

## ARE DRONES A BOON OR BANE?

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**Abstract:** *Every generation of humanity has inventions, which greatly influences our lifestyle, behavior and thinking. It's also true for security technologies. There is not a single year without any military conflicts, acts of terrorism or natural disaster. Not so long ago the UAVs were classified as military technology, however in the last 10 years civilian and industrial UAV developers and customers started to appear. In August 2013 the Association for Unmanned Vehicle Systems International (AUVSI) organized a conference in Washington with 80000 participants from 40 country. It was said that there will be approximately 10000 unmanned aerial vehicles in the US [6][7].*

*In the article with some examples we show the UAV's fields of application and the complex challenges of their use.*

**Keywords:** UAVs, drones, civilian-, military application

### 1. INTRODUCTION

According to the European Committee: "In 2050 civilian air traffic presumably will have different categories of flying vehicles, some with pilots, some without. That's why it's important to establish an European Market for RPASes or drones." A hundred years ago the transmission of electrical signals seemed to be unreal and fantastic, half century ago nobody heard of video monitoring systems. What will be the next phenomenon or device that will be able to influence our need in the information technology? One of this can be the unmanned aerial vehicles. The aerospace industry's small developments together with the successes of robotics greatly accelerated the development of drones. Not from far from now these robotic flying vehicles will (1) start to catch those who violate the speed limit on the roads (2) spread flyers (3) deliver packages or offer services for those who live far from cities. Not so long ago the UAVs were classified as military technology. But recently civilian developers and customers started to appear. Since the technology is developing rapidly and not only in the military field, "the RPASes will have to be able to fly in a not divided airspace, which means to take part in the normal civilian air traffic. Nowadays this technology is used for photographing and monitoring infrastructures, but in the future they may be able to transport people and cargo [33].

Since the development of the technologies and the marketing activities the market is growing steadily. The operation of drones which seems like toy planes are hard to understand for ordinary people. Most importantly using their unique ability of monitoring, equipped with a video- and heat sensing camera and other sensors they are able to transmit real-time information.

For example drones equipped with infra-red cameras do preplanned patrols over areas which are regularly affected by forest fires. They can be a cheap solution of minimizing the casualties [6][7][8][9][30][39].

## 2. THE SIZE OF THE DRONES ARE "LIMITLESS"

One of the most important parameters of flying vehicles, also for drones is the ability to fly, but the second to this is dependency to weather conditions (not only wind, but rain and ice too).

However for customers the main parameters to compare and choose which UAVs to use are: (1) flight duration and range (2) usability of payload, application and physical parameters.

The payload is one of the parameters on every flying vehicle, which customers are never satisfied with. In the past it seemed very impossible to build an unmanned aerial cargo vehicle. However Lockheed Martin and Piasecki Aircraft Corporation have been developing such vehicles for years, which will be able to lift and carry for a given distance a car. This vehicle will be able to take off and land vertically, maximum flight duration is only limited by the capabilities of the on-board electric power system. Assuming that the UAV's engine will use liquid fuel or batteries, operation time will be measured in minutes or hours instead of days [6][7].

Newer types of engines use solar panels, like the one developed by TitanAerospace, called Solara 50 which is planned to fly in the stratosphere (also called as aerial satellite). The wingspan is 50 m and it is able to carry 15 m long and 31 kg heavy payload, with a flight speed of 104 km/h. It will be able to fly for even a month in 15-20 km heights and will conduct military and civilian tasks. Primary the drone will be used for cartographic and meteorological purposes. The pictures about the surface of the Earth will be estimated to cost 5 dollars for every km<sup>2</sup> it is seven times less than the ones made by satellites [1][2][4].



FIG. 1. A TitanAerospace's Solara 50 UAV

Google with the Solara 50 (in Project Skybender) plans to establish 5G internet connection in areas where there were no internet, or where it would be very expensive to establish connection. The project is in the test phase now. The only problem is that the microwave signals that transmit the internet become very weak by the time they reach the surface transmission towers because of the great distances.

Further problem is the execution of continuous flight using only solar power. It is questionable that what happens when the plane fails, how fast they will be repair the error, and how long the area will be without internet. If these problems will be solved, the first real execution will be in the third world countries [5][6][7][37].

These stratospheric drones will look like storks, but there are drones that are cm long and resemble to mosquitoes or flies. These UAVs are able to lift a miniature camera and transmit real time information of the target object. The most important in development is to hold the balance between the own weight, payload, power supply and lifting power [6][7].

### 2.1 Nano Humming bird

Since 2006 DARPA contributed with 4 million dollars to AeroVironment to develop a nano size aerial vehicle (NAV). The new model, called the Hummingbird looks like a real hummingbird (Fig. 2.). The result is a hand made prototype, which has a wingspan of 160 mm and a weight of 19 g, making it lighter than an AA battery. This includes the systems necessary for flight: battery, engines, communication systems and a video camera.

The customers only has to to fly the robotic bird to the window of the target, which can monitor with its own camera [10][11][12][13][14][15].

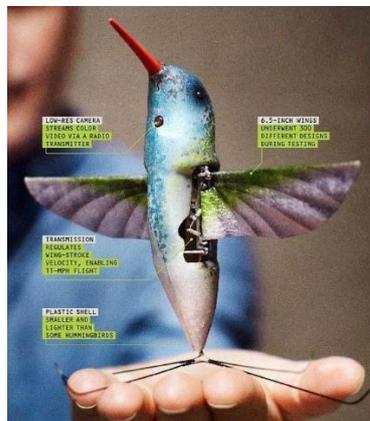


FIG. 2. Nano Air Vehicle „Hummingbird”

### 2.2 RoboRaven

Since 2007 the Robotics Centre of the University of Maryland (USA) is working on a fundamental different propulsion system for drones. This type of UAV can act like a bird, which enables it to covertly monitor the target [6][7].

The engineers in Maryland created a solar powered UAV called the RoboRaven III. The solar panels are on the upper part of the wing. The efficiency of the solar panels is 6%, but with the improvement of the solar technology this number will increase. The first versions of RoboRaven was presented in the spring of 2013 which then didn't had solar batteries, and had independent wing mechanisms, which all could be programmed differently. This enables the maintaining of flight stability [31][32][37].



FIG. 3. RoboRaven III

### 3. RECONNAISSANCE AND FIGHT DRONES

The first unmanned flight took place in 1916, when an American engineer, Elmer Sperry launched the flying torpedo, controlled by gyroscope systems. Working for the navy, Sperry soon started working on flying bombs - the prototypes of modern missiles.

Radio controlled UAVs are first made by the British, before the World War II, when the Queen Bee first flew. This airplane, which was first called to be a drone, was launched from a carrier with a catapult, and after it finished the mission landed on water [6][7][34].

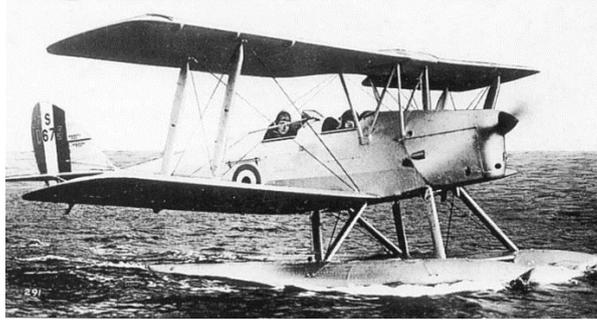


FIG. 4. Havilland Queen Bee

Today UAVs are being used on carriers, especially "stealth" drones like the American X-47B. It is not a separated unit, but a "flying system" with automatic take-off and landing, flight procedures and air refueling. This system is able to stay in air for even a week and if it's necessary they can refuel each other in the air. At the same time the on-board self-diagnostic systems can signal in time that the UAV needs repair.

The US Army's drones (Predators and Reapers) currently do patrol duties in Jemen, Somalia, Iraq, Pakistan and Afghanistan, so they test the technology in real environment. British UAVs in Afghanistan are controlled from the US. After it became public knowledge in May 2013 a campaign started against the use of drones, but the outrage stopped fast, because the PRs of the Department of Defense also started a marketing campaign.

A German UAV controlled by NATO operators almost collided with a passenger plane over Afghanistan. For the public it only became known because the videos made by the on-board cameras were uploaded to YouTube channels, which showed they only missed each other by a meter.

At the same time American drones still patrol over Kabul Airport, but the events must have shocked the Germans, because they refused to take part in the joint European development of the "Euro Hawk".

Drones can be the source of major problems in both the air and the ground. The laws which regulate the use of UAV systems are "immature" even in developed countries.

There is no evidence of fatal accident, but drones cause more and more problem in flying. There are lots of events tied to drones for example: (1) an old Soviet UAV with a red cross on its side scared to death the population of Balkuduk, a Kazakh village, when it crashed with a huge thump or (2) recently information come to light about a German UAV which crashed into a cargo plane on the ground in Afghanistan. According to the UAV's on-board camera, it seems that it's an "angry robot", because it accelerates toward a scared and fleeing crowd, than the profile of the cargo plane appears on the screen, and with a band the video ends. It later revealed that the UAV was controlled by an operator, who had no idea how to slow down the drone and shut off the propulsion system.

For the operators of the unmanned aerial vehicles the accusation and reservation of the qualification is getting more important. For the civilian population this is still new. A pilot who works in civilian aviation said about UAV operators: "Some generations has to pass until we can trust these operators in armchairs. Until that, I'm sorry but the air is ours".



**FIG. 5.** „Predator” UAV launching a missile

In the UN the Human Rights Committee, agreed that the minimum of using military robots in the field of operation is to not allow this electric equipment to be able to decide over the life of humans. Currently this law is about only ground equipment, but it would be logical to extend this to aerial vehicles too.

Thanks to the processing of the data from the on-board and other sensors, drones are able to distinguish objects from the air. Depending on the level of autonomy it is not a problem for the system to give an order about destroying the object, unless the first law of Asimov, which forbids the robots to kill anyone in any circumstance.

Asimov, the writer, never thought that robots can be susceptible to "illnesses". We can only hope that the operating systems and software which enables the controlling of the UAVs are robots and invulnerable. In reality however it's different, for example: in the Creech Airbase in Nevada one of the software which controls the movement of the Reapers and Predators in the Fall of 2011 was infected with a virus which monitors the order of the typed characters [6][7][8][9].

#### **4. FRIENDLY AND NOT TOO FRIENDLY UAVS**

In the civilian fields of use the military technology blends in between the peaceful equipments, as it happens with lots of technological fields the borderlines become blurry between the ability of regular and special systems.

The Parrot is equipped with an IP camera, a WiFi tool and a free iOS access, but it can be also equipped with high resolution camera and an RC tool with greater range.



**FIG. 6.** ParrotAR.Drone

The advanced AR. Drone 2.0 can be controlled with an remotely controlled quadcopter helicopter mobile or with an tablet, and has high resolution cameras and ultrasonic altimeter. During flight the on-board camera records HD video, that is transferred to the system in real time. The customer friendly tool enables to upload the video to the internet with just one click. With the pilot application everything is done easily without wires. The developers also thought about those who wants to make longer videos, so an USB module is also present on the quadrotor [17][18][38]. For example: (1) the paparazzi no longer has to risk their health and safety, waiting in bushes or on fences, they just uplift the drone and they are already in the mansion of the celebrity. Or (2) the tendency of using drones also spreads in the media and news, there are examples of using drone-made photos and videos in protest movements in Poland, and Moscow. These are not made by the police, but the fans. The recordings uploaded to the internet we can see clearly what happened.

Nowadays, principally similar models to the Parrot patrol around German railways, checking the technological infrastructure. The MD4-100 Microdrone "helicopters" are currently doing their test flights over traffic roads. Their main use is to stop the increasing vandalism, to prevent the painting of buildings with aerosol paint.

*"According to AUVSI in the future the tasks of RPAS will include precision agriculture, monitoring of the environment, protecting and other controlling tasks and security. Planes and helicopters responsible for controlling industrial tools, networks and works of art, along with the dangerous areas and plow lands will be taken over by RPASs."* [33]

Drones used in forestry provide information about the spreading of plant pests, and monitor wild animals and locate forest fires. These and similar tasks require constant patrolling.



**FIG. 7.** Parrot AR 2.0 drone

To avoid the significant fuel and other costs University of Queensland in Australia has developed polyplane drones (Figure 8). These low cost, used once tools have good flying parameters, launching from the right altitude in the right direction they can be operated cheaply for example during fires [6][7][19][20].

Or imagine that a mobile service provider is located in the stratosphere, which makes it unnecessary for the networks provider to build network towers on the surface. A "network tower" flying on an altitude of 20.000 m can cover 45 000 km<sup>2</sup>. If we could provide the slow speed flight of hovering of the UAV, this service could be sold as a good communication possibility, which doesn't need the public knowledge of the user's location.



**FIG. 8.** Polyplane UAV

One of the most interesting developments is thanks to the Japanese security company, Secom. It provides the customers the possibility to rent a quadcopter (Fig. 9.), which automatically flies to the air (starts its mission), if the alarm sets off and makes a high resolution recording to help the work of the detectives [21]. The drone makes pictures of the target - the face of men and the license plate of the vehicles - which is sent to the headquarters of the security company, where it is evaluated. More drone equipped with cameras save the customer the cost of deploying large numbers of monitoring system. The only drawback of the system is that the top speed is 10 km/h [19][22][23][35][36].

It is less fortunate that drones designed to hack systems are also starting to appear. The WASP UAV is came to life as a modification of the FQM-117B. It is equipped with electronic systems which makes it capable to detect the signals of GSM and WiFi networks and hack or disturb these signals [24][25].



**FIG. 9.** The world's first security drone

The length and wingspan of the drone is 1,8 m with a weight of 6,5 kg, including the high resolution camera, the GPS for the autonomous navigation and a computer which does the hacking. The matchbox sized computer has the full capability of a Linux operating system, the hard drive is 32 GB [6][7][26].

Another proof of the drones' wide area of use is that pizza delivering quadcopters are came to being. In urban cities, in peak time an UAV can deliver the food in minutes. This service is provided with a modified UAV, which had the original task as a monitoring drone. After the disarmament of the professional camera, the "Domicopter" delivered two pizzas in a thermobag for the customer [27].



FIG. 10. Pizza in the sky – more like marketing than a real service

The most obvious use for UAVs is police monitoring. For this a small, slow rotary winged aircraft is needed. For these tools a new name will appear in the near future - "Camcopters" [28][29].



FIG. 11. The Russian made S-100 UAV

## 5. SECURITY OR THREAT?

Since the price of UAVs is dropping from month to month, and the home use of radio-controlled models are increasing, the illegal use of these "flying toys" is starting to be a real threat. There is no better proof than (1) the protected witness Gaspare Spatuttsa claimed that 25 years ago the mafia was researching methods about carrying explosives in the airspace. The leaders of the "Cosa Nostra" Sicilian criminal organization the Graviano clan (brothers Filippo and Giuseppe) [16] personally ordered to Spatuttsa to make radio-controlled models, which can carry a small amount of explosives to a "destination"; (2) the German secret service identified a terrorist network, who were planning attacks using drones, which would carry explosives in the air. Imagine, what effects can a special mini-missile, classified as a "surface-drone", cause.

The user can use these tools for a "good cause" like the Belorussian forensics A.Vnukovich. In 2007 he planned and made a radio-controlled glider, equipped with a camera and launched it to find an illegal distillery, hiding in the woods [6][7][40].

## CONCLUSION

Because of the increasing attention toward drones we can presume that there will be a "war" in the air. What should we do? Forbid the sell of these "toys"? It's like stopping the overusage of medicine or the sale of fuel.

Today an operating drone can be built at home. There is no guarantee that terrorists won't do the same.

The industry is growing steadily, and it is desired to regulate the use of UAVs as fast as possible, so we can take advantage of these equipment's services and don't suffer from the drawbacks.

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