BEYOND UTM

NEW TRAFFIC MANAGEMENT SYSTEMS SHOULD DRASTICALLY SIMPLIFY THE REQUIREMENTS FOR CONDUCTING UAV OPERATIONS BEYOND THE LINE OF SIGHT OF THE OPERATOR. **PIOTR SIRKO** LOOKS AT SOME OF THE GEOSPATIAL HURDLES THAT WILL NEED TO BE OVERCOME FIRST

The number of UAVs sold and operated is increasing rapidly. In most countries, however, they cannot be operated out of line of sight of the operator or above 150m, drastically reducing their potential to business. To unlock their full potential, UAV traffic management (UTM) is required. In the future, fully automated UTM systems will track the position of UAVs, maintain communications with them and provide instructions to them to ensure they do not come into conflict with other aircraft, UAVs or obstacles when undertaking flights beyond the visual line of sight (BVLOS) of the operator. Constant communication between UTM and UAVs will ensure that the UTM can provide a new route to UAVs in flight, because a diversion is required due to emergency flights or weather hazards, for instance.

However, it is still highly probable that a whole range of other rarely discussed issues will have to be solved before autonomous UAVs become commonplace. Here are the main geospatial concerns.

Navigation

Even with UTM, current airspace limitations might remain in place for the foreseeable future. At the low altitudes permitted, UTM will need to take into account obstacles, as a collision with a high-voltage transmission line, for example, could endanger life in a populated area and cut off electricity to thousands of users.

As a result, companies developing UTM are also working on creating low-altitude maps that contain information about obstacles such as powerlines, high buildings and large trees. The sheer number and the type of low-level obstacles is a problem, however, as even if an environment is mapped, that map will need to be constantly updated. It is also unclear how to ensure that obstacle databases contain information that can be used and trusted in safety-critical flights.

The aviation world could provide some answers. In Europe, the European Aviation Safety Agency certifies if navigation database suppliers have put in place data-processing systems that comply with the requirements set out in internationally recognised standards such as EUROCAE ED-76 and RTCA DO-200A. This demonstrates to national competent authorities that the suppliers' data can be used for aviation.

No equivalent certifications or processes exist in the UAV world. Industry groups, such as the Global UTM Association (GUTMA), are attempting to provide appropriate standards but these are currently focused on basic issues such as registration and flight declaration protocols. Even if these groups do draft suitable standards, it is unclear to what extent state bodies will have to be involved in certifying the data and if and how terrain data should be audited.

The separate issue of covering costs for creating and keeping maps up to date will also need to be solved. Given that UAVs, at least initially, might operate far closer to the ground than general aviation, the locations of more obstacles might have to be tracked, which means increased costs. Of course, it might be possible to use the UAVs themselves to monitor obstacles – some parallels exist with initiatives that use UAVs to map terrains. Nonetheless, the extent of updates required and who would bear the costs is unclear.

Mapping communication coverage

In many potential UAV operating environments, it will be critical to maintain communication between a UAV and UTM throughout a flight – the UTM will have to direct the UAV out of harm's way in case of, for instance, any diversions or emergencies affecting manned aircraft.

A WHOLE RANGE OF RARELY DISCUSSED ISSUES WILL HAVE TO BE SOLVED BEFORE AUTONOMOUS UAVS BECOME COMMONPLACE

The aviation industry has already devised solutions for maintaining air-ground communication that could theoretically be used for transmitting the type of information required for UTM to maintain control of UAV flights, such as VHF data link.

However, many UAVs are unlikely to be able to support these solutions, which were developed with manned aircraft in mind, as they are too small or have limited power. The data throughput might also be too limited to support many UAVs controlled by a fully automated UTM.

Instead, cheaper, less 'power hungry' consumer communication systems are often considered to be suitable for UAV-UTM communication. One possible system is GSM

3G/4G. However, GSM coverage is limited and primarily geared to users at ground level, so it will be important to map it at altitude, to understand which routes UAVs can take without losing contact with UTM. In aviation, test flights are often used to assess whether the signal strength provided by ground-based infrastructure can ensure a flight through a particular area is safe; this may be necessary with UAVs as well. However, it is unclear how to do this cost-effectively, especially since there would need to be regular surveys to ensure signal levels haven't decreased.

Satellite communication technologies could overcome the limitations of GSM. Several companies are currently testing miniaturised receivers that could be used on UAVs. Plans exist to roll out high-throughput, low earth orbit, satellite communication technologies, which would enable broadband connectivity over large areas. However, these technologies are not yet operational and the economic models for their operation are unclear.

Noise

Even once appropriate routes for UAVs are designated, issues relating to noise nuisance could arise. Many airports are receiving increasing numbers of complaints from local residents about noise nuisance, with studies showing that people are becoming increasingly sensitive to noise and disturbance. Although a UAV is much quieter than an aircraft, the low altitudes at which many operate and their sheer number might cause their noise to affect more people than traditional aircraft. Maximum average limits of UAV noise exposure might have to be mandated to ensure that people are not adversely affected.

Today in Europe, the Environmental Noise Directive mandates the creation of environmental noise maps. If BVLOS UTM-directed UAV flights become commonplace, local UAV traffic may be one more factor to take into account when modelling noise.

This could potentially be quite costly. Even if this is not the case, UAV noise might have to be considered near infrastructure supporting multiple UAVs, such as parcel delivery hubs. What remains unclear is who will bear the costs, what their extent might be and how resident complaints would be handled.

Handling of emergencies

With the vast numbers of UAVs expected, it is virtually certain that emergencies and abnormal situations will occur. One can distinguish between emergencies in which a UAV can be brought in a controllable way to the ground and those in which all control is lost. In the former case, it is unclear how to decide where to make emergency landings. Will there will be designated emergency landing spots along UAV routes or will UTM make the decision during the flight, based on available information? Given the possible latency involved in communication between UTM and UAVs, some of the processing necessary might have to be handled by the UAV itself. This could potentially be accomplished using location tracking and image processing, but such decision-making algorithms would have to be tested and certified.

Image recognition technologies are being pioneered today for smartphones, but if these were to make safety-critical decisions then issues of responsibility would arise. It's important to be clear who will be responsible in cases where the UAV causes material damage, or an inopportune landing site is selected. It is likely that appropriate regulation will have to be put in place to deal with these issues. It will also be important that appropriate certification is available and tested for whichever solutions are selected and that they meet clear standards, which are yet to be developed. In cases, where the UAV made an uncontrolled descent to the ground, questions of responsibility for route-selection will inevitably arise if the UAV causes damage or harm. Will routes have to be certified to be acceptably safe based on the terrain or population density?

> WITH THE VAST NUMBERS OF UAVS EXPECTED, IT IS VIRTUALLY CERTAIN THAT EMERGENCIES AND ABNORMAL SITUATIONS WILL OCCUR

Conclusion

Although the UAV industry's efforts are focused on BVLOS flights, other additional issues will have to be solved to ensure flights are carried out safely and with minimal disturbance to residents under the flightpath. Some of the most important issues are geospatial in nature and will require input from many disciplines to solve. It is important to address this early on to avoid false starts, help keep UTM costs to a minimum and eventually exploit the full potential of UAVs.

Piotr Sirko is a consultant at Helios (www.askhelios.com)

TOPCON

The Intersection of
Infrastructure and **Technology**

The Intersection of **Infrastructure** and **Technology**

Quantum leaps in communication and measuring technologies are transforming the way infrastructure is built. By creating solutions that embrace these advancements, we work to help you stay ahead of the developments today and tomorrow.

Our integration of high-accuracy positioning, high-speed imaging, cloud-based information management and down-to-earth simplicity creates higher productivity, enhanced quality and improved sustainability.

Drive your business with technology, go to: **topconpositioning.com/INFRASTRUCTURE**