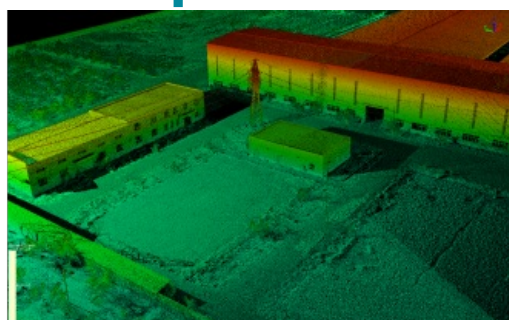
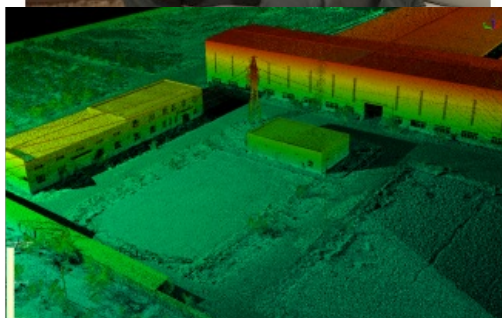


# FASTER AND CHEAPER SURVEYING AND MONITORING

## 5G Promotes Prosperity of Low-airspace Economy



Based on an assessment of all the geomatics-related trade events in the world, the unmanned aerial vehicle (UAV or 'drone') service-provider sector is growing faster than any other. Companies in that sector are particularly interested in the evolution of 5G because it can boost their quality of service and innovation. In turn, the regulations will mandate the ability to transmit real-time hyper-local geodata between local authorities and drones used in urban areas. Low-airspace services must not only be very efficient, but also safe. 'GIM International' spoke to Aleksandar Aydemirski, 5G principal engineer and drone specialist at Huawei in Germany, to find out more.



While it is still not entirely clear how 5G will affect the capture and use of geoinformation by drones, the general

outline is becoming increasingly visible. Most telecom authorities are preparing their countries for the fifth generation of (mobile) telecommunication, and many telecom operators are upgrading their cellular network and transmission infrastructure. The Chinese company Huawei is the world market leader facilitating these activities (independently confirmed by OVUM). Aleksandar Aydemirski, 5G principal engineer and drone specialist at Huawei in Germany comments: "The facilities of 5G will come to the market gradually. The current network is mostly sufficient to meet today's client wishes in geodata capture. But over the next years, in view of the new 5G features and fewer legal restrictions for drones, new services will emerge. Client organizations that make intensive use of location-based data will be able to do their work much more cheaply, quickly and easily – whether that involves monitoring infrastructure, surveying and mapping, public safety, immersive virtual reality or location-based services and so on."



Aleksandar Aydemirski: "Initial services for 5G will differentiate, but the leading operators will not take long to make vertical applications for UAVs a high priority" (Photo: VBB)

### Basic aspects

For one thing, the data transmission speed will be ultra-high. In 2018, speeds in Western Europe could reach 1Gbp/s in exceptional cases but mostly stopped at 50Mbps/s (with the average being 39.2Mbps/s). With 5G the speed can be as high as 10Gbp/s (10,000MB/s), depending on the compatible high-end devices. Moreover, data transfer remains stable for the entire transmission time, unlike 4G, and all this with low latency (the time interval between the data being sent and received). The latency of 4G is 35 to 50 milliseconds; in a recent outdoor trial Huawei achieved sub-1ms with 5G. Needless to say, that will be crucial in many future applications, such as connected/autonomous cars.

In parallel, the professional drone market is really taking off. The Federal Aviation Administration (FAA) forecasts that in two years' time the number of non-military commercial UAVs (i.e. not for consumer services) in the USA will exceed 1.6 million aircraft. The European Union expects that there will be – besides seven million recreational drones – a fleet of 400,000 drones offering such services in member states over the coming decennia. In the SESAR Joint Undertaking (JU) European Drones Outlook Study, more than half of the services described are related to the geomatics industry: from surveying and monitoring to precision agriculture and public safety.

Aydemirski acknowledges the importance of geodata not only for the UAV market (and vice versa), but also for drone regulations. Before a

drone is allowed in urban areas, the regulations will make it mandatory for the authorities to be able to track and identify the aircraft, prevent it from entering a forbidden zone or warn the operator about a sudden no-fly zone. As a consequence, it will be mandatory for the drone to be able to communicate its 3D coordinates in real time. "This requirement is more or less the same as what is necessary for connected, autonomous vehicles," he points out. In the case of 5G, the enhanced mobile broadband will allow higher throughput to be transmitted to and from the UAV, with low latency enhancing the reliability of the connection between the drone, the relevant authorities and the operator. It makes an informed flight possible, fully integrated in the UTM (air traffic management for low-altitude drones). In urban areas the network coverage will be enhanced by massive multiple input multiple output (MIMO) technology and 'beamforming'. Massive MIMO optimizes data speed and ensures better throughput and better spectrum efficiency. Beamforming implies that there can also be antenna beams angled more steeply upwards into the lower skies; drone communication will benefit enormously from this as a way of overcoming today's severe signal interference challenges.



The full capability of the European low-air traffic system will open up after 2030. The results of the first demo projects will become available in 2019. (Source: SESAR-JU U-space blueprint)

## Rural areas

Eventually, there will also be 5G in inhabited rural areas, but the frequencies will probably be different: in the 700MHz spectrum. Unless a dedicated low-altitude aerial coverage network is deployed, the air coverage will be more or less similar to what it is today. In urban areas, frequencies between 3.4 and 3.8GHz will be used, thus providing wider bandwidth. Here, the capacity will be shared between tens of thousands of users – from smartphones, connected cars and household equipment to personal digital assistants and drones operated by multiple business users. The above-mentioned dedicated network refers to Huawei's interesting Digital Sky Initiative. Aleksandar Aydemirski explains: "It provides low-airspace network coverage up to 300m, not only creating an advanced test environment for drone applications, but also supporting beyond-visual-line-of-sight (BVLOS) flight control verification and large-volume data transmission. So in areas where 5G will be delayed, or where massive MIMO and beamforming will not be deployed, telecom operators can still ensure the low-altitude aerial coverage by overlaid 4G cells. One of those cells covers several ground sites." This will offer a solution for many operators, even coexisting with 5G. In some European countries, the telecom regulators are starting to demand in their spectrum auctions that telecom operators provide broadband for more than 95% of the total landmass within a few years of the frequency being granted. "That is the case here in Germany, with the result that 98% of households will be covered with a minimum of 100Mbps, but also that all roads and railways will be covered with at least 50Mbps. In contrast, the 4G requirements were mostly concentrated on 95% of the population, covering mainly urban areas."

## Time frame

The drone market is currently limited by two main factors: battery power and the regulations. In other parts of the world with less stringent regulations things could move faster but, as far as Europe is concerned, communication with UAVs will be more automated and real time by 2025. That mobile connectivity will also permit BVLOS operations, which will boost the low-airspace economy. The full operational, digitized capability of the low-air traffic system will open up after 2030, including services offering integrated interfaces with manned aviation. The telecom networks will develop synchronously. Aydemirski is convinced: "The regulations only open up once the technology availability is there and when all the new processes have been tested and verified." Ten years from now, all systems will have been adapted. A drone will be capable of reporting its precise position – GPS enhanced by RPS capabilities – that is verified by the network. "In most cases, that means the mobile network," he emphasizes. "Currently, civilian drones in the market use open-standard GPS modules. Ground stations and drones interact with each other via the point-to-point communication mode, and such a mechanism is prone to tampered GPS data. Because of rogue drones, probably with modified GPS modules and anti-fence features, airports in the USA, China and most recently the UK have encountered multiple drone disruptions. If those drones had been 'connected', that would not have been possible."

By the end of 2019 there will already be some 5G networks in Europe, the USA, South Korea, Japan, China, the Middle East, Australia, Canada and the North African countries. "But the mass deployment will come in 2020," states Aydemirski. "And at different scales; one operator might start by deploying hundreds of sites in European countries, compared with tens of thousands in China."

## Mindset

When Aydemirski is asked about the impact of some countries' fear of Chinese espionage on Huawei's market position, he replies: "We cope with the uncertainty of international politics with the certainty of legal compliance, and we have maintained our leading market position. That is because of the technology and the way we deliver." So what is his stance in view of the fact that geodata is privacy related in many applications? Aydemirski fiercely states: "Huawei is a 100%-staff-owned private company. We have never and will not provide any government with any access to any customer's data. Cybersecurity is Huawei's number-one priority, and an area in which we invest heavily. We fully agree with the need to ensure the security and integrity of national networks and we are very much willing to work with governments and with the rest of the industry. We have established cyber security test centres in the UK and Germany and, in March, a third centre is opening in Brussels. These centres provide full transparency on our solutions to governments and other stakeholders. Despite the allegations, we have a proven track record of providing secure products and solutions. In my view, today's ICT supply chain is highly globalized, so cyber security needs to be addressed jointly at a global level, and equipment vendors should not be treated differently based on their country of origin."



Drones equipped with Lidar for inspections is an emerging business. Huge volumes of data are generated, requiring >200Mbp/s real-time transmission. (Source: GreenValley International)

Huawei has invested US\$2 billion in 5G research and standardization alone, and Aleksandar Aydemirski is happy he can put this to good use by partnering with telecom companies to support the first round of commercial 5G network launches this year. The increase in business growth of the professional drone market will follow. "Initial services for 5G will vary in different parts of the world, but the leading operators will not take long to make vertical applications for UAVs a high priority. The competition with aerial surveying will be easier to

win. New types of added-value service providers will appear, but better time management will be the first asset of 5G in all normal data-collecting processes. If a drone is able to transmit data to the operator in real time, that data can be analysed while flying and the operator just needs to alter the location of the airborne drone to optimize the data collection. The update frequency of topographical datasets or infrastructure inspections can be much higher, because it will be much cheaper and easier than with manned aircraft. The same goes for the use of drones by the police in monitoring events.” He cannot predict whether it really will take ten years before every geoinformation specialist using UAVs can benefit from 5G. “But the mindset about the time frame is changing. I see a growing level of trust between different industries, and converging visions about opportunities. Utopia is starting to materialize.”

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