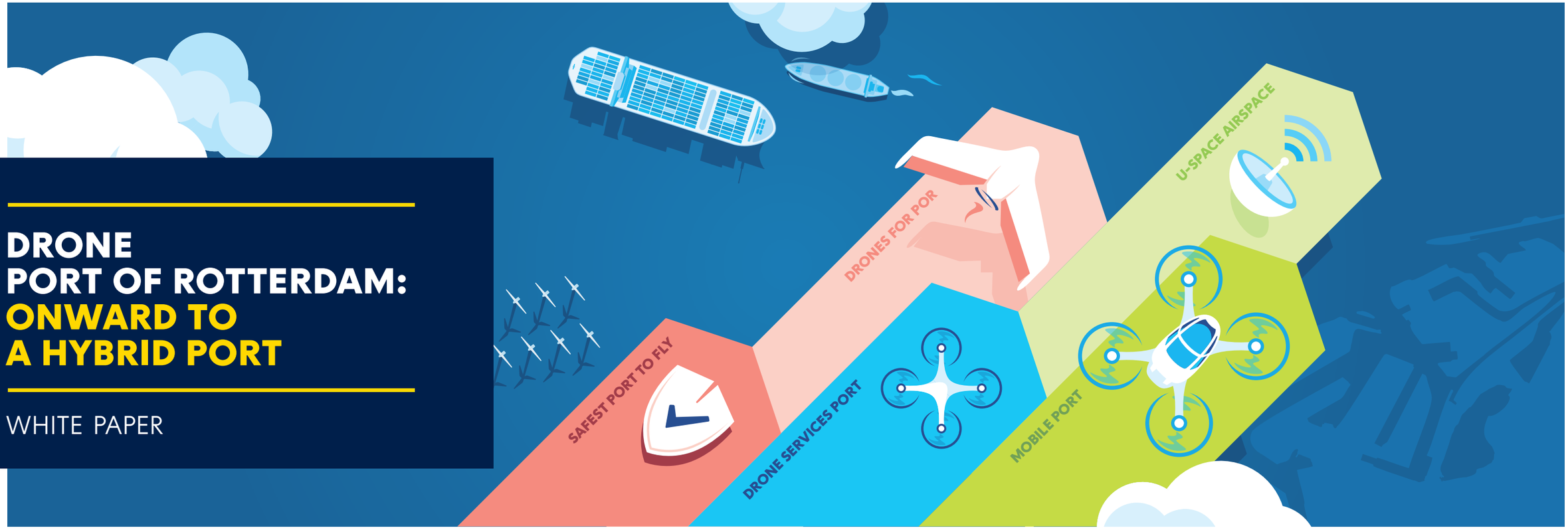


DRONE PORT OF ROTTERDAM: ONWARD TO A HYBRID PORT

WHITE PAPER

The use of drones is in line with the strategic ambition of the Port of Rotterdam Authority to be an even safer, more sustainable and more efficient port. The innovation programme Drone Port of Rotterdam is intended to develop the port area into an area where providers of drone services can experiment in a relevant environment. 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. Together with businesses and the authorised bodies, we are preparing our airspace and procedures for this in steps.

author: Ingrid Römers

Drones are fast, clean, maintenance-friendly, relatively cheap and safe. The Port of Rotterdam Authority does not have a fleet of drones of its own, but it has been hiring drones for many years to render assistance in various tasks. Companies in the port of Rotterdam also use drones to an increasing extent, to inspect complex installations in the process industry that would otherwise be very difficult to reach. The deployment of drones is safer for people, it is more efficient, and it contributes to maintaining the infrastructure well. In the future, drones will also play a role in fighting drug-related crime or detecting air pollution. There have already been trials with package delivery by drone to sea-going vessels and inland vessels. Before long, this method will be used to take spare parts, documents and medicines to vessels. Later on, drones will be able to take larger packages and even people on board, but when exactly is hard to predict. When Jeff Bezos announced the first deliveries by drone in 2013, he expected this service to be operational in his own company by 2020. Full exploitation of this type of delivery, however, will not be realised any time soon. This does not mean that drone development has come to a standstill. On the contrary, the drone world is bristling with activity.

Drone Port of Rotterdam

To explore the possible applications of drones further and on a larger scale, we set up the innovation programme Drone Port of Rotterdam. Not unlike the majority of technological innovations, the full exploitation depends on a combination of technical development, regulations, knowledge of added value, specific business cases, and the degree to which the new technology is accepted and embraced. The Drone Port of Rotterdam programme can make the difference in each of these aspects.

Drone Port of Rotterdam consists of five parts:

1. Rotterdam, the safest port to fly;
2. Drones for the Port of Rotterdam Authority;
3. Drone Services Port;
4. U-Space airspace;
5. The mobile port.

Test environments and demonstrations

So far, technical tests with drones have only been conducted in risk-free areas or areas that were closed to the public, such as farm fields. New parts, control methods, materials, and sense-and-avoid techniques are rigorously tested before they enter production, and so is the performance of already existing drones. The Dutch government has developed policies that cover testing and experimenting with remote control, out of the pilot's sight, and automatic flight. In the next two years, permits will be granted under certain conditions for drones to fly in a 'temporary area with restrictions' Beyond Visual Line of Sight (BVLOS). This will allow for experimental flights of more than 500 metres.

Businesses that want to explore specific applications or business models will need additional, relevant test environments where the risks can still be controlled. This is the type of purpose for which the Port Authority wants to make the port area available. With a Dutch company and a fixed-wing drone for long-distance flight, we set up a fixed station between Europoort and Maasvlakte in 2022 for half a year. In collaboration with helicopter operator NHV of the Pilotage Service, we will examine how the drone and helicopter can use the airspace safely together. In this period, the drone will perform tasks for the Port Authority and public services, such as surveillance tasks in the port and at sea. Companies, too, can hire the drone to test their use cases or develop their ideas, for instance about package delivery.

There will also be demonstration flights from Maasvlakte to an offshore platform with other drone types for delivery and

Port of Rotterdam

long-distance surveillance. Organisations interested in developing services involving drones and potential clients using these services will be invited to gain more knowledge about these drones and to get or suggest ideas. These demonstrations will take place in the Dutch Drone Delta (DDD), of which the Port of Rotterdam Authority is one of the co-founders. The DDD joins forces with public services, business and relevant stakeholders for the future of Urban Air Mobility. The DDD is committed to creating social support for drone applications and focuses on autonomous long-distance flight, the safe integration of manned and unmanned traffic, delivery by drone, and the transport of freight and passengers between and in cities. The demonstrations in the Rotterdam port area are part of this.

1. ROTTERDAM, THE SAFEST PORT TO FLY

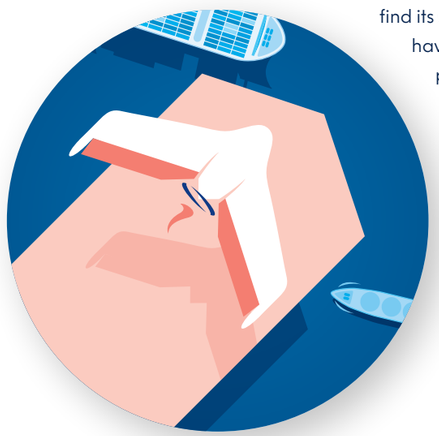
These developments are driven not only by technology but also by legislation and regulations on the use of drones. The European Union is working on harmonisation and regulations, with the emphasis shifting from regulation-based to risk-based policies. Drone use is permitted on an increasingly wider scale, on the condition that safety is safeguarded. Providers of new drone services have to analyse the risks and demonstrate that these are reduced to acceptable levels.

We have the ambition to be the Safest Port to Fly. In consultation with the authorised bodies, we will assess the port area for drone-related risks and propose measures to mitigate these risks so as to safeguard a safe use of airspace while drones can be deployed in the best way possible. The four other Dutch sea ports are also involved in this consultation, in which aspects like privacy and cyber security are discussed as well.

With partners in the Safety Region, we will set up a protection model in the next few years to prevent the use of drones for mala fide purposes, including espionage, sabotage and drug trafficking. This model has been developed by the Royal Netherlands Aerospace Centre (NLR) and the Netherlands Organisation for Applied Scientific Research (TNO) in cooperation with the Dutch Ministry of Defence. The steps of this model range from prevention and detection to neutralisation.

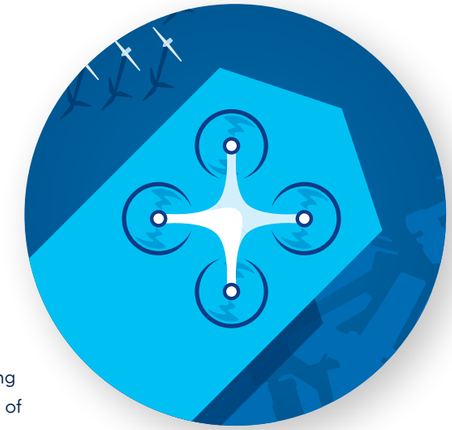
2. DRONES FOR THE PORT OF ROTTERDAM AUTHORITY

The role of cameras in the port is getting more and more important. These can be fixed cameras but also mobile cameras, like those attached to a drone. Shipping masters on patrol vessels are already being assisted by fire department drones when handling incidents like water pollution for instance. Drones can map the size of an oil spill and find its source quickly. In a similar way, they can detect the location of heavy objects that have fallen overboard. Vessels nearby can be alerted in time so that collisions are prevented. Drones also provide support when quays and other infrastructure are inspected. They conduct checks and perform measurements in the port area, a method that is more efficient and improves safety. When a storm is brewing, drones can be deployed to check if vessels are moored securely at their berths. After a storm, drones can assist in speeding up clean-up operations by mapping debris and waste that has been blown into the port basins. An incident vessel with shifted containers on board that asks for admission to the port of Rotterdam can be assessed quickly with the help of a drone so that proper measures can be taken.



Applications of this type are the subject of regular pilots, for instance on increasing the mooring capacity for inland vessels carrying hazardous substances. Via a drone, the Harbour Master's Division watches if everything is going fine. In this way, assistance provided at the location can be restricted to situations in which it is absolutely necessary.

3. DRONE SERVICES PORT

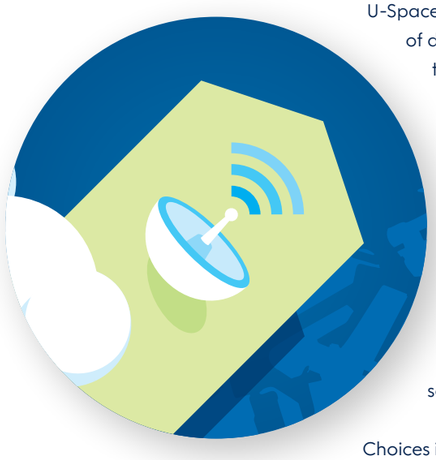


With the rapidly advancing technological developments, there are more and more drone applications that are interesting to port areas in particular. Examples include taking samples or performing inspections of hold and cargo even before the vessel arrives at the port. Here, drones will be used that can find their way autonomously while detecting and avoiding objects during flight. This may help vessels and terminals comply with all regulations without any delay.

Vessels receiving delivery by drone of parts required for repairs at sea can reduce their berthing time in the port. Progressive shipping companies are thinking about ways to adjust safety regulations on board to provide for the safe landing of drones on their vessels.

Applications for clients, such as transporting documents and delivering parts over various distances, as well as gas detection, emission monitoring and measuring quality (of water for example), require different types of drones and services. As a Drone Services Port, the Port of Rotterdam wants several drone services to be available to all sectors of the port business community, from maritime and inland shipping to the offshore industry, as from 2022. To this end, we are actively looking for companies that provide drone applications in the maritime sector and that want to cooperate with us.

4. U-SPACE AIRSPACE



U-Space airspace is the European name for environments in which major traffic flows of drones need to be managed. Preparing the port area for a future in which drone traffic is likely to intensify is a process in steps and takes careful consideration. On the one hand, infrastructural adjustments are needed, including sky ports where drones can take off and land safely. On the other hand, tasks and powers have to be laid down clearly.

The Harbour Master has always been the competent authority that organises and provides VTS, Vessel Traffic Services, for maritime shipping. These outstanding VTS services have made Rotterdam a safe port for maritime shipping for many decades. We want to examine if the Port Authority can also manage air traffic in the lower airspace as a regular port operation. Or should this task be assigned to air traffic controllers, for instance, who have so much experience in the field of manned aviation?

Choices in setting up and managing procedures for this airspace of up to 150 metres will be essential in the next few years. The same applies to financing these. Shore-based radar and personnel costs of maritime shipping VTS are partly paid from the port dues. For the use of drones, some kind of air dues or air tax might be charged.

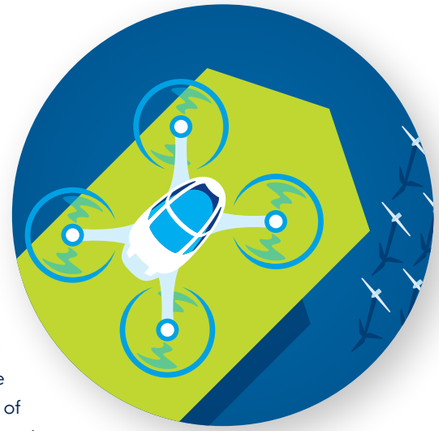
Port of Rotterdam

On the basis of market surveys and interviews with supply parties and demand parties, we expect drone traffic to be busy enough for the port of Rotterdam to put U-Space airspace in place so that we can use a wide set of rules drawn up for these spaces. 'There will be value in a good organisation of the lower airspace,' said one of the port's clients.

Legislation for U-Space airspace will take effect in January 2023. Next year, we will know which role the Port of Rotterdam Authority will be playing in this context. In the same year, we will start developing a prototype to gain experience with the U-Space concept: an Unmanned Traffic Management system for managing airspace in the port. Drone service providers report their flights via this system. The port will be a controlled area to which every authorised operator gets access and can perform its flights safely and without any conflicts with other traffic. The police and port manager can consult the system for information about the drones in the air. Are these flights legal? What are the positions of these drones? This system can even be made accessible to the public at large via apps. When they spot a drone, they can establish via the app why this drone is deployed. They can also see which company operates it and whether this operator complies with the GDPR.

5. THE MOBILE PORT

The ability to operate long-distance flights is a major step towards the realisation of a hybrid port, in which drones are used in addition to pipelines, railways, roads, and waterways for freight transport. With Drone Port of Rotterdam, we will look for opportunities in the various logistic chains when drones with a payload of up to hundreds of kilos will become feasible.



In the long term, passenger transport per drone will no longer be a dream. Drones can then be used for taking service engineers or pilots to installations that are hard to reach or to vessels outside the port in a relatively short time.

We are currently consulting with several frontrunners in passenger drone design how these drones can contribute to improved mobility in the port. This would be interesting to crews that want to travel to the airport quickly to make the most of their leave, and it would reduce congestion on the A15 motorway, on which there is increasingly heavy commuter traffic. If a CO_2 tax for travelling by car is introduced, passenger drones will definitely be a viable alternative. In short, this possibility is worth investigating.

Today, passenger transport by drone is still a distant prospect. We assume that the first tests will take place in 2024 and that the corresponding legislation will become effective two years later. All the same, in the coming years, we want to use a step-by-step approach to prepare our airspace and procedures for the full (commercial) exploitation of drones. Drone Port of Rotterdam lays the foundation for this.

Exploring together and sharing knowledge

The Drone Port of Rotterdam is the ideal setting for experimenting in the relevant environment, in which we, the Port of Rotterdam Authority, learn about the risks and uncertainties before we invest in infrastructure, our own drone fleet, safety, protection, et cetera. We will gain more insight into the infrastructure we need, whether additional rules for a highly industrialised (port) area are required, and what these should look like. We will find out how a single, uninterrupted airspace can be created for the port and how far it will stretch.

Cooperation and knowledge sharing are essential to accelerate the development of the potential of drone technology for port areas. Drone Port of Rotterdam is a process we want to work on as Port Authority together with entrepreneurs in the port and the competent authorities.

For further information, please contact:

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

Port of Rotterdam