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Factsheet

Authorization of drone flights in Switzerland

Since the end of November 2017, Swiss Post has been operating a completely autonomous drone delivery service between two hospitals in Lugano. As a result, delivery times for critical lab tests have been cut from over 30 to about 5 minutes. Swiss Post is already planning similar delivery services for hospitals in Bern, Luzern and St. Gallen. This example alone shows that the commercial use of drones has gone from futuristic vision to present-day reality. At the end of 2017, FOCA had approved 17 applications for complex drone operations and another 23 were pending, including for 100-kg helicopter drones to monitor power lines over the Alps – a task currently being performed by conventional helicopters with a significantly larger environmental footprint.

Although the number of persons directly employed in the Swiss drone industry remains comparatively low, the jobs they hold are, as a rule, highly qualified. A series of companies emerging as start-ups are direct offshoots of university research. Examples are senseFly, which has since been taken over by the French manufacturer Parrot and which employs over 100 people in western Switzerland, and Pix4D, a spin-off from the Federal Institute of Technology that has 60 employees. According to the consulting firm PwC, the global market for drone technology will grow to 127 billion US dollars in 2020.

Assessing the risks

As unmanned aircraft, drones used for purposes other than as a hobby have to undergo a different risk assessment. A comprehensive assessment will consider the risks on the ground, the risks for other aircraft, and the risks for the environment or for critical infrastructure separately and in the aggregate. Thus, for example, an agricultural drone that weighs 20 kg and is used for low-level spraying operations over fields presents a significantly lower risk for the general public, despite its heavier weight, than a 5-kg drone operating in the middle of a densely populated area. The individual risks posed by different operations in turn influence the technology used. If there is no other choice but to fly a drone over a densely populated area, numerous measures must be taken to mitigate the danger of total loss of control.

Before Swiss Post conducted the first drone tests over Lugano, for example, the programmed flight paths were corrected several times at FOCA's behest, to ensure that the drones flew over heavily driven roads or popular pedestrian routes as little as possible. Should control of the drone be lost, a last-ditch rescue system allows the drone to glide to the ground with a parachute while sending out acoustic alarm signals.

A drone always presents a risk for other aircraft. Drones over which control has been lost have in some cases risen vertically or otherwise moved to a flight path that was unplanned by the operator. This is why complex operations in which drones fly either autonomously or in traditional aviation air space must undergo further risk assessments. Test flights conducted by Daimler/Matternet/Siroop over Zurich revealed that the drones operated not only within the control zone of Zurich-Kloten airport and Dübendorf, but also in the vicinity of hospital landing pads used by ambulance helicopters. In other words, flight paths had to be configured so as to minimize the risk on the ground and at the same time take account of the complex airspace around Zurich. They also had to be configured to allow for exceptional circumstances. As a result, in normal circumstances incoming aircraft rarely approach Zurich from the south during the day, although a wide-body jet like the A380 can ask to take such an approach for safety reasons.

Ambulance helicopters can approach a hospital at any time or fly across the city on a rescue operation. This is why a "no-fly zone" has been established around every hospital landing pad. In addition to the flight path, which can now be maintained to within +/- 10 metres, redundant systems had to be created for drone operators that allow approaching helicopters to be recognized and evasive action to be taken.

Application procedure

Before a complex drone operation can be authorized, the first thing is to determine as many risks as possible. Depending on the specific operation, the drone has to meet various technical and operational criteria in order to receive authorization to fly. For example, electronic and battery systems need to meet completely different criteria for flights at very low, instead of normal, temperatures. If a drone is supposed to fly, as in Lugano, around-the-clock, it must be able to resist wind and rain as well as low temperatures. It must be equipped with enough redundant systems, should the automatic steering break down, to continue its flight, to land at a safe spot or to deploy an emergency parachute. Since there are as yet practically no certified drone systems, the authorities have to test, in each individual case, whether the technology used meets the conditions for flight and whether secure components have been incorporated.

On the basis of the Swiss *Guidance for an Authorisation for Low Level Operation of RPAS (GALLO),* published in 2014, the SORA (Specific Operations Risk Assessment) system was made available internationally last year. It has already been deployed in Switzerland and takes into account

- the area of operation,
- the air space,
- the flight system,
- the purpose of the flight, and
- the operator's knowledge.

In order to obtain an authorization under SORA criteria, 13 steps have to be taken, most of which require specific technical and/or aviation knowledge. What happens when that technical knowledge is not available at one stop, but is instead spread among various authorities, was made abundantly clear in Germany when the US manufacturer Matternet, which delivered the Swiss Post drones, withdrew an application for a similar project because the competent regional authorities were unable to implement a complex SORA process.

Outlook

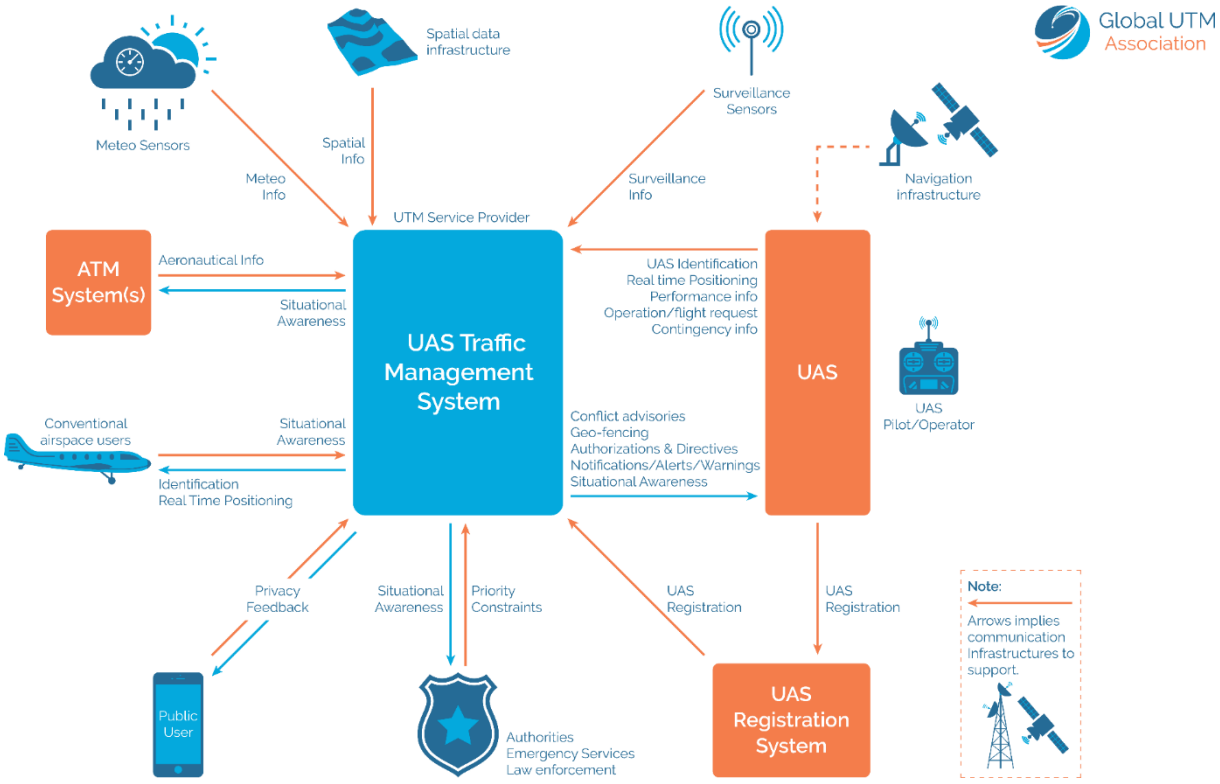
The number of unmanned civilian and military flights will continue to rise sharply. This means that, increasingly, tasks performed by manned flights will be shifted to drones. Unmanned air taxis are already being developed to provide autonomous passenger transport in urban areas. Large, heavy package drones will perform regular delivery services, solar-powered drones will take over the tasks of telecommunication satellites at high altitudes and surveillances drones will manage traffic.

If unmanned flights are to be safely incorporated into the existing system, the supervisory authorities must have the requisite professional knowledge. It can be assumed that certain tasks currently requiring a huge individual effort will in future be easier to deal with. Certified drone systems, in which the technology and

the operator have to meet the same standards as manned flights, will facilitate the SORA process. The same holds true for the operations themselves, which will in future be handled by U-space. As a result, drone activity within FOCA will shift away from individual authorizations to standardized drone supervision. As the growing number of drones will, in the medium term, replace existing manned flights in very few cases, the FOCA's workload will increase and exceed the capacity of the existing workforce. For example, the Spanish aviation office, AESA, has hired 15 people to deal exclusively with drones.

U-space: a long-term solution

On 14 September 2017, a drone demonstration in the middle of the city of Geneva, not 2 kilometres from the airport, stirred great interest both in the technological world and among the European Commission representatives in attendance. For the first time in Europe, U-space was used for drone flights in the middle of an urban area with flight restrictions. But what is U-space? Roughly speaking, U-space comprises digital infrastructure, services and procedures designed to support safe and efficient access to lower airspace for drones. It applies in particular to BVLOS (Beyond Visual Line of Sight) flights and commercial operations. U-space provides an interface to manned flights, ATM providers and authorities. The services are based on highly digitized and automatic functions on the ground and in the drones.



U-space is being introduced step by step in Europe and Switzerland. The first services that will be made available are e-registration, e-identification and simple geo-fencing. Flight planning with air space authorization, live tracking and monitoring will follow. At the invitation of the EU, FOCA and Skyguide representatives presented the Swiss U-space prototype on 4 October at the Informal Drone Experts Group in Brussels. Since that demonstration, a major U-space component has been trialed at every drone operation

authorized by FOCA. Skyguide radar data are made available to the drone operation flight director, whereby he/she sees the same incoming and outgoing aircraft as Skyguide in the area concerned.

It will soon be technically possible to register and identify drones electronically. This will also lead to considerable improvements in enforcement. Sensitive areas can be dependably protected and guilty drone pilots can hereafter be identified. What is more, U-space will yield many more advantages in the coming years, and they will also benefit manned aviation. It will take a few years for manned and unmanned aviation to be seamlessly and comprehensively interlinked. U-space is nevertheless being developed at a fast pace, not least thanks to an innovative industry. Meeting aviation industry safety standards and laying the groundwork for certification and standardization will nevertheless take time.