DRONE PORT OF ROTTERDAM: U-SPACE AIRSPACE PROTOTYPE

WHITE PAPER

Aviation and shipping have always been two separate entities. This is set to change now that drones are becoming part of port operations. Port of Rotterdam Authority considers safety to be paramount. This will also apply to the low altitude airspace, in which these drones operate. Will the Port of Rotterdam Authority itself manage the airspace as a regular port operation? Or will another body be responsible for ensuring safe airspace? We want to investigate this in the Port of Rotterdam's U-Space Airspace prototype.

author: Ingrid Römers

What exactly does airspace management involve? What are the roles and responsibilities? What technical support do Unmanned Traffic Management (UTM) systems provide? In other words, how will the low altitude airspace in the port be organised and controlled in a way that ensures safety and provides opportunities?

As part of the 'Drone Port of Rotterdam' innovation programme, we are setting up a 'Rotterdam U-Space Airspace prototype'. This kind of prototype will provide answers to these specific questions as well as the general question about how to organise the airspace above an area where someone – e.g. a municipality, a farmer or a port authority – is in charge. It will give a substantiated impression of the type and amount of work involved in drone airspace control and the costs involved. And all this will come before any final decisions are made either by the Port Authority or by national governments. The Ministries concerned (I&W and Defence) and the competent authority (Inspectorate for the Environment and Transport) will be involved in setting up the prototype. It is their task to set up the governance, finance and legal framework for airspace management. The Ministry of I&W will set priorities for initial U-space airspace locations, develop the method of (compulsory) designation of areas as U-space airspace, answer the question of who the designation will apply to, and set the requirements for this airspace and the U-space services offered within it.

Organising U-space airspace will also require broad agreement among all stakeholders in the port. Drone service customers and providers alike see the Port Authority as logically the most appropriate party to take on the task of coordinating activities among a range of stakeholders. A prototype will provide this opportunity and at the same time feed results and experiences back to the regulators. It will create an interaction between practical experiences and the proper establishment of all necessary rules, procedures and protocols. Properly organised prototypes can be a huge help in setting up safe U-space airspace. The port can play a leading role in this.

Before considering low-level airspace, U-space and its services, we shall have a closer look at the reasons for setting up the Rotterdam U-Space Airspace prototype.

Increase in drone traffic

Many companies, governments and emergency services in the port see drones as a way of efficiently inspecting and maintaining assets, providing better security, combating narcotics-related crime such as detecting intruders and drugs collectors, measuring emissions and further improving ship visits by getting items on and off board earlier using delivery drones. There are also many developments in the area of cargo and passenger drones. We expect to see the first vertiports (areas designed specifically for aircraft that land and take off vertically) in 2024 for testing and demonstrations. Starting in 2026, we expect the first commercial flights using flying taxis, albeit with a pilot. Manufacturers are currently developing these drones to carry between two and six passengers. While more flights in the same airspace at the same time will be the rule rather than the exception, they must not interfere with the work of the emergency services.

Sustainable and smart port

The use of drones is in line with the Port of Rotterdam Authority's strategic ambition to be a clean and smart port. Drones are fast, clean, relatively cheap and safe and require little maintenance. In the hybrid port of the future, drones will be used in addition to vessels, trains, and trucks for the transport of freight and passengers. The Port of Rotterdam Authority's strategic ambition is to increase port efficiency and improve trade flows based on the pillars of sustainability, digitisation and innovation.

These ambitions will not alter the Port Authority's core tasks: a thriving port-industrial complex, safe and smooth shipping and keeping the port and its surroundings safe, healthy and attractive. Safety is the number one priority at the port. Not only the safety of shipping, but also that of companies, residents, port workers, and professional and recreational users of the port area.

Port of Rotterdam

Pioneering role in automated transport

Drones are becoming increasingly autonomous. For this reason, drones are part of the Connected Automated Transport programme at the Port of Rotterdam Authority. It focuses on the question of how digitisation, automation, connectivity, control systems, AI and machine learning are interrelated and contribute to connected, automated (and zero-emissions) modes of transport. Drones are also part of the digital transformation in a smart port, and the role of traffic management is central to the various modes.

Safety and security in the air

Taking care of safety, security, privacy and the environment in the port area have always been related to shipping traffic on the waterside and industrial port activities on land. Now that we are entering the area of drones, it will also cover airspace, especially the Very Low Level (VLL) airspace.

Increasing the operational safety of both manned and unmanned traffic in the port area and improving the visibility of manned and unmanned aircraft is therefore the main motivation for creating the U-space airspace. Security plays a role, as does better identification of unmanned aircraft to support local enforcement and the banning of flights over sensitive locations. Airspace monitoring will provide insight into the use of the sky and provide the ability to enforce regulations. With U-space, we will know who and what is flying, we will learn to recognise patterns in terms of when and where there are lots of flights and identify whether or not they are desirable. It will be possible to give the police, fire brigade and customs priority in the event of incidents and investigations.

UTM, U-SPACE AND DRONE OPERATORS

An Unmanned Traffic Management system (UTM) or U-space is the drone traffic control system. It will comprise a number of AI-based automated communication services specifically designed to manage drone traffic.

U-space airspace is the piece of airspace in which this service is provided. Every user of this airspace has to follow the operating rules and is required to use the UTM and other services.

UTM features include obstacle assessment, conflict detection, dynamic no-fly zones – for example over tankers or hazardous material zones – and the recognition of government drones. In addition, the UTM can provide information on drone traffic – for example to vessels – and on questions concerning the legality and purpose of observed flights.

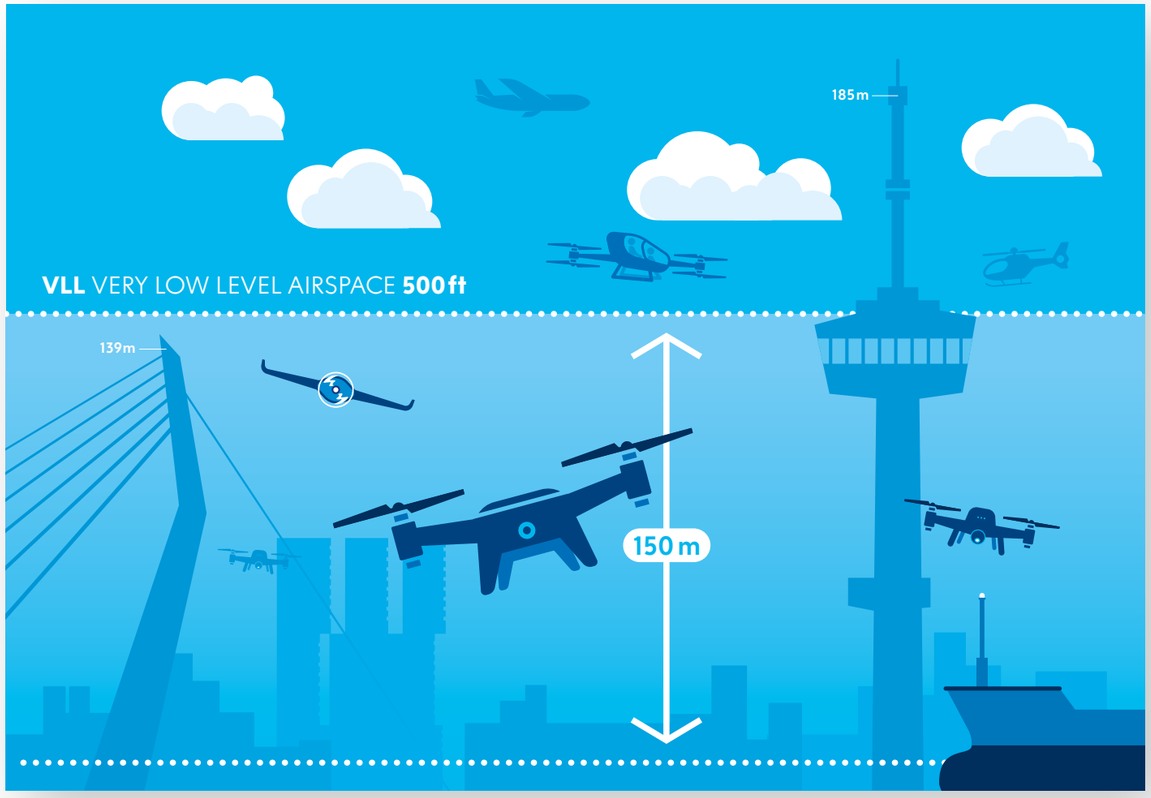
Automated services of this kind are made available by U-Space Service Providers (USSPs). These operate under the supervision of the competent authorities and have to meet stringent conditions before being granted a certificate allowing them to provide the services. Although the EU leaves the provision of services by U-Space Service Providers to the market, it does require them to be certified organisations.
Only when the unmanned traffic control system is fully operational and has the agreements, protocols, communication tools and standards in place to ensure future growth of unmanned air traffic occurs in an orderly manner and in accordance with all legal EU requirements will we be able to speak of U-space. U-space is therefore the European version of a UTM system.

Drone operators can use U-space to plan and execute their missions in the best possible way. It connects all drones in the sky to each other and makes them visible to operators as well as to authorities and, via apps, to citizens. The EU rules allow for the possibility of U-space service providers to offer their services to users, the drone operators, for a fee.
The operator remains responsible for safe flight operations. In this respect, U-space services, such as providing an air picture, allow the operator to take responsibility.

MANAGING THE LOW-LEVEL AIRSPACE AS A REGULAR PORT OPERATION

In 2017, the EU published the U-space Blueprint with the basic principles and the preliminary concept for rolling out U-space. The blueprint followed on from the 2015 EU Aviation Strategy that recognised the benefits to European society and economy of complex drone operations with a high degree of autonomy.

The way in which national governments should organise U-space airspace, including roles and responsibilities and requirements for Unmanned Traffic Management systems, was set out in EU Legislation 2021/664 of April 2021. This regulation addresses the safe integration of drones into the aviation system and the management of lower airspace. Guidance material for harmonised implementation by Member States was published by the EU at the end of December 2021.



The European regulation will apply in the Member States from 26 January 2023. This means that from that moment on, U-space services can be offered in the designated airspace. This legislation covers the first two phases of U-space in which the foundation and initial services may be provided. The date the regulation comes into force also marks the moment after which services may only be provided by parties that have been certified by the Member State or EASA. For the last two phases of airspace management (including fully automated deconfliction and interaction with manned air traffic control), legislation is currently being prepared.

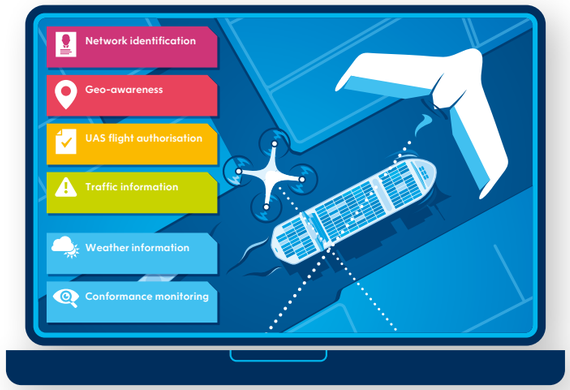
The regulation also stipulates that drone operators may only access U-space airspace if they use U-space services and comply with security and privacy regulations. Manned aircraft such as helicopters are required to make themselves visible electronically. With U-space, you are effectively establishing a controlled area because unmanned aircraft cannot enter it unauthorised.

The authorisation consists of the obligation to provide notification of the drone flight and concerns the flight's time, altitude and route and whether it is compatible with the other announced flights. It also serves as a check as to whether all the conditions set are being met.

Before a flight is registered in the UTM system, the operator must have applied for the licence. The Environment and Transport Inspectorate (ILT) is the body responsible for issuing permits to operate a certain type of flight. Every company that is granted an operating licence from ILT is adequately equipped to execute flights safely.

At least four mandatory U-space services must be offered in U-space airspace;

- Network identification; the ID of the drone operator and the flight.
- Geo-awareness; U-space also has geo-zones; for example, zones above certain terminals in the port, in which safety and other requirements of varying stringency are imposed on operators, aircraft and flight operations. The Geo Awareness Service will provide operators with information on airspace restrictions and defined geographical zones.
- UAS flight authorisation (pre-flight information); ensures that flight operations do not cross each other's paths; this service approves flights in relation to other flights; each flight receives a flight approval before it is allowed to take off, based on the filed flight plan.
- Traffic information (in-flight information); this service checks whether there is traffic in the vicinity and warns other air traffic when this is the case. The service helps when priority needs to be given to emergency services in crisis situations and emergencies and warns operators when they need to divert from previously approved flight plans.



Additional U-space services that may be required or offered in addition to the four mandatory services include weather information services and a compliance monitoring service.

Mobile apps could supplement the system by offering features such as a user interface for providing notifications of flights. Overall, the system displays who is flying, who has flown and their flight paths.

AUTOMATED COMMUNICATION WITH UNMANNED AIRCRAFT

One provider of Common Information Services (CIS) is designated for each U-space airspace. The CIS provider is responsible for the exchange of information between the service providers and between the providers in adjacent areas. The EU is standardising the way information is made available. For example, identical interfaces must be created between the different airspaces.

Part of the services offered by the U-Space Service Providers (USSPs) will be based on information (airspace structures, meteorological information, etc). The Common Information Service will ensure that the sources of this information are aggregated and systemically accessible. Legally speaking, these service providers and CIS must remain strictly separated. While the CIS is a government-appointed body, the service providers come from the market.

All in all, a large number of parties are needed to make U-space possible: not only air traffic control, USSPs, drone operators and other airspace users, but also suppliers of information and sensors, data security providers, local, national and international authorities, enforcers, manned air traffic control, drone manufacturers, shipping and terminals, researchers and also citizens.

Exploring together and sharing knowledge about the low-level airspace

The prototype will offer the Port of Rotterdam Authority the opportunity to assess what is needed to organise safe airspace and to build up a knowledge of U-space. It will help to decide whether we would like to have a role in low altitude airspace in the future and what that role should be. The prototype is a collaborative partnership between the authorities, the municipality of Rotterdam, stakeholders, knowledge institutes such as the NLR and industry, and will help advance the many drone applications in the port from a neutral position. The port can play a leading role in this because thanks to all the water, the risks involved are lower than they would be over cities.

The Port of Rotterdam Authority has therefore taken on an investigative role in the rising volume of air traffic. The prototype will help us research how drone operators will be able to offer their services safely to our clients. We can connect the information layers that we already have – shipping traffic, weather forecasts, charts showing high obstacles – to the UTM system. It can therefore become a very strong asset with economic value for our port.
The U-space airspace prototype will put the Port of Rotterdam Authority at the forefront, serving as an example for the roll-out to other areas in the Netherlands.

For further information, please feel free to contact:

Ingrid Römers
Senior advisor at the Port of Rotterdam Authority
iiem.romers@portofrotterdam.com
+31 (0)6 1582 2469 or visit **www.portofrotterdam.com/**drones

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