DRONE ECONOMICS

New EU-funded research explores the costs and benefits of integrating Unmanned Aircraft Systems into Europe's transport networks

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In the Kempen region in northern Belgium, a key healthcare provider recently acquired a valuable new tool – the ability to send and receive medical deliveries by drone.

Using BVLOS flights, drones have begun carrying time-sensitive cargo such as tissue and blood samples between the hospitals of AZ Turnhout, AZ Herentals, and A-kwadraat. The flights more than halve delivery times in the semi-rural region. A delivery between AZ Herentals and AZ Turnhout by road takes at least 46 minutes; drone flights can cover the distance in about 20.The landmark initiative marks one of the first operational demonstrations of U-space deployment for emergency healthcare logistics in Europe. It is the product of multinational cooperation via the BURDI (Belgium/Netherlands U-space Reference Design Implementation) project, a 3-year effort co-funded by the European Union under the Connecting Europe Facility and supported by SESAR Joint Undertaking.

BURDI partner Skeydrone (a joint venture between the Belgian ANSP Skeyes and Brussels Airport Company) is acting as the U-space Service Provider (USSP) for the Kempen medical flights operating a UTM platform developed by Antwerp-based Unifly to offer U-space services to Skyports Drone Services flying their drone in Belgium remotely from the UK.

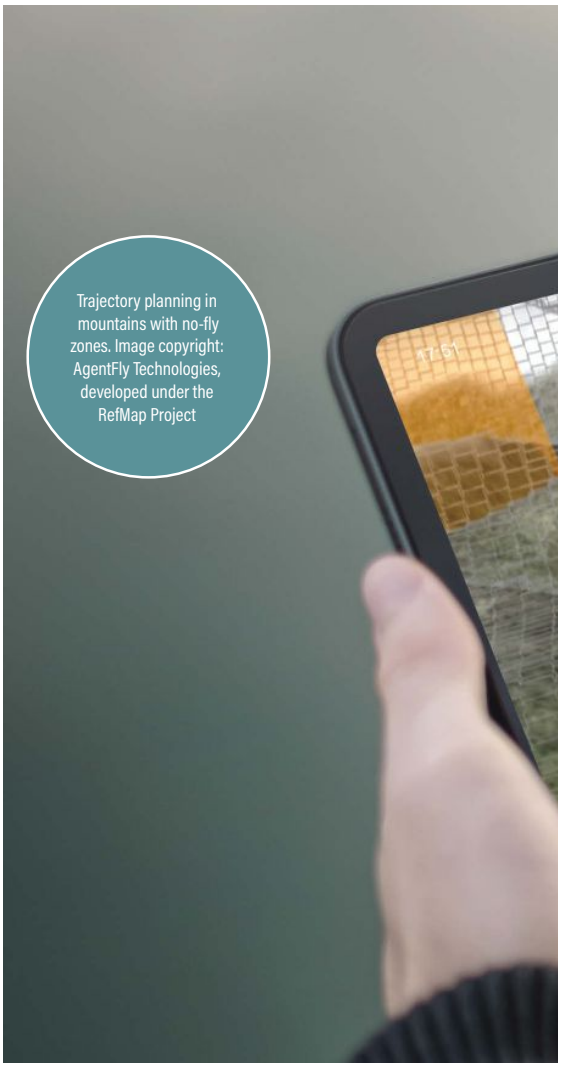
The technical feasibility of such test cases, exciting as they are, does not automatically imply economic feasibility and social worthiness. So, how costly is the integration of UAS (unmanned aircraft systems) in the European transport networks? How much should U-space cost? As drone operations become more widespread, what are the benefits and disbenefits they bring to society? Under which conditions will large-scale operations become profitable yet also sustainable?

Such issues form the focus of the research roadmap of Future Needs Management Consulting Ltd, a consultancy with extensive expertise in socio-economic research and analysis related to innovative transport deployment and the future of aviation.

Future Needs have been active on the drone economics front across multiple past and ongoing aviation-centred EU projects. In the Horizon-funded RefMap project, the consultancy is exploring how drone operators can profit from becoming more environmentally sustainable. In the SESAR JU-supported ImAFUSA project, Future Needs assesses welfare impacts of large-scale drone deployment for society as a whole, quantifying benefits such as economic growth, real estate impact, increased connectivity and leisure opportunities alongside disbenefits such as likely annoyance from noise, visual pollution and energy sufficiency.

Anna Palaiologk presenting results of research work Future Needs has conducted on the future of the aviation economy

Future Needs's work in BURDI, meanwhile, has focused on U-space, exploring its development costs, operational costs, pricing for likely users, and its benefits for society compared to the business-as-usual scenario of UAS deployment in its absence.



Trajectory planning in mountains with no-fly zones. Image copyright: AgentFly Technologies, developed under the RefMap Project

U-space development

The integration of UAS into transport networks is to be achieved in Europe through dedicated U-space areas created and monitored by individual member states. While it is hard to realise its value at the moment, with a few drones flying over our cities, U-space services, particularly those classified as U4, are designed to support high-density autonomous drone operations and become justified as the volume and complexity of drone traffic increase. Since January 2023, EU Implementing Regulation 2021/664 has been in force, establishing the legal framework for creating such low-altitude airspaces.

The first U-space airspace will focus on sensitive areas such as cities and near airports and other transport hubs.

However, to date, U-space remains in its infancy, with many open questions regarding how these systems will be fully developed and deployed as well as the relative costs and benefits involved.

It is here that Future Needs' work on the BURDI project helps fill a key gap, providing some of the first estimates of the relevant development and operational costs involved,

as well as the prices market players are willing to pay for U-space.

U-space services are categorised across four levels, from U1 (foundation services such as registration and geo-awareness) to U4 (fully integrated, advanced traffic management with high levels of automation). Higher service levels will require more complex infrastructure and capabilities.

In order to identify the development and operational costs of U-space, Future Needs researchers identified all of the elements of labour, training and infrastructure required to provide the relevant services at each level. This included projections for U3 and U4 services, as to date no U-space has reached this level of maturity.

The cost of U-space

For the development of U-space infrastructure, the main costs concern: the procurement of digital platforms by USSPs and their adaptation to local requirements; the establishment of a Common Information Service (CIS); and the need for system interoperability with existing ATC and smart city infrastructure. Infrastructure investments will also be required for ground-based sensors, communication networks, edge computing and cloud infrastructure, and robust cybersecurity systems.

Initial U-space development costs must also cover the necessary training of personnel. This will include compliance and regulation training and certification, air traffic management training and system engineering training. For example, ANSPs will need to provide additional training for air traffic controllers and have tools installed for supporting U-space related services.

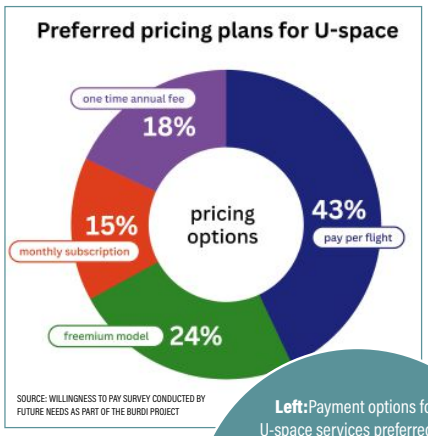
How much will this cost in practice? At this stage, data is limited, however some insight is provided by BURDI partner Skeyes, Formerly known as Belgocontrol, Skeyes is an autonomous public company responsible for ensuring the safety and efficiency of air traffic within Belgium's airspace. They provide essential ATM and ATC services, including infrastructure and systems for data processing, communication, navigation, surveillance, and meteorology, and has been offically designated as single CISP in Belgium.

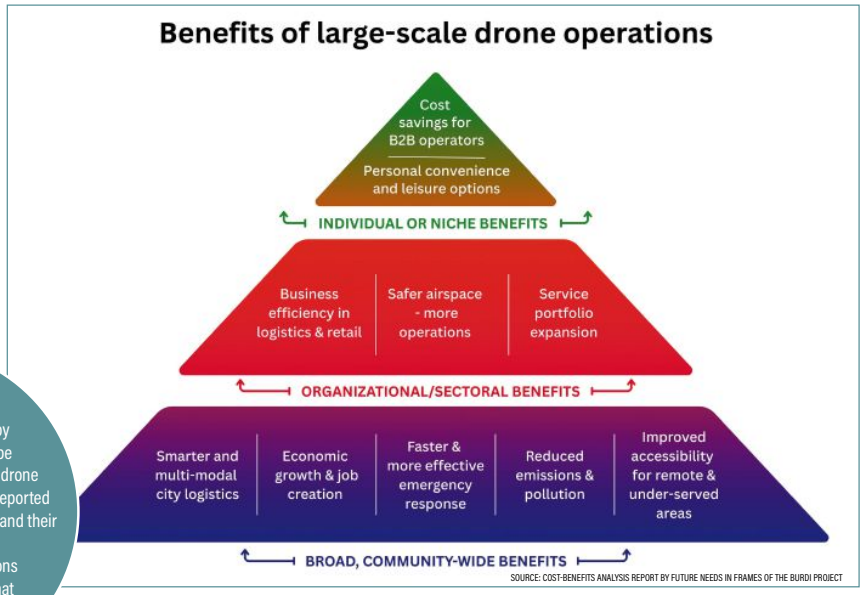
For the development of U-space in Brussels, Skeyes estimates development costs between €600k–€750k from 2025 to 2026. However, Future Needs researchers note that these costs are indicative and focus only on CISP and embedded inter-USSP functions, as other technical cost details are not yet available. Adding more services will cost more. Further, this does not cover the U-space operational costs. These ongoing expenses will include system maintenance, updates, and technical support; licensing and compliance with evolving aviation and data protection regulations; and regular training for regulators, operators, and service providers. Additional costs may include energy costs, leasing land for vertical take-off and landing areas, and the maintenance of drone hubs, storage facilities, and control centers.

The costs will vary depending on scale and location. For its part, Skeyes projects operating costs of €750k–€900k per year from 2027 to 2050. However these only cover a portion of the categories described above. A more complete cost assessment is expected when the project and SESAR activities reach a later stage.

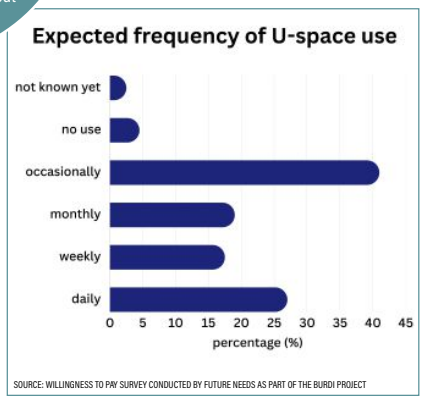
Who will pay for U-space, and how?

The initial development costs of U-space in





Left: Payment options for U-space services preferred by drone operators across Europe
Right: Benefits from large-scale drone operations supported by U-space reported and anticipated by drone operators and their clients
Below: Frequency of operations requiring U-space services that respondents expect to carry out



Europe are broadly expected to be covered through public funding by member states. However, operational costs will likely be borne by users of U-space, namely the UAS operators (or their clients), with USSPs charging for access to U-space and associated services.

Future Needs' researchers conducted a willingness to pay survey addressed to U-space users (drone operators in professional categories) and U-space providers. The survey gathered responses from a range of public, research and private organisations across Belgium, the Netherlands, other EU countries, and the UK. Among others, the survey covered service usage, cost expectations, perceived benefits, and pricing models.

The most preferred pricing model among respondents was pay-per-flight, reflecting the expected occasional nature of U-space usage. The freemium model also received notable interest, likely due to its flexibility and the perceived value of unrestricted access to services, even at a slightly higher cost. Subscription models were less popular, indicating that most users are not yet ready to commit to regular, ongoing use of U-space services.

In terms of demand, the largest group of respondents anticipate using U-space only occasionally. However significant percentages anticipated using it daily, weekly or monthly, with only a small number responding that they did not anticipate using U-space, or were unsure of how frequently.

That said, willingness to pay remains limited – 40% responded that they have no intention to use or pay for such services, while 22% said they were willing to pay up to 100€ for a U-space drone flight, which is close to the cost of average drone flights today in the absence of fully developed U-space. Further, over 80% would not accept more than a 10% increase in current operational costs to support U-space integration. These results suggest that while there is enthusiasm for U-space, most users expect funding support from public or institutional sources to offset initial adoption costs.

From the benefits of U-space to the welfare of citizens

Future Needs have also qualitatively assessed the benefits that U-space would bring compared to a "do minimum" approach (fully monetizing these is not possible yet due to limited data).

Benefits of fully realised U-space would include improved multi-modality and integration of UAS with other transport modes, enhanced safety and security, advanced traffic management, increased compliance, expanded service availability, and broader accessibility, alongside potential gains in public acceptance, environmental performance, and job creation. Yet such cost-benefit analyses still only capture part of the story. As Future Needs founder and experienced transport economist Anna Palaiologk explains, "When new transport systems like Urban Air Mobility are introduced, they do more than just move people faster-they change how we live, how we feel, and how we experience our cities. Yet, most transport planning still focuses only on cost, speed, or efficiency, not on how mobility actually affects people's happiness and satisfaction with life."

Future Needs' work in BURDI is thus complemented by its broader research roadmap exploring the likely impacts of UAS on the welfare of citizens more broadly. In its work on welfare impacts, for example, the company is exploring questions such as how UAS might affect housing prices and whether these systems help counter, or exacerbate issues of inequality.

In this sense, medical delivery flights such as those in Kempen are just the tip of the spear when it comes to the impending rise of UAS and U-space. Few citizens are likely to complain about drone flights carrying potentially life-saving materials. But what happens if and when these are joined in the skies by drones carrying tube socks and make-up kits ordered over the internet? How can we ensure that benefits outweigh the potential negative impacts?

As U-space matures and UAS take flight, understanding their full economic and social impact is thus essential to ensuring that the skies above Europe become new roads not only for innovation and efficiency, but also for inclusive and sustainable improvements to how we live and connect. ❖