UAM requires open-access airspace

Creating a safe, harmonised airspace with the aid of sophisticated deconfliction tools

Executive Summary

Although air traffic is only just beginning to recover from record low levels, sustained growth will return, and especially so in the case of unmanned aerial vehicles (UAVs). With the potential to move deliveries and personal transportation from congested roads into the open skies, UAVs represent a potential revolution in Urban Air Mobility (UAM). Faster and easier journeys for goods and people alike will reduce costs, cut pollution and unlock a raft of new economic opportunities.

To support these new business models, the aviation industry is currently tackling the critical challenge of how to safely, securely and sustainably integrate unmanned and manned traffic. This white paper will argue that the approach proposed by the European Aviation Safety Agency (EASA) is certainly safe and secure, but that it is far too restrictive to be sustainable in economic terms.

The latest deconfliction and interconnectivity technologies will enable safe, secure and sustainable real-time separation of traffic in both urban and rural environments. While there should continue to be tight restrictions on sensitive areas such as airport control zones, the default position will be: UAVs may fly unless specifically prohibited from doing so.

The approach outlined in this white paper uses existing proven technology to ensure safe, equal access to a harmonised airspace for all users. This will be a key enabler for countless new UAM and commercial drone use cases, ensuring the required economic scale to transform the growth potential of urban environments. It will also provide new opportunities for Air Navigation Service Providers (ANSPs) to offer their skills and experience to serve the fast-growing UAV market.

Air Traffic Management

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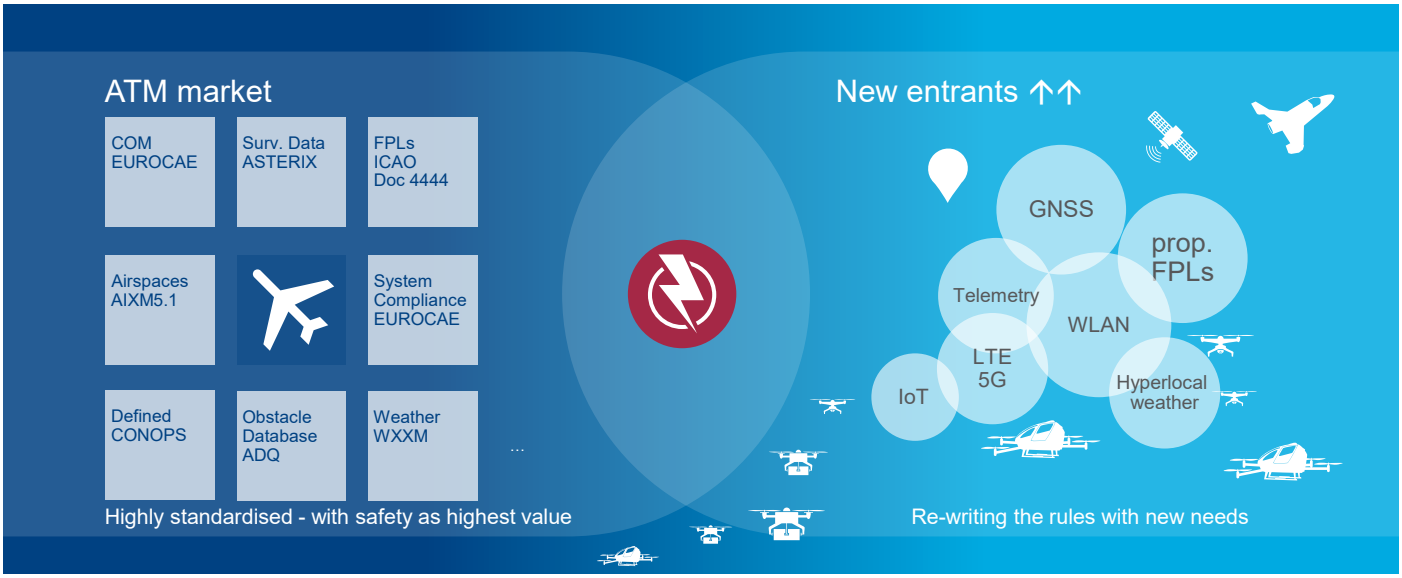
Unmanned opportunities

Safely and sustainably integrating UAVs into existing airspace is one of the critical issues facing the aviation industry. In the ongoing pandemic, air traffic has only just started to recover from record lows, but growth will certainly return—and it will be dramatic in the case of UAVs. Whether remote-controlled or autonomous, UAVs are set to revolutionise everyday life, impacting everything from travel to agriculture, policing, planning, deliveries, maintenance, asset management and construction.

Urban environments—which typically have both high population density and severe road congestion—are especially fertile ground for UAVs. Cities that can innovate in this area will gain significant first-mover advantage, driving much-needed economic growth and inward investment. However, to unlock the transformative economic potential of unmanned air traffic, the industry needs to ensure that it can co-exist with manned traffic without degrading safety and security, without disrupting existing operations, and while respecting regulations.

Given both their population density and proximity to major airports, cities are where UAV traffic is most likely to come into conflict with existing manned air traffic. Nevertheless, conflicts are also possible in rural areas, where drone traffic will need to avoid airspace users such as general aviation aircraft and rescue and police helicopters. This implies that the industry needs a scalable approach to deconfliction that can be applied to all classes of airspace, in both urban and rural areas.

Figure 1: Harmonisation requirements in readiness for urban air mobility



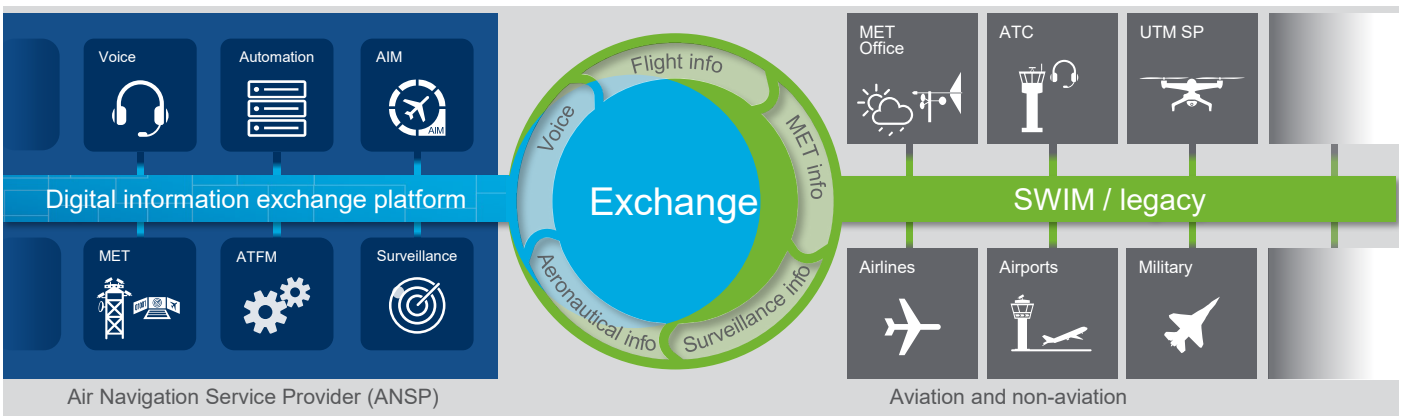
Fair access for all

The European Aviation Safety Agency (EASA) has published draft regulations on the management of unmanned airspace (U-space), proposing that there be only one common information service (CIS) provider for each U-space area. Under the draft proposal, each state can define as many different U-space areas within its existing airspace as it chooses, and CIS organisations cannot also act as the U-space service provider (USSP).

The EASA proposal is undeniably a valid way to ensure safety and security. However, it essentially creates a series of monopolies on airspace: the relevant USSP must give permission to fly. This white paper argues that such an approach is not only unfair, but also fails to support many of the future use cases for UAVs. As an example, a user who hails an air taxi will not want to wait 30 minutes for clearance to fly.

Using the latest deconfliction technology, it is possible to rethink air segregation in order to ensure fair access for all and to support the ad hoc use cases that UAM demands. Naturally, there will continue to be more strongly segregated or even prohibited areas for UAVs—for example, terminal control areas and control zones. But in general terms, with the right technology and data exchange in place, the default position can be equality for all air users: you can fly unless specifically told not to. For major drone operators of the future—including urban delivery services and air taxis—this is the only model that will unleash the full potential of the new business models.

Figure 2: Seamless information exchange between all stakeholders



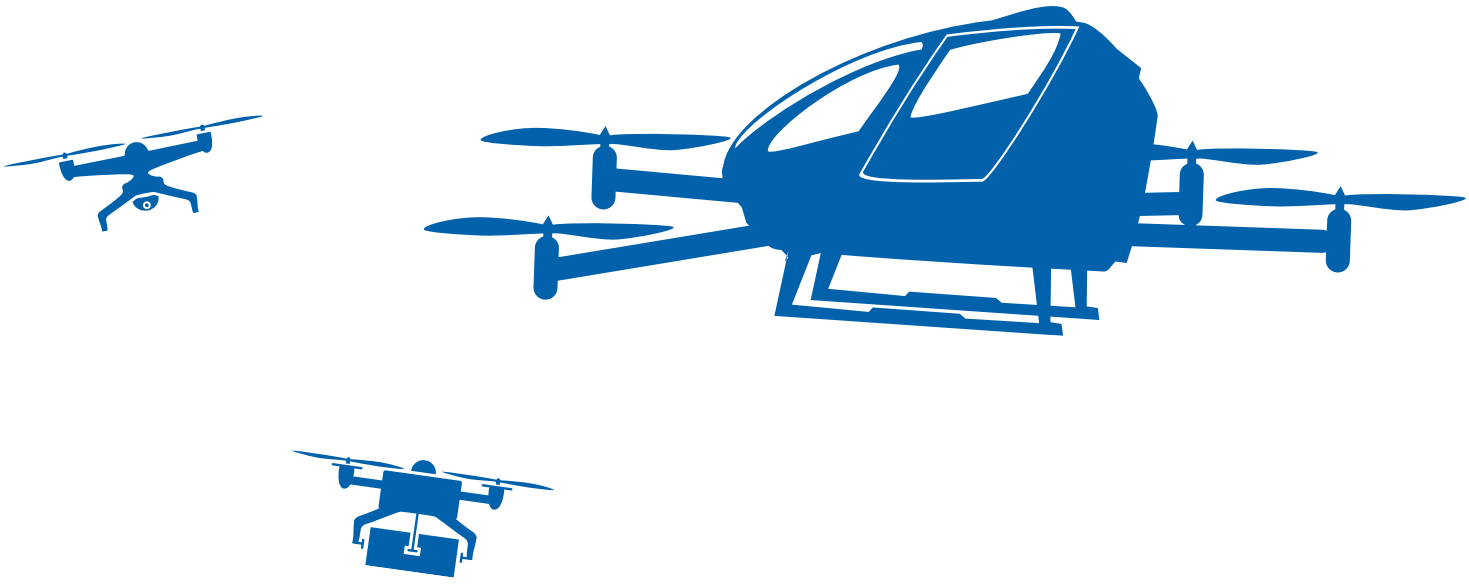
Sustainable UAV operations

To ensure economic sustainability for UAV services, countries need to ensure a high degree of freedom to use the available airspace. If UAV operators must negotiate with a USSP for the approval of every flight plan and every change of course, many of the inherent speed and flexibility advantages of UAVs will completely disappear. Many new business models make no sense without free access to airspace.

Of course, freedom must not come at the cost of safety and security. This means that USSPs must be provided with sophisticated tools for dynamically defining prohibited areas of airspace.

Equally, to operate in urban areas, UAVs will likely need to meet minimum standards for manoeuvrability, for their ability to sense other traffic, and for their capacity to communicate with the USSP. Based on their performance characteristics in these domains, USSPs should be able to dynamically define separation parameters for different UAVs. The better equipped and more cooperative a UAV is, the more freedom it should have in using airspace.

Frequentis proposes that existing technology in the ATM and UTM domains is capable of managing safe, secure and sustainable UAV operations alongside manned aviation. In this model, commercial off-the-shelf UTM components and services will interface with the existing ATM ecosystem to create a common operational air picture.



Proven technology

The required deconfliction technology for combining manned and unmanned traffic safely in the same airspace is already proven in the ATM domain. If UAV operators use existing aviation data standards to provide data on flight plans, performance characteristics and drone position, their unmanned traffic can be seamlessly blended with existing manned traffic.

In practical terms, the proposed approach will also avoid disruption to existing ATM operations. Assuming that ANSPs are permitted to act as USSPs, the total amount of traffic handled by each controller may increase significantly. However, the high degree of automation present in the existing deconfliction technology means that personal workloads will remain the same.

At the same time, the new UAV traffic will provide an additional income stream for ANSPs. In light of uncertainty about the near-term future for passenger air travel, aviation authorities should therefore act to preserve overall ATM system capacity by unlocking the potential financial benefits of the UAV model.

One potential objection is that the existing technology is not yet proven to solve the longer-term challenge of integrating autonomous drones. This is certainly true: more validation and development are required, as well as significant new regulations and standards. But today's technology has proven readiness to get the UAV economy off the ground and to keep ANSPs busy while conventional passenger aviation continues its recovery.

Figure 3: Surveillance data fusion for manned and unmanned aircraft

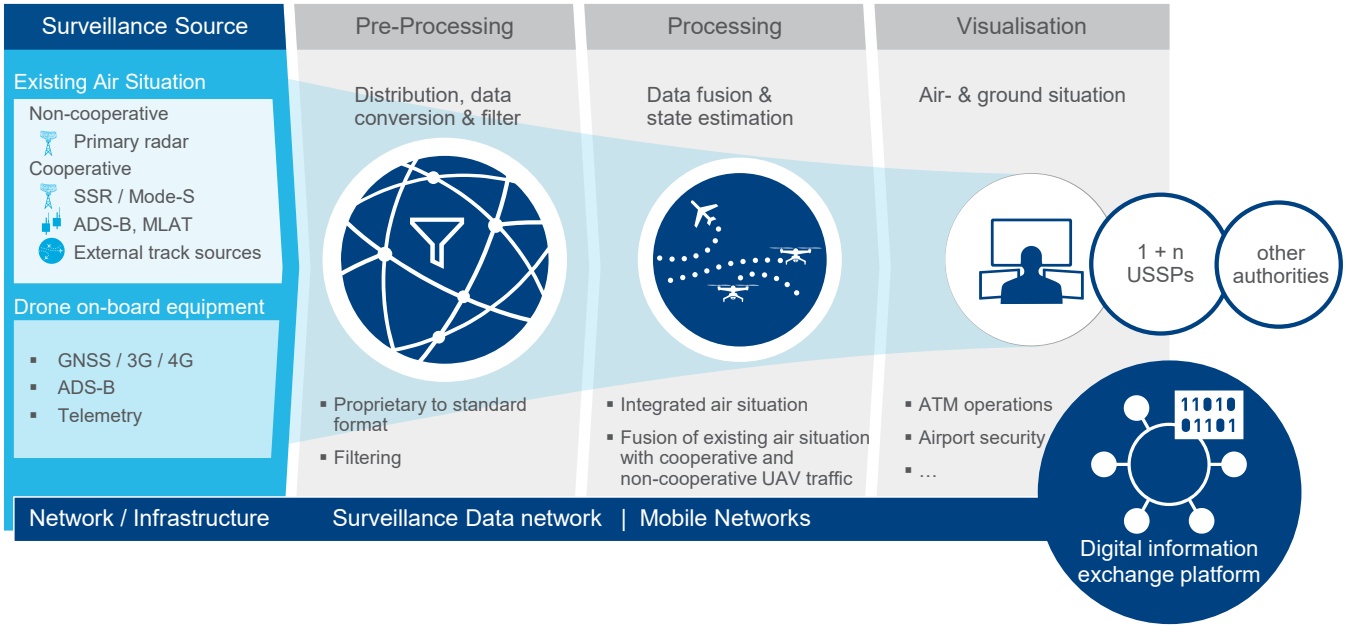
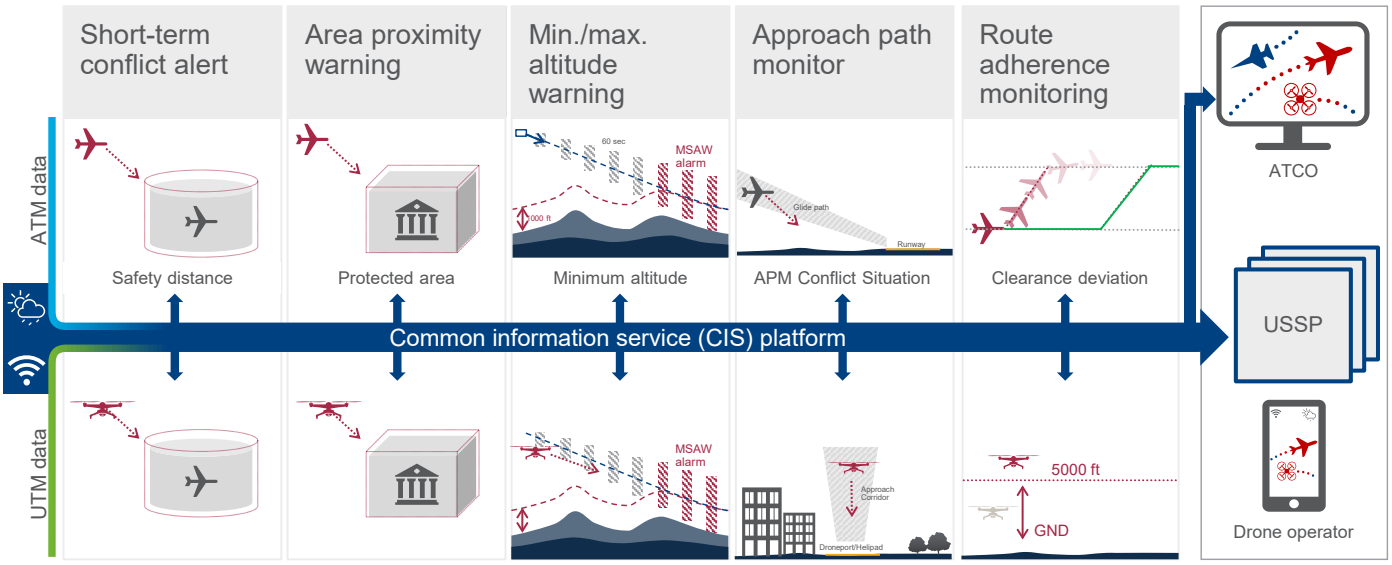


Figure 4: SafetyNets – the baseline for tactical deconfliction in shared environments



Comprehensive data services

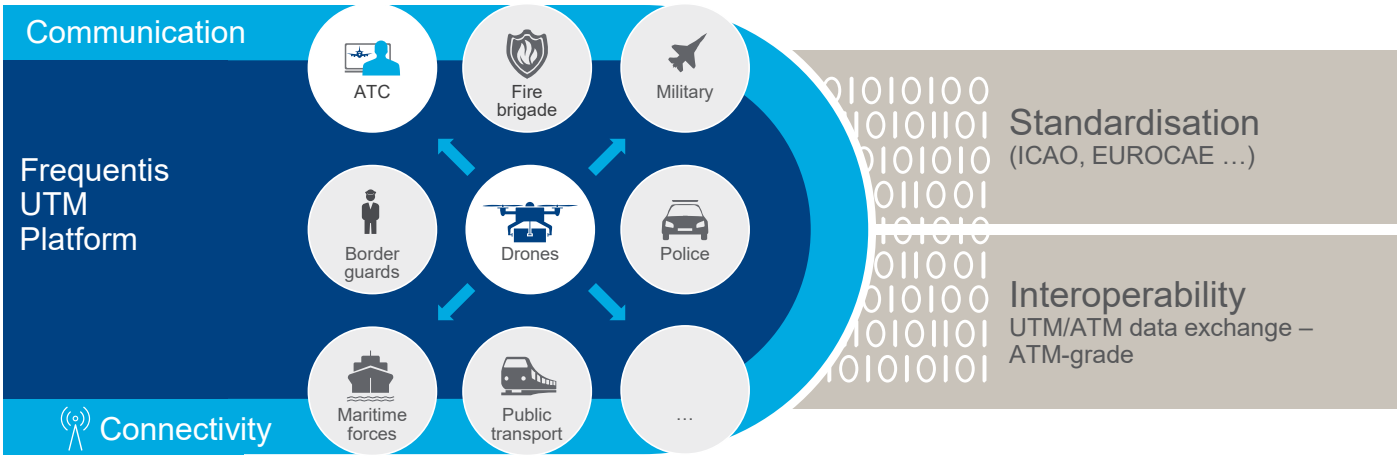
In addition to extending existing deconfliction and safety-net functionality from ATM into the UTM domain, the proposed Frequentis approach also provides data on potential hazards in domains such as weather and connectivity.

Ensuring both safety and security for UAV traffic—especially in urban areas with the potential for many simultaneous airspace users—will depend on highly reliable mobile networks. By incorporating data from monitoring partners that work directly with the mobile network operators, Frequentis can provide dynamic coverage data to USSPs, so that it is immediately clear when a UAV may be unable to receive instructions. To manage such scenarios, the USSP would swiftly adopt a safety fallback position, geofencing any uncommunicative UAVs and alerting other airspace users approaching known areas of insufficient network coverage.

Frequentis can already demonstrate the fitness-for-purpose of combined ATM/UTM components and services hosted on a scalable cloud infrastructure that assures fair accessibility to all stakeholders. The solution provides highly automated real-time separation assurance even for busy airspace—specifically in areas where UAM operations have the potential to conflict with airport traffic—enabling the efficient management of a unified airspace without segregation.

The combination of an integrated trajectory-management service based on flight plan information with real-time secondary surveillance radar information during flight operations will ensure reliable safety-net warnings for ATM stakeholders. It will also support dynamic geofencing to enable UAV self-separation, based on data provided by a centralised Flight Information Management System (FIMS) infrastructure.

Figure 5: Key enabler for interoperability and standardisation



Cross-divisional collaboration between all UTM stakeholders (e.g. common air picture)

Collective and cooperative services

The proposed solution architecture is built around a federated set of safety-critical microservices run by USSPs and hosted on a centralised cloud infrastructure, which will consume essential data from multiple sources, combine and distribute it to all stakeholders in a standardised way. This will enable the collective and cooperative provision of reliable U-space services for UAM use cases and other commercial drone operations in areas of dense air traffic.

USSPs and ANSPs will exchange information and coordinate their activities using interoperable standards that support highly automated drone traffic management and situational awareness among all U-space stakeholders. With standardised data and protocols, it will be easy to share data and provide ATM/UTM services across national borders.

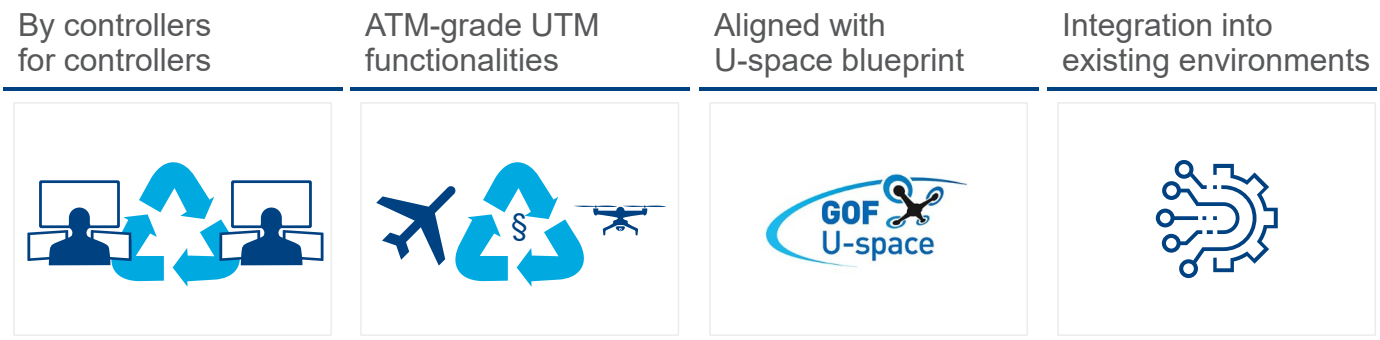
The solution outlined by Frequentis in this paper complies and integrates with existing ICAO regulations, the European Commission's U-space initiative and the regulatory framework currently under development by EASA and the European Commission.

Frequentis is proud to be a leading supplier to the Air Traffic Control market. In our 70+ year history, we have supplied more than 700 systems to the leading CNS/ATM agencies in over 60 countries—more than any other international supplier.

We already have extensive experience in ATM/UTM, having made key contributions to the SESAR GoF U-space project with regards to Information Systems for organising flights in lower airspace as well as orchestrating various UTM providers and authorities. The SESAR GoF project has proven how important it is to have a company with deep understanding of the ATM-specific requirements in a coordinating role between the UTM and ATM industry and between UTM service providers.

Following the award of a contract to implement the first UTM system in the Nordic region, Frequentis has proven its market-leading role as UTM and information system supplier to the ATM industry. Frequentis will provide Norway's Avinor Air Navigation Services with a technically advanced, ATM-grade UTM solution.

Figure 6: the Frequentis fully expandable and modular system design empowers urban air mobility



Frequentis is the only provider capable of delivering end-to-end UTM solutions incorporating connectivity services based on cellular infrastructure using only in-house expertise and products: ranging from operational process design to go-live support, as well as all other required tools for efficient and safe operation.

Conclusion

In the mid- to long-term, UAM and other commercial drone use cases may employ fully autonomous technology and depend on a high degree of interconnectivity between vehicles. This is how self-driving cars are expected to operate, but the situation is naturally more complex where UAVs are concerned, because they have an extra dimension in which to move.

The immediate future for UAVs—restricted both by the available technology and regulatory frameworks—is one in which vehicles that are remotely controlled by humans will need to share certain portions of airspace with conventional piloted aircraft.

The proposed Frequentis solution uses proven, safety-assured technology from the ATM domain to make UAV-based business models viable today—in terms of safety, security and economics. It also strictly limits the additional workload for human air traffic controllers, while keeping them in the loop for safety assurance.

In addition, the Frequentis solution raises the possibility of ANSPs using their existing technology to monitor airspace and provide safety services for UAVs, potentially creating a valuable new revenue stream at a time of uncertainty around the economics of manned aviation.

This white paper proposes an approach to managing UAM and other commercial drone operations that is deployable today to kick-start a whole new industry, and that will adapt to future requirements as all stakeholders build experience and decide on the ultimate direction of travel.

To learn more about Frequentis solutions for UAM, visit our website today.

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