

Review

Some Aspects Related to Drones

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Abstract: Drones developed very quickly and today have come to conquer airspace even more than conventional aviation. Whether they are unmanned or with a crew, whether they are on autopilot, usually remotely coordinated, or remote-controlled or even manned, drones in their diversity today have taken on a very large scale and they will surely develop rapidly and further, being the ones that will make their mark on future flights at low or medium altitude. The paper presents some aspects related to drones, a review of their development today and some ideas regarding the functions they already have and will have in the near future. The flight has already reached a point of great development, but at this moment, the drones that have recently reacted have started to develop very fast and occupy important places in the class of aircraft with or without a pilot. It must be made the specification extremely important that drones will be the ones that will help us to conquer space and explore various planets, as rovers do now because small flying vehicles are better able to penetrate new, unknown and hard to reach spaces.

Keywords: Drones, Drones Today, Aerospace, Aircraft

Introduction

Aviation is the branch of aeronautics that deals with the construction, operation and use of aircraft heavier than air. "Aviation" also means all the planes and personnel that a country has.

By purpose and destination, aviation is divided into:

Civil aviation, with branches:

Transport aviation, which is used to transport passengers and goods.

Sports aviation, whose main purpose is to recruit young people to become pilots or paratroopers. Also within the sports aviation are organized the activities of flying with or without motor (gliding) for the sport pilots, as well as the activities of parachuting and aeromodelling.

Utility aviation, which provides various transport services in the field of health (medical aviation) and tourism (recreational aviation), respectively provides chemical treatment works in agriculture and forestry (agricultural aviation).

Military aviation, which is a category of armed forces, intended to conduct combat operations in cooperation with ground troops, the navy and other military forces as well as for independent missions. Military aviation also performs air transport activities (troops, equipment) for its own purposes.

The first experimental glider was built by Otto Lilienthal in 1890. The advent of internal combustion engines boosted the construction of aircraft. The Wright brothers built the first aircraft with such an engine, making the first flight on December 17, 1903. According to the Smithsonian Institution and the International Aeronautical Federation (ISP), they made the first controlled flight onboard (piloted) with a heavier aircraft than the air, at Kill Devil Hills, four miles south of Kitty Hawk, North Carolina, on December 17, 1903. In accordance with their own statements, unproven on any evidence, the Wright Brothers built the first aircraft with such an engine (December 17, 1903).

The first aircraft to take off with its own means of the flight was built in France by the Romanian inventor Traian Vuia (March 18, 1906). In December 1910, the Romanian engineer Henri Coandă made the first flight with a jet plane, which he built in France.

Among the pioneers of aviation are the Frenchman Louis Blériot (who in 1909 crossed the English Channel by plane), the Brazilian Alberto Santos-Dumont, the Frenchman Henri Farman.

In Romania, the first plane was built in 1910 by Aurel Vlaicu.

Between the two world wars, transport aviation is developing, for passengers and cargo. During the Second World War, the construction of airplanes was perfected,

making high-speed aircraft (500-750 km/h). After the Second World War, the aviation technique registered a significant leap following the endowment of the planes with jet engines, a fact that led to the realization of the modern supersonic planes.

In recent years, fast passenger planes, turbojets and turboprops have been built.

The history of aviation has duration of over two millennia. Thus, the oldest man-made flying objects can be considered kites made around 200 BC. in China and with which a person could fly over enemy territory during armed confrontations. The case of Prince Yuan Huangtou is known, who after such a flight, survived by untying the kite that was carrying him in flight.

Leonardo da Vinci's aspiration to flight was represented by various projects of the great Renaissance genius, but he failed to put anything into practice. In the period between the 17th and 19th centuries, observations on the atmosphere led to the creation of hydrogen balloons. Based on the theoretical basis of fluid dynamics and Newton's laws, modern aerodynamics is born. In the first half of the 19th century, hot air balloons were used to carry out even combat operations, as in the case of the American Civil War or the Battle of Petersburg.

The word aviation, with its current meaning, was introduced in 1863 by the Frenchman Guillaume Joseph Gabriel de La Landelle (1812-1886), a forerunner in this field, in the work "Aviation ou Navigation aérienne". It was not until the early twentieth century that experiments and achievements in the field of aviation proved that it was possible to build a heavier-than-air aircraft.

This era ends at the beginning of the twentieth century. All kinds of flying machines are created, some of them really fantastic. But by 1800 we were witnessing the development of aerostatics and numerous attempts at gliding.

Man's desire to fly is also illustrated in the mythological literature of various cultures. An example is the myth of Icarus who built his wings from feathers and wax. Also in Ramayana, the term Vimana evokes palaces and flying cars. A strange aircraft, similar to a spaceship, is also described in the Bible in the Book of Ezekiel.

The Latin scholar Aulus Gellius presents the attempt of the Greek mathematician Archytas (428-347 BC) to build a small aircraft shaped like a bird propelled by a jet of steam.

Zhuge Liang (180-234 AD) is credited with building the first flying lanterns, a kind of forerunner of hot air balloons. They had the shape of a paper bag with the opening down, which was a lantern that heated the air inside. During the war, they were intended to scare the enemy. Subsequently, these flashlights were expanded, but more for religious events, in no case for a human flight.

Around 400 BC. a kind of propeller flying vehicle (bamboo helicopter) appeared. These were reconsidered two millennia later by George Cayley.

Yuan Huangtou, the son of Emperor Yuan Lang, manages to build a kind of kite large enough to carry it in flight by launching from a tower.

In the ninth century, the Arab scientist Abbas Ibn Firnas built a glider with which he flew over the Jabal al-Arus hill. Trying to return to his place of departure, he collapses and injures himself. From here he concludes that the aircraft should have been provided with a tail, which would have played a role in maintaining balance and stabilizing the direction.

Between 1,000 and 1010, the Benedictine monk Eilmer of Malmesbury managed to glide about 200 meters, but he also suffered an accident.

In 1488 Leonardo da Vinci drew a kind of glider to which the inside of the wings was fixed and at their tips was provided with adjustable parts. It was not until the 20th century that a prototype was built after this project.

In 1647, the Italian inventor Tito Livio Burattini, invited to the court of the Polish king Vladislav IV, built a four-wing aircraft with which, the following year, he managed to make a cat rise above the ground, but not on himself. It is considered the most elaborate glider to be built by the 19th century. Its flying dragon was one of the most sophisticated aircraft built until the 19th century.

All of Leonardo's flying machine designs had as their main part wing systems whose movement ensured lift. Moreover, in 1655, Robert Hooke proved the impossibility of human flight without an engine-powered aircraft.

In 1670 Francesco Lana de Terzi published a paper suggesting that it is possible to fly with devices lighter than air. He built an aircraft that contained some copper spheres in which a vacuum was created, but the attempt failed because the atmospheric air pressure would damage the spheres.

In 1709, Bartolomeu de Gusmão submitted a petition to King John V of Portugal, requesting financial assistance for an aircraft, which was never tested. However, he manages to build a hot air balloon with which he flies on August 8, 1709.

In 1738 Daniel Bernoulli formulated the principle of energy conservation in the case of fluids, which would bear his name (Bernoulli's equation), which expresses the interdependence between pressure and speed in the fluid and which would become one of the theoretical bases of flight mechanics.

On November 21, 1783, Pilatre de Rozier and Marquis d'Arlandes left Paris aboard a similar balloon created by the Montgolfier brothers, being the first manned and documented flight.

In the same year, on December 1, Jacques Charles built the first hydrogen balloon.

The first woman in flight is considered the Countess of Montalembert, who flew over Paris in a balloon on May 20, 1784.

One of the forerunners of the theory of aerodynamics was the British physicist George Cayley, who, at the beginning of the 19th century, formulated the basic principles of this discipline.

Thus, he argues that in order to perform the flight, the weight and strength of aerodynamic resistance must be overcome and the wings of the aircraft must not necessarily be as winged as those of birds but must maintain its balance and stability. To launch aircraft, propose the use of the inclined plane.

Based on the work of François Launoy, Cayley built a type of helicopter in 1796, to make an ornithopter in 1808 and the following year a glider that flew without a man on board. William Samuel Henson and John Stringfellow, resuming Cayley's work, build a steam engine, but it turns out to be too difficult to take off.

In 1861 balloons were used during the American Civil War.

In 1874 Gustav Wilhelm von Achenbach designed a propeller airplane.

Otto Lilienthal made a series of gliders with which, between 1891 and 1896, he made a series of flights in the vicinity of Berlin. The hang glider made by him successfully completed several flights. But he did not have a steering control system, Lilienthal having to swing his torso to guide the glider in a certain direction.

On May 6, 1896, Samuel Pierpont Langley launched a glider that flew almost a kilometer and reached a height of about 30 m.

On October 2, 1899, Percy Pilcher lost his life at the age of 32 following a hang gliding accident.

In 1900, inspired by Lilienthal's work, the Wright Brothers experimented with glider flight. According to the Smithsonian Institution and the International Aeronautical Federation (ISP), they made the first controlled flight onboard (piloted) with a heavier-than-air aircraft at Kill Devil Hills, four miles south of Kitty Hawk, North Carolina. On December 17, 1903. They are the first to fly a plane, namely on December 17, 1903, according to their own testimony without presenting any evidence. Until 1908, the Wright brothers consistently refused to present their aircraft or fly with them in public.

In early 1901 and 1902, Gustav Whitehead managed two flights aboard a small monoplane equipped with a small engine, both designed by himself. But unfortunately, he did not photograph the event and therefore there is no reliable evidence.

Other flight attempts had been made by Félix du Temple in 1874, Alexandr Mojaiski in 1884 and

Clément Ader in 1897, but they do not have a precise confirmation in the documents of the time.

On March 18, 1906, Traian Vuia became the first man in the world to fly with a heavier-than-air aircraft (the Vuia 1 plane).

Jacob Ellehammer flies in a closed circuit 42 m at a height of 50 cm on September 12, 1906.

Alberto Santos-Dumont, after several balloon flights and a witness flight of 4-7 m at a height of 50-70 cm performed on September 13, 1906, on October 23, 1906, in Paris made his famous flight with the 14-bis plane (Quatorze-bis), which is considered the first certified flight with a heavier-than-air aircraft.

Another achievement of Santos-Dumont is the first world record recognized by the International Aeronautical Federation, namely the flight of 220 m in 21.5 sec, a record set on November 12, 1906.

The first crossing of the Atlantic was made by British aviators John Alcock and Arthur Brown in June 1919. But the one that went down in history is that of Charles Lindbergh in 1927.

Only a few years after the appearance of the first planes, in the First World War, a new weapon is introduced on the battlefield, the military plane and thus it quickly moves to mass production. Some types are built in thousands of copies, the pilots become professionals, but nevertheless the spirit of adventure specific to a period of continuous innovation does not disappear.

Competition between the great powers led to the establishment of several thematic competitions, among the first being the military airplanes in Reims in October and November 1911, where French and British builders compete.

This competition was aimed at obtaining increasing orders for exports.

On October 5, 1914, in the vicinity of Reims, a German plane was shot down by a French plane, this being the first air-fight in history. From this moment on, air duels are multiplying, to which the development of synchronized machine guns also contributes.

Aviators are beginning to be considered knights of the air, some of them being famous heroes with their victories. Thus, the German Manfred von Richthofen, also known as the Red Baron, shot down 80 enemy planes and for the Frenchman René Paul Fonck, the number of planes shot down is 75.

The largest aircraft manufacturers of this period are France, the United Kingdom, Germany and Italy.

In the period immediately following the First World War, we witnessed an unprecedented development of aircraft (the Golden Age of aviation). A reconversion of the former military pilots takes place and thus commercial and postal aviation develops.

In 1919, on February 8, the first trade link between Great Britain and France was inaugurated.

In 1939 (April 26) a record speed (755,138 km/h) was recorded, reached by the famous Messerschmitt Bf 109, one of the most modern fighter planes of that era.

In World War II, aviation is used on the battlefield on a large scale. We are witnessing the heyday of the aircraft with propeller and internal combustion engine, to be replaced by jet and radar aircraft.

As at the beginning of the interwar period, the beginning of the postwar period is marked by a surplus of aircraft. Regular commercial transport begins, able to overcome atmospheric and climatic difficulties and even fly without visibility. The development of the jet engine leads to the emergence of supersonic airliners.

Currently, the largest passenger aircraft in the world is an Airbus A380, with a capacity of about 800 passengers and the largest cargo aircraft is an Antonov An-225, which can lift 700 tons.

The achievements of Aurel Vlaicu, Traian Vuia and Henri Coandă determined the birth of Romanian aviation simultaneously with the world one.

In 1906 Traian Vuia succeeded in the first self-propelled flight with a heavier-than-air aircraft. Aurel Vlaicu makes an airplane in the form of several models (Vlaicu I, Vlaicu II) with which, in 1912, he won five memorable prizes at an air rally in Aspern, Austria.

Henri Coandă, discoverer of the effect that bears his name (Coandă Effect), made in 1910 the first jet aircraft (jet aircraft).

In the Second World War, the Romanian army was equipped with planes made by the Romanian Aeronautical Industry and to which Elie Carafoli's projects also contributed. Thus, at the beginning of the war, Romania had 276 fighter jets (García, 2020; Rana, 2020; Garfo *et al.*, 2020; Kumar and Sreenivasulu, 2019; Mishra and Sarawagi, 2020; Welabo and Tesfamariamr, 2020; Antonescu and Petrescu, 1985; 1989; Antonescu *et al.*, 1985a; 1985b; 1986; 1987; 1988; 1994; 1997; 2000a; 2000b; 2001; Aversa *et al.*, 2017a; 2017b; 2017c; 2017d; 2016a; 2016b; 2016c; 2016d; Ayiei, 2020; Brewer, 1991; Chilukuri *et al.*, 2019; Cao *et al.*, 2013; Dong *et al.*, 2013; Saheed *et al.*, 2019; Riman, 2019; Matthews and Sun Yi, 2019; Dwivedi *et al.*, 2019a-b; Eremia, 2020; Franklin, 1930; Hanrahan, 2014; He *et al.*, 2013; 2008; Hertel, 2017; Komakula, 2019; Langston, 2015, 2016; Lee, 2013; Lin *et al.*, 2013; Liu *et al.*, 2013; Padula and Perdereau, 2013; Perumaal and Jawahar, 2013; Petrescu, 2011, 2012; 2019a-v; 2020a-g; Petrescu and Petrescu, 2019a-f; 1995a-b; 1997a-c; 2000a-b; 2002a-b; 2003; 2005a-e; 2011a-c; 2012a-b; 2013a-e; 2014a-h; 2016a-c; 2020; Petrescu *et al.*, 2007; 2009; 2016; 2017a-ak; 2018a-w; 2020; Petrescu and Calautit, 2016a-b; Dekkata and Yi, 2019; Fahim *et al.*, 2019; Hassouni *et al.*, 2019; Riman, 2018; Nacy and Nayif, 2018; Kortam *et al.*, 2018; Welch and Mondal, 2019; Eissa *et al.*, 2019; Younes *et al.*, 2019; Svensson *et al.*,

2004; Rahman, 2018; Richmond, 2013; Kisabo *et al.*, 2019a-b; Kisabo and Adebimpe, 2019; Kosambe, 2019a-d; Sharma and Kosambe, 2020; Oni and Jha, 2019; Chaudhary and Kumar, 2019; de Lima *et al.*, 2019; Babu *et al.*, 2019; 2020; de Mota Siqueira *et al.*, 2020; Tumino, 2020; Mishra, 2020a-b; Brischetto and Torre, 2020; Vladescu, 2020).

Materials and Methods

For millions of people, traveling by plane is a confusing, uncomfortable and even scary experience, even if, statistically, the chances of being struck by lightning are higher than those of perishing on a plane. Now, please fasten your seat belts for a thrilling journey into the lesser-known world of airplane pilots.

The flight instructors found that the most difficult and important moments of a flight are takeoff, landing preparation and or the visual cues that a pilot uses during the flight.

Flying used to be a glorious business, but since the passengers began to board the plane in pajamas and the airlines began to threaten to pay for the toilet, the glory has deteriorated.

However, it is an expensive business: Flights are not cheap and although there is no guarantee of a job, in the end, becoming a pilot can be as expensive as a house in the city.

In some countries, on the other hand, pilots are still being sought, especially experienced ones for use in civil or military aviation, because there, most often in developing countries, there is a chronic lack of pilots and good administration of those countries.

The job of the pilot, although generally highly esteemed and well rewarded, remains today unfortunately a difficult one, even difficult, because flights are not yet guaranteed, as safety and comfort. There are often unforeseen technical problems, design issues that are not seen from the first checks or the first flights, some design errors can occur when you do not expect, unfortunately, there are also human piloting or bad errors. support from control towers, various other human errors and less often cars or computers, where the software can sometimes cause problems, but unfortunately the weather always speaks for itself, being able to influence for better or worse a certain flight in its totality, there being multiple cases when the atmospheric conditions led to serious aviation accidents.

Unfortunately, the flight technique is not yet perfectly developed even if today it has developed considerably.

There are still old or very old aircraft (kept) in flight, for financial reasons, which fall when you least expect it.

Not to mention the terrorism, the birds that hit aircraft and caused them great damage or even led to their fall, some dangerous lightning strikes for aircraft, the freezing of the guide fins and/or maintenance (icing) on older aircraft...

Some experienced pilots recommend autopilot shortly after takeoff and before landing, so almost the entire flight. Some airlines require this to reduce the risk of pilots behaving like cowboys in the air. They have faced such situations in the past, for example with pilots accelerating as they approached the airport, like a horse who, when he feels that he is approaching the house and its manger, begins to gallop happily faster as he will get to rest, food and comfort (Hertel, 2017). This is a very dangerous maneuver and consumes a lot of fuel because it often means that the plane has to rise again in altitude before landing.

But when you are at a high altitude and all you have to do is maintain the flight course and monitor the speed, then the pilot starts to get bored. This is another reason why it is good to use autopilot. You need to set the adjustments according to altitude, route and accelerate manually.

Many pilots generally earn between 8,000 euros and 10,000 euros per month, without taxes. But the cliché that pilots earn a lot of money is no longer valid. There are a lot of pilots in less developed countries, or who fly small or less important planes, who have low salaries. Some earn only 1,200 euros per month in the first years and from this salary, they have to pay the debt from the aviation school, which is often very high, in those locations being often missing pilots or more few than the minimum necessary.

A few minor things happened to me, says an experienced pilot. For example, a generator broke. On another occasion, the autopilot did not work. My biggest scare was during a landing in Bristol, when I was a co-pilot. The runway in Bristol is very short and has a steep slope at the end. It was raining and windy that day and the captain missed the ideal landing moment. We continued to glide over the runway. Since the plane would not have been able to stop in time and most likely we would have fallen off the slope, I had to take the helm from the captain and try another landing.

The captain muttered, unable to move. I had to get his hand off the helm. After I landed, he apologized to me, so I didn't make too much fuss about it and the passengers had no idea how close we were to getting injured.

If it's just a passenger leaving the phone open (if you don't put the phone on airplane mode during the flight), then most likely nothing will happen. But if there are several who do this and are still located close to the flight deck, we will hear the feedback in the headphones. That noise is louder than radio messages and can disturb navigation devices. Not the GPS itself, but devices that replace the GPS in an emergency.

“When German pilot Andreas Lubitz intentionally crashed a Germanwings plane in March 2015, did it change the conditions of the pilots?”

I don't work for a German airline, but I'm German. Some of my colleagues made some stupid jokes. Once, when I was in the cockpit, a flight attendant asked me if I was going to commit suicide. Maybe it was just a joke on her part, but I'm not kidding about this.

I tend to think that Lufthansa, the company that owns Germanwings, had to deal with some more serious consequences after Lubitz's accident. They were fully aware of his mental state. When you go through the selection process for a job at an airline, there is always a psychological test that is the most important criterion. He was employed, although he had problems since then and had been absent from school for several months to treat depression. The airline never apologized for what happened and I think it should.

It's definitely a big responsibility. It is also strong to have the authority to give orders to people to ensure their safety. The flight and ground crew must listen to your letter of the law and at the end of the day, it's great to feel how so many bad things could happen, but you took care of hundreds of people to get home safely” (Hertel, 2017).

A former NASA employee wants to gather people from around the world to plan a mission to "Europe, one of Jupiter's moons" (Fig. 1).

It is possible that there is life closer than I thought and that we can form a small planet, practically a satellite, but still large enough to support life on it, even if it is only a satellite of the planet Jupiter, being Europe.

Like all great steps for mankind, taking a man on one of Jupiter's moons must begin with a small step and that's exactly what Europe's goal is trying to do. A small team of architects, futuristic designers, independent space pioneers and even Jacques Cousteau's son, Pierre Yves Cousteau - plan to send human beings on a journey back to Jupiter's Europe.

Before launching the spacecraft, launch a crowd-researching campaign. You still can't sign up to go further - and inevitably die somewhere further - than anyone has ever done. They will not leave in the next decade, but it is possible that it will happen in 30 years from now. Or maybe 50? "If no one starts this research, we will never get anywhere," von Bengtson said. "This project is just the beginning."

Although it is not the largest moon of Jupiter, Europe has received a lot of attention lately. NASA probes that flew through Jupiter's system in the 1970s have revealed that ice-covered Europe is one of the finest objects in the galaxy. Although it is five times farther from the Sun than Earth, scientists speculate that beneath the frozen surface of Europe could be liquid oceans, warmed by underwater volcanoes and the friction caused by Jupiter's gravity.

And wherever there is liquid water, there is also the possibility of finding life. That's why NASA wants to launch a probe there in 2022 to document the environment and that's why Europe's goal is to look forward to sending people there.



Fig. 1: Europa, one of Jupiter's moons. Europa is on the right, with another moon to its left and Jupiter in the background. The photo was taken by Voyager 1

"It is the body in the solar system that has the greatest potential to host extraterrestrial life," said von Bengtson. "We have every reason to want to go there."

He explained: "You can't go on Venus because it has a pressure of 93 bar and acid rain. Mars belongs to the last millennium. Is boring. It's just a desert. What's the next destination? Jupiter, with this beautiful ice planet."

Von Bengtson is a Danish space architect and designer who worked for NASA and writes for Wired. As I spoke to him, it became increasingly clear that he was drawn to the very complexity of Europe's goal - it's not at all easy to send someone millions of miles away, land on the icy surface, cross it and explore the water. Below (Richmond, 2013).

When I asked him "Why Europe?" He first told me about the possibility of finding life, after which he admitted: "Plus it seems cool to me. Land on the ice? Penetrate the crust? Turn your capsule into a submarine? Isn't that the most exciting mission possible?" From the point of view of an engineer and designer, it's hard to disagree.

We are seven billion people on Earth. It would be easy to convince a few thousand to work on this project.

Bengtson's initial calculations estimate that Europa is 600 days away - a much more practical visit - relatively speaking - than one on the exoplanets light-years away. The NASA Galileo spacecraft reached Jupiter in six years, but the probes travel much slower, trying to maintain their energy and longevity. When you have people on board, the idea is to travel as fast as possible. For example, the European Space Agency spacecraft landed on the moon within a year, while Apollo missions lasted three to five days.

"Of course, NASA is an organization run by people like von Bengtson, who love to find solutions to seemingly impossible problems and the people at NASA

I spoke to told me that a pilot mission to Europa is almost impossible.

In fact, they even laughed in my face when I told them that.

Fran Bagenal is a professor of astrophysics and planetary science at the University of Colorado. He worked for NASA during the Voyager and Galileo missions to Jupiter at the Galileo spacecraft and recently co-investigated the NASA New Horizons mission, which sent a spacecraft in 2006 to explore Pluto and the Kuiper Belt. He explained to me, in an e-mail, the difficulties facing the Europe Objective.

A - Difficult location - Europa is at a great distance in Jupiter's gravitational field and it takes a lot of fuel and a long time to enter orbit around Europa."

B - Radiation - charged particles trapped in Jupiter's strong magnetic field destroy all electronic devices. So you have to have a specially prepared shield.

Von Bengtson is very aware of radiation. One day of radiation in Europa can kill you, he said. It's no secret, but we can handle it. How? This is a question that will be answered in Phase I of the Europe Objective. Welcome to crowd researching.

The Europe Objective website will have a forum where the potential difficulties that the mission will face will be posted and anyone in the world can try to solve them and if the solution is not a bad joke or a prank, it will appear on the site and will be analyzed by the team of specialists.

It seems impractical, if not impossible, but von Bengtson has every reason to be optimistic: He has already started a successful space program with online funds, "Copenhagen Suborbitals." The motherboard has produced a video with the mission where you can see them testing homemade missiles to send people into orbit (Fig. 2), (Richmond, 2013).



Fig. 2: Building a homemade spacecraft

"We managed to launch a space program with the help of everyone who contributed to it," said von Bengtson. "Many ideas come to us from people or by reading the wired blog. So I thought a Phase I could be created for this mission in Europe. Instead of receiving funds from people, we can receive ideas and solutions from different people in different fields (Richmond, 2013)".

Von Bengtson hopes that after the launch of the website, the idea of a pilot mission in Europe will ignite the imagination of the world as it ignited his own. For him, it's the only practical way to do something so impractical.

"The idea was not to be three nerds who meet from time to time to set up this project, because it would be completely unrealistic," he said. "The second option would have been a priority project funded by the government. This will never happen. But I think it's possible to do that if you join forces with everyone who finds it an interesting and exciting project. It's the only way you can do that, or at least the research phase. "

Maybe the united minds of people will be able to design a rocket and a spaceship. After all, it's just the research phase. For NASA, the idea of sending people to Europe is the least practical part.

"What's the point of sending people?" What can people do that a robot can't do better? "Bagenal asked." And robots do not need to breathe, eat, drink, have no excretion and do not need to return. Robots have better bodies, eyes, hands, noses, ears and brains than humans.

She is an expert and it is difficult to contradict her when she talks about the superiority of robots. But it's painful to hear someone say that and it challenges von Bengtson to come to the defense of our fragile and evil species (Richmond, 2013).

It must be made the specification extremely important that drones will be the ones that will help us to conquer space and explore various planets, as rovers do now because small flying vehicles are better able to penetrate new, unknown, hard to reach spaces.

Of course, it's much more complex to send people into space, but I have a few arguments for that, von Bengtson said. "One would be - you know the Spirit and Opportunity robots on Mars? "They were there for seven years and were estimated to have done the equivalent of four weeks of human labor. So robots have limits."

Indeed, Objective Europe is still at the stage where it doesn't even know how much it doesn't know, so it's possible that NASA will build much better robots while Objective Europe manages to build a spaceship. But maybe exploration means putting your ass in a chair, seeing things no one else has seen and dying in a place where no one has died.

"It's also about human exploration, going there," von Bengtson said. Throwing a stone into your neighbor's garden doesn't mean you've been there. It was just a stone. It's the same here. We have to go there as human beings, as presence, to really be there."

For the human being to be able to do the impossible, he must have impossible expectations. "I wouldn't start the project if I didn't think it was feasible," von Bengtson said. "So I don't think we have the brains to find solutions."

"There are seven billion people in this world. I really think you can arouse the interest of at least a few thousand," he said. "I would be very disappointed if the human species did not come up with solutions. However, in 100 or 200 years, people will be sent to Europe. I'm sure we can move this project forward. We can cut 50 years of waiting. We could make it feasible in 30 years, so to speak."

The Europe goal is not of national interest, it is not back and forth and it has no funding. At the moment it is a plan of an optimistic Dane with many connections and of his friends. He said he discussed the issue with his friend, Syd Mead, the futuristic designer behind Tron and Blade Runner. The team is waiting for reactions from the public.

"Basically, this project - even if it turns out to be unfeasible - is still very interesting," said von Bengtson, listing all the new information and progress that would come from this project. "Even if we don't succeed, we will still get smarter out of this. We can't fail."

So first we document ourselves with the help of the public. Then we do tests and then we send a brave soul into space. It's a mission that would overshadow Neil Armstrong's accomplishment. I asked von Bengtson what words he would say when he first set foot on the moon of Jupiter. He laughed, "I'd hire a screenwriter" (Richmond, 2013).

More than 100 years ago, most people would have said they would never be able to fly. How is it possible to fly without wings? The idea of flying was actually madness but also a danger at the same time and yet, in the next century, a series of interesting discoveries were unleashed that would change the world forever.

It was a time when everyone was trying to overcome their own barriers and limitations and many inventors began to invent the flying machine, from Traian Vuia to the brothers Orville and Wilbur Wright, the most famous as the inventors of the aircraft.

Most inventors of that time, however, were impulsive, disorganized, eager only for the fame they could gain from an invention that would change humanity. Some have tried to create wings for their arms. Others created planes that looked like huge shadows. Of course, most have collapsed due to multiple malfunctions.

But the Wright brothers were much more scientific and methodical, believing in their idea from the beginning and applying a safer test environment, hoping to create a real, functional aircraft. Even today, scientists do not just build things or visual objects, but their functionality is tested to ensure that it fulfills the purpose for which it was created.

Thus, the way the birds fly was analyzed in detail, in order to try to copy as much as possible this natural mechanism.

In 1901 and 1902, the Wright brothers tested larger gliders with increased efficiency. Based on the results, they added a floating tail, two propellers, wing twistors and a gasoline engine.

In Romania, on March 18, 1906, Traian Vuia made one of the first self-propelled flights (without catapults or other external means) with an apparatus heavier than air, following various tests and projects in which he believed.

After an acceleration over a distance of 50 m, the aircraft rose to a height of almost one meter, over a distance of 12 m, after which the propeller blades stopped and the plane landed.

Many newspapers in France, Italy and the United Kingdom have written about the first man to fly a heavier-than-air aircraft, equipped with its own take-off, propulsion and landing systems. Traian Vuia died in

1950, after patenting other projects such as a steam generator (1925) or two helicopters (1918 and 1922).

Henri Coandă, discoverer of the effect that bears his name (Coanda Effect), made in 1910 the first jet aircraft (jet aircraft).

At the other end of the world, the Wright brothers, after numerous attempts, managed on October 5, 1905, to fly over 34 miles in 38 min. In 1909, they founded the Wright Airline for the manufacture of aircraft for the US Army. The modification of their project continued until 1912 when one of the brothers died.

The flight has already reached a point of great development, but at this moment, the drones that have recently reacted have started to develop very fast and occupy important places in the class of aircraft with or without a pilot.

The Unmanned Aerial Vehicle (UAV), also called a drone, is an aircraft that lacks a human pilot, being guided either by a digital autopilot onboard or by remote control from a control center. From the ground or located in another manned aircraft. Drones are used in the military, rarely in the civilian field. They have a payload onboard. Military drones are used for reconnaissance, surveillance, espionage, or combat purposes. Depending on the purpose, they have reconnaissance equipment and/or weapons as a payload.

The first drones were mobile targets in flight that had to be shot down by military pilots during training. Then the name drone moved to unmanned aircraft. But they evolved so much that they managed to transport passengers, to be designed as mini ships with or without a pilot and they diversified a lot depending on their main destination.

In the famous Terminator blockbuster, the future is dominated by robots, while steel birds patrol over the city to identify and kill people. Those birds have been flying in the sky since the First World War. At that time, they were not very evolved.

July 31, 2018, 11:16 p.m. On the platform of the North Station (Bucharest, Romania), at line four, young X is walking restlessly, although the train will arrive in just over 44 min. Another young man, Y, approaches, exchanges a few words with X, after which the latter slips Y a white envelope, for which he receives some banknotes. In a few seconds, the police appear, who handcuff them both. There are several grams of cocaine in the sachet. The young people are upset: They had the impression that the famous surveillance cameras next to the platforms no longer work and they felt safe. What they didn't know was that a few meters above them was a miniature flying vehicle. Equipped with an infrared video camera and proximity sensors, he had spied on the young men while on duty and alerted the police at the station. The maneuver had been fast - the device can reach 35 km/h and is very quiet, thanks to the electric motors and the case made of an extremely light alloy.

For two years, the "Vigilant" plan closely monitored public activity. The purpose of this program? An army of Unmanned Aerial Vehicles - small unmanned aerial vehicles (UAVs), small flying robots capable of pursuing anything and everyone and there aren't many places to get rid of their "eye". UAVs monitor schools, kindergartens, parking lots, train stations, banks and, more recently, supermarkets.

This scenario may not be as futuristic as it seems, because science labs around the world are working on such equipment.

UAVs have already been used in Kosovo, Afghanistan and Iraq, where they have proved extremely useful. The logical continuation of the concept would be the development of UAVs that operate in confined spaces. In France, the Délégation Générale pour l'Armement (DGA) collaborated with ONERA (National Bureau for Aerospace Studies and Research) to organize a competition between French engineering colleges. After three years of research and testing, the candidates gathered at the Mourmelon military base in September last year to compare the prototypes they had created. Although the ingenuity of the glory aspirants prompted the assistance with a lot of shapes, propulsion systems and materials used, most UAVs crashed after only a few seconds of flight.

There are still many problems to be solved. Miniature UAVs, with a maximum wingspan of 15 cm, must fly at moderate and high speeds without making any noise. "One of the main goals of the research is to improve aerodynamic performance," explains Jaque Fort, an engineer at ONERA. Their small size and weight make these vehicles much more vulnerable to wind currents than airplanes, which absorb atmospheric turbulence much better. Now, ONERA engineers are trying to better understand the constraints (eddy currents and other turbulences) to which small UAVs are subjected. To accomplish their goal, they perform tests and simulations in the wind tunnel. The conclusions are astonishing: Although many researchers have opted for propulsion systems, perhaps an even more viable solution would be to draw inspiration from nature, from birds or insects. "Winged or vibrating wings is not a stupid concept. The plane is raised with the help of the propulsion speed, but the fluttering of the wings would be at least as good. Unfortunately, it is difficult to reach such systems, because those movements are difficult to reproduce," says Fort.

Unmanned aerial vehicles, "drones", are the most important military innovation in recent years. If until recently drones were used only in theaters of war, they could soon become ubiquitous. From agriculture and archeology to journalism, drones promise to transform many fields in the coming decades, marking an unprecedented change in our daily lives.

The first use of drones in a military conflict took place in 1982, in the war in Lebanon, when the Israeli army sent such unmanned aircraft to study the Syrian defense systems and to accumulate the data necessary for their destruction.

The success of the Israeli campaign rekindled the US military's passion for Unmanned Aerial Vehicles, the official name of drones (UAVs). In fact, one of the most famous drones used today by the US military, Predator, is inspired by an Israeli design.

Following the development of the Global Positioning System (GPS), which allows accurate navigation anywhere in the world, drones can be used all over the planet, being controlled by pilots at military bases in the United States.

Because drones have many advantages over manned aircraft, they have become an essential weapon in the US military's arsenal. In 2001, when the United States declared war on the 9/11 terrorist attacks, the U.S. military owned 50 drones. Today, their number is 7,500 and US officials plan to expand the global drone network to fund this project at the expense of conventional programs.

Over the past decade, drones have become a key tool of the US military and the CIA. Their role is evidenced by the fact that in 2009, the first year of Barack Obama's term as president, he ordered more drone strikes than his predecessor George W. Bush in all eight years.

Yesterday, 40 Predator drones were in the air at any one time, flying over the hot areas of the globe (such as Afghanistan, Pakistan, or Yemen), but in the coming days or months, they will be more and more in more places.

The Pentagon will spend \$ 5 billion on drones this year and the number of pilots trained to drive these UAVs from the ground is already higher than that of pilots specializing in fighter jets and bombers.

Countries around the world are following the American model, with drones becoming an essential component of the armed forces. The military field is not, however, the only one that registers important transformations as a result of the appearance of drones. These unmanned aircraft are beginning to be used in more and more fields.

Initially, several artificial space satellites were used around our planet and today their number has exceeded the number of thousands, speaking of tens of thousands of satellites. The exact figure is not officially known or does not want to be disclosed, but it is estimated that in a short time they will exceed about 60 thousand.

In drones, the growth is much faster and simpler, they are often cheap, easy to build and use, there are today many commercial models that are freely available for anyone who wants them at very low prices, below that of a phone. Good mobile.



Fig. 3: Today there are many variants on the market, including small and cheap drones, which can be controlled using a smartphone

Drones will be increasingly difficult to calculate (count) and control.

There are many drones capable of monitoring forest fires and reporting them faster than satellites, but unfortunately, they have been built and maybe used laser drones capable of severely burning forests, roads, industrial or military targets...

If initially the drones were manufactured exclusively by defense companies, their cost amounting to several million dollars, today there are many variants on the market, including small and cheap drones, which can be controlled using a smartphone (Fig. 3).

Due to the low cost of purchasing a simple drone (or building it), these unmanned aircraft are becoming more and more used outside the armed forces.

In the United States, many amateurs have built drones or bought such devices. Thanks to them, uses of drones for public purposes have been identified. In Texas, a tech enthusiast discovered with his drone that a meat processing plant was illegally dumping tons of pig blood into a nearby stream. The images captured by the camera attached to the drone supported the complaint submitted by the person to the environmental agency, which sanctioned the company.

In California, real estate agencies have begun using drones to film and photograph luxury properties in the air, with much more compelling materials allowing them to get a better price for them. The practice is so widespread that Los Angeles police have been forced to issue a warning, urging drone operators not to violate FAA (federal airspace agency) legislation. However, police cannot sanction drone operators if they fly below the 120-m (400-foot) ceiling, where FAA rules do not apply.

As a result of a law recently passed by the US Congress, the airspace that is now reserved for piloted aircraft will become available, starting in 2015, to civilian and military drones. Once drones have access to the airspace available to aircraft today, their number is

expected to increase exponentially. According to FAA experts, in 2020 more than 30,000 drones will fly over the United States.

Drones are already used to guard US borders and are soon to be used by firefighters' organizations (for example, to fight forest fires).

The FBI and police organizations in the United States are already using drones. A premiere was recorded in June 2011: The first arrest assisted by a drone. North Dakota police wanted to find three allegedly armed criminals, members of an anti-government group, who could be anywhere on an area of 12 square kilometers. Because they wanted to avoid an armed confrontation, they asked the Customs and Border Patrol Agency to send one of the 8 Predator drones, the spy drones used by the US military in Afghanistan and Pakistan.

The drone sent by the federal agency quickly found the criminals and the attached sensors found that they were not armed, so the police were able to approach to arrest them.

Since then, Predator drones have flown more than 25 flights to police, FBI and DEA (anti-drug agency). Because they cannot be heard or seen, they offer considerable advantages to police departments compared to helicopters, so experts expect drones to be widely adopted, with the number of civilian drones soon surpassing that of drones military.

Another advantage of drones is the cost. Recently, the Los Angeles Police Department purchased 12 new helicopters at a unit price of \$ 1.7 million. For comparison, a Qube drone designed by AeroVironment specifically for law enforcement costs only \$ 40,000.

There are already plans in the European Union for the use of drones in order to monitor the use of subsidies by farmers. In 2011, the European Union paid 44 billion euros in agricultural subsidies and under Community law, at least 5% of the area cultivated with these funds must be inspected annually.

If these inspections were initially carried out by authorized personnel, more and more countries have resorted to satellite imagery to check whether farmers meet the conditions for granting subsidies and then use them according to established conditions. Satellite inspections are 3 times cheaper than those carried out on the spot by inspectors so that in 2010 over 70% of the checks were performed using images captured by satellites. These can sometimes be misleading, however and are difficult to obtain in countries with generally unfavorable weather.

Now, drones are beginning to be seen as a potential solution for agricultural inspections. Unlike satellites, they can shoot from different angles and the captured images are more detailed. The drones have already begun to be tested in Catalonia, southern France and Italy and will be widely used in the coming years. For this, however, it will be necessary to change the European legislation, currently being allowed to use drones only up to a distance of 500 m from the operator.

Drones began to be used in Japan as well, proving useful both in agriculture, where they helped automate the process of spraying crops with pesticides and in investigating accidents, as in the case of the Fukushima nuclear power plant, where they were used. To safely assess the problems encountered.

Another use of drones comes from Russia, where archaeologists use these aircraft to film sites using infrared cameras, the materials obtained being used to create computerized 3D models of the structures identified underground.

Sea Shepherd, an environmental organization that advocates against whaling, has been using drones since this year to identify Japanese vessels that capture and kill cetaceans. The new technology allowed environmentalists to discover the Japanese fleet this year before it began its research mission. "We can cover hundreds of miles of ocean with these drones, which have proven to be an essential tool," said Paul Watson, the commander of the ship *Steve Irwin*, used by the Sea Shepherd to prevent whaling.

Another field that drones promise to transform is that of journalism. In the United States, the country with the most drones, journalism faculties have already begun to prepare students for this new stage of the journalistic profession.

"The idea of 'drone journalism' is not more than a year old. The first time I saw this idea was in Poland, during a protest when someone used a remote-controlled mini-helicopter to film the event," said Professor Matt Waite, founder of the Drone Journalism Lab at the University of Nebraska.

With the help of drones, images inaccessible to ground reporters can be obtained and the price of these aircraft is reasonable. Recently, drones were used to capture images during protests in the Russian capital, Moscow, against election fraud.

One of the first media institutions to use drones in the reports was the digital newspaper *The Daily*, which obtained with their help extraordinary video images in which one could observe the devastating effect of a tornado that hit Alabama.

The drones were also adopted by the paparazzi, who discovered that they could obtain with their help images to which they would not otherwise have access. On the Cote d'Azur, where many celebrities spend their summers, drones are already an essential tool in the arsenal of photographers.

Some activists fear that the spread of drones will lead to a violation of the right to privacy.

Raoul Felder, a New York divorce lawyer, says that "if Israelis can use drones to track down terrorists, then a jealous husband will certainly be able to use a drone to track down his wife when she leaves home." late hours".

In fact, specialists working on the design of drones for the army are already thinking about how they can be used by the population.

Missy Cummings, a former US Navy pilot who is currently a professor at Massachusetts Institute of Technology (MIT), is working with her students to design a personal drone the size of a pizza box. The role of the drone commanded by Boeing is to accompany the soldiers on the battlefield and to warn them when they identify potential danger. Cummings says the same drone could have countless civilian applications. "A parent could use it to track children on their way to school to make sure they get there safely and schools could use drones to monitor their perimeter."

If drones could affect the right to privacy through their ubiquity, the same could have positive consequences. Andrew Stobo Sniderman and Mark Hanis, co-founders of the Genocide Intervention Network, argued in a recent New York Times article that drones could be used to prevent genocide by filming human rights violations from the air, making it impossible to hidden massacres such as the one in Srebrenica in 1995.

The next step the U.S. military is considering is equipping drones with the ability to self-identify enemy targets without human assistance.

Currently, the weapons with which the drones patrolling the battlefields are equipped are launched only after the pilots' commands, but the American researchers are working on the design of systems capable of making autonomous decisions.

At the border between South and North Korea, there are already "robotic guards" capable of autonomous decisions. "Super aEgis 2" turrets can detect a man 2.2 kilometers away, regardless of the weather, by attacking enemies with a 12.7 mm machine gun.

Specialists believe that it will not be long before the drones become autonomous and will identify enemies with sophisticated algorithms and then attack them with weapons.

Ronald C. Arkin, the author of the "Governing Lethal Behavior in Autonomous Robots" study funded by the US military's research wing, says that "lethal autonomy is inevitable." The United States is not the only country conducting research in this area, with China also investing large sums.

The US military estimates that in 2030 insect-sized drones, equipped with cameras and sensors, will be used for espionage. This prediction could become a reality even earlier than 2030: A team of researchers from Harvard's micro-robotics lab created a coin-sized mini-drone called Mobe using a 3D printer.

All these efforts seem to shape a future in which the sky will be filled with tens of thousands or hundreds of thousands of drones, which will be integrated into everyday life, in what is announced to be the "age of drones", Fig. 4 (Drone, 2012).



Fig. 4: A simple military spy drone

Unmanned aerial vehicles - or drones - are a fast-growing aviation sector with significant potential to create new jobs and growth in the European Union. That is why the EU has adopted a regulation aimed at the safe integration of remotely piloted drones into European airspace.

The Regulation establishes a set of common rules for civil aviation safety and a revised mandate for the European Aviation Safety Agency (EASA). The new EASA Regulation replaces the 2008 legislative framework.

On 26 June 2018, the Council adopted new proportionate and risk-based rules that will allow the EU aviation sector to grow and become more competitive.

For example, the new rules also apply to the registration threshold for drone operators: They should be registered if their drones can transfer the kinetic energy of more than 80 joules to the impact on a person.

Although some drones are as heavy and fast as an airplane, they can also take the form of very small electrical "toys" that are widely available to consumers.

After 2008, smaller drones created regulatory problems for the EU, whose competences were limited to unmanned aerial vehicles heavier than 150 kg.

Lighter drones were subject only to different and fragmented national safety rules at the EU level. Moreover, certain essential security measures were not applied consistently.

The reform of aviation rules was also necessary because EU air traffic is expected to increase by 50% over the next 20 years.

The European Commission estimates that by 2035, the European drone sector:

- Will directly provide jobs for over 100,000 people
- Will have an economic impact of over EUR 10 billion per year, mainly in the field of services

As the use of drones expands, so will the need to find a balance between their advantages and the problems they generate. For example, unmanned aerial vehicles can provide added value when used for data collection and interpretation in different sectors of the economy. But drones can also create problems in terms of data protection, privacy, noise and CO₂ emissions.

On 12 March 2019, the European Commission adopted rules at the EU level establishing technical requirements for drones.

In accordance with the EFSA Regulation, the new rules set out the basic principles for ensuring the security, safety and protection of privacy, as well as the protection of personal data. They also aim to reduce bureaucracy and encourage innovation.

The regulation also removes certain rules that could inhibit entrepreneurship. It is expected to generate legal certainty for a sector comprising a large number of small and medium-sized enterprises and start-ups.

In addition, the regulation introduces a safety approach based on risks and performance. This means that the regulation recognizes the various risks that arise in different sectors of civil aviation. For example, helicopters or light recreational aircraft are subject to simpler and cheaper type-approval procedures than commercial aviation (Council of the European Union, Policies. Drone).

Results and Discussion

The category for professionals includes drones designed specifically for shooting, filming, or mapping terrain, the most advanced technological models. These models have GPS and controllers, which allow fine movements, filming or spectacular pictures. At the same time, they allow you to change the camera lens and the video camera in order to obtain the best results for the proposed purpose. Another advantage is the autonomy of the drone's battery so that it can be used for a longer period of time in the air, which does not often prove to be extremely efficient.

Remote Control Drones

This model of the drone is generally small in size, to be easier to handle and was created exclusively for fun. They have a lower speed and are controlled by remote control with or using an application on the phone. The operating time of these drones is between 5 and 10 min and then the batteries must be recharged for new reuse.

These drone models can break down quite easily, but you can find spare parts at a fairly low price. Some models also include camcorders or cameras with an average quality of the result.

Drones for Shooting and Filming

They aim to capture images at very high qualities, being used less to tumble through the air. They are more sophisticated and expensive aircraft that provides a stable platform for the camera. This sophistication means that they are larger and heavier, which makes them more durable. With this advantage, however, comes the need to legally register them in order to fly them. To keep the camera stable, they are often equipped with a system of tilting and rotating the camera, thus absorbing the shaking of the moving drone.

Speed Drones

With the invention of these devices, it was logical to expect the emergence of a sport that has them as stars. The small drones used for competitions are built to be easy to handle and very fast. They are equipped with First Person View (FPV) glasses that allow the operator to see everything the drone sees, thus guiding it during the race:

- RTF drones mean ready-to-fly - the drone does not need assembly and is ready to fly as soon as you take it out of the box
- ARTF drones mean almost-ready-to-fly-these drones may need minor assemblies or additional equipment such as a radio controller before putting them into operation
- BNF drones mean Bind-n-fly - they are basically RTF drones with a receiver, but without a radio controller, its purchase being made separately

Autonomy and Battery

Any drone has the disadvantage of short battery life. Because the larger the battery, the heavier the drone and the more energy it needs to fly at high speeds, the capacity of the battery is very limited. If you want the flight to be longer you will need to bring the drone to the ground and replace the battery with a full reserve.

Speed and Range

Modern drones are capable of remarkable speeds. Some can even fly at 50-60 km/h, with little exercise and skill, just like learning to ride a bike and drones have certain "auxiliary wheels", i.e., limited flight modes that limit the speed at which a drone can lift and fly. Using these models will make it easier for you to fly it because you will have more reaction time. Wi-Fi drones can be controlled within a radius of 30 m, but antenna controllers can have a wider range.

Functions and Accessories

GPS - the drone is programmed to track the user. This way you can be in the car, on a bicycle or a boat

and the drone will follow you, without controlling it from the remote control:

- Obstacle sensor - the drone will detect obstacles that could be a danger and will avoid them automatically
- Extra batteries
- Spare parts: Such as propellers that often fail during drone use
- Storage or transport box or backpack
- Phone holder on the controller or remote control (Fig. 5)

A quadcopter also called a four-rotor or quad-rotor helicopter is a multi-rotor helicopter that is lifted and propelled by four rotors. Quadcopters are classified as rotor ships, as opposed to fixed-wing aircraft, because their lift is generated by a set of rotors (vertically oriented propellers).

Quadcopters generally use two pairs of fixed propellers; two Clockwise (CW) and two Counterclockwise (CCW). They use the independent speed variation of each rotor to gain control. By changing the speed of each rotor it is possible to specifically generate a desired total thrust; to locate the center of thrust both laterally and longitudinally and to create a total desired torque or return force.

Quadcopters differ from conventional helicopters, which use rotors and are able to change the inclination of their blades dynamically as they move around the rotor. In the early days of flight, quadcopters (later referred to as "quadrotors" or "helicopters") were seen as possible solutions to some of the persistent problems in vertical flight. Problems related to inductive control (as well as efficiency problems from the tail rotor, which do not generate a useful lift) can be eliminated by counter-rotation and relatively short blades are much easier to build. Numerous designs appeared in the 1920s and 1930s. These were among the first Vertical Launch and landing vehicles (VTOLs), heavier than air. However, early prototypes suffered poorly and latter prototypes required too much pilot workload due to poor stability and limited control.

At the end of 2000, advances in electronics allowed the production of cheap flight controls, accelerometer (IMU), global positioning systems and cameras. This has led to the quadcopter configuration becoming popular for unmanned aerial vehicles. With their size and maneuverability, these quadcopters can be transported both indoors and outdoors.

At a small size, quadcopters are cheaper and more durable than conventional helicopters due to their mechanical simplicity. Their smaller blades are also advantageous because they have lower kinetic energy, reducing their ability to cause damage. It is also possible to mount quadcopters with protective devices that close the rotors, further reducing the potential for damage.

However, as the size of fixed propulsion quadcopters increases, they develop disadvantages compared to conventional helicopters. Increasing the size of the pallets increases momentum. This means that changes in blade speed take longer, which has a negative impact on control. Helicopters do not face this problem, as increasing the size of the rotor disk does not significantly affect the ability to control the pitch of the blades.

Due to their ease of construction and control, quadcopter aircraft are frequently used as model aircraft designs (Fig. 6).

Early Attempts

Breguet-Richet Gyroplane (1907)

A four-rotor helicopter designed by Louis Breguet. This was the first rotating-wing aircraft to rise from the ground, although only inbound flight at an altitude of a few meters. In 1908 it was reported to have flown "several times".

Oehmichen No.2 (1920)

Etienne Oehmichen experimented with rotorcraft models in the 1920s. Among the six projects he attempted, his No. 2 helicopter had four rotors and eight propellers, all driven by a single-engine. The angle of these blades could be changed by deformation. Five of the propellers, which rotated horizontally, stabilized the car sideways. Another propeller was mounted to the nose for steering. The remaining pair of propellers functioned as propulsion before. The aircraft showed a considerable degree of stability and an increase in control accuracy for its time and performed over a thousand test flights during the 1920s. By 1923 it was able to remain in the air for a few minutes and on April 14 1924 established the first FAI registration for 360 m (397 m) helicopters. Demonstrated the ability to complete a circular course and later completed the first 1 km (0.62 mi) closed-circuit flight by a rotor ship.

Bothezat Helicopter (1922)

Dr. George de Bothezat and Ivan Jerome developed this aircraft with six-slab rotors at the end of an X-shaped structure. Two small variable pitch propellers were used to control traction and tilt. The vehicle used the control of the collective passage. Built by the US Air Service, it made its first flight in October 1922. About 100 flights were made by the end of 1923. Although it proved feasible, it was underestimated unanswered, mechanically complex and susceptible to problems reliability. The pilot workload was too large during the bite to attempt lateral movement.

A Quadrotor Converters (1956)

This unique helicopter was designed to be the prototype of a much larger line of quadrotor civilian and

military helicopters. The design included two engines that drove four rotors through a v-belt system. Successfully flown several times in the mid-1950s, this helicopter proved its quadrotor design and was also the first four-rotor helicopter to demonstrate a successful flight ahead. Due to the lack of orders for commercial or military versions, the project was terminated. The converters proposed the E model, which would have a maximum weight of 19 t, with a payload of 4.9 t over 300 miles and a speed of 278 km/h.

Curtiss-Wright VZ-7 (1958)

Curtiss-Wright VZ-7 was a VTOL aircraft designed by Curtiss-Wright for the US Army. The VZ-7 was controlled by changing the traction of each of the four propellers.



Fig. 5: A GPS drone is programmed to track the user



Fig. 6: A Quadcopter camera drone in flight

In recent decades, small-scale unmanned aerial vehicles have been used for many applications. The need for aircraft with greater maneuverability and ability to move has led to an increase in quadcopter research. The four-rotor design allows quadcopters to be relatively simple in design, but very reliable and maneuverable. Research continues to increase the capabilities of quadcopters, making progress in multi-boat communication, environmental exploration and maneuverability. If these developing qualities can be combined, quadcopters would be capable of advanced autonomous missions, which are currently not possible with other vehicles.

Some Current Programs Include

The Bell Boeing Quad TiltRotor concept further takes on the concept of a fixed quadcopter, combining it with the concept of the tilt-rotor for a proposed military transport C-130.

AeroQuad and ArduCopter are open-source hardware and software projects based on Arduino for the DIY construction of quadcopters.

Parrot AR. The drone is a small radio-controlled quadcopter with cameras attached to it, built by Parrot SA, designed to be controlled by smartphones or compressed devices (Fig. 7 and 8).

Nixie is a small drone equipped with a camera that can be worn as a band.

Airbus is developing a battery-powered quadcopter that will act as an urban air taxi, initially with a pilot, but potentially autonomous in the future.

Several camera projects have become commercial failures:

- Zano (drone) - a high-quality Kickstarter project to build a quadcopter camera, Zano failed after delivering only a small part of its orders in a partially malfunctioning state.
- Lily Camera - a startup trying to make a drone with a quadcopter camera, sued by the San Francisco district attorney, after closing it without fulfilling any of its pre-orders.

In July 2015, a video was posted on YouTube by an air quadcopter burning a gun in a wooded area, causing regulatory issues.

Quadcopters (Fig. 9) is a useful tool for university researchers to test and evaluate new ideas in a number of different fields, including flight control theory, navigation, real-time system and robotics. In recent years, many universities have shown that quadruplets perform increasingly complex aerial maneuvers. Swarms of quadcopters can feed in mid-air, fly in formations and autonomously perform complex flight routines, such as flips, darting in circles.

There are many benefits to using quadcopters as versatile test platforms. They are relatively inexpensive, available in a variety of sizes and their simple mechanical design means they can be built and maintained by amateurs. Due to the multidisciplinary nature of the quad-copter operation, academics in several fields need to work together to make significant improvements to the way quadcopters work. Quadcopter projects are usually collaborations between specialists in computer science, electrical engineering and specialists in mechanical engineering.

Quadcopter unmanned aerial vehicles are used for surveillance and reconnaissance by military and law enforcement agencies, as well as search and rescue missions in urban areas. One such example is the Aeryon Scout, created by Canadian company Aeryon Labs, a small UAV that can move quietly and use a camera to observe people and objects on the ground. The company claims that the quadrotor played a key role in a drug raid in Central America, providing visual surveillance of a compound of drug traffickers (Aeryon refused to name the exact country and provide other specific details).

After a recreational quadcopter (or "drone") crashed into the lawn of the White House on the morning of January 26, 2015, the secret service began a series of test flights of such equipment to develop a security protocol against quadcopters.

During the battle of Mosul, commercially available quadcopters and drones were reportedly used by the Islamic State of Iraq and the Levant (ISIL) as surveillance and weapon delivery platforms using makeshift swings to place grenades and other explosives. The ISIL device became a target of Royal Air Force warplanes.

The largest use of quadcopters in the United States was in the field of aerial imaging. Quadcopter UAVs are suitable for this job due to their autonomous nature and huge cost savings. Drones were also used to photograph with light painting.

In 2014, The Guardian reported that major media outlets began making serious efforts to explore the use of the robot, for reporting and verifying news about events that include floods, protests and wars.

Some media outlets and newspapers use telephones to capture photos of celebrities.

In December 2013, Deutsche Post garnered international media attention with the Parcelcopter project, in which the company tested the shipment of medical products by drone delivery. Using a micro drone md4-1000 quadcopter, the packaging was transported from a pharmacy on the Rhine. It was the first delivery of civilian packages by drone.

Quadcopters are used for a wide variety of humanitarian applications, from disasters to animal conservation. During Hurricane Harvey, many quadcopter pilots at their disposal landed in Houston, Texas, to provide assistance to first responders.



Fig. 7: The first prototype of Parrot AR.Drone



Fig. 8: Parrot AR. Drone 2.0 takes off, Nevada, 2012



Fig. 9: A Quadcopter coaxial rotors - OnyxStar FOX-C8 XT Observer

Quadcopters have also been used in various art projects, but not limited to drone photography. At least one drone demonstrated the feasibility of painting graffiti on a spray-painted wall. They can be used in high-performance art with new degrees of positional control that allow new uses of puppets, characters, lights

and cameras. They were also used in light shows, including the most prominent on February 20, 2017, Super Bowl LI show, in which Lady Gaga, in a pre-recorded segment, was accompanied by a swarm of 300 drones forming a flag. Americans in the sky.

Quadcopters are used all over the world for racing (also known as "racing drones") and freestyle events. Freestyle racing and quadcopters are built for speed and agility. Freestyle drones tend to be relatively small, with 250 mm between the propulsion shafts.

There are at least two international Dion racing organizations/promotions, including the Drone Racing League and Multi GP.

In the United States, the legality of the use of remotely controlled aircraft for commercial purposes has been the source of legal problems. Raphael Pirker, a professional photographer, was fined by the FAA in 2012 for "endangering people on the ground" (a regulatory offense) after using a fixed-wing, Zephyr - a five-kilogram Styrofoam aerial model aerial photograph of the University of Virginia campus in 2011. In March 2014, a federal administrative law judge ruled in Pirker's favor, ruling that his drone was an "aircraft model" and thus did not comply with FAA regulations on other aircraft types. The FAA appealed to the National Transportation Safety Committee; The NTSB appointed a new administrative law judge who overturned the previous finding and ruled that, under the FAA Authorization Act, the FAA was competent to regulate "any invention, used or designed to navigate or fly in the air," whether unmanned or manned. Pirker was fined \$ 10,000, but in January 2015 settled the issue with the FAA, agreeing to pay a \$ 1,100 fine without admitting guilt.

Since March 2015, the United States has created an intermediate policy for the lawful use of unmanned aerial vehicles for commercial use, in which each operator can apply for a waiver in accordance with Section 333 with the FAA. Since August 2015, the FAA has granted more than 1,300 petitions to various use cases and industries. In addition, the FAA began talks in November 2015 to ask all enthusiasts to also register personal drones on the FAA website.

In addition to the registration requirement, the FAA has also issued various operational requirements as follows:

- I fly only less than 400 m above the ground
- The operator must maintain eye contact with the aircraft at all times
- Do not fly near manned aircraft, especially near airports
- Do not fly over groups of people, stadiums, or sporting events
- Do not fly near emergency response efforts, such as fires or forest fires

Each rotor produces both a force and a torque around its center of rotation and a traction force opposite to the flight direction of the vehicle. If all rotors rotate at the same angular velocity, with the one and three rotors clockwise and the two and four rotors counterclockwise, the net aerodynamic torque and therefore the angular acceleration on the tilt axis is exactly zero, which means that there is no need for a tail rotor as on conventional helicopters. The descent is induced by the imbalance of the balance in the aerodynamic torques (i.e., by moving the cumulative thrust controls between the pairs of counter-rotating blades).

To allow for greater power and stability at a reduced weight, a quadcopter, like any other multicopter, can use a coaxial rotor configuration. In this case, each arm has two motors running in opposite directions (one facing up and one facing down).

The main mechanical components required for construction are the frame, propellers (either fixed pitch or variable pitch) and electric motors. For optimum performance and simplified control algorithms, engines and propellers should be placed equidistantly. Recently, carbon fiber composites have become popular due to their lightweight and structural rigidity.

Quadcopters and other multi-copters can often be used autonomously. Many modern flight controllers use software that allows the user to mark "waypoints" on a map, on which the quadcopter will fly and perform tasks such as landing or gaining altitude. The PX4 autopilot pilot system, an open-source software/hardware combination that has been in development since 2009, has been adopted by both enthusiasts and carmakers to provide quadcopter projects with flight control capabilities. Other flight applications include crowd control between multiple quad-copters in which the visual data of the device is used to predict where the crowd will continue to move and in turn directs the quadcopter to the next appropriate reference point (Anderson, 1997).

The entrepreneur, who runs SpaceX and Tesla, made the statement at the Air Warfare Symposium in Florida.

Musk said there must be a competitor for the F-35 and it must be a man-controlled remote drone, but "with increased maneuvers of autonomy."

"It simply came to our notice then. But that will simply be the future," Musk told Mediafax.

He has repeatedly warned of the dangers of artificial intelligence: "The era of jet planes is over. It's about drones now."

The F-35, which has cost the U.S. military \$ 406.5 billion to date, is the most expensive military program in U.S. history. The project suffers from technical problems and delays caused by them.

Musk has said in the past that artificial intelligence is more dangerous than nuclear bombs.

"We have to be very careful with artificial intelligence because it is more dangerous than nuclear bombs," he wrote on Twitter a few years ago. In an interview with CNBC, he gave as an example of the series of films "Terminator" that shows where we can go if we are not careful.

Musk is not against the development of this technology but says it must be used with great care. In fact, Tesla uses AI for its Autopilot system that allows cars to drive on their own.

A Silicon Valley company has used Siemens software to design life-saving drones that make medical transportation to remote parts of the world faster and more reliable than ever.

The idea of rescue drones, which transport medical products to hitherto inaccessible areas, was born during a visit to Tanzania.

An Ifakara Health Institute researcher showed Keenan Wryobek a long list of cases where local doctors did not have essential medicines to treat their patients. Wryobek, who later co-founded Zipline International Inc., learned from his own experience that the supply of medical products in Tanzania is almost nowhere in the country comparable to the situation in the US and that the lack of blood supplies in Tanzania leads to the death of patients. Even common medications, such as topical antibiotics for patients with lacerations, are often not available.

Wryobek was especially impressed by the fate of a teenager: A small cut on the young man's arm became infected after a few days because he did not receive the necessary antibiotics in time. With immediate treatment, the wound would heal as soon as possible. In this case, however, the infection spread further, until, finally, part of the arm had to be amputated.

"Through a blood donation, a woman who lost a lot of blood at birth can be helped relatively easily," says Wryobek, now Zipline's director of products and engineering. But a Silicon Valley company has used Siemens software to design drones that make medical transportation to remote areas of the world faster and more reliable than ever.

In Rwanda, Zipline rescue drones travel to the most remote regions and operate continuously. If the blood needed is not available, then the situation becomes fatal. "Throughout my career, I have worked on some very important projects, the scaling of which has never really succeeded. But there were also some projects that were completely insignificant, but which still sold very well. What we were looking for was a meaningful product that could be scaled," says Wryobek.

In 2016, Zipline developed and produced reliable, long-range, high-precision drones, building an efficient medical goods delivery system in Rwanda, a landlocked

country in East Africa. "At the same time, our first flight logistics system has become the only drone-only delivery system in the world," said Zipline CEO Keller Rinaudo. "And it saves lives every day in Rwanda!"

Since launching the service in Rwanda, Zipline rescue drones have flown more than 7,000 flights, delivering more than 13,000 blood supplies. With a speed of over 100 km per hour, medical products reach their destination faster than any other means of transport and this without a pilot on board. The drones have an operating range of 80 km and can be loaded up to 1.75 kilograms. After less than 30 min, the ordered medicines land easily with a parachute in the established area. "Our challenge is to create an aircraft that can reliably conduct its itinerary in all weather conditions, managing unforeseen adversity," says Wryobek.

In the early years, the company used a cheap Computer-Aided Design (CAD) system. But, in a short time, the restrictions became visible when it came to commissioning. Engineers needed a solution with additional functionality that would automate certain tasks and facilitate interaction with the CAD database. At the same time, the new solution had to include special add-ons. "I came up with all the arguments to convince the Zipline of NX," recalls Scott Parker, a mechanical engineer at Zipline.

"For flying objects like ours, it is very important that each piece fits perfectly with the rest. With the previous CAD system, I needed hours for the necessary tests. With Siemens NX CAD software, you only upload data. Everything is fast and errors are ruled out." As the team of three engineers became a team of nine people, "it was necessary to work several people at the same time on the drone," says Paul Perry, a mechanical engineer at Zipline.

"The aircraft brings together many disciplines: Electrical engineering, mechanical engineering, manufacturing technology and, of course, aviation technology," says Wryobek. "NX is a powerful tool that intertwines all these disciplines", Fig. 10.

CAD software also allows Zipline engineers to determine where drones should be used in high-quality aerospace material and where they can use plastic or foam to achieve the same structural integrity and mechanical function - at significantly higher costs. reduced and lower weight.

Given the high weight of medical products to be delivered, weight tests are very important. Every kilogram minus increases the range of the aircraft by five percent. With NX Journal, Zipline can create a list of specific parts, which allows a detailed summation of individual weights, thus optimizing the drone. The weight can be reduced with a quick thickness or

occupancy analysis, so the Zipline needs fewer iterations and hours of testing to reach the intended weight. "Drone optimization focuses on the construction and thermal issues," explains Perry. "As weight is the most important variable for us, we are mainly concerned with design improvements. So we can reduce weight without sacrificing rigidity and strength."

Before the rescue drone goes into production, it goes through several simulations. In these virtual test flights, the Zipline can, for example, simulate the thermal characteristics of the battery or the thermal behavior of the drone in the tropical climate of Rwanda.

Zipline drones are designed to be easy to build. "We're simplifying assembly," says Sam Chaknova, a mechanical engineer at Zipline. His colleague, Jeremy Schwartz, a robot engineer at Zipline, adds: "If one of our drones takes off in Rwanda, it will give blood to someone in great need of it. We're making this easier here in California with our tests. What a wonderful thing that our drone actually saves a person's life!"

In Rwanda, rescue drones travel to the most remote regions and operate continuously.

With the help of digitalization and autonomous drones, Zipline sets new standards in the medical goods delivery market. The company, based in Silicon Valley, California, USA, develops, manufactures and operates small robotic aircraft for the delivery of much needed medical products. With the help of Zipline drones, people in hard-to-reach areas with inadequate road infrastructure can quickly and safely gain access to life-saving medicines and blood supplies at affordable prices. In Rwanda, rescue drones developed with Siemens NX software have already carried out thousands of interventions and saved hundreds of lives - with almost 100% reliability.

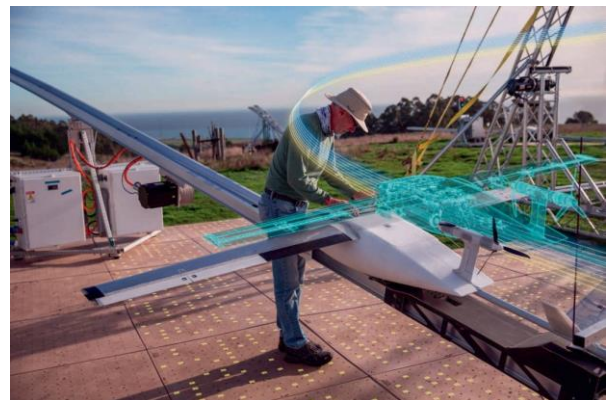


Fig. 10: A Silicon Valley company has used Siemens software to design life-saving drones that make medical transportation to remote parts of the world faster and more reliable than ever

Unmanned aerial vehicles - UAVs, or aerial drones, have experienced rapid development in recent years, including or especially in the military field. Many of the world's governments have made serious financial investments in the development of military drones, quickly understanding the real value of using these new technologies in defense. Most military equipment manufacturers have been arguing for several years that military drones are practically the future of military technology, which is why the list of military drone research and production companies is growing day by day.

At the same time, a number of armies have moved at a steady pace in the use of aerial drones in military operations. Case studies are becoming increasingly voluminous. Turkey brought an example this spring of how a military drone war can be successfully waged in northern Syria. The results show unequivocally that military drones have considerably changed the essence of warfare, both in terms of strategies, tactics, but also in the way of operation and management of perceptions. All this speaks to the fact that the new era of military drones has set in. At the same time, the accelerated proliferation of military air drone technologies at the level of state and non-state actors has become a reality, which will generate, sooner or later, new risks and threats to the international security situation.

Technological Developments of Military Air Drones

Military drone technologies have developed rapidly in the last ten years so that by 2020, about 40 states have purchased and owned military combat or research drones. Defense industries in about 28 states are developing, to a greater or lesser extent, technologies for military air drones. American World of Drones statistics places the states of the world in three main groups: (1) States that already use combat drones in military operations, (2) states that possess military drones, but have not (yet) used them in combat and (3) states that develop technologies for military drones. At the same time, military air drones were classified according to the US Air Force system. Level 1 includes low-altitude, low-endurance drones, such as the Orbiter drone and level 2 consists of high-endurance, high-altitude drones, such as the Reaper. There is also Level 2+ (Tier II +), which includes high altitude and high endurance military drones, such as the American military drone Global Hawk.

Military mini-, micro- and nano-drones are not included in the above classification system. These electronic drones are used to investigate enemy actions in areas very close to the fighters and visually inaccessible to them. They are very small in size, comparable to those of insects, however at most 10 cm. One of the most famous models is the Black Hornet, used by the British military in Afghanistan since 2013, to help them see what is happening behind the walls, etc.,

over a maximum distance of 1.5 km. The movement of the drone is controlled from a hand-held bracelet. They can be equipped for night vision and have a range (1) of several tens of minutes.

Small tactical air drones are mainly used in tactical research in order to gather SRI information about enemy targets. They have a flight range of about 12 h and can have a range of up to 90 km. Such as the Fulmar model, produced by the French company Thales. The same class includes the Aladin model of the German company EMT, with a range of only 15 km, respectively the American model Raven, a UAV with electric motor and range of 10 km and which can operate autonomously - "offline", or can be commanded from the ground.

Most military drone models in the possession of most modern armies are those in the category of medium-sized UAVs. In the US, these drones are referred to as MALE - drones that can operate for a long time at medium altitude, or HALE - at high altitude. This class is represented by the Heron model produced by Israel Aerospace Industries. The aircraft is capable of flying for 52 h at an altitude of 10 thousand meters. It weighs over a ton and its wingspan is 16 m. The model is also in service in other countries such as the USA, Canada, Turkey, Australia, Morocco and India. The Bundeswehr uses the Luna model, manufactured by EMT. For the past 20 years, the Luna has flown thousands of hours in Afghanistan and Kosovo, with the only drawback being that the range is limited to 100 km.

Large military drones are best represented by larger US UAVs, most notable being the Predator model and its more powerful Reaper successor. It is reported that these devices produced by General Atomics have been sold at a price of about 17 million USD/piece. Reaper has a range of up to 1000 km and a range of 14 h. The device allows it to be equipped with various ammunition, such as projectiles aimed at destroying ground targets. The United States uses this type of drone in military operations against state actors with whom it is not officially at war, or to destroy the infrastructure of non-state actors and people suspected or proven of terrorist activities. Reaper devices are in the possession of some NATO states - Spain, France and Great Britain. It should be noted that the CH-4 drone developed by China - and sold at least to Egypt and Iraq - looks very similar to the Reaper, at least in terms of the exterior architecture.

The largest and most powerful unmanned aerial system - UAS Unmanned aircraft system in the world at the moment (and precious considering the \$ 130 million price of such a device without combat equipment), is the American model RQ-4 Global Hawk, produced by Northrop Grumman. This huge American drone flies at an altitude of up to 18 thousand meters, for a minimum of 30 h. It is used for real-time collection of high-

resolution and accurate military information. For this, the device is equipped with sophisticated military intelligence equipment, especially with advanced ISR, IMINT, SIGINT and COMINT capabilities. It has already been used to support military operations and monitor areas of armed conflict in Iraq, Afghanistan, North Africa, the Middle East and Asia-Pacific. The EQ-4B Global Hawk version has the equipment to provide an air communications node - Battlefield Airborne Communications Node, while also providing support to save the lives of its own military. International experts in the field expect a competing model from the Chinese CH drone series to appear in the near future.

The most important manufacturers and exporters of military air drones are the USA, Israel, followed by China. The United States has exported military drones to 54 states, initially only to NATO member states. The first exception was made with India, through a contract signed two years ago, following contracts with many other states. The reference military drone is the MQ-9 Reaper, which has been used for support in various theaters of operations for more than ten years. Israel has managed to build a drone with similar performance, the IAI Heron aircraft. According to SIPRI Institute statistics, Israel would still have the largest list of "discrete" exports of military drones, which would include Western states such as the United States, Britain, Canada, France, Germany, Spain, the Netherlands, or others such as Russia, Ukraine., Australia, Brazil, India, China, Azerbaijan and Nigeria.

China has become an "ideal" exporter of military drones because it does not condition deliveries through political clauses, taking advantage of many market opportunities with exports to about 37 countries. He developed the Caihong family of military drones - of which the CH-5 stands out as operational, altitude and payload performance and many other drones. The most important military research (military intelligence) and attack drone is the Wing Loong II drone. Another achievement is the AV500W attack drone. Since 2015, it has delivered combat drones and drone technologies to Russia, Pakistan, Iraq and Nigeria, countries that have also developed specific technologies with China. For example, the Pakistani military industry has manufactured drones apparently based on CH-3 drone technology. Later, the modernized Chinese model CH-4 appeared in the Middle East, used by Iraq to execute blows on Islamic State fighters since 2015. Saudi Arabia, the United Arab Emirates, Egypt and Jordan also purchased CH-4 aircraft., the first two and manufacturing versions of this model.

Other major manufacturers and exporters are Austria (exported drones in 13 countries), France (in 11 countries), Canada, Germany, Iran (in 5 countries each), Russia (in Kazakhstan, Belarus, Armenia and Ukraine before 2014).

With regard to combat drones, it is noteworthy that more than ten states own such aircraft and have already conducted military operations in which they used these drones to perform airstrikes - USA, Israel, United Kingdom, Russia, Turkey, China, Iran, Pakistan, Iraq, Nigeria, Azerbaijan and the United Arab Emirates. Many other countries, including China, India and Saudi Arabia, have combat drones in their military arsenals.

Until 2015, the use of aerial combat drones with different ammunition for the execution of airstrikes was not intense internationally. Significant was only their first use in 2001 in Afghanistan by the US, then by the UK. Or in Gaza by Israel. The subsequent proliferation of military drones in general - and attack drones in particular, has made it possible for the latter to be used more and more frequently in large-scale military operations. The USA holds the first place in the world ranking both in terms of production and marketing of attack drones with various ammunition (air-to-ground missiles, guided projectiles, etc.), as well as in the use of military drones as stand-alone weapons for airstrikes. Israel is apparently in second place. Although this state is not exactly transparent about the concerns of improving combat drones, the use of attack drones by this state has been frequently reported.

In this context, the use of combat drones by Pakistan in 2015, or by Nigeria in 2016 can be noted. Also in that year, Iran extensively used indigenous Shahed 129 strike drones in Syria, Azerbaijan used the Israeli IAI Harop UAV in Nagorno -Karabach, Iraq used the Chinese CH-4 drone and Turkey used its own production drones Bayraktar. Even the United Arab Emirates used the Chinese Wing Loong II drones in Yemen and Libya in 2018. At the end of last year, two significant military operations were registered - Russia in Syria with Orion drones and France in Mali with the American MQ-9 Reaper drones. This year has already seen an innovative military operation carried out exclusively with attack drones by Turkish troops in northern Syria and the recent use of military drones by Russia in Venezuela.

In recent years, during Russia's military operations in eastern Ukraine and Russia's military involvement in the Middle East, the organizational model and methods of combat use of Russian military subunits equipped with military air drones have been continuously improved, as well as their characteristics. Technical-tactical aspects of unmanned aerial vehicles produced by the Russian defense industry.

As a result, military drones have become a significant new military force, successfully used on its own or in cooperation with other forces to maintain initiative and superiority in theaters of operations. To close the gap with the great "military drone powers", Russia has acquired Israeli military drones. Then he made his own military drones from the Forpost series, being built and put into operation at least 10 types of UAVs. More

representatives are the Orlan, Eleron and Tachyon, Altius-M and Granat models.

Thus, if in 2012 Russia had almost 200 air drones, in 2018 the Russian army already had in its arsenal over 2000 such devices, with which it equipped about 40 military subunits whose mission is exclusively the use of military drones. Other models of military drones known to be equipped with Russian forces are Orion, Hunter-B, Phantom, Searcher Mk II and Birds Eye 400.

There are media reports showing that each Russian ground forces brigade has reached at least one UAV company, each aviation squadron has at least one group of UAVs and air force brigades and divisions and missile troops have platoons and UAV companies. In other words, military units of research and combat air drones have become a significant part of the Russian military body. In addition, aerial drones have become the main tool for obtaining "online" information at a tactical level. It is believed that due to the ability of drones to provide reliable real-time information to combat troops, a new concept of warfare has begun to develop, consisting of the use of UAV units in combat, independently or together with attack groups. Special Forces, to carry out the entire process of hitting the targets - identifying the location of the targets, executing the shooting range and evaluating the result.

Extremely recently, the use of Russian military drones in Venezuela has been reported. The presence of Russian soldiers in Venezuela to support President Maduro was known, but media reports reported that Russian military air drones were conducting military operations in the depths of the state this spring. The Russian MFA confirmed (May 9) the presence of Russian military drones, specifying that the drones act "as part of a search operation", obviously without details. However, there are reports that Russian drones are combat drones and are used by Russian soldiers in the Special Forces to annihilate foreign mercenaries and paramilitary forces hostile to the Maduro regime.

The Turkish fleet of military airborne drones with ammunition onboard has been permanently strengthened by the defense industry for the last ten years, so that earlier this year, carrying out a massive attack exclusively with combat air drones became a new alternative military option for Turkish military strategists in their operations in Syria. Recent public reports indicate that, due to its achievements in the field, Turkey joins the states with the strongest fleets of attack drones - the USA, Israel, Great Britain, France, China and Iran. It is believed that Turkey has made highly effective military air drones, even becoming a "drone power" - surpassing France, or the world's second-largest active user of lethal drones. The effectiveness of these weapons in military actions (including counter-terrorism) on national territory and in Syria - where the tactical situation (2) is extremely complicated, in Iraq, or Libya

has been successfully tested by the Turkish military, given that the losses human and material resources have been reduced to a minimum. According to experts in the field, the use of military combat drones has the advantage that Turkey has military intelligence capabilities that cover the area of operations in Syria sufficiently well and which also allows the safe return of combat drones to the base. At the same time, the Turkish Army has advanced capabilities to simultaneously wage adequate electronic warfare to support combat drone strikes.

Turkey managed to use innovatively in February A.C. in "Operation Shield Spring - OSS" a massive campaign of drone strikes on Syrian armed forces in the Idlib area, causing serious losses to Assad's forces (3). It was the biggest demonstration of Turkey's power to wage a drone war. The operation presented elements of novelty on several levels, which practically suggest the crystallization of new military doctrine or conception of the use in conventional military operations of military drones as an independent air force. It was also the largest deployment of the Anka-S and Bayraktar TB2 drones, manufactured by the Turkish defense industry, both in terms of the wide scale of use and the intensity of use in combat. Turkish drones dominated Syrian airspace at low altitudes, demonstrating the advantage of not using other classical air or ground forces, given that the accuracy of the shot, the lethality and the destructive power of the blows were extremely high. That is why many armies are probably analyzing the details of the "lessons" given by the Turkish military about the effectiveness of combat drone warfare and there are already countries that are extremely interested in purchasing Turkish military drone systems, participating in joint industrial projects with Turkey, or receiving Turkish technology for the production of attack drones. Ukraine, Pakistan, Indonesia, Qatar and Tunisia are the first:

- (1) For example, the mini-drone produced by the Norwegian company Prox Dynamics can sail for up to 25 min on a single battery charge
- (2) The military situation on the ground in northern Syria is very complicated. The Syrian and Russian air defense systems protect the positions of interest and objectives held, carrying out unpredictable military actions and hostile to Ankara's operational and political interests. This landscape is complicated, disturbing and just as hostile to Turkish interests, by Iranian forces operating alongside those of Bashar al-Assad
- (3) Figures circulated in the Turkish and international media show the loss of Syria of several thousand soldiers, 151 tanks, eight helicopters, three drones, three fighter jets, about 100 armored military vehicles and military trucks, eight systems air defense, over 80 cannons and cannons, etc. Massive low-altitude drone strikes by Turks against Syrian forces have hampered

(embarrassing, according to some observers) Russian forces deployed in the region, whose air defense systems have been outdated and unnecessary. According to Turkish President Recep Erdogan, his drones successfully destroyed eight Russian anti-aircraft complexes "Pantsir", specially designed to protect critical targets and infrastructure against precision and low-altitude airstrikes - a statement rejected by Moscow, of course, being labeled a political exaggeration (Eremia, 2020)

While some people have thought and created drones and techniques to identify a person and kill without escape, by inserting a bullet with explosives in that person's brain that will make his brain dust, the drone moving extremely faster than the bee around the person's head, until he finds the optimal firing position, there are also people who thought of creating a helpful guide to teach people how to try to survive the attacks of such drones. Where are the ethics of such politically ordered actions, or if it exists we do not ask now and it would not make sense?

US remote-controlled drone strikes have killed about 361 people in Pakistan, Yemen and Somalia (reportedly, but the actual figure could be much higher). These three countries were the main theaters of operations in which the US government (with the help of the United Kingdom) launched drone surveillance operations. Armed drones are seen as a necessary evil in the so-called "War on Terror" waged by Western states. They boast that the attacks killed Pakistani Taliban leader Hakimullah Mehsud and al Qaeda's number two Abu Yahya al-Libi. Although such attacks theoretically weaken the Taliban's power, less than two percent of drone attacks kill top terrorists. Many other attacks have killed children, civilians and people suspected of terrorism.

With this strategy of escaping who can in mind, Dutch designer Ruben Pater has made a Guide to Surviving Drone Attacks. The guide shows you the shapes of the most used drones, from "Reaper" to "Killer Bee", along with information on how to hijack, deprogram and mislead a drone. It can be downloaded in 27 languages.

"A lot of people are fascinated by drones," says Pater, "but they don't realize the capabilities and weaknesses of such a technology. Once you understand what a drone can do, you are no longer afraid of it and you can think about how to protect yourself."

The drone survival guide has two main sections: Deprogramming drones and how to avoid them. "If you put reflective pieces of glass or other similar material on the roof of the house, this will mislead the drone's camera," says the guide. "If you transmit on different frequencies you can break the connection between the pilot and the drone." Although Pater insists that the guide is more of an art project meant to increase the number of

people informed about drones, than a practical guide for those who are about to be destroyed by a Predator drone, he was very careful when he conceived it, out of fear. Not to be used for malicious purposes. "We only used information available from news sites. The techniques I have chosen are meant to bypass the drone's surveillance and turn the sensors upside down, but I don't explain to anyone how to shoot one down. "

This is good to know, because Peter told me he saw jihadists share his guide on social media. He is unlikely to find out anything new, given that much of his information is taken from documents found in an Al Qaeda building in Mali, which contained much more technical information than appeared in the guide. However, I mention that in the guide there are some techniques "that can be used... to force the drones to self-destruct or to hijack them completely."

"Correct. The technique you are talking about is GPS disorder, which is a very difficult tactic to hijack a drone. Some say the Iranian state used this method to capture a drone in 2011, but it is more likely that no one has succeeded so far. That's why I included the method in the guide: Because it's almost impossible to do. But the idea that you can control the drone by fooling its GPS is very interesting. "

Although it seems a minimal threat to Westerners, Pater said the Federal Aviation Administration said it would use more than 30,000 drones in the US alone in 2020. If that happens, chances are it will apply in the UK as well. Thus, the drone survival guide is a kind of help for "21st-century ornithologists". It's just that these "birds" can blow people up from 15 km with laser-guided bombs.

One of the drones in Pater's guide makes me shiver. He told me that only after giving the survival guide to a friend did he realize how dangerous European Barracuda drones are. "My friend worked for the company that made the braking systems for Barracuda. He told me that it works almost completely independently, from launching to attacking targets, all without human intervention. You just tell him what to kill and he goes to do it. It's creepy." According to the company that produces Barracuda, new missions can be assigned to it from the ground up. She immediately reacted to instructions received in a 2012 test.

With government drone programmers completely anonymous, not only are drones perfect for long-range wars, but they make the future of their use opaque. To show us a probable direction, Pater talks about a new type of drone that doesn't appear in the guide. "The American defense giant, Lockheed Martin, recently announced a new model. The SR-72 is a hypersonic drone that would be the fastest thing in the air, with a speed six times faster than sound." On their website, Lockheed lovingly says that "at that speed, the device

would be so fast that the opponent would not have time to react or hide."

"Imagine what it's like to lose control of the drone at that speed," says Pater. "It's such a fast robot that it can't be stopped if it fails. What a good idea. He could accidentally kill or destroy another or other people if he accidentally got out of control."

With these new technologies used in the field of drones, Pater hopes that his guide will fulfill his role soon. "The aim is to inform people about the capabilities of drones and to start a debate on whether or not we should use such equipment for military and espionage purposes. Most of us already hate states that use drones for these purposes out of our tax money. We have the right to know what this technology is capable of so that we can judge whether it is used correctly or not", (Hanrahan, 2014).

EADS Barracuda is a European Unmanned Aerial Vehicle (UAV), which is currently being developed by EADS for the role of reconnaissance and air combat (UCAV). The aircraft is a joint venture between Germany and Spain. Project development was halted after the first prototype crashed into the sea as it approached landing during a test flight. The program resumed in 2008, with a second prototype completed in November 2008. The rebuilt Barracuda underwent a series of successful flight tests in Goose Bay, Canada in July 2009, followed by other flight campaigns in 2010 and 2012. With Dassault nEUROn for strategic and defensive contracts. Both are safe and have a top speed of about 0.85 Mach. While Germany and Spain are behind Barracuda, France, Italy, Sweden, Switzerland, Greece and Spain fund nEUROn. Not much is known about Barracuda, as it is still in development; however, it is believed to have an operating ceiling of approximately 6,096 m and a maximum payload of 300 kg (Fig. 11). Barracuda was born as a UAV design studio, designed to push EADS into the medium-length UAV market, a market it considers dominated by the United States and Israel. Its official debut was at the 2006 International Aerospace Exhibition, where military applications and specifications for Barracuda were presented. The current objective of EADS is to obtain Barracuda certification for scheduled flights to designated airspace in Germany, while the long-term objective is to be certified for non-segregated airspace. It also intends to develop Barracuda as a modular platform so that it can be mounted for different roles, such as a maritime patrol. No offensive capabilities are planned, but they can be reorganized to carry weapons if customers express interest. Barracuda may be able to carry weapon systems. The systems will be installed in the central loading compartment.

Germany is also discussing a partnership with Sweden and Italy for a multinational drone effort to compete with France's Dassault nEUROn program. Spain, Italy and Sweden are already participating in the

French-led effort. The Barracuda frontal flight took place in April 2006 in a remote location on the Iberian Peninsula. The flight was a success, but the prototype crashed into the water during a test flight off the coast of Spain on September 23, 2006. Barracuda is based on commercially available components, but also on many refined systems. Its fuselage is made entirely of carbon fiber, but also has a higher strength/weight ratio than traditional aircraft materials, such as aluminum (the structure of Eurofighter Typhoon and Boeing 787 Dreamliner are made significantly in this regard). The only significant metal component is the wing space, which passes through the middle and strengthens the wings. The wing space allows easy removal of the wings for transport. Barracuda uses a specially formed fuselage, which includes air entering the S pipe and the V tail, to disperse the deflected radar, causing the UCAV to slip.

An old dream of scientists and inventors is coming true: The US military has successfully tested a single-person flying machine (Fig. 12).

It is an electric passenger vehicle with vertical take-off, called the Hexa. The flying machine was successfully tested at Camp Mabry in Texas. The vehicle is controlled by a joystick and has a triple redundancy autopilot system.

The creator of this aircraft says that traveling by car is three times safer than flying a small plane.

The aircraft could soon become part of the US Air Force.

Weighing less than 200 kilograms and 18 rotors like commercial drones, the aircraft built by the Texan company LIFT Aircraft does not require a pilot to be used.

At the test conducted at the military base Camp Mabry, near Austin, Texas, the car got up and walked over those present. It was led by Matthew Chasen, CEO of LIFT Aircraft.

The flight test is part of a partnership between the company and the Air Force, entitled Agility Prime and which aims to equip the army with flying vehicles, but also allows the introduction of the aircraft for commercial purposes.

"We make the flight so simple, safe and cheap that anyone could drive Hexa without special skills or training to use the flying machine," said Matthew Chasen. "We are making the flight available to anyone for the first time in history," he added.

The Hexa flying vehicle can fly up to a height of 200 m and in some cases up to over 350 m, but not above populated areas.

"The idea that an electric vehicle with vertical takeoff and landing - a real flying car - might look like one from a Hollywood movie," said Air Force Secretary Barbara Barrett at the launch of the partnership.

"But through this partnership with industry and state agencies, we can prepare the United States for the aerospace phenomenon," she added.



Fig. 11: A barracuda reconnaissance and combat UAV, manufacturer EADS



Fig. 12: The US military has successfully tested a single-person Hexa flying machine

The US Air Force has spent \$ 25 million on the Agility Prime project this year.

The race for the commercial launch of a flying car is one that has been entered by large companies such as Airbus, Boeing, or Uber and the Japanese government has announced that it hopes to have such a vehicle on the consumer market in 2023 (Vladescu, 2020).

Conclusion

Whether we agree or not, the time for drones has arrived quickly, they are becoming more and more, more diverse, more significant, with good or bad uses in almost all known fields.

Today's drones can indicate a high-speed forest fire, but they can also cause it with low-power lasers.

Drones can save lives by taking seriously ill or injured people to the first central hospital that can treat them quickly to save their lives, transporting drugs in an emergency even in hard-to-reach areas, but at the same time, military drones have been created, the attack, small, medium or large, as well as bee or bird drones, able to identify a person and attack him at a certain time to exterminate him without real chances that he can escape.

We already have much reconnaissance, photography, mapping, espionage, security and surveillance drones, transport, rapid intervention and on their model have already been built vehicles for transporting people, of different kinds, with or without a pilot., including for one person, usually the pilot, these being practically real flying cars, able to take off or land at a fixed point, from small, confined, isolated spaces, on buildings or mountain peaks, on water, in difficult areas accessible, with very high flight safety, but which for the moment have a rather low flight autonomy, but this will increase in the future as the respective vehicles will be gradually perfected.

Today there is a multitude of recreational drones that can fly demonstratively, take pictures and movies from above, carry smaller and lighter packages, spy, or monitor large areas and can be easily handled from a simple smartphone. by an adult or even a more skilled child, their purchase prices being already very low and encouraging.

It must be made the specification extremely important that drones will be the ones that will help us to conquer space and explore various planets, as rovers do now because small flying vehicles are better able to penetrate new, unknown, hard to reach spaces.

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Ethics

This article is original and contains unpublished material. Authors declare that are not ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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Fig. 2

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Fig. 3

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Fig. 10

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Fig. 12

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