Quick start approach to tracking

As outlined in the Overview of Tracking resource, one of the main advantages of implementing a live tracking system is that it allows Civil Aviation Authorities (CAA) to monitor drone activity in near real-time, enabling swift action to prevent collisions with other aircraft. It can also help identify illegal drone activity, such as flying in restricted airspace or in no-fly zones, and gives the CAA a way to contact the drone operator directly.

An operational live tracking device on the drone is also essential for the implementation of a technical UTM (Unmanned Traffic Management) system.

When introducing complex technical systems, it's often beneficial to break down the system into discrete modules. By building out and testing each module step-by-step, it's possible to learn as you go, which often results in a better end-product. We recommend taking this modular approach when developing and implementing live tracking systems. Below, we outline a quick start approach for developing a live tracking system.

1. Limit the number of drones being tracked

As developing a tracking system is inherently complex, we recommend simplifying the process by limiting the number of drones being tracked by the system to those conducting high-risk operations. Initially, it is less important to track drone conducting low-risk operations such as small drones flying over private property or low-flying spraying drones operating over farms.

2. Define which information should be transmitted by live tracking

Key data such as the drone's ID, position, altitude, speed, and heading need to be transmitted in near real-time to ensure effective tracking.

3. Check the coverage of GSM Network

Currently, GSM modems are available for drones. However, for live tracking to be effective, the areas where the drones operate must have sufficient GSM coverage. This information can be verified by consulting maps provided by GSM operators, which are readily accessible online (e.g., https://www.gsma.com/coverage/).

4. Test the GSM modems

If a GSM network with adequate bandwidth is available, conduct tests to assess their reliability and data transmission delays. It is also important to confirm that the GSM modem can transmit the unique ID assigned to the drone by the Civil Aviation Authority (CAA) during the registration process.

5. Provide hook-on devices for tests

To increase the adoption of live tracking devices, it may be beneficial for the Civil Aviation Authority (CAA) or a collaborating company to offer or rent out GSM modems that can be hooked onto drones at a reasonable cost. These modems should be easily attached to drones without requiring complex integration. They should feature their own power supply, integrated GSM capability, and preferably multi-SIM card support, along with water and dust protection. By providing these hook-on devices, modems' interference with other electrical components can be analyzed. During testing, valuable data regarding signal delays, connection failures, and readability can be gathered. Following successful tests, well-functioning modems can then be promoted for wider use.

6. Use an ADS-B transmitter for operations in sensitive areas and/or shared airspace

Drones can be employed for specific tasks, such as surveillance of runways for crewed airplanes, to identify obstacles that could pose dangers during takeoff and landing (e.g., as seen in the Concorde disaster in Paris in 2000). Drones are well-suited for this task due to their ability to fly at high speeds, minimizing the need for runway closures for extended periods of time.

For this particular task, an ADS-B transmitter can be installed on the drone. While ADS-B may not be suitable for installation on all drones, it can serve as a practical solution for a limited number of drones with responsibilities in shared airspace.

7. Test satellite connections in areas with no GSM coverage

Drones are often required to operate in remote areas, such as for delivering medical supplies, conducting search and rescue missions, mapping disaster damages, or performing general mapping tasks where GSM networks are unavailable.

If drones operating in areas with no GSM coverage need to be live-tracked, it's important to test satellite connections using StarLink or Iridium modems. It's important to note that StarLink antennas are relatively large (over 20 cm in diameter), and the use of Iridium modems can be quite expensive.

8. Test LoRa Networks

For sensitive areas, assess whether installing a LoRa network is a viable option. LoRa networks operate independently from GSM networks, offering relatively low installation costs and minimal maintenance requirements. This ensures reliable and secure live tracking, making it a good option for drone corridors or sensitive airspace where live tracking is essential for air security as a redundant service. Additionally, in disaster scenarios, a LoRa network can be rapidly deployed, allowing for the safe management of all air traffic, including helicopters, crewed airplanes, and drones.

Future Steps

Use a general hook-on device that works with different communication options including GSM networks and satellite communications

We propose developing a hook-on device that ensures dependable and secure live tracking and can switch between telecommunication networks depending on availability and coverage. This device will utilize the GSM network where available, and in areas without GSM coverage, it will switch to cost-effective burst mode communication via the Iridium satellite network.

This device will be developed as open hardware, allowing for cost-effective production.

Future options should take ADS-L into consideration

Currently, there are only a limited number of ADS-L devices available. However, the specifications released in 2023 show promise. It is possible that ADS-L devices could serve as a solution for widespread live tracking and even autonomous collision avoidance in the future.

Once a system is established, roll out the system to track more drones

After having tested the live tracking devices with a few drones successfully. This tracking solution should be rolled out to a higher number of drones, so it can be tested if the respective system can handle a bigger number of drones. Test the delay between sending and receiving, check if the transmission from the receiving station to the CAA is working properly