unmanned Aircraft Eco-System in Europe'

26 April 2022

The information and views set out in this report are those of the Drone Leaders' Group and do not necessarily reflect the official opinion of the Commission.

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1. PREAMBLE

Europe has the ambition to lead the transition to a healthy planet and a new digital world. Two objectives deserve to be highlighted in this respect: first, the EU has set itself the clear climate objective of **becoming the first carbon-neutral continent by 2050**. Secondly, **the digitalisation of the economy** in order to strengthen its competitiveness and to empower people with a new generation of technologies. Achieving these twin goals will depend on the transport sector entirely playing its part, including the emerging drone sector. These two priorities are embedded in the Commission's Sustainable and Smart Mobility Strategy[1] adopted in December 2020. In addition, the European Commission has shown its willingness **to reinforce the EU's role as a geopolitical actor**, a position clearly endorsed by the Strategic Compass adopted in March 2022, with a clear objective to build a stronger and more capable EU in security and defence.

In the wake of the Sustainable and Smart Mobility Strategy, the Commission announced **the preparation of 'A Drone Strategy 2.0 for a smart and sustainable unmanned aircraft eco-system in Europe'** to be adopted by the end of 2022. This Drone Strategy should contribute to the objectives set out in the Strategy, but also to the 'Action plan on synergies between civil, defence and space industries'[2] which was adopted in February 2020, and which includes a '**EU Drones Technologies Flagship' project.**

The drone services market is constantly increasing in terms of companies and volume of operations. However, large segments of the market are not yet mature and there are several conditions that still need to be addressed for drone applications to be fully operational, safe and competitive.

Unmanned Aircraft Systems have been actively used in the defence sector for the last 30 years, but the European military market for drones remains less mature than in other continents, whilst the key contribution of military drones to future European Strategic autonomy is widely recognised.

On the civilian side, **Innovative Aerial Services (IAS)**[3] are quickly developing. They include aerial operations (surveillance, inspection, imaging, …), as well as a whole new emerging market called **Innovative Air Mobility (IAM)**[4] (international, regional and

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[1] Communication for a "Sustainable and Smart Mobility Strategy – putting European transport on track for the future", adopted in December 2020 including drone initiatives under flagship 7 (Innovation, data and artificial intelligence for smarter mobility).

[2] Communication for an "Action Plan on synergies between civil, defence and space industries", adopted in February 2021 including a "Drones Technologies" Flagship.

[3] According to EASA, IAS correspond to the set of operations and/or services that are of benefit to citizens and to the aviation market and that are enabled by new airborne technologies – the operations and/or services include both the transportation of passengers and/or cargo and aerial operations (e.g. surveillance, inspections, mapping, telecommunication networking).

[4] The concept of Innovative Air Mobility ('IAM') is to accommodate operations with novel aircraft designs (that do not automatically fall under one of the known categories, but which have VTOL capabilities for take-off and landing, specific (distributed) propulsion features, can be operated in unmanned configuration, etc.), that are conceived to offer a new air mobility of people and cargo, in particular in congested (urban) areas, based on an integrated air and ground-based infrastructure. IAM describes a diverse array of aircraft types (such as manned and unmanned), whose designs are enabled by ongoing innovations particularly in the areas of hybrid and electrification of propulsion systems, energy storage, lightweight materials, digitalisation and automation. These innovations have made

urban air mobility). These new vehicles represent a major development for the transport of freight and people, particularly within or out of urban environments that can contribute to reduce emissions and increase road safety, while providing new services to all communities.
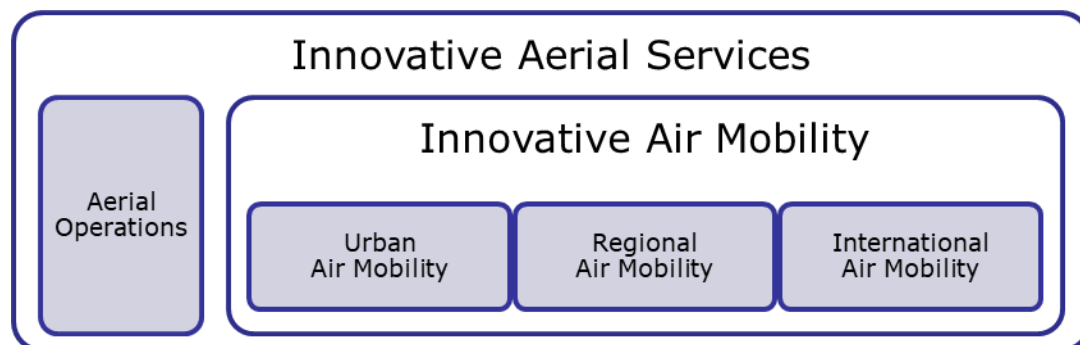
Figure 1 Innovative Aerial Services

For further reference in the following text, the term 'drones' will be used to cover all vehicles involved in Innovative Aerial Services including manned eVTOL, as well as Unmanned Aircraft Systems used in the defence sector.

The EU legislator, the Commission, the European Union Aviation Safety Agency (EASA) and the Member States all have an institutional responsibility to safeguard the safety, security and efficiency of drone operations. Developing new EU wide rules for drones is all the more important as there were very few regulatory frameworks in place in the EU Member States, as well as at the global level. Unlike in other sectors, where **the EU regulatory harmonisation process** started after the adoption at national level of sometimes longstanding and diverging regulations, here, it has been possible to start from the outset with a truly common set of rules. This is a quite unique opportunity that cannot be missed.

The EU is playing a key role in developing the right drone regulatory framework for its 27 Member States to unleash the development of this promising sector. DG MOVE has worked intensively since 2014 on building the foundations of a comprehensive EU policy in the field of drones. A first Communication setting out the foundations of this policy was adopted in 2014[5], followed by several major steps, such as the '**Aviation strategy for Europe**' of 2015[6] and several landmark Declarations endorsed at High Level drone conferences held in Riga, Warsaw, Helsinki, and Amsterdam[7].

There have been many significant technological, regulatory, and commercial developments during this period. The action plan contained in the 2015 Aviation Strategy has been largely completed and now it is time to chart an updated course for the EU

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possible an array of novel designs spanning multi-rotor, tilt wing, tilt-rotor, powered wing, offering short take-off and landing (STOL) through to vertical take-off and landing (VTOL) capabilities.

[5] Communication for "A new era for aviation Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner" (2014)

6 Communication for "an Aviation Strategy for Europe" (2015)

7 High Level Drone Conferences in Riga (2015), Warsaw (2016), Helsinki (2017), Amsterdam (2018, 2019)

policy on drones. Building on these achievements and in line with the Sustainable and Smart Mobility Strategy, the Commission wants to renew its strategic vision for the development of the drone sector in a new Drone Strategy 2.0. Greening mobility is the new licence for the transport sector to grow, and drones have a role to play here.

The Drone Strategy 2.0 should set out a **High-Level Vision** and an ambitious pathway, with concrete **objectives**, for the development of civil and defence drone platforms and services, in order to place Europe at a competitive world level.

2. THE DRONE LEADERS' GROUP COMPOSITION AND MANDATE:

In addition to DG MOVE's regular channels of consultations, such as the Drone Informal Experts Group, it was considered useful that the Commission should be assisted by a Group which could give a high-level steer to the development of the Drone Strategy 2.0 and provide recommendations for its drafting.

The Drone Leaders' Group ('the Group') was set up in September 2021 (see composition in annex 8.a) and held four plenary meetings between 20 October 2021 and 26 April 2022. Three hearings were organised in February-March 2022, to which the members of the Informal Drone Experts Group were invited (see timetable in annex 8.b).

These **three hearings** respectively addressed the following topics:

- Urban Air Mobility (cargo/passengers) and U-space
- Enhancing UAS services including the SME dimension
- Developing Military/Civil synergies and technology building blocks

Each of these hearings was chaired by two members of the Group and the conclusions of these hearings were presented to a plenary meeting of the Group and largely supported by its members. These conclusions are integrated in this final report.

Based on this work, the Group formulates the following Report, consisting of a high-Level vision and recommendations to assist the European Commission in the drafting of the Drone Strategy 2.0.

3. A HIGH-LEVEL VISION FOR DRONES IN 2030

The Group considers that any future EU Drone Strategy needs to be based on a clear vision of how success will look like in 2030. For this purpose, the Group agrees on the following High-Level Vision for a European drone eco-system in 2030:

By 2030 drones and their required eco-system will have become an integral part of the life of EU citizens and Member States.

They will be used to provide numerous services to the benefits of diversified civilian and defence end-users, including EU citizens, organisations, States, and industry. These aerial operations will include emergency services, inspections, and surveillance, using drones as flying Internet of Things (IoT) platforms to gather data, as well as for the delivery of goods.

IAM services will also have started to provide regular people transport services in various European cities and for some regional connections, initially using aircraft with a pilot on board but with the aim to fully automate their operations. Urban Air Mobility will have started to become an integral part of the future urban multimodal intelligent mobility ecosystem and the infrastructure enabling these services will be fully deployed and integrated.

The current U-space regulatory framework will have been completely rolled out in a seamless EU market. Additional advanced U-space services will support large scale highly automated and digitally connected affordable, safe, secure, and environmentally friendly unmanned aircraft operations in several Member States. The integration between manned and unmanned traffic in the same airspace will have been initiated, inside and outside U-space airspace.

The EU drone industry will become viable, and accessible to EU citizens and businesses with an active participation of actors of all sizes, including a variety of diversified SME's, fostering collaboration between all actors, and broadening the spectrum significantly beyond the limited number of global multinational stakeholders.

Civil-defence industry synergies will be systematically identified and exploited. They will benefit both sectors. They will improve the competitiveness of European industry and strengthen Europe's strategic autonomy, by allowing Member States to rely on competitive UAS technology of European origin.

All drone services will be provided in a manner that ensures safety, security, privacy, and affordability, in line with citizens' expectations and addressing their concerns. Drones used for the transport of people and goods will be particularly oriented to the achievement of publicly accessible services, thus creating benefits for citizens and local communities.

Drone services will effectively integrate or complement existing transportation systems and contribute to the decarbonisation of the transport system, while minimising their impact on the environment throughout their life cycle.

The drone eco-system thus created will provide jobs, promote, and protect European technological know-how and allow for growth opportunities for the EU economy as a whole, enabling European companies, including new SMEs to grow and flourish as global leaders.

4. SMART OBJECTIVES

The Group considers that it is necessary to formulate a set of SMART (Specific Measurable Achievable Reasonable Time-bound) objectives to be used to measure progress on achieving the Vision and the targets to be reached by 2030. In this regard, the Group agrees on the following set of objectives:

- Number of cities/regions that will be served by IAM regular commercial services *(Target for 2030: at least 45 in the EU and at least one per Member State)*
- Number of Member States where emergency health services (medical samples, defibrillators, air ambulances) will be provided using drones *(Target: services used in at least 20 Member States)*
- Use of European U-spaces Airspace by commercial drone flight operations *(Target: at least 100.000 a day)*
- Number of EU Member States where advanced U-space Services (additional to those defined in the current regulatory framework) are operational in at least one U-space. (*Target: at least 6 Member States*)
- Number of USSPs designated in each U-space airspace *(Target: at least 2)*
- Safety level achieved (Target: the ratio between the number of accidents vs the number of drone flights is as low as required for manned aviation)
- Aerodromes falling under the EASA Basic Regulation, cities with over 100.000 inhabitants, and critical infrastructures will have assessed the security risk related to drone incidents and put in place procedures and measures that will protect them from such incidents proactively and reactively *(Target: 100%)*
- Number of assessments run by the EIB "European Drone Investment - Advisory Platform" and number of loan agreements granted by European Investment Bank (EIB) to drone sector stakeholders *(Target: increased percentage respectively of 10%, year on year)*
- Carbon emissions of urban and regional IAM operations *(Target: 0%)*
- The civil and military drone technology used in Europe will be designed and/or produced in Europe *(Target: at least 50% of total value of drones used in Europe)*
- Number of Universities / Technical Schools that offer drones subjects or specialisations (*Target: at least 40 in the EU and one per Member States*).
- Turnover in the overall drone eco-system and its contribution to EU GDP (*Target: at least € 15 billion*)

5. FROM VISION TO REALITY

The drone technology ecosystem is an emerging and complex system of regulatory measures, enabling technologies and services provided to customers. The value chains and business models associated with U-space, Innovative Aerial Services including Innovative Air Mobility have not yet been fully implemented and to a large extent are still to be rolled out. Building on the approach taken in the 2015 Aviation Strategy, the Group is of the view that with the evolution of the sector, this renewed Drone Strategy should be further built on the **risk-based operation-centric approach** that has underpinned the development of the regulatory framework up to now.

Indeed, a wide spectrum of distinct types of drones and use cases have emerged in the past few years will coexist in the future, ranging from the use of small drones for inspection, Medium Altitude Long Endurance drones for defence and security operations, to the use of large eVTOL aircraft that will be used for the transport of people (and that will initially be operated by a pilot on-board). The Drone Strategy 2.0 should therefore recognise the differences and commonalities between these different scenarios and avoid taking a one-size fits all approach to all issues. In this respect, a drone **taxonomy**, i.e., a scheme of classification, in which the different possible UAS/IAM vehicles and operations are organised into distinct groups or types, would be helpful.

To deliver the Vision, the Group has identified **8 thematic areas** that should be addressed in the Drone Strategy 2.0 and made specific recommendations for each of them, with several measures aiming to address existing obstacles to the development of drone applications and transport services and to the competitiveness of this industry. In addition, the Group also proposes several concrete **objectives** aiming to measure progress towards the achievement of the main elements of this Vision in 2030.

6. SPECIFIC RECOMMENDATIONS

6.1. Drones value chains, business models and creating opportunities (including funding)

The B2B IAS value chain is composed of **several segments** which are all interlinked:

- Drone operators (service provider) performing Innovative Aerial Services;
- IAM operators offering innovative transport services;
- Drone manufacturers which produce the hardware. This activity may also include the assembly of some components produced by third parties;
- Producers of other payloads to be integrated to the drones, e.g., for filming, inspection, cargo, monitoring or measuring purposes;
- Technology providers for the platform who develop equipment and software systems whether for communication, control of the flight, situational awareness, or to enable specific or autonomous operations);
- Distributors selling or renting finished UAS to third companies;
- Ground infrastructure operators such as vertiports and airports;
- Air traffic management suppliers (e.g. ANSPs, U-space service providers, Common Information Service Providers);
- Telecommunication infrastructure providers, as well as navigation and surveillance infrastructure providers.
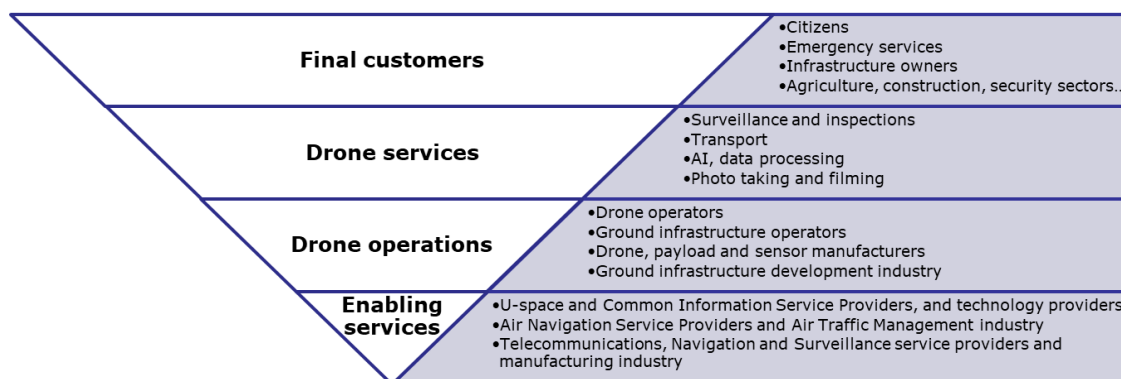
Figure 2 Drone value chain

Each individual link of the value chain needs in principle to be competitive to allow access by all industries potentially benefitting from drone operations and services, as well as final customers, and ultimately to provide societal value. The Group considers that the Drone Strategy should ensure that competitive forces in the **drone services market** as introduced by the existing rules will effectively make the use of drones affordable for final customers.

The **U-space service market** provides enabling services for automated and scalable drone operations and drone services, in urban environment, including for long distances. This enabler should be as **cost-effective** as possible, while providing **equitable access** to airspace for a diversity of drone operators from across the EU and enabling military and State manned and unmanned aircraft operations in a **safe and efficient manner**. The Group therefore considers it important that U-space services be provided by several U-

space Service Providers (USSPs) in competition. At the same time, clear rules are needed as regards the pricing of the Common Information Services (CIS) but also for the Air Navigation Service Providers (ANSPs) when they provide data to the U-space providers. In the absence of such rules, SMEs would be particularly affected which are a major actor for the development of the economic fabric encompassing U-space and private investments would stifled overall.

The markets for specific drone operations and services are relatively immature and currently **largely relying on research, innovation and testing activities**. Most of the funding for these activities has been and should continue to be provided by private entities, based on a clear business perspective. However, **EU support for research** in the drone sector is also being substantial in the past and critical for an early deployment. 320 projects relating to the drone sector were conducted under **Horizon 2020**, with a total budget of almost 980 million euros invested in the development or use of drones for innovative applications. The Group considers it important that such support is intensified, better flagged, and extended to promote cross-sectoral collaboration under the new **Horizon Europe** programme.

The ecosystem of companies operating in the civilian drone sector is mainly made up of small or very small companies. The provision of **specific financing schemes, intended for new business involving EU companies, including SMEs,** to support their research and innovation activities is particularly important. Collaborations with SME, supporting their development, may boost cross-cutting innovation. However, there are significant obstacles for SMEs to compete in the drone sector, especially as regards the transition from research and development to large-scale development and deployment. The need to foster more software development expertise and transfer of "invention to innovation" from academia/R&D into industry (e.g., academic tools need to become industrial tools) should be reflected in the Drone Strategy, so that industry can benefit from state of the art in Computer Science research design assurance and cyber security sandboxes.

Access to EU funding options and aid should be facilitated for SMEs. The Group recommends the implementation of measures aimed at simplifying the processes, ensuring easily and affordable access to information and allowing objective pre-qualifying criteria, to facilitate SMEs' participation to funded projects. Furthermore, in EU research funding applications process, a positive evaluation could be given to the incorporation of SMEs in consortium with larger companies. The R&D/admin costs should not be an entry barrier to engagement in EU funding programs.

To demonstrate technological progress and, gain practical experiences and support collaborative deployment efforts overcoming "first mover disadvantages", the Group considers that **EU wide demonstration programmes** would be essential. If European champions are to emerge, it is essential that they can grow beyond national boundaries and operate in multiple member states. UAS operators must be unhindered by technical or regulatory differences between Member States. EU wide demonstrations are a key tool to encouraging consistent implementations. They also allow best practice to be identified and deployed. These demonstrations also help to increase the information of stakeholders not familiar with drones and facilitate their introduction. For example, cities might be interested in using drone technologies to solve daily problems with inspections and surveillance services, but there might be a lack of knowledge and experience to

implement them. It would be helpful to create a good best-practices data base for all stakeholders, including dedicated support tools for public authorities at national and local levels.

6.2. Regulatory framework

Under the new EASA Basic Regulation[8] adopted in 2018, all drones, irrespective of their weight are subject to **EU harmonised safety rules**. Deriving from those safety essential requirements and **following the same risk-based operation-centric approach** embedded in the Regulation, the Commission adopted in 2019 Implementing and Delegated regulations[9] setting out **common technical and operational requirements for drones**. These implementing rules are the corner stone of the new drone regulatory framework, which facilitate the development of the drone industry and market. To ensure the scalability and safety of drone operations, the Commission adopted in 2020, three Implementing Regulations on **U-space**[10].

This set of EU drone regulations have contributed to clarify the conditions of operations for all drones. However, flying a drone not only implies compliance with relevant regulations applicable to safety, but also with rules on **privacy** and **security**. Furthermore, as the drone regulatory framework is still relatively new, many aspects of it are still in the process of being implemented at European and national levels.

Taking these aspects into account, the Group considers that there are some challenging aspects of the existing regulations and following regulatory gaps to be addressed. The Group also identifies some potential measures, including new regulations that are required to complete the drone regulatory framework.

With regard to **future regulatory tasks**, the Group considers that the European and national regulators should first identify the far-reaching objectives of the regulation, establish a consensus, whilst always focusing on future flexibility, given the rapid degree of innovation in this area and define a stepped approach towards achieving these goals. The timeline should be set correctly and be kept as it gives visibility to the investors.

The EU should start the process of revising the **rules of the air** to ensure a smooth integration between manned and unmanned traffic, as well as between IAM and regular air traffic, allowing operators of manned and unmanned aircraft as well as State, including military, manned and unmanned aircraft to freely and safely operate within the same or transit between all required airspaces. The Group supports the definition of a consistent legal framework of responsibilities for future fully autonomous distributed UAM/UAS services which is one of the conditions to enable scalable traffic.

The Group emphasises the need to roll out the rules for the '**certified category**', which involves common rules for the certification of aircraft, of operators and remote pilots.

This also includes developing a regulatory framework for **vertiports** and other **ground infrastructure.** When developing rules for vertiports, proper attention should be brought

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[8]   Regulation (EU) 1139/2018

[9]   Regulation (EU) 945/2019, Regulation (EU) 947/2019

[10]   Regulation (EU) 664/2021, Regulation (EU) 665/2021, Regulation (EU) 666/2021

to interface with aerodromes, **interoperability**, and **open access** of equipment to ground infrastructures by UAS/IAM operators. In this regard, the regulatory framework should ensure that those ground infrastructures do not become proprietary and follow the same open model as airports and heliports.

The Group supports the adoption of new **European standard Scenarios** and **pre-defined risk assessments** which are aimed to facilitate some low to medium risk use cases in the '**specific category**'. Insofar as the operational authorisation process can be facilitated by these specific requirements, this regulatory framework will also support SMEs' inclusion in the drone operations market.

The Group considers that in some cases, the **'specific category' is too restrictive.** The SORA mitigation requirements to reach Specific Assurance and Integrity Levels (SAIL) category 3, even on proven / reliable systems, are difficult to reach without an UAS redesign and should be reviewed.

Furthermore, when relevant, the EU regulatory framework, including the U-space regulations, should be promoted bilaterally and at the level of **ICAO**, as a basis for a future **global drone regulatory framework** to ensure consistent approaches with other Regions and at the global level. Such cooperation should also cover the review of ICAO Annex 2 (rules of the air) to cover drone operations' specificities.

The question of market access should also be addressed with due regard to the situation of the drone sector. Currently, the **economic and financial conditions** to obtain a Community Air Carrier operating licence are set out in Regulation (EC) 1008/2008. This Regulation covers the transport of passengers, cargo and mail and is therefore also potentially applicable to drone operators. However, these rules, which were originally designed to cover large Commercial Air Transport undertakings, might be disproportionate in the context of the drone sector and should more adequately cover the drone operators. The Group would support a review of this Regulation in order to ensure fair market access and establish common requirements which are more suited to the economic and financial situation of drone undertakings. On the issue of "**Ownership and Control**", instead of imposing strict legal requirements which could hinder the development of IAM and limit access to venture capital, the Group recommends using the investment screening instrument, which is more flexible and adequately protects the strategic autonomy of the EU when necessary.

The regulatory framework should **facilitate real-world flight testing/trials** in order to prompt the introduction of innovative technologies. A facilitating project/experimental framework, allowing research and demonstrator projects to perform their test without the burden of having to comply with all regulatory requirements applicable to normal operations in a geographical area would support both innovative technologies and SMEs.

The Group considers that there is a **risk of shortage of domain experts at both local and national level**. This is one more reason why drones' rules should be as user-friendly as possible and not be too cumbersome on both the drone operators and the National Aviation Authorities (NAAs). Nonetheless, the NAAs should be supported to gain the competences that reflect the highly digital and automated nature of the technologies underpinning drone operations and U-space services provision. Beyond the technical competence, NAAs will have to adapt to the changing environment and should be put in the position to smoothly manage Specific Operations Risk Assessment (SORA)

approvals, U-space airspace establishment and certification & compliance monitoring of UAS operators, Common Information Services and U-space service providers.

In addition, drone regulations are not always easy to grasp by **local authorities** (cities, metropolitan areas, communities, etc.), which lack basic knowledge about the aviation ecosystem. Hence, capacity-building actions should be taken to improve the understanding and practice of local administrations of the rules in place in order to support operations approval, certification and safety oversight. The Group would encourage national competent authorities to avail themselves with adequate resources and training capacities for its staff to swiftly approve the launch and deployment of drone operations at national and local levels.

Another concern which has emerged is the **lack of coordination/harmonisation** between competent authorities in implementing drone rules whenever EU rules leave room for interpretation. The flexibility provided for in the EU drone regulatory framework could lead to different interpretations and approaches by Member States, ultimately affecting harmonisation. Finding the right balance between flexibility and harmonised conditions should also contribute to ensure a level playing field between Member States/Regions and facilitate cross border operations. More coordination should help to avoid the risk of de-harmonised national implementations of EU rules. For example, despite the fact that Implementing Regulation 2019/947 required Member States to provide "UAS Geographical Zones" data by 1 January 2022, as of today, the data needed for the development of the geo-awareness requirement of the Open Category is not fully available and, when available, not always in the same format. The Regulation should impose a generic format in order to make sure that the requirements laid down in Implementing Regulation 2019/947 are effectively applied.

The Group notes with concern that **some standards still need to be developed** and that the process is slow. The drone sector is very dynamic, and this feature collides with the usual long deadlines involved in developing standards. The drone and U-Space technologies are a mixture of ATM, IT and telecom technologies. The traditional approach should be widened - including making room for standards developed on the basis of open-source software development. In ATM, EUROCAE's standards are generally a good starting point. The standardisation process should be as efficient as possible, for example by already preparing standardisation material during research, development, and demonstration activities, as indeed SESAR JU is doing. Such process must be accelerated and, in order to do so, EUROCAE and EUSCG activities should be coordinated and promote the "agile" development of standards that take into account the needs and the high speed of technological advances in the drone sector.

At the same time, the Group recognises that the EU has a unique chance to define reliable global standards for **cybersecurity**, without impairing efficiency. In this regard, the Group supports the development of concrete regulations and definitions for cybersecurity protection mechanisms and ensuring protection of technologies, such as cloud-based distributed systems or over-the-air updates of vehicle software. The definition of a clear pathway to certification for "system of systems", including cloud-based safety related technologies would enhance the attractiveness of EU drone technologies and guarantee its strategic autonomy.

The EU rules on data protection are in place and fully applicable to drone operations. However, there is some uncertainty in the sector and the general public on how to ensure compliance with privacy and data protection rules. The Group would support the development of specific and user-friendly guidelines or checklists explaining to drone operators on how to comply with **data protection and privacy requirements**.

6.3. Technology building blocks, including harmonisation and standardisation, and Civil-Defence drone industry synergies

The Group welcomes and fully supports the objective of the "Action Plan on synergies between civil, defence and space industries" to reap synergies between the civil and defence use of drones and related technologies, including counter-drones' solutions. The recently adopted "Versailles Declaration"[11] emphasised further the need to foster these synergies and invest in critical and emerging technologies.

The availability of the required components, vehicles and systems in Europe is a core condition for developing a competitive and autonomous European drone services sector. It is necessary to ensure that the drone manufacturing industry will have a reliable supply of essential parts and financial and technical resources to develop and manufacture state-of-the-art products.

Drones, drone operations and drone traffic management are **a complex ecosystem** of components and information exchange platforms, requiring highly optimised, safe, and secure elements such as flight control systems, cyber-secure datalinks and connectivity, resilient navigation, Detect & Avoid, electrical and hybrid propulsion, batteries and power management, autonomous flight and mission management systems. In turn, these are dependent on many **enabling technologies** such as Artificial Intelligence, robotics, semi-conductors, and cloud technologies.

In this respect, the Group recommends that the Commission should develop a strategic **Drone Technology Roadmap** for critical drone technologies and dual-use drone systems. The roadmap should identify and prioritise the future critical drone technology needs. The Commission should seek the support of the EU Observatory of the Critical technologies in executing this task, with the input of all stakeholders.

A lot has been already done to support critical technologies. For example, the Commission has set up a **European Battery Alliance[12]**, which aims to ensure that the EU can depend on a domestic battery value chain, which should then also be available for the drone industry. The Group emphasises the importance to ensure that the needs of the European drone sector are well covered within this and similar initiatives.

Furthermore, some intangible resources, such as **radio frequencies**, are a limited commodity. Close coordination with other relevant actors and organisations (e.g., ICAO, ITU) is needed to safeguard that the drone sector has sufficient frequencies and protected spectrum available for safe operations. The Group points out that a lack of access to frequencies could hamper the development of long range BVLOS operations in the

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[11]   https://www.consilium.europa.eu/en/press/press-releases/2022/03/11/the-versailles-declaration-10-11-03-2022

[12]   https://www.eba250.com

'specific category' and called for an assessment of the drone industry needs in this regard.

Standardisation and interoperability of the enabling technological building blocks is a key enabler for faster development cycles. All relevant actors should work together to develop standards, including those for dual use. It is necessary to encourage industry participation in standards development. The Group recommends a funding initiative to support SMEs in standardisation activities as well as effective procedures to develop standards in a faster way to ensure that the innovative pace of the drone industry can be met.

As regards certification, the Group considers that, while considering military specificities and existing military certification standards, **the harmonisation of certification requirements for civil and military applications** towards those set by EASA would facilitate the development of dual-use applications. . In addition, it called for the **further development of standard scenarios** for the specific category for operations that could have both civil and military applications.

On **EU funding**, the Group considers that the different EU funding instruments for supporting drone complementary, providing financial support, including to start-ups, throughout the entire development cycle from research to market, promoting cross-sectoral collaboration and alignment and ensuring that promising projects funded at an early phase are not starved of funding before they are deployed. The current separation of civil and defence funding programmes does not facilitate the development of dual-use technologies due to gaps when moving a project from civil research to military implementation or vice versa. A **dedicated funding pathway** for dual-use technologies by design could be created to better recognise spin-offs and spin-ins while ensuring that the sectorial funding mechanisms remain in place

Ultimately, a dedicated **PPP/Joint Undertaking** could be set up to support the development of dual-use drones and UAM. Such a JU could concentrate on developing a **large-scale flagship** project, for example a civil-military cargo drone.

Finally, the Group proposes the creation of a network of the existing **Drone dual-use centres of excellence** at EU-level, where both civil and military drones could be jointly tested, based on a simple "test & share" principle. Such flying-safe space would allow gaining flight hour experience to prove safety under a "fly-before-certify" approach. This could also facilitate the development of **networks of incubators** connected to these centres. These incubators would serve also as information hubs on financing, training and regulatory requirements related to drone research, services, and operations. As already mentioned, harmonising the requirements and processes to obtain flight authorisations would facilitate cross-border testing and flight demonstrations.

6.4. System resilience and non-cooperative drones

Drones are a new, fast-growing, and affordable technology, which is highly digital. While bringing benefits, they can also pose security risks and be a major public concern due to potential unsafe operation, damage to people and property on ground. **Unauthorised drone flights remain a problem**, especially around commercial airports, and critical infrastructures. Clueless, Careless or Criminal drone operators can endanger

passengers, other drones and aircraft crews and lead to short-term disruptions of air traffic, closures of entire airspaces or airports, and even to the total loss of an aircraft, in addition to economic losses.

Ensuring a high level of **security** is essential not only for drone operations but to ensure the trust of the public and societal acceptance. Therefore, it is necessary to develop and share security criteria to counter UAV and ensure cybersecurity compliance.

The EU should focus on developing state-of-the-art drones with high security. With this in mind, the Group recommends the development of a **"European Trusted Drone" label** for cybersecurity approved drones in the 'open' and 'specific' categories. The label should be issued by a relevant Authority after a manufacturer has provided evidence that a specific drone fulfils a set of agreed requirements, in relation to, e.g., the provision of a secured communication link, secure identification and use of open-source code. This would make it possible for any end-user in Europe to purchase such trusted drones in confidence. This label would benefit not only drone operators but also all entities responsible for the monitoring the use of airspace. The use of "European trusted drones" could be required for all operations in a restricted airspace, helping to separate legally operated drones from illegal ones.

In a longer term, the Group recommends adopting a "**European Drones Act**" which would require that public entities only procure and use drones which have obtained the European Trusted Drone label.

Most of the Member States, if not all, have already taken steps on establishing counter-drone measures. However, the Group considers that more needs to be done in terms of **critical infrastructure protection.** There are already some good guidelines, for example by EASA, on how to manage drone incidents at airports. However, there is no uniform EU counter-drones legislation and hence Member States rely on their existing national legal frameworks, and the reporting systems on incidents are also divergent between Member States.

The Group recommends that the Commission provides more **EU level guidance and sharing of information** for public authorities on national and regional level on how to detect, track, identify, neutralise, and mitigate threats from non-cooperative drones and defining the roles and responsibilities in terms of detecting. Furthermore, the Commission should develop unified performance measures to be used across the EU to ensure that the counter-drone systems are indeed efficient, and if it becomes necessary, propose new measures to improve their performance.

Finally, the Group points out that the Member States should ensure **sufficient training** for relevant personnel, including local authorities, to increase their preparedness to identify and respond to non-cooperative drone threats.

6.5. Developing airspace capabilities (U-space development and integration with Air Traffic Management)

U-space is the bespoke, **fully digital, and automated traffic management system** that has been designed to enable the safe, efficient, and affordable scaling up of drone services.

U-space development was initiated in 2017 with the SESAR U-space Blueprint[13] and is the subject of ongoing research and innovation, and an initial regulatory framework has already been adopted to **harmonise** the **pioneer implementation projects** blossoming across the European Union[14]. This initial framework is based on the provision of four services to UAS operators and allows the accommodation of routine flights in designated pieces of airspace. However, at this stage it does not achieve full integration of U-space and Air Traffic Management (ATM), nor does it enable the provision of U-space services to manned aircraft.

To realise the High-level Vision, the Group therefore recommends several initiatives related to U-space development and ATM integration, including civil / military interoperability.

In the short to medium term, to facilitate the roll-out of the initial framework, Air Navigation Service Providers and U-space service providers should agree on the necessary protocols to **exchange information**, including with military entities in charge of security and defence activities, on relevant traffic or on dynamic airspace restructuring, and the role and exchange of information with Common Information Service provider should be better defined. Development of the related **standards** should consequently be prioritised.

In particular, U-space service providers should be able to capitalise on existing mobile **telecommunication** technologies and standards, such as those resulting from the Aerial Connectivity Joint Activity. The use of U-space solutions and operational concept for a more automated ATM should also be considered.

There would also be a need to support large scale **demonstration and validation activities** and harmonise efforts to validate prototyping implementations and draft standards on full-scale realistic test beds.

Necessary **Communication Navigation and Surveillance (CNS) infrastructure and performance requirements** and characteristics should also be further studied to strengthen the harmonisation of U-space performance requirements and the interoperability of operations.

To further support the implementation of the initial framework, there needs to be more communication and information on the benefits of U-space as an enabler of operations, and the role of **local authorities** in U-space implementation. As U-space will be an integral part of the city, aviation should better understand the urban environment, and conversely local authorities should have a closer relationship with not just the U-space ecosystem but also ATM.

To enable a **tighter integration with ATM**, the consideration of military aviation, and the incorporation of Innovative Air Mobility, facilitate the transition from manned piloted eVTOL through automated to autonomous operations, U-space R&D, combined with innovative operational procedures, should look at advanced U-space services, as well as the possibilities to provide U-space services to manned aircraft.

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[13]   https://www.sesarju.eu/u-space-blueprint

[14]   https://www.eurocontrol.int/product/european-network-u-space-demonstrators

Demonstrators should benefit from **regulatory sandboxes**, concrete frameworks which, by providing a structured context for experimentation, enable where appropriate in a real-world environment the testing of innovative U-space technologies, services, or approaches, under the regulatory supervision of competent authorities and EASA.

U-space **innovation hubs and living labs** should also be encouraged to provide a wider scheme, via which stakeholders (including citizens, local authorities, and urban planners) can engage with the authorities to raise questions and seek clarifications or non-binding guidance about issues in the context of compliance with the U-space regulatory framework and its interfaces with sustainable urban mobility plans (SUMPs).

Finally, **U-space** and **ATM** should evolve towards a seamless **integration**, and potential synergies should be exploited so that the future Digital European Sky would be the safest, most efficient, and environmentally friendly in the world. Efforts cannot be made only on U-space, but U-space should be used to support ATM digitalisation.

Further to the existing network of U-space stakeholders, a demonstrator network establishing an initial critical mass of early movers on breakthrough innovations for the U-space and ATM integration would be key to gain trust and support an accelerated market deployment of innovative solutions. The demonstrators should be closely connected to the standardisation and regulatory activities. This would help create buy-in from the supervisory authorities and operational staff, providing tangible evidence of the performance benefits in terms of environment, capacity, safety, security, and affordability.

The Group recognises the need to ensure that **affordable electronic conspicuity solutions** should be applied to all airspace users not covered by the current European ADS-B mandate, including recreational (gliders, paragliders, etc.) or ultra-light aircraft. Such 'light' conspicuity solutions should ensure their safe integration along with other airspace users and allow their free movement in the EU airspace. The needs and specificities of all airspace users should be considered when designing future global technology solutions.

The aviation sector is still in the process of understanding what it will take to transition to the Digital European Sky, and one should be looking at what ATM/U-space convergence would look like in practice over the short, medium, and long term, eventually delivering an ATM/U-space development and **convergence**, and future full **integration, roadmap**. Such roadmap should be elaborated in coordination with all affected civil and military airspace users and associated stakeholders, including technology providers. It should also be harmonised with international partners to avoid diverging aircraft equipage requirements in different regions.

6.6. 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).

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.

To address those challenges and facilitate the development of IAM, the Group presents several recommendations.

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 recognised 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. Furthermore, a **market study** could be launched to capture the needs of IAM in the health domain and evaluate the market for such services in Europe, and hence the best use of research funding.

There is also a need to **learn the lessons** from the unexpected, grassroots success of **micro mobility** services (free-floating e-scooters in particular) in terms of benefits but also public perception and management of externalities, to avoid similar conflicts in the deployment of IAM.

IAM should systematically be considered as part of **sustainable urban mobility plans (SUMP**s)[15], 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.

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[15] As being discussed with the European Parliament which welcomes the inclusion of air transport and UAM solutions in the proposal for a regulation of the European Parliament and of the Council Guidelines for the development of the trans-European transport network 2021/0420(COD)

- 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 EU infrastructure funding pathways. Funding should also focus on **multi-mode infrastructures** where aviation could benefit from **energy and telecom cross-fertilisation**.
- 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 analysed, finding a balance between location requirements, affordability and other aspects such as nuisance to neighbours and visual pollution to avoid jeopardising social acceptance. **Connectivity** to local **airports** and other **modal hubs**, including with public means of transport, should be prioritised.

Further research could be conducted on **operations limiting factors**, which may hinder IAM development, such as battery technology development. Once more, **regulatory sandboxes and living labs** would enable highly visible, commercially viable demonstrators, which would provide the public with a first-hand experience of real-life operations. Such sandboxes would offer a tightly controlled environment that underscores the safety of operations, as well as enabling test scenarios with the potential of becoming revenue generating operations. This would create exchange platforms between industry and neighbourhood associations and give industry operational experience and opportunity to develop technologies and testing methodology to evaluate noise in an urban operating environment, as well as give regulators valuable feedback on the adequacy of rules.

Finally, a **harmonised and synchronised roadmap** should be established at European 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 decarbonisation in urban areas are included.

6.7. Societal acceptance and dealing with externalities

Although drones are sometimes negatively perceived, a recent study by EASA on the social acceptability of UAM[16] highlighted an overall positive attitude of the public.

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[16] https://www.easa.europa.eu/newsroom-and-events/press-releases/easa-publishes-results-first-eu-study-citizens-acceptance-urban

However, there are still significant concerns related to safety, environment, and security in particular.

Recommendations related to societal acceptance of IAM were already included in the previous section, but the Group provides the following further guidance.

When speaking about public acceptance towards 'drones', a differentiation is needed between cargo/delivery UAS eVTOL systems used for passenger transport, which can be manned (with pilot on board) or unmanned and military drones. Those different aircrafts and use cases have different operational characteristics and safety standards. The value and criticality of the mission conducted should also be considered when assessing the complementarity, impact, cost benefit and value of IAM/UAS to the society. Drones should be promoted as a mean to enable the **continuity of public services, protection and life-saving missions** as well as services to remote and difficult-to-access areas of the Union.

National studies on social acceptance should be considered by the Member States, broadening the effort already made by EASA, followed by a Working Group with participants from all countries to jointly evaluate possible solutions and common messages.

Local administrations should be involved and treated as a key partner for social acceptance. **Guidelines, and handbooks and training opportunities** should be developed for local authorities to help them implement IAM and address externalities as part of their sustainable mobility planning activities. Local authorities should convey a message of certainty and **transparency** to society about what, how, when and where IAM will be deployed.

Citizen participation in the regulatory sandboxes, living labs and demonstrations should be encouraged to include local/regional aspects.

Stronger communication is needed to distinguish commercial drones from toys and highlight the good progress achieved in establishing an **effective safety regulatory framework**. More educational and promotional activities are needed. That should be one of the main tasks of living labs.

Societal acceptance will be increased by demonstrating that drone/IAM operations can make a significant contribution to the **decarbonisation of transport** and to the reduction of air pollution, especially in urban areas, by having zero net carbon emissions, taking the full vehicle lifecycle, energy production, storage and modal shift into account. This requires a focus on investing in generating the large amounts of renewable energy needed to charge batteries.

Noise mitigation measures to limit the impact on over-flown citizens should be fully taken into consideration when designing routes, procedures, and other operational practices. The impact on business performance, should routes be extended to mitigate noise/visual pollution needs to be balanced against the overall risk of rejection of IAM operations by local communities. An unbiased and inclusive approach should be developed in order to measure and monitor innovative mobility indicators on various aspects including performances and impacts, involving citizens, authorities, and industry stakeholders alike.

Guidelines should be developed on aspects related to the implementation of relevant **privacy, liability, and insurance** legislative requirements.

As discussed before, cybersecurity to prevent drone hi-jacking, spoofing etc. is vital, and authorities should be able to verify that the system is strictly following **cyber-protection** requirements.

6.8. Developing knowledge, training staff, and building competence

The development of drones and the introduction of drone services will have an impact on the required knowledge, skills, and competences in a range of fields, such as drone operations, IT, data and automation related competences, and competences to deal with technological and regulatory evolution. Therefore, the Group recommends that Member States, industry, and the social partners should prepare a **roadmap for the development of drone service knowledge, skills and competences**, based on an assessment of needs . As indicated above, training should also be made available for the public sector since proper staffing is also an issue for regulators.

UAS operations will require operators to be responsible for multiple tasks covering navigation, flight control, communication, system monitoring, and mission management. To address this, the Group recommends that specific training procedures for UAS operators should be considered. Due to the innovative nature of IAM operations and design, on the basis of the existing aviation training concepts and requirements for traditional commercial pilots, performance-based pilot training could be adjusted and facilitated. This will also create additional jobs as the entry barriers for becoming an eVTOL pilot can be lowered and attract more EU citizens.

Large scale **demonstrators** could provide an effective solution for addressing diverse types of training needs. Furthermore, development of virtual reality **simulators** for operations could provide safe ways to gain experience.

The Group recommends the setting up of **education and training programmes** specific to drone technologies, regulatory frameworks and integration to SUMPs activities in all Member States. Such academic programmes across Europe would foster the competences and technological progress but also increase the public awareness and acceptance of drone utility.

7. CONCLUSION

The Drone Leaders' Group welcomes the work of the Commission in the preparation of the Drone Strategy 2.0, notably the inclusive nature of its approach and the attempts to reach out to all stakeholders. The extensive Commission consultation process, the organisation of hearings, and the Group discussions all contributed to shape this report. The outcome of these discussions is reflected in this report for which the Drone Leaders' Group took a holistic approach in order to cover all aspects of drone policy.

The Drone Leaders' Group invites the Commission to take note of this report and the recommendations contained therein when finalising the Drone Strategy 2.0. The members of the Group stand ready to provide support to the Commission, if needed, for the implementation of its recommendations.

Brussels, 26 April 2022

Annex A   Membership

Henrik Hololei	DG MOVE, Chair
Andrea Anesini	European Air Sports
Sebastian Babiarz	Global UTM Association
Cristiano Baldoni	d-Flight
Pierre Becquart	Régie Autonome des Transports Parisiens
Eamonn Brennan	EUROCONTROL
Giancarlo Buono	International Air Transport Association
Raul Medina Caballero	ES Dirección General de Aviación Civil
Vincent De Vroey	AeroSpace and Defence Industries Association
Nathalie Errard	Airbus
Richard Frizon	SESAR JU
Eduardo Garcia	Civil Air Navigation Services Organisation
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Elisabeth Landrichter	AT Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
Manuel Le Bail	Parrot
Marian-Jan Marinescu	Member of the European Parliament
Kyle Martin	General Aviation Manufacturers Association
Marco Pellegrino	Aeroporti di Roma
Christof Raab	Alliance for New Mobility Europe
Olivier Reichert	SAFRAN
Oliver Reinhardt	Volocopter GmbH
François-Xavier Rivoisy	Aéroport de Paris
Jiří Šedivý	European Defence Agency
Laurent Sissmann	LEONARDO
Jacek Woźnikowski	UAM Initiative Cities Community (UIC²)

Annex B   Hearings and Drone Leaders' Group Plenary meetings

Plenary Meeting #1	20/10/21	• Tour de Table: presentation of Drone Leaders' Group members' priorities by DG MOVE and discussion • Presentation of the Roadmap of Drone Leaders' Group work
Plenary Meeting #2	10/02/22	• Review of comments to the Open Public Consultation • Recommendations on several areas • Follow-up: preparation of 3 Hearings
Hearing #1	18/02/22	• Urban Air Mobility (cargo/passengers) and U-space
Hearing #2	25/02/22	• Enhancing UAS services, including the SME dimension
Hearing #3	08/03/22	• Develop Military/Civil synergies and technology building blocks
Plenary Meeting #3	15/03/22	• Report of hearings by Co-rapporteurs and discussion • Presentation of the structure of the draft final report
Plenary Meeting #4	26/04/22	• Discussion and endorsement of the Final report containing recommendations for the Drone Strategy 2.0