International Journal of Economics, Business and Management Research

Vol. 1, No. 03; 2017

ISSN: 2456-7760

OPPORTUNITIES FOR USING LIGHT GENERAL AVIATION IN THE SITUATIONS OF CRISIS.

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ABSTRACT

The world in which we live is situated in the shadow of global dangers, such as: frequent natural disasters, greater possibilities of technical – technological accidents and terrorist attacks as well, and so on… No matter that modern people possess fascinating knowledge and abilities, crises and disasters happen as the consequences of nature processes (flooding, droughts, landslides, earthquakes, tsunamis, fires, storms, epidemics of diseases, hunger) and they also happen because of the imperfection of technology of human errors (industry, chemical and nuclear accidents, the acting of which is connected to land, rivers, seas, oceans or air). Unfortunately, terrorist attacks (to outstanding individuals, institutions of a society or common citizens, frequent hijackings of aircrafts, ships) become greater concern to us and the consequences of them are global crises.

If we know that the Republic of Serbia from 2000 to 2015 suffered a number of devastating floods and fires, and that in these crisis situations only one is used for light general aviation in the system of protection and rescue, which in itself raises the question of why this is so and which justifies it.

The author's intention is to work through this broader expert public about the experience, which in the world there are when it comes to the use of light general aviation, and how to present that in Serbia there are resources the same as high quality flight personnel that are active could include in rescue operations and help the whole our territory.

Keywords:. Crisis management, Light general aviation, Helicopters, Crisis situation.

INTRODUCTION

The world in which we live is situated in the shade of global dangers, such as frequent natural disasters and also more opportunities for technical-technological accidents and terrorist attacks as well. No matter that a human of nowadays possesses fascinating knowledge and abilities, crises and disasters happen because of the acts of nature (floods, draughts, landslides, earthquakes, tsunamis, fires, storms, contagious diseases epidemics, famine etc.) as well as because of the imperfection of technologies or humans errors occur (industrial, chemical and

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nuclear accidents the occurrence of which is related to land, rivers, seas and oceans or air), unfortunately more and more concern are because of terrorist attacks (to eminent individuals, institutions of a society or common citizens and hijacking of aircrafts, boats are frequent) and the consequences are the crises of global size.

In its close past, The Republic of Serbia was affected by numerous natural disasters, their consequences and destructive effects took away many human victims and made a great material damage to the complete society. The floods in May 2014 will be remembered by the fact that they faced the Republic of Serbia with the crisis situation of global size, because of which the Government of the Republic of Serbia pronounced the state of emergency from May 15 to May 23, on the complete territory of our country. The sector for the states of emergency engaged all the potentials available to it: the complete capacity of fire fighting and rescue units, all specialized teams for rescuing and working on water as well as the specialized units of Civil Protection for working on water in endangered areas. The members of the Police, Gendarmerie, Army of Serbia, Red Cross of Serbia and Mountain Rescue Service gave a great contribution to rescuing and assistance to the endangered.

The citizens of Serbia and public companies invested thousands hours of voluntary work in resolving one of the greatest natural disasters which occurred to us. About 31 thousand people were evacuated from the most endangered areas, many families stayed without their homes and entire property. In the municipality of Obrenovac, which suffered the greatest disaster, more than 25 thousand people were evacuated. Together with the floods 775 landslides appeared as well as the short-term contamination of surface and underground waters, as well as the contamination of agricultural land of great proportions, and thousands of livestock died or drowned (Sector for the States of Emergency).

If we made a gradation of the natural disasters for the period 2000-2015, according to the consequences to the Republic of Serbia, it would look like this: floods, fires and draughts, storms and hails, snow and extremely low temperatures, landslides and earthquakes.

Managing crisis situations is of the essential importance for every country and as well as for the Republic of Serbia. In order to successfully resolve the crises on its territory, it engages specific forces which are the part of the system of Civil Protection. Kinds and number of the engaged resources are in direct relation with the characteristics, marks and complexity of the given crisis situation. No matter how developed the economy of a country is, the resources are always deficient and there are never enough of them. The Republic of Serbia has great problems in economy, demonstrated through the fall of the standard of living, great unemployment and stagnation of economic activities which, itself, demonstrates that the funds for the Civil

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Protection have more symbolic character. That is why it is necessary for the available resources to be used extremely efficiently and rationally.

The intention of the author is to, through this project, get the wider professional public acquainted with the experiences which exist all over the world when it is about the use of light-general of aviation in the resolution of crisis situations and as well as to point out that in the Republic of Serbia there are the resources of it as well as the aviation staff of good quality which could actively be involved in the actions of rescue and aid.

2 DIVISION OF AIRCRAFTS AND AIRCRAFT ENGINES

According to the translation the word "avion" comes from the Latin word avis- bird (Todorovic, 2008) and represents the device for flying, of solid construction. It consists of the body (kite) (fuselage, lifting and command areas, landing gear), equipment and drive. The first successful construction, with the realization, did the brothers Wilbur and Orville Wright. On their construction they managed to take off in 1903. That was recorded as the historical beginning of the human flying, with the device called an aircraft (U.S. Department of Transportation/ Federal Aviation Administration, 2013).

Mass usage of aircrafts is related to its combat intention and started in the end of the First World War. The superiority for the reason of larger number of aircrafts in the combat aviation influenced the result of the Second World War, because the side which controls the sky controls the battle and the territory of the battle. Aircrafts are used for civil and military purposes. For civil purposes they serve for the transport of passengers and goods, and for military purposes they primarily serve for taking control in the air space and for actions from air to the targets on land and floating objects (Lazic 2012) as well as for the transport and landing of troupes and technique.

2.1 AIRCRAFT ENGINES

There are four big groups of aircraft engines and they are (U.S. Department of Transportation/ Federal Aviation Administration, 2004):

1. Piston engines- the propulsion of these engines is made by a propeller which presses air backwards as a ventilator and creates the equal pressure in the opposite direction. These engines were characteristic for biplanes and monoplanes before the appearance of jet engines. Nowadays, only small aircrafts (***light-general of aviation***) use such engines.
2. Turboprop engines – they are similar to piston engines because they have a propeller, but it is driven by a gas turbine which produces direct propulsion by releasing exhaust gases.

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They are used mostly for the planes which fly on short distances because they are not economical.

3. Turbojet engines – These are in fact gas turbines which draw power from burnt gases which come from its rear end. They are very strong and consume much fuel and they are very noisy. There are the versions which have in-built so called chamber of combustion in which the surplus of fuel combust in exhaust gasses in order to enlarge the propulsion and provide greater economy.
4. Turbofan motors- they are used by most modern passenger aircrafts because they combine great power, economic fuel consumption and relatively low level of noise.

2.2 DIVISION OF AIRCRAFTS ACCORDING TO THEIR CHARACTERISTICS AND PURPOSE

According to all the previous data, there can be made general division of aircrafts: (Gvozdenovic, 2005):

- Traffic aircrafts: They serve for the transport of passengers and goods, by which the transport can be public or for own needs.
- General category of aircrafts: all the aircrafts that do not belong to the traffic ones and they are divided into:
  - Aircrafts of general category for acrobatic flights
  - Aircrafts of general category for semi-acrobatic flights
  - Aircrafts of general category for standard flights
- A special category of aircrafts: ("self-construction" or amateur construction, ultra light aircrafts, experimental aircrafts, kites etc.).

For the subject of this research the first two categories of the division of aircrafts are important. According to them their division continuous to their purpose:

- Aircrafts for transport of passengers and things,
- Aircrafts for transport of goods (cargo aircrafts),
- Aircrafts for working in agriculture and forestry,
- Aircrafts for fire fighting,
- Aircrafts for emergency cases,
- Aircrafts for trainings (school flying),
- Aircrafts for space control (patrol flying),
- Aircrafts for sport flying.

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Each of the mentioned types of aircrafts is adapted to their purpose and according to the regulations and laws that follow the safe usage. Some of them are adapted by the number of seats for passengers transport or free space for transport of goods (cargo) while agricultural aircrafts are intended for flying low above the land. The aircrafts for space control or patrol aircrafts are the subject of research and their characteristics reflect in various constructions and selection of propulsion group. On the territory of the Republic of Serbia the aircrafts of the Serbian Army belong to this group (hunter aviation in the mission of protecting air space and helicopter units in the service of searching and rescue and the missions of firefighting); the Ministry of Interior with the helicopter unit of the control of air ways in the country, monitoring from the air and also in the service of searching and rescue; and SMATSA Flight control with the type of aircrafts adapted to giving services of calibration of land radio-navigation devices from the air and checking flying procedures and usage in meteorological purposes (SMATSA- General information 2015). The aircrafts "JAT" economics aviation, aircrafts for flying staff training in Vrsac, as well as a large number of very different types of aircrafts of light- general of aviation on the sport airports all over Serbia which are owned both by clubs or private owners.

3 LIGHT GENERAL AVIATION

General or common aviation does the operations within the civil aviation and is registered as unplanned performing of air transport. The flights are performed in the range from flying boats to jet business aviation. Most of the world air traffic belongs to this category, as well as most of the airports in the world are adapted to this aspect of aviation (What is General Aviation, 2012).

General aviation covers a wide specter of activities both commercial and non-commercial, including aero clubs, school centers for training pilots, agricultural aviation, light aviation and maintenance of aircrafts (Crane, 1997).

Globally, general aviation is the most frequent on the territory of North America, with over 6.300 airports adapted to this purpose (of which about 5.200 in the USA and a little more than 1.000 in Canada). According to the data of the AOPA (Aircraft Owners and Pilots Association)(US's General Aviation, n.d.) general aviation on the territory of the USA provides more than 1.3 million of business with the realization of about 1% of the total national income annually.

In Great Britain more than 21.000 civil aircrafts are registered, and they belong to this category of aircrafts and general aviation is on the top of performing air services and activities. (Authority, 2006).

The similar data about the wide spread usage of light general aviation can be obtained anywhere else in the world, only the ranges are different, depending on the country, in accordance to its

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material potentials. That is why it is necessary to harmonize and standardize great number of safety regulations and legislations, according to the law on air traffic. (Knecht, 2012).

3.1 REPRESENTATIVE IN THE CLASS

According to the statistics (Simpson 2015), most of aircrafts of light general aviation in the world come from the American company Cessna Aircraft Company with the model C172. Beside Cessna, there are some other companies which are significant by the number of sold aircrafts and their quality and prevalence in the world such as: Piper Aircraft, Beech Aircraft Corporation, Diamond Aircraft Industries. The model Cessna C172 is stated as the most successful manufactured aircraft in the history of aviation. The production began long ago in 1955 and more than 43.000 pieces has been manufactured so far (Goyer, 2012).

Characteristics:

Cessna C172 is a light single-engine aircraft, of completely metal construction, high-wing aircraft with canards and with four seats. The landing gear is fixed, of the tricycle type. Picture 1.

Dimensions: (Cessna Skyhawk, 2015)

Length	8.28 m
Height	**2.72 m**
Wingspan	**11.00 m**
Wings - area	**16.17 m2**
Interior of the cockpit	Height **1.21 m; width 1.00 m; length 1.21 m**
Number of seats	**4**
Additional space	**0.85 m3**

Weights:(Cessna Skyhawk, 2015)

Maximum weight	1.160 kg
Maximum weight before taking off	**1.157 kg**
Quantity of useful fuel	**144 kg**

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Basic weight of the aircraft	**744 kg**
Useful cargo	**416 kg**

Performance:(Cessna Skyhawk, 2015)

Maximum speed in horizontal flight	230 km/h
Maximum fly in	**1,185 km**
Taking off	**Length necessary for taking off : 497 m**
	Taxing on land: 293 m
Landing	**Length necessary for landing: 407 m**
	Slowing down on lend: 175 m
Maximum height of the flight	**4.267 m**
Maximum speed of ascending	**223 m po min**
Maximum flight speed	**302 km/h**
Speed of bringing to an irregular position	**89 km/h**
Operative work time	**4.25 hours**

Propulsion group (Cessna Skyhawk, 2015)

This model has been equipped with a four cylinders piston engine of the type Lycoming. It uses two types of fuel: Avio gasoline 100 LL of blue color and the green one 100/130. Two-branch metal propeller has been embedded in the engine.

The organization with the greatest number of aircrafts of light general aviation in the world is the American Civil Air Patrol, which has more than 4.500 aircrafts. Most of them are just Cessna C172 and recently, with the progress of technique, the model C182 has appeared with approximately the same characteristics as the previous model, but with improved performances. (Patrol, 2002).

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Besides the education and training the aircrafts in this organization are used in crisis situations: missions of searching and rescue, aero-photo recording, following and monitoring, transport of the injured and ill, providing food, water and medicines on the endangered areas as well as fire fighting etc. That is exactly the subject of this research – the opportunity of using light general aviation in the situation of crises – advantages and disadvantages.

4 CRISIS MANAGEMENT

Most theoreticians agree that the first decade of the third millennium, the decade of the crisis in politics, economics, education, traffic, energetic as well as all the other social activities. The crisis is a follower but also a frame of a modern man's life. And really, nowadays, nothing is so certain as crisis which has become the environment in which an individual, an organization or a society as a whole function. (Vladimir Grujic, 2012). In media, but also in the everyday communication among people, the word crisis is one of the most frequently used words. It is used in the description of the situations with potentially negative consequences in which modern societies are situated. A crisis, no matter how it looks like, introduces us in the area of risky acting.

We represent the attitude that the crisis management in an organization does planning in advance in order to have a ready response in every situation and to each question "what if" i.e. in order to, in case of a crisis, by applying developed and constantly improved procedures, minimize all possible losses and harmful consequences, and thanks to which the organization affected by the crisis would return to normal condition. In crisis situations the most important thing is to maintain the continuity of the organization and its ability to function. When facing a crisis, only those organizations which are capable and ready to change can succeed. To turn a crisis into a chance and rule it to succeed in preserving key resources and capacities of the organization means to be strong. The organization which is strong is capable to "be able and to successfully fight with a change, faster and better than its competition" (Adiges 2009).The most successful are those organization of which the management do not wait for a problem to appear but they prepare for it proactively. The management of the organization, besides the plan A with which the organization enters the crisis, have to have the developed plans B and C and to be ready to apply them. Strong organizations take measures and procedures, and develop the procedures in order to become stronger, and weak organizations become surprised and do nothing and become defeated by the crisis.

For understanding the crisis management in the system of protection and rescue of a country the important aspects represent the doctrine of the documents which treat the areas important for engaging state organs, business subjects and citizens in crisis situations. The system of protection

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and rescue of the Republic of Serbia is regulated by its legislation: Constitution, National Strategy for Protection and Rescue, States of Emergency Law, Local Management Law, Law on Protection from Fire, other laws and judicial acts (statutes, regulations and decisions), overtaken international obligations, signed and ratified international contracts in this subject.

By approving the National Strategy for Protection and Rescue by the Assembly of the Republic of Serbia, the basic suppositions for reacting on time of the state's organs, business subjects and citizens in crisis (emergency) situations and participating in the protection and rescue of people and material property, environmental protection and cultural heritage. Appropriately to its role, tasks, place and organization ability the civil protection is the most important and basic component of the system of protection and rescue. According to this, all the activities of the system of civil protection have been derived from the National Strategy for Protection and Rescue, principles of international humanitarian right and international right on protection of people, material property from natural and other disaster and as well as from overtaken international obligations.

In order to respond successfully to its purpose in crisis situations, the system of protection and rescue "includes": programming, planning, organizing and training, realization, monitoring and financing the measures and activities for the protection and rescue of people, material property and environment from natural, technical-technological and other disasters with the aim of preventing from the dangers and reducing the number of accidents and victims, and removing and reducing harmful effects and consequences of natural and other disasters." (National Strategy for Protection and Rescue, 18/11/2011).In order to realize all these tasks, the powers of the system of protection include: headquarters for emergency situations, civil protection units, firefighter rescue units, police, Army of Serbia, subject of which the regular activity is rescue, as well as business companies and other firms, Red Cross Serbia, Mountain Rescue Service of Serbia and associations trained and equipped for protection and rescue.

In many crisis situations (floods, fires and similar) the aid to the endangered and harmed can only be given from the air, either by light general aviation or by helicopters.

The experiences of other countries which confront crisis situations very similar to those of the Republic of Serbia are very educational, for example Switzerland and Austria are the countries which are, topographically, mountainous and which, in the system of protection and rescue exclusively lean on helicopters. Unlike them, Germany and France, in the same service of rescue and protection of population combine the use of light general aviation and helicopters while on the other side the USA, Canada, Australia and England particularly in the system of protection and rescue lean on light general aviation. If we know that the Republic of Serbia, from 2000 to

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2015 suffered many disastrous floods and fires, and in these crisis situations light general aviation in the system of protection and rescue was used only once, the fact itself questions why it is like that and how it is justified.

5 USE OF HELICOPTERS IN CRISIS SITUATION

Although the aircrafts with fixed wings get their full significance in the aircraft industry nowadays, the flight of helicopter was the first flight thought by a human. In fact, ancient Chinese played with manually movable toys which would fly up if you rotate them fast. Such toys appeared 400 B.C. in China and were the subject of research of Sir George Cayley, the father of the modern flight theory. In Europe, the earliest appearances of such "toys" appeared in the renaissance paintings of Leonardo da Vinci. In 1483 (Bozic 2010) he made the sketch of helicopter which had a rotor like a screw, made of stiff canvas. In the literature that invention was known as "Helical Air Screw". Although the Leonardo's device was, for that period, a progressive invention, it did not evolve because the technology of the period was not adequate for the production of such an aircraft.

A helicopter is an aircraft which flies and moves through the air by one or more horizontal rotors (propellers). Helicopters are classified as aircrafts with rotational wings (lifting surfaces) which is different from classical aircrafts with fixed wings. The word "helicopter" comes from the Greek words "Helix" (spiral) and "piteron" (wing).

While one hovers a helicopter the speed of drifting by the edge of the rotor disc (circle surface created by the blades during the rotation of the rotor) increases from the middle toward the outer edges. If the number of rotations or the length of the blades increases, with the aim of achieving greater lifting and speed, there occurs a harmful phenomenon of supersonic drifting the tops of the blades and creation of the additional great resistance of air. The larger the number of rotation is or the length of the branches, the zone of supersonic drifting is greater. Thus, further power increasing and fuel consumption do not increase the speed because the resistance of air increases.

As soon as the helicopter moves from the state of hover to the progressive flight, the most frequently forward, the speeds of drifting rotor start to change on the various positions within the disc, and everything started to additionally complicate. Regarding generally, the speed of air drifting increases on the side of the offensive blade while it reduces on the side of output one. By increasing the speed of flight that difference is increased and there comes the stronger moment of rolling around the longitudinal axes of the helicopter because on the offensive side the lifting is bigger and on the back side it is smaller. That is why the blade, during one cycle of rotation for 360° changes the offensive corner (for example on the output side the lifting is increasing) in order to compensate the moment of rolling. But the work of the offensive corner is limited and

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can be changed only to some maximum value. When, for example, a helicopter flies by the speed of 210 km/h the local speed of the tips of the blades of specific length is 676 km/h. In fact, their local speed oscillates in the area from 467 to 884 km/h.

The development of the motor (aggregate) is of the basic importance for any form of the flight. While the aircrafts could fly with the motors of relatively small power, the success of helicopters had to wait the development of the technology which enabled the manufacture of lighter and stronger motors. The historical records show that the necessity for the motors of enough power and weight is really the key which caused the success of helicopters.

After the first take-offs in the1920s, the "race" in the development of the first practical helicopters started. The demand was to enable hovering without safety wires, and to show the manoeuvre abilities because of which the further investments in the technologies would be cost-effective. The project of the Frenchman Louis Breguette was of great importance, and he constructed the helicopter with coaxial contra-rotating rotors. After the failure of his first helicopter in 1908 Breguet withdrew from the world of aviation, but in the 1920s he returned to his experiments with helicopters and founded the factory "Syndicat d'Etudes du Gyroplane" in 1933 (Bozic 2010). His company presented the experimental aircraft "Gyroplane Laboratoire". It was driven by the "Hispano-Suiza" motor of the power 225 kW, the diameter of the rotor was 15.89 m, the weight 1430 kg, and was designed only for a pilot.

In the year 1936, the Breguet's gyroplane set four records: the height of the flight of 158 m, the duration of the flight 1 hour, 2 minutes and 5 seconds, the flight of 44 km and the maximum speed of 44.692 km/h. The Breguet's gyroplane is nowadays considered as the first practical helicopter.

In the period after the World War II, in the United States of America the accelerated development of helicopters started, so, in a short period, many models appeared. Of course, by that it should be mentioned the Bell Model 30 which was the first commercial helicopter and the first produced in the Bell's factory, and it was used as the example for more famous model 47, which was applied mostly in the War in Korea for the evacuation of the wounded (Bozic 2010).

In the beginning of the 1950s, the constructors started to see the limitations in using piston engines in helicopters. A slight increase in power meant a great increase in weight, so they knew that soon they would reach an insurmountable maximum of load capacity. In 1951 Chales Kaman adapted his model K-225 that it could accept a new type of engine- turbo shaft. That enabled great increase of power and in the same year the first helicopter with a gas turbine took off. Namely, in 1950, the Government of the United States of America granted to the General Electric the contract for the development of the first turbo shaft engine intended exclusively to

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the use in helicopters. The development lasted almost a decade, but in 1959 the motor T-58, which was the first turbine motor certificated for the use in civil helicopter, was presented.

The first helicopter which used the motors T-58 was the well known Sikorsky SH-3 Sea King. It was predicted for the use in boats, regarding that it had five foldable blades of the main and tail rotor, for the purpose of easier storage. Because of the amphibian body it can land on the surface of the sea. The crew consists of four members (2 pilots and 2 technicians) and in the function of rescue it can transport 22 persons.

Probably the most famous helicopter of all times has the mark Bell UH-1, but it is better known by its nickname – Huey. The UH-1 has two blades on the main engine and two blades on the tail rotor, which gives them a recognizable sound while flying. It was driven by General Electric T-58 turboshaft engine, too.

40 years so far, the framework of helicopter units in the military aviation on the territory of the Republic of Serbia has been the light multifunctional helicopter SA 342 Gazela. It was used and it is still used for performing numerous tasks, as a helicopter for communication, transport and transfer, for sanitation, then for searching and rescue, monitoring and artillery combat. Picture 2.

Drive group and performances:

- Motor Turbulence Astazou XIVM, power 631 kW,
- Maximum speed: 310 km/h
- Cruising speed: 264 km/h
- Flight: 670 km
- Plafond of flight: 5,000 m
- Climb speed: 9 m/s
- The duration of the flight: 3 h 17 min
- Length : 11.97 m
- Diameter of the rotor: 10.5 m
- Height: 3.15 m
- Weight of the empty one: 908 kg
- Weight of the loaded one: 1,800 kg
- Quantity of fuel in the tank: 454 kg**.**

Load capacity:

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- 300 – 600 kg of load in the body or by hook (maximum load capacity of the load taken by hook 800 kg) or one pilot and four passengers, or two members of the crew, of one pilot, one wounded on a stretcher and one medical worker.

Beside the mentioned, for the same tasks, on the territory of the Republic of Serbia, within the helicopter units of the Ministry of Interior, the following are used:

– Light helicopter (SA-341/342 and B206B) which can transport up to 4 passengers + pilot,
– Medium helicopter (AB-212) which can transport up to12 passengers + crew , (Serbia 2015)and
– The Army of Serbia possesses the helicopters Mi-8 and Mi-17 which we will not discuss.

The purpose of these aircrafts is:

- Transport of people and things:

It represents the principal activity in the work of the Helicopter unit. It is done for the necessity of all mentioned users, according to the Law on Air Transport and Technical Opportunities of Aircrafts. The transport is done both in daytime and nighttimes conditions.

- Medical transport

It supposes the transport of the injured, wounded and ill persons with the presence of a professional medical team. For doing the medical transport it is necessary to estimate and provide all the conditions which relate to the comforts of using helicopters and equipment for the transport of an ill or injured person. A helicopter can also be used for medical transport in the case when it does not have its own medical equipment but when the prescribed equipment for the medical aid is provided by a professional medical team.

- Firefighting

In the actions of firefighting a Helicopter unit takes part in cooperation with other organizational units equipped and trained for firefighting. In fire extinguishing and rescue of people a Helicopter unit can be engaged:

- In immediate firefighting with the use of a tank for water
- In evacuation of people from burning objects by helicopter lifts and other equipment
- In monitoring, control and localization of forest fires in accessible and inaccessible areas.

- Service for search and rescue:

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Searching and rescue are done for the purpose of finding and saving the endangered, missing (lost) persons, vehicles, aircrafts and similar by using a helicopter, special equipment and rescue teams.

6 ADVENTAGES AND DISADVANTAGES OF LIGHT GENERAL AVIATION COMPARING TO THE USE OF HELICOPTERS

In aviation, a frequently asked question is: What should be chosen first, a plane and a helicopter? Of course, the answer to this question is given by the nature of the activity itself and for which purpose the aircrafts will be used.

Although the Republic of Serbia is the country with modest financial opportunities, of which the resources are significantly limited, there is the inclination to the use of helicopters as aircrafts of the first choice for rescue and transport, and although even a superficial analysis reveals that, in most cases, the use of light general aviation would be far more rational and appropriate. To give the answer to the question: "Which are the advantages and which are the disadvantages of light general aviation comparing to helicopters is not easy, but the comparison is possible and necessary", especially because the answer is rather convincing considering the facts.

- Light general aviation disposes a large number of various types of aircrafts (single engine and twin engine) with approximately the same flying characteristics of various capacities of load (passengers and cargo loads). These types of aircrafts are related to another division: light planes by weight on take-off up to 5,670 and smaller. Both planes adapted to commercial transport and those for cargo transport belong to this group.
- Light general aviation, comparing to helicopters, has far less expenses for using and maintenance. Especially important fact is that nowadays nearly all light aviation in the world has unified standards concerning drive group, where more than 90% of the market belongs to Continental and Lycoming engines, by which the expenses of the training of people for the maintenance are significantly reduced, which is not the case for helicopters, for each helicopter a special drive group is developing.
- Also, a drive group of light general aviation does not demand more people for maintenance of individual systems, because the whole system of a drive group is reduced to a simple functioning and use, which means that the complete preparation of a plane for a flight is much shorter and less complicated. And that means that the proportion hours of flight and preparation of aircraft for the flight in light general aviation is far better comparing to helicopters.
- Also, the speed of preparation of aircrafts on land is much in favor of light general aviation, according to the manual for preparation of the plane Cessna 172 is performed by

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1 to 2 technicians in the duration from 15 to 30 minutes. The preparation of the helicopter Gazella for a flight is much longer because of the complexity of the systems that controls it, averagely, for the preparation of the helicopter Gazela, 3 to 4 technicians are necessary and the preparation lasts from 30 to 60 minutes.

- Light general aviation belongs to saving fuel consumer. According to the data from the manual for the plane Cessna 172, the consumption per an hour of flight is 37 liters. According to the technical documentation for the helicopter of the type Gazela, it is said that the average consumption is about 133 liters per an hour of flight.
- According to the official data of the Civil Air Patrol and the section for emergency situations the value of an hour of flight for the Cessna 172 is 165$ and for the helicopter Gazella it is over 6,000 $.
- The aircrafts of light general aviation are principally several decade times cheaper than helicopters. According to the data of the manufacturer the average price of Cessna 172, equipped with all modern devices for communication and navigation is about 250 thousand dollars, while the average price of the helicopter Gazella, with standard propeller is about 5 million dollars, analogously to this, the price of spare parts is about 20 to 25 times higher for the maintenance of helicopters.
- The amortization while using light general aviation can be regarded through the fact that a life of an engine is up to 3000 hours of flight, while jet engines of helicopters seldom reach 1000 hours of flight.
- The maximum duration of flight with a full tank of light general aviation averagely is 5,5 -6 hours and a flight of 1.100 to 1.300 km, while it is significantly less of helicopters, averagely totally 3 -3,5 hours and flight totally 500 to 700 km.
- Light general aviation has greater resistance to complex meteorological conditions; meteorological minimums are determined according to the composition of reliefs and vary depending on the country. Also, every aircraft contains its maximum limits to which pilots have to stick for a safe flight. Considering the fact that helicopters fly in the zone of lower altitudes (the most frequent tasks are done on the altitude from 200-400 meter relating to a relief) so every change of weather near the soil significantly influences the realization of the flight. Great difficulties for flying are especially caused by fog. The planes of light general aviation are also sensitive to the same meteorological conditions but the zone of the flight of light general aviation is on higher altitudes (1000 – 3000 m).
- Flying training of the pilots of light general aviation is significantly cheaper than the training of the pilot of helicopter. In the process of obtaining a helicopter pilot, the level of training is much more complicated, because when they complete the training, pilots of light general aviation have the opportunity to become pilots of helicopters only then do they start a retraining for a specific type of a helicopter. If the average price of the

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training of a pilot for light general aviation is 8 thousand dollars, the price of the training of a helicopter pilot is increased for the retraining and is about 20 thousand dollars.

- The price of training of a pilot of light general aviation and a pilot of helicopter is even difficult to compare, the official data from the site of the AOPA reveals that the average price of a flight on Cessna 172, per an hour of training is 46 dollars, with all the expenses, while the price of the flight of a helicopter with a turbine engine is 226,94 dollars per an hour, while for the helicopters with jet engine the price is over 400 dollars (Heli 2015).
- Take-off and landing are the most critical phases of performing a task for light general aviation and for helicopters. The planes of light general aviation, while taking off and landing need flat surfaces to 500 m long, it is ideal if they are concrete runaway, but it is possible to use parts of highways, roads of first category or grass surfaces which also give good conditions for them. Helicopters have a significant advantage in this subject because they can land to all terrains wider than 1,5 diameter of the rotor.

The performed analysis enables us to make an argumentative conclusion that light general aviation has a significant potential and that it can be used in crisis situation if their key characteristics match the nature and purpose of the given task.

CONCLUSION

A successful management of crisis situation is essentially important for the Republic of Serbia. The crisis management obtains its full affirmation both as a science and a practice in our society which has constantly been exposed to various challenges and dangers. We especially think about all those situations that can go out of control no matter whether they can be caused by the effects of nature or they are the consequence of technical technological accidents of terrorist attacks. The precondition for a successful resolution of each crisis is a successful and efficient crisis management which includes organized and well trained system of Civil Protection operated permanently on all the levels. By a successful use of all the available powers and equipment of the system of Civil Protection of the Republic of Serbia in resolving a crisis, the citizens obtain security and trust the efficiency of the country and its institutions.

The experiences of many countries in the world and in Europe prove the justification of the use of light general aviation in crisis situations resolution. The Republic of Serbia, from 2000 to 2015 suffered many disastrous floods and fires and in these states of emergency the light general aviation was used only once in the system of protection and rescue, nearly always helicopters were the aircrafts of the first choice.

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The authors presented in this project the attitude that to answer the question "Which are the advantages and which are the disadvantages of light general aviation comparing to helicopters?" is not easy but it is necessary and possible and when we consider all the facts the advantages of light general aviation would be:

- A great number of various types of planes (single-engine and double-engine) is available,
- There are far less expenses for the usage and maintenance,
- It has unified standards concerning drive groups, which significantly makes less expensive and simplifies the training of the staff for maintenance,
- Belongs to a very economical fuel consumer,
- The value of an hour of flight is dozens of times less comparing to helicopters,
- It is dozens of times cheaper in the moment of purchase an aircraft,
- Amortization is much better, especially if we regard the life of the engine,
- Maximum duration of flight and approach is much longer,
- Significantly greater resistance of flying in complex meteorological conditions,
- Flying training is several times cheaper, faster and simpler
- Training of a pilot is dozens of times cheaper.

Contrary to this the disadvantages of light general aviation are:

- For lending and take-off it needs a runaway or a free flat surface to 500 meters.

Besides that, we should regard that the northern part of the Republic of Serbia is flat, all grass surfaces and parts of the motor roads of the first class and highway can be used for take-off and landing. If we talk about central and southern part of the Republic of Serbia, it can be noticed that there is clearly defined and well arranged network of airports on the whole territory which can be used, as well as alternative roads of the first class, highways and flat grass surfaces.

Besides the "JAT" business aviation and the "SMATSA" (Aviation Academy in Vrsac) all aero clubs on the territory of the Republic of Serbia have light general aviation, no matter whether as the property of clubs or the private property of the individuals who are their members. This is the number of over 120 aircrafts of the light general aviation of various types and capacities of loads. Contrary to this, none of the aero clubs on the territory of the Republic of Serbia possesses helicopters.

It is clear that the opportunities of light general aviation are not insignificant, we should only recognize them, and the people who will use it in crisis situation for the purpose of protection and rescue should be trained through the creation of plan and program of education for obtaining and improving the knowledge in this important segment of air components of the system of Civil

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Protection. By realization of the training of the power of light general aviation and the people in the system which will use it in a given crisis situation the necessary trust will be developed and high level of training in this important part of the system of Civil Protection will be provided. Indisputably, it is necessary for the existing light general aviation to be technically lifted to a higher level and one part of it to be equipped by the most modern systems for engaging in crisis situations. It is also necessary to obtain greater technical harmonization –unification and equipping with the use of modern technologies and standards by which the air component of the system of Civil Protection will be efficient, safe and on time. The Government of the Republic of Serbia, by establishing the budget funds for the situations of emergency, has provided additional funds for financing the preparations and the purchase of new necessary equipment as well as for the realization and the development of the program. (National Strategy for Protection and Rescue, 18/11/2011). By that, it was enabled that all the elements of the System of Civil Protection obtain the necessary financial support (and by that light general aviation, too) for modernization and rising the level of their functional abilities. The experiences of the country of the EU can be of great and priceless help here.

This work has no pretentions to give final answers to the question of appropriateness and justification of the use of light general aviation comparing to helicopters in crisis situation, and especially not to question extraordinary efforts, excellent training and education, bravery and victims of the pilots and crews of helicopters in the actions of protection and rescue of human lives and property. The purpose of the author was to point out important resources and objective opportunities of light general aviation in the resolution of crisis situation which can endanger human lives and threaten to destroy property.

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