



GSMA Internet of Things Case Study Beyond Visual Line Of Sight Platform by KPN and TEOCO

INTRODUCTION

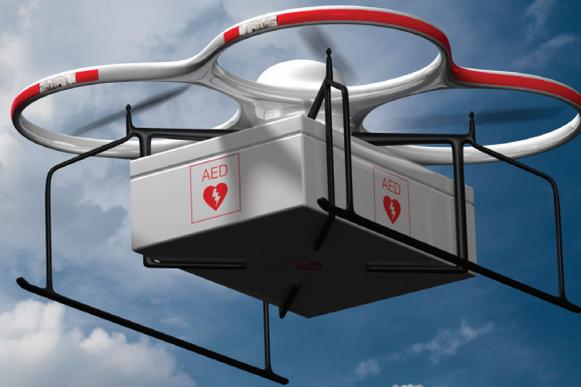
The demand for services provided by Unmanned Aerial Vehicles (UAVs) is growing, especially as communities realise the potential public safety, economic and climate benefits. Everything from managing forest fires, assessing traffic accidents, surveying natural disasters, critical infrastructure to delivering life-saving medical supplies to remote regions. In addition, other sectors, such as industry and agriculture, are increasingly interested in the value that UAVs can deliver.

KPN, in collaboration with TEOCO, is utilising TEOCO's AirborneRF solution to develop a platform for enabling a multitude of critical communication services in support of UAVs operations. By closely working together with an ecosystem of partners, the platform will share data across many different domains, including aviation, telecom, business, government and regulatory agencies - with connectivity data playing a central role. The information will be gathered and analysed to provide answers to critical questions like, 'Where and when is it safe to fly?' and, 'Who is flying, and why?'

While the benefits of UAV services are self-evident, there are critical infrastructure and safety considerations at play particularly for operation Beyond Visual Line of Sight (BVLOS) where such benefits are greater. Each UAV flight that extends beyond visual line of sight will require an approved flight plan that is filed with the appropriate government agency.

These flight plans are designed to ensure the UAV will not interfere with other manned or unmanned aircrafts; putting safety, whether in the air or on the ground, as the number one priority.





How mobile networks enable uavs

Mobile network information, analytics and connectivity data are critical for creating Beyond Visual Line of Sight (BVLOS) UAV flight plans, flight clearance updates, and various in-flight activities. Examples for services where KPN plays a key role in the future include:

- Remote Identification
- Command and Control
- Payload Connectivity
- Ground Risk Assessments
- In-Flight Notifications / Live Network Updates

THE SOLUTION

A Platform for Information Sharing

Aviation systems and mobile networks have not traditionally intersected, however, it is believed this will need to change as UAV services continue to grow. KPN and TEOCO are creating a platform with a unique interface that links cellular networks and aviation systems such as Air Traffic Management (ATM), Unmanned Traffic Management (UTM), and Flight Information Management System (FIMS).

Horizontal partnerships underpin the core functionality of the KPN platform, where cooperation and partnerships for different drone service areas will enable UAVs to generate value for specific sectors and/or companies.

One of the key benefits of the KPN UAV platform is its ability to provide valuable live network data across an integrated end-to-end ecosystem. This information is used for operational support, including command and control, sharing of video and other data assets, and the ability to meet appropriate bandwidth to support real-time data streaming and other UAV-enabled services. Having the ability to update and share information in real-time is critical due to the dynamic nature of flight paths, ground risks, weather, network availability, etc. Sharing these informational resources across the ecosystem from a common platform ensures all stakeholders are always adequately and accurately informed.



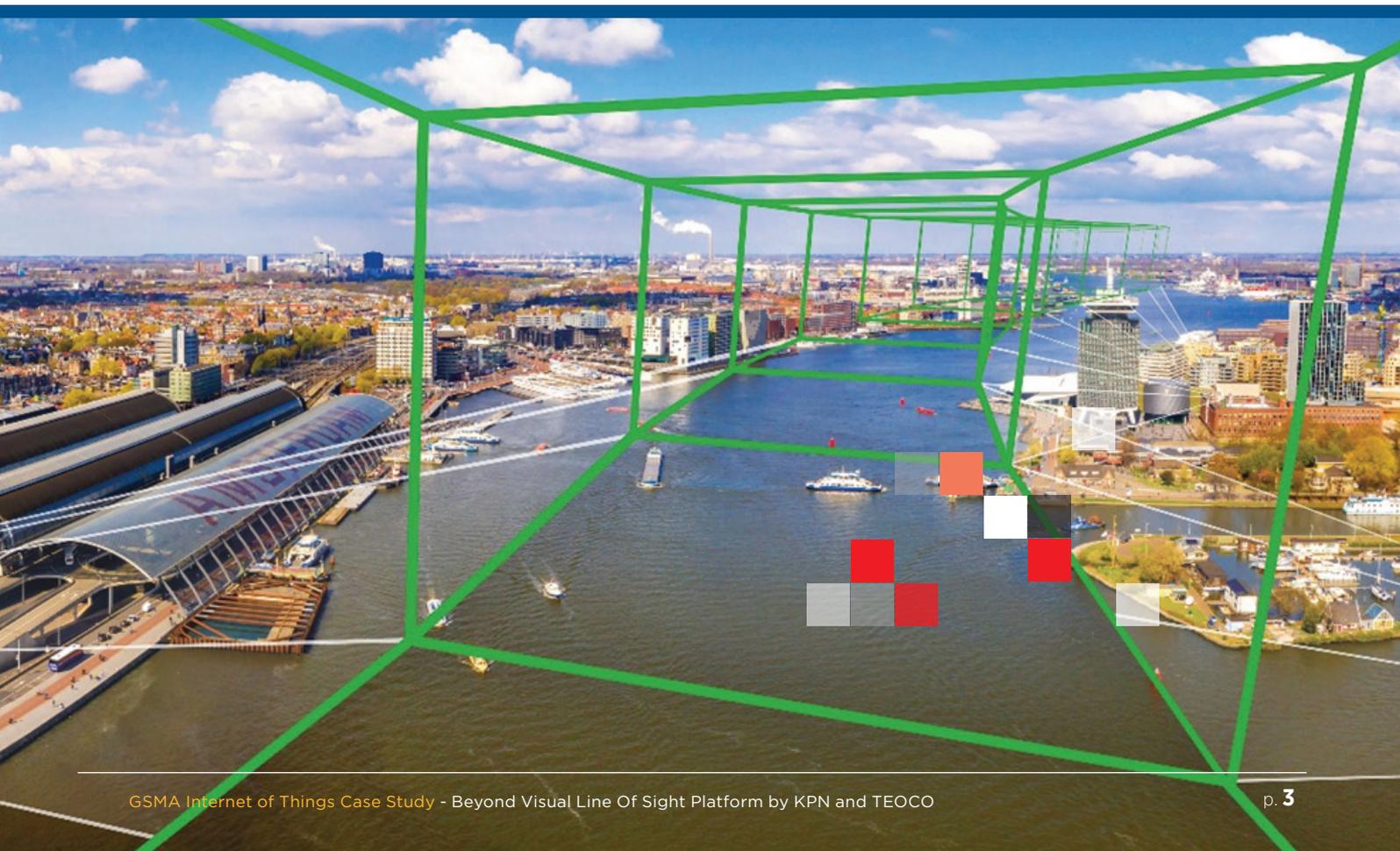
Establishing Safe Dynamic Flight Corridors

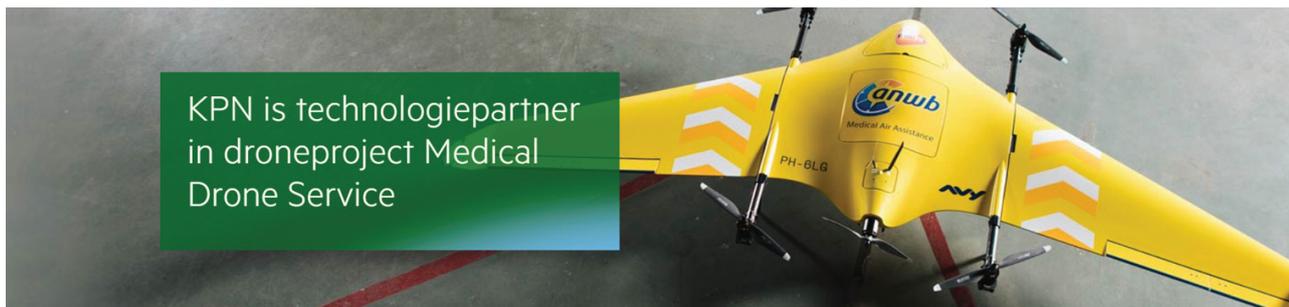
Each BVLOS flight requires a flight plan to be filed with the local regulatory authority before takeoff, and mobile network providers are best suited to provide this critical information. KPN and TEOCO, utilising TEOCO's AirborneRF solution, have developed and implemented tools (currently only for testing purposes) to determine safe flight corridors at a given time – a critical component of any UAV flight plan. Input to the Specific Operations Risk Assessment (SORA) methodology will be based on KPN's live real-time network updates, to ensure there is adequate cellular connectivity within the proposed flight path and time. This is necessary to satisfy the minimum requirements for establishing and maintaining network remote IDs, command and control connectivity, and enough payload for pictures and/or video transmissions or other devices requiring connectivity. These services will be available in the near future and will be based on KPN's 5G mobile network, but the preparatory steps are already being implemented on 4G / LTE.

UAV flight paths need to avoid heavily populated areas, but these locations can generally fluctuate depending on different variables, including traffic, special events, seasonality and time of day. Dependent on regional regulatory and privacy legislation, the platform could also potentially* provide highly accurate and reliable ground risk assessments of population densities based on location, date and time - all in high resolution. This information, when paired with geographical terrain and cellular signal data, will further enhance the creation of safe flight corridors that can be adjusted in near real-time as the environment changes.



(*This feature is still in development. KPN is investigating whether network-based information will allow estimates on population density within their coverage areas and within the appropriate legal constraints.)





USE CASE

ANWB Medical Drone Proof of Concept

The Erasmus MC and Sanquin Blood Bank, in collaboration with ANWB Medical Air Assistance, PostNL, and their technology partners KPN and the drone development company Avy, are investigating how UAVs can be used for medical applications such as transporting blood, medicines, and diagnostic samples to patients and care institutions. Within a period of three years, the partners involved in this collaboration aim to determine what kind of contribution drones can make to society, ensuring that care is delivered at the right time and the right place. The consortium believes that drones can be an efficient means of transport in a society where traditional logistics are being challenged by many factors such as clogged roads and carbon emissions. Drones can also ensure healthcare remains accessible and affordable.

KPN will provide the communication links with the drone. “We provide the secure and reliable (data) connectivity that is needed and, in collaboration with other partners, also the critical data required for flying beyond visual line of sight of the drone operator”, explains Jacob Groote, who is responsible for rolling out KPN’s 5G services. “We began exploring this Proof of Concept with our 4G/LTE network, but we’ll

move onto our 5G mobile network once it is possible. 5G services, such as network slicing, will become very relevant for BVLOS flights.”

In the proof of concept, a specialised transport drone is deployed that can support payloads for sending lifesaving medical equipment and urgent supplies to remote or hard to access regions. Even inner cities could benefit – especially when high volumes of traffic make traditional transportation options too slow. Due to the inherent risks involved in transporting medical materials by drone, it is necessary to ensure a flight path that is not just fast, but also safe and reliable. KPN and TEOCO are working together to ensure safe and successful BVLOS flights for public safety and other commercial UAV services through their joint platform.



About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators and nearly 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit www.gsma.com

About KPN



KPN is a leading telecommunications and IT provider and market leader in the Netherlands. With our fixed and mobile networks for telephony, data and television we serve customers at home and abroad. KPN focuses on both private customers and business users, from small to large. In addition, we offer telecom providers access to our widespread networks.

For more information, visit www.kpn.com

About TEOCO



TEOCO is a leading provider of analytics, assurance and optimization solutions to over 300 communication service providers (CSPs) and OEMs worldwide. Our solutions enable the digital transformation of CSPs while enhancing their network QoS, improving their customer experience and reducing their operational costs.

Through advanced analytics and automation, TEOCO solutions provide actionable and measurable insights into network and customer behavior. This includes the optimization, effective monetization, and delivery of new and existing services, such as VoLTE and Video. Our commitment to network flexibility and agility makes TEOCO the obvious choice for CSPs looking to leverage NFV/SDN and the rise of 5G, and to maximize the revenue potential of new opportunities tied to video and the emerging Internet of Things (IoT).

For more information, visit www.teoco.com