

## PRELIMINARY RESEARCH OF AIR RESCUE SERVICES IN THE WORLD AND IMPROVEMENT FOR THE SLOVAK REPUBLIC

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**Annotation:** The paper tackles the development of air rescue services in the world, comparing their activities. It presents a general overview of the development history of these services from the beginning to today. It also deals with the economic demands of the operation of air rescue services. The intention and main goal of this paper was to analyse various solutions of air rescue service in selected states, organization of the rescue itself, including rescue in mountain terrain for the optimization of air rescue services in the Slovak Republic.

**Keywords:** mountain rescue service; medevac; helicopter emergency medical service; aircrew

### 1. INTRODUCTION

The paper tackles the topic of individual air rescue services in selected countries of the world. Air rescue services are a comprehensive term covering the use of air transportation, airplane or helicopter, to move patients to and from healthcare facilities and accident scenes. Personnel provide comprehensive prehospital and emergency and critical care to all types of patients during aeromedical evacuation or rescue operations aboard helicopter and propeller aircraft or jet aircraft. An air ambulance is a specially outfitted helicopter or fixed-wing aircraft that transports injured or sick people in a medical emergency or over distances or terrain impractical for a conventional ground ambulance.

Effective use of helicopter services for trauma depends on the ground responder's ability to determine whether the patient's condition warrants the air medical transport. Protocols and training must be developed to ensure appropriate triage criteria are applied. Excessively stringent criteria can prevent rapid care and transport of trauma victims; relaxed criteria can result in the patient being unnecessarily exposed to the potential dangers of dangerous weather conditions or other aviation-related risks.

Helicopter emergency medical service (HEMS) can travel faster and operate in a wider coverage area than a land ambulance. This makes them particularly useful in sparsely populated rural areas. Air medical services have an advantage for major trauma injuries.

During the elaboration of the topic, knowledge from abroad was used, such as on the helicopter emergency medical services and safety [1], a history of aeromedical evacuation [2], or on the crashes in the air ambulance services [3], etc.

The Faculty of Aeronautics is devoted to researching issues such as the work on the alternative methods of landing and transporting people and material by helicopters using rope and non-rope procedures and air rescue [4], on the rope procedures for extraction and insertion of persons used by helicopter emergency medical service [5], on the activities of the air rescue service in the territory of the Slovak Republic [6], or on the helicopter emergency medical services response time in the Central European Region [7], or on the development and operation of air rescue services in the world [8], etc.

## 2. METHODOLOGY OF PROBLEM SOLVING

The problem-solving methodology was based on the use of a set of scientific methods of description, analysis, deduction, induction and synthesis of knowledge for the formulation of recommendations. When examining the issue, it was appropriate to first describe the current state of HEMS in Slovakia and in selected countries. Focus mainly on the technical equipment of rescue units, personnel and how training takes place, the composition of HEMS crews and the specification of their work tasks. An important aspect of the study was also the financing of HEMS in selected countries, the operating costs for a certain type of HEMS operation. Proposals for optimizing operations have been developed for the air rescue services of the Slovak Republic. When analysing the number of interventions of rescue units per year, the issue of expanding these services is very topical. The analysis of aircraft technology, its parameters, also showed the topicality of the purchase of new helicopters to increase the mobility of HEMS in Slovakia.

## 3. RESULTS

Air rescue service, sometimes called Aeromedical Evacuation or simply Medevac, is provided by a variety of different sources in different places in the world. There are a few reasonable methods of differentiating types of air ambulance services. These include military, civilian models and services that are government-funded, pay-for-service, donated by a business enterprise, or funded by public donations. Each of models is explored separately. The figures represent own data processing using the air ambulance service websites in the country concerned. This information applies to air ambulance systems performing emergency service. In almost all jurisdictions, private aircraft charter companies provide non-emergency air ambulance.

### 3.1. Air Services operated by Government

In some cases, governments provide air ambulance services, either directly or via a negotiated contract with a commercial service provider, such as an aircraft charter company. Such services may focus on critical care patient transport, support ground-based the HEMS on scenes, or may perform a combination of these roles. In almost all cases, the government provides guidelines to hospitals and HEMS systems to control operating costs and may specify operating procedures in some level of detail to limit potential liability. The Polish LPR (Lotnictwo Pogotowie Ratunkowe, [9]) is a national system covering the entire country and funded by the government through the Ministry of Health but run independently. The LPR consists of 18 regional units, and covers almost all of Poland.

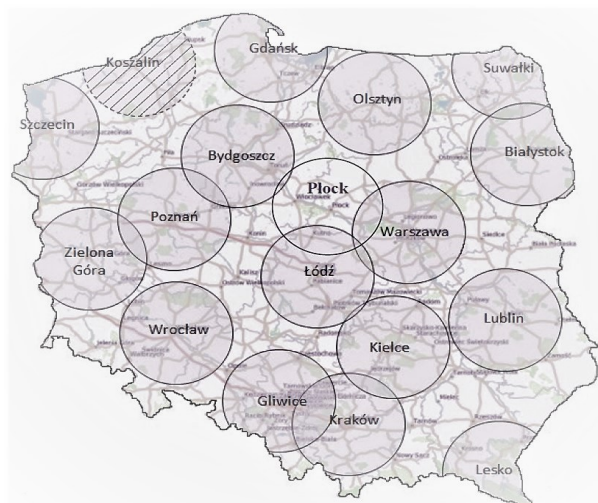


Figure 1 LPR stations in 2020

### 3.2. Multiple purpose

In some jurisdictions, cost is a major consideration, and the presence of dedicated air ambulances is simply not practical. In these cases, the aircraft may be operated by another government agency and made available to HEMS for air ambulance service when required. In some cases, local EMS provides the flight paramedic to the aircraft operator as needed. Sometimes the air ambulance may be run as a dual concern with another governmental body. In other cases, the paramedic staffs the aircraft full-time, but has a dual function.

### 3.3. Payment for services

Local jurisdictions do not charge for air ambulance service, particularly for emergency calls. However, the cost of providing air ambulance services is considerable and many, including government-run operations, charge for service. Organizations such as service aircraft charter companies, hospitals, and some private for-profit HEMS systems generally charge for service. Within the European Union, almost all air ambulance service is on a paid for service basis, except for systems that operate by private subscription. Many jurisdictions have a mix of operation types. Fee-for-service operators are generally responsible for their own organization but may have to meet government licensing requirements. REGA of Switzerland is an example of such a service [10].

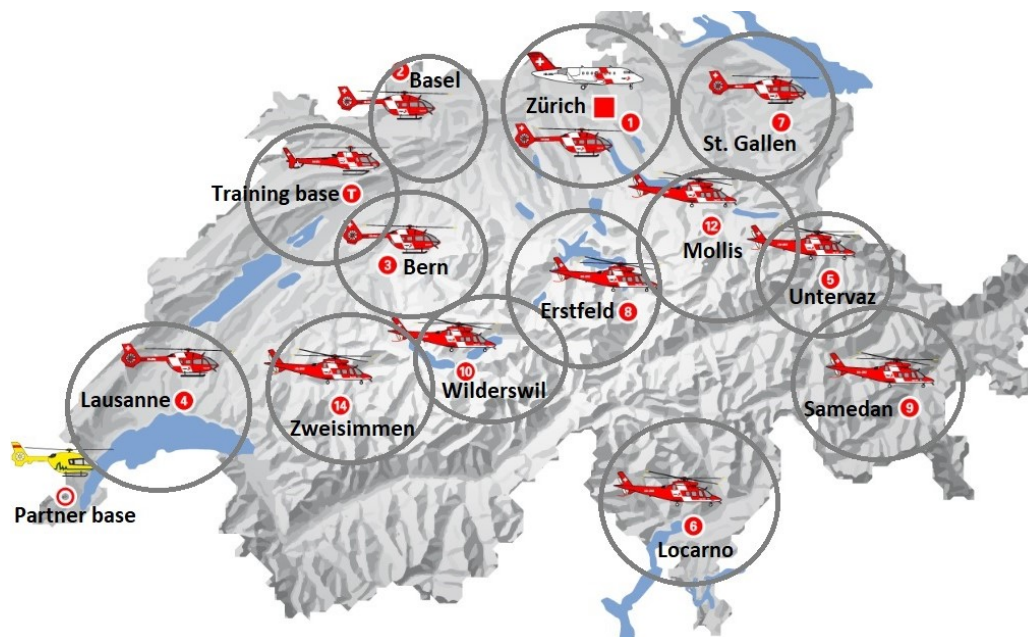


Figure 2 REGA HEMS stations

### 3.4. Air rescue services financed by private enterprise, donations or from public funds

In some cases, air ambulance services may be provided by means of voluntary charitable fundraising, as opposed to government funding, or they may receive limited government subsidy to supplement local donations. Some countries use a mix of such systems. Österreichische Automobil, Motorrad und Touring Club ("OAMTC") of Austria is an example of such a service [11].



**Figure 3** OAMTC Austria air rescue bases

In some cases, a local business or even a multi-national company may choose to fund local air ambulance service as a goodwill or public relations gesture. In these cases, the operation may vary, but is the result of a carefully negotiated agreement between government, HEMS, hospitals, and the donor. In most cases, while the sponsor receives advertising exposure in exchange for funding, approach to daily operations, relying instead on subject matter specialists.

#### **4. PERSONNEL**

Each rescue team consists of plenty of personnel that can be divided into main categories. Only in the case of good coordination of all the components of this large team, the rescue service will work.

##### **4.1. Medical personnel**

The medical personnel of a helicopter ambulance have historically been a physician-nurse combination, paramedic-nurse, or a nurse-nurse combination. Criteria for working as a medical doctor in aeromedical services depends on the jurisdiction. Some general practitioners also work for air ambulances.

The flight paramedic is usually highly trained with at least 5 years of autonomous clinical experience in high acuity environments of both pre-hospital emergency medicine and critical care transport.

A nurse specialized in patient transport in the aviation environment. The flight nurse is a member of an aeromedical evacuation crew on helicopters and airplanes, providing in-flight management and care for all types of patients.

Air rescuer means a member of the Air Rescue Service who following the instructions of the helicopter pilot, specially trained for work and rescue at heights. He cooperates with the physician at the place of intervention and during transportation.

The rescuer is responsible for communication and coordination, monitors the flight route, alerts the helicopter crew to a suitable landing site, independently carries out and organizes the rescue of injured persons, and performs specified medical acts.

##### **4.2. Operators of emergency service**

Operators as part of the emergency service, are involved in dealing with the consequences of emergencies on their territory. The technical equipment must be of a very high standard and fully

correspond to the needs and requirements necessary for the perfect tasks' solutions. Operators provides the coordinates of the location of the emergency, transmits the necessary information about the hit, the number of the affected, their health, the location of the requested hit and the information needed for the helicopter landing, detection and provision of up-to-date information on the current weather conditions.

### **4.3. Aircrew**

Pilot is responsible for the operation of all HEMS airplane crew from the start of pre-flight preparation to the end of the flight, especially the type of flight, the character of the space, terrain, weather conditions and, after the risk assessment, decides on the actual implementation of the flight, must be trained in these conditions for mountain terrain flights. Must be a possession of a valid license and must also have a valid airplane commander license.

Ground staff is providing maintenance and repair of airborne complexes, special equipment on board, namely meteorological, diagnostic and control equipment. It records the operating documentation and the information system, checks the aviation equipment according to established standards and recommendations.

Ground staff organizes training of technical personnel for the type of helicopter, deals with domestic and foreign partners, handing over and taking over aeronautical equipment from repairs, knows aviation technology, rules of its operation, regulations for operation of aviation technology.

## **4. DISCUSSION**

The suggestion part of the paper stems from the assessment of advantages and disadvantages of using airplane during crisis cases, risk assessment and opportunities for the introduction of new types of aircrafts. In the case of ground staff, suggestions for optimizing patient transport services to hospitals and medical facilities.

### **4.1. Advantages and disadvantages**

Air medical services can travel faster and operate in a wider coverage area than a land ambulance. This makes them particularly useful in sparsely populated rural areas. Air medical services have a advantage for major trauma injuries. The well-established theory of the golden hour suggests that major trauma patients should be transported as quickly as possible to a specialist trauma centre.

They can also provide critical care when transporting patients from community hospitals to trauma centres.

Harsh weather conditions are a major disadvantage of the air rescue services. It is necessary to adapt the choice of a suitable medical device to monitor the vital functions of the patient. Rescue operations on board the aircraft require a suitable interior, so it is necessary to ensure patient stabilization before loading into a helicopter or aircraft.

### **4.2. Suggestion for improvement of HEMS in Slovakia**

The analysis of interventions for the year 2016 ATE (Air Transport Europe) helicopter shows that their rescuers operations a total of 998 times throughout the Slovak Republic [12]. Most rescuers operations were performed in the Košice and Poprad region, which is directly related to the alpine terrain. Rescuers intervened the most in the High and Low Tatras, forests and also in hard-to-reach terrains where a deck winch and ropes were used.

In the Centers of Western Slovakia - Trenčín and Bratislava, the requirements for intervention in traffic accidents were recorded the most. August was the strongest month for 2016. ATE crews intervened almost 215 times.

**Table 1** Number of ATE rescue operations for 2016

PLACE OF RESCUE	NUMBER OF RESCUE OPERATIONS IN 2016
	TOTAL
Košice region	307
Prešov region	220
Banska Bystrica region	162
Nitra region	101
Bratislava region	72
Žilina region	65
Trenčín region	49
Trnava region	22
<b>TOTAL</b>	<b>998</b>

**№1.** Given that in the Košice and Prešov regions have been recorded most invasions HEMS it is appropriate to consider the extension or establishment of new centres of air medical service. The great opportunity is that the two regions are connected by the D1 highway, which will allow the patient to be quickly transported by land medical services if this is not possible by air. For Košice Region, the most suitable airport for the establishment of HEMS would be Bidovce, which is used only for domestic flights.

As a new section of the D1 highway was opened in this region in 2019, the possibility of rapid transport of patients by land would be greater. At the same time, air traffic would be maintained at the airport, which would still require modernization of the airport and permanent technical maintenance, which would mean new jobs for the local population.

Disadvantages include the rejection of cooperation between the Košice Region and the local government of this region, lack of funds, financial demands on construction and lack of qualified staff.

**№2.** At present, Air Transport Europe company in Slovakia using Bell 429 and Augusta A109KA helicopters. EC 135T2 - it is a model of a light twin-engine helicopter manufactured by Airbus Helicopters (formerly Eurocopter), which has been operating since January 2019.

Based on the analysis of flight characteristics it is suitable to propose its deployment to the area of western Slovakia for Bratislava, Nitra and Trenčín. One of the reasons may be that it is a simple terrain.

**Table 2** Helicopter comparison

	<b>EC 135T2</b>	<b>Agusta A109KA</b>
<b>Crew</b>	1-2 pilots	1-2 pilots
<b>Passengers</b>	7	6-7
<b>Length</b>	12,6 m	13,04 m
<b>Height</b>	3,51 m	3,5 m
<b>Empty weight</b>	1455kg	2000 kg
<b>MTOW</b>	2910 kg	2850 kg
<b>Engines</b>	2x, Arrius2B , Pratt & Whitney PW206B	2x, Pratt & Whitney Canada 206C
<b>Max speed</b>	259 km/h	285 km/h
<b>Range</b>	635 km	964 km
<b>Ceiling</b>	3045 m	6000 m
<b>Rate of climb</b>	7,62 m/s	9,8 m/s

Air rescuers intervene mainly in traffic accidents and need to land on smaller areas in the range of 20x20m where, however, with a helicopter type Agusta A109KA landing would be more difficult. Also, this type of helicopter is faster, which meets the requirements in terms of speed.

If the company were extended by a new rescue center at the airport in Bidovce, it would be appropriate to deploy helicopters of this type. In own fleet, the company would have three types of helicopters and, in a way, they could combine the use of helicopters as appropriate. Because each helicopter has its advantages and disadvantages would be solved the economy and the suitability of using these helicopters in a terrain, whether it is an intervention in a mountainous terrain or an accident in a road accident.

Air Transport Europe is the holder of all the EC 135T2 helicopter repair and servicing certificates, which means that the company can launch this type of helicopter, including pilot training, new training centers, cooperation with the Czech company DSA, which has been operating helicopters for several years and has experience with training of personnel.

**№3.** When improving the air rescue services, we must not forget the ground personnel, which is also an important component of the entire rescue system. The emergency medical aid crew was financed in 2006 by EUR 28,547, today it is EUR 29,235. While payments for ambulances for 12 years stagnated at approximately one level, prices of all economic inputs in Slovakia meanwhile increased. In order to address this situation, it is appropriate to propose an increase in the price for the provision of emergency medical services, they will maintain the current level of emergency medical services provided, and to increase payments from health insurance companies in order to alleviate the costs of emergency medical service providers.

## 5. CONCLUSION

Air rescue services have an important position in each country's rescue system. It proved the activity that these services are to perform continuously, namely saving human lives. In the Slovak Republic HEMS play a more important role in terms of terrain diversity, therefore the proposals for optimizing HEMS services concern her territory. It has been pointed out as the establishment of a new HEMS centre affects the situation in the region, including all advantages and disadvantages. The

deployment of new aviation technology as a solution to more economical operation of services is a suitable step for their optimization. One of the ways of optimization was to increase investment in these services through payments from health insurance companies and to tighten the conditions for the operation of transport health services.

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