

Drone Operations in a Critical Infrastructure Environment

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With drones becoming an essential part of operations in industrial settings and critical infrastructure environments, no one can deny that, whether they are used for inspections, surveillance, mapping or logistics, they can be extremely beneficial. But what exactly is the benefit of the application of these technologies? What are the advantages for plant operations? Are they simply a fad with no long term perspective? And most importantly, how can one implement a UAS division in operations on industrial settings in a way that is realistic and efficient?

Luckily, HHLASky GmbH has had the amazing opportunity to execute drone operations in a critical infrastructure environment at container terminals for the past years. In operating drones in such a challenging context, we have been able to gather considerable experience to address the previous questions.

HHLA Sky GmbH is a technology provider from Germany for both software and hardware. The company is based in the city of Hamburg and operates regularly in its working harbour. There, we have the opportunity to improve certain tasks already being carried out on the terminal in which we are based in a more efficient way. We've been able to see how beneficial the application of these technologies can be in port logistics and critical infrastructure in general. We, as a company, have also experienced challenges, for which we have had to develop new operational concepts, processes and technology in a way that results in actionable data for the end-user.

One aim of the company has been to optimize already existing operations with automatic systems. To fulfil this aim, we utilize our own control centre, which is capable of controlling more than 100 simultaneous UAS flights through a mobile connection under BVLOS rules. The level of automation provided by this platform has opened new doors to a high level of quality, efficiency, and safety for different use cases.

One of the first use cases that comes to mind are inspections. Container terminals depend on multiple container cranes that require regular inspections to determine and document their status, at least twice a year. With traditional inspection methods, climbers have to execute high-risk operations on infrastructure by physically climbing the cranes. The average height of such cranes in our terminals is 83 metres in the lowered position. That means that they put themselves at risk every day to perform this task. If any mistake were to be made during an inspection, this can pose a hazard to the life of the worker due to the height at which the work is performed.



Photo: Thorsten Indra

The solution we provide significantly mitigates the risk of these operations by replacing the climber with a system that can perform the job faster, more efficiently, and which, unlike human life, is replaceable. A real benefit for work place security and insurance premiums.

Utilizing automated drone inspections also increases efficiency and reduces down time, given that, for starters, the preparation for an inspection with unmanned aircraft systems takes significantly less time than it would with professional climbers. It also takes significant less time to finish a job.

An average of 5 climbers are needed to do a full inspection of a container crane, taking an average of 24 hours to complete. In comparison, a single person can carry out the same inspection, reducing the time to 8 hours with a manually operated system. This would include the preparation phase, flights and and post processing of up to 1000 pictures. An increased level of automation further increases this efficiency, and also makes the missions repeatable. With this structured process, comparison over time becomes possible, and thereby lays the foundation to detect degradation earlier, so that maintenance measures can be carried out at the right time.

Since, as mentioned before, container cranes are typically inspected twice a year, they have to be put out of service for the amount of time it would take to perform the inspections. This inhibits the cranes from working around the clock, an action that is essential to the harbour ecosystem.

Utilizing a UAS to perform manual flights for inspections can reduce the time the cranes would be inactive by

approximately 72%, and it is estimated that it can reduce economic losses caused by this inactivity by 90%. This knowledge can be transferred to other complex infrastructures which need to be inspected regularly for safety and compliance reasons.

Having access to automation features provides an extra reduction of time to fulfil the same task. HHLA Sky GmbH has developed a feature on our control centre, which lets the user plan and execute precise automated inspection. Our so-called "Recording Mission" planning feature enables the user to execute a manual flight around critical infrastructure, which is automatically saved. These missions are anchored to a reference point device placed on top of the cranes and programmed with precise, specific camera actions. Once this process is done once, the mission simply is saved and can be re-used, again and again, as needed. It will be executed perfectly, regardless of whether the crane has changed its position or not. As a result, efficiency and effectivity is increased further.

Another use case that greatly benefits from UAS operations is intralogistics. The fulfilment of spare parts and documentation transport within a critical infrastructure environment is an essential and often overlooked aspect of the business, which normally is done with cars.

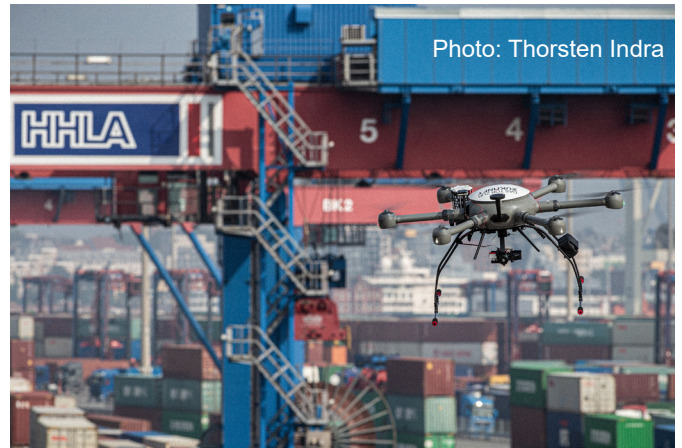


Anyone who has seen an industrial campus or a harbor map, especially of the biggest ports in Europe, knows how complex and time-consuming it can be to drive around a terminal to simply deliver small parts or documents that may be the key to have a continuous operation. This strategy is highly inefficient, creates unnecessary costs and, for the most part, creates unwanted CO2 emissions and creates extra costs.

We have determined that the implementation of UAS can reduce the time required by approximately 50%, as well as reducing costs by 70%. On another hand, it cuts emissions caused by the use of cars to 0.

Overall, intralogistics will be a really good application for drones, but there is a trick. Since most missions would have to be long range flights, the key in order to make these tasks possible is BVLOS operations. To make that possible, one needs a safe and effective platform that meets the applicable cybersecurity standards.

On another hand, one has to be innovative, but not too idealistic. Simply having the proper technology is not



enough or realistic. Just like in any operation in critical/hazardous infrastructure environments, appropriate procedures and certified equipment have to be implemented, in order to minimize the risk of human error and to ensure a smooth execution of tasks.

The cybersecurity aspect cannot be forgotten in these environments. It is a well known fact, that protecting an information critical infrastructure is of outmost importance. HHLA Sky GmbH noticed that, in order to cover that need, a proper certification of our platform and processes was needed. Because of this need, we went trough the process, and were able to receive the world's first IEC 62443 Cybersecurity certification for drone systems from the German inspection agency TÜV NORD.

Based on our experience, a company should put emphasis on creating a culture where crew resource management, communications, standard operating procedures and procedures for abnormal situations are kept to high standards. One must remember that, when performing simultaneous BVLOS flights, special care must be taken that mitigation measures are in place. One is basically performing air traffic controller tasks in conjunction with pilot duties. That means that a reduced "Airline Concept" must be put in place.

It would be wise for the manufacturers of the systems, meaning software and hardware, as well as the users, to repeatedly test and implement operational concepts. These two parties should stay in close communication to further improve these concepts, which will, as a result, improve the safety, quality and efficiency standards in the industry as a whole.



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