

A Model for Using Drones for Medical Reconnaissance in Combat Operation

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Abstract— This paper presents a model for the use of unmanned aerial vehicles in the medical support of military formations at the tactical level. The medical support system of the Armed Forces of the Republic of Bulgaria is described and a model for the use of drones by the medical posts of military formations in combat operations is presented, emphasizing the use in the field of medical intelligence, deployed elements and minimum technical requirements for unmanned aerial vehicles to ensure the implementation of medical support tasks.

Keywords — drone, medical intelligence, military formations, evacuation, support.

I. INTRODUCTION

Medical support is a complex of activities carried out with the aim of strengthening, protecting and restoring the health of personnel in peacetime, during operations in crises, conflicts and during war. Medical support is an element of the National Health System and is organized in accordance with the Geneva and Hague Conventions. The main goal is to ensure the prevention of injuries and diseases, timely and adequate medical care and evacuation, specialized treatment and rehabilitation, by maintaining reliable, secured and flexible medical capabilities, complementary or supplementing those in the collective defense system. [1]

A. Medical support of military formations

Military medical facilities (MMFs) are organizational structures in which doctors and dentists, independently or with the help of other medical and non-medical specialists, carry out activities related to the medical support of the Armed Forces. MMFs are divided into four groups, levels, called “Roles” according to the capabilities they possess, increasing on a progressive basis, to conduct treatment, evacuation, supply with medical equipment and other activities that are essential for maintaining the health

of the personnel of the military formations. “Roles” are defined in accordance with the available minimum clinical capabilities, and not capacity and maneuverability. The minimum capabilities of each MMF are generally included in the capabilities of the higher level, so that Role 3 can perform the functions of Role 1 and Role 2. A MMF cannot have lower capabilities than those assigned to it. Therefore, it cannot have a Role (X) – minus. [2]

The scope of medical support activities is defined as “Roles” from 1 to 4, corresponding to the standards adopted in NATO in the logistics doctrine.

Role 1. It is carried out in formations up to the battalion/regiment level under the leadership of a doctor and includes the provision of the following types of medical care:

- emergency medical care,
- primary outpatient medical and dental care,
- stabilization and preparation of patients for evacuation,
- medical evacuation of sick, injured and those in need of specialized care,
- preventive military medicine, including health promotion and a complex of hygienic, prophylactic and anti-epidemic measures.

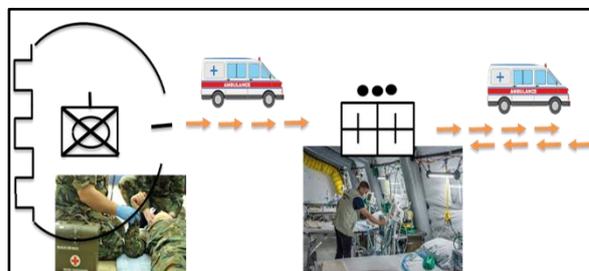


Fig. 1. Role 1

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Role 2. Usually carried out at the brigade level, serving also adjacent formations. It includes:

- evacuation from Role 1, reception and triage of patients,
- stabilization of vital signs and treatment of shock,
- control of injuries, provision of life-saving surgical care and treatment of lightly injured and sick until their return to the formation,
- preparation of patients for further evacuation, with the possibility of temporarily taking patients (until they are stabilized) in a situation of mass casualties or interruption of the evacuation chain,
- activities in preventive medicine, dentistry, stress management and strengthening of mental health.

Role 2 is classified as “Role 2 - basic” and “Role 2 - reinforced”. The individual units in both types of Role 2 are built on a modular principle, with the possibility of reinforcing Role 1 if necessary.

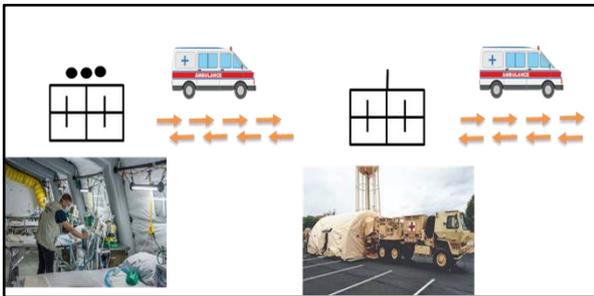


Fig. 2. Role 2

Role 3. It is carried out in medical institutions for hospital care (field or stationary) and includes:

- reception of patients from Role 2 or directly from the site of the injury/incident,
- triage of victims for evacuation to Role 4 or hospitalization of wounded and sick, who can be provided with comprehensive assistance and ensure return to the line, in accordance with the evacuation policy,
- provision of specialized medical care by specialist doctors, without which patients would not withstand evacuation to the institutions at the next level.

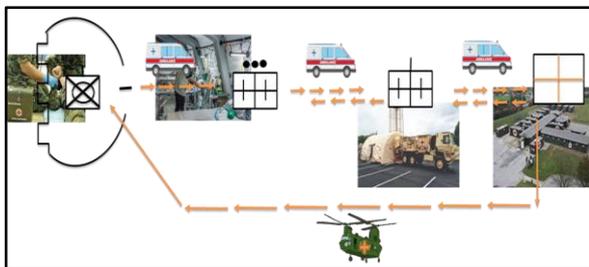


Fig. 3. Role 3

Role 4. It is carried out in medical institutions with the highest level of competence and includes:

- reception of patients from Role 3, other medical points directly from the site of injury/incident,

- provision of comprehensive medical care, reconstructive surgery and rehabilitation of patients until their final recovery. [3]

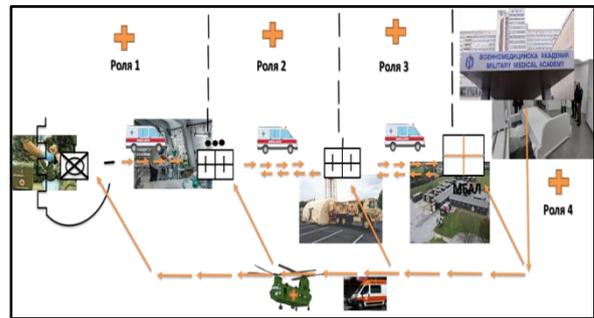


Fig. 4. Role 4

Medical forces and assets maintain the same level of readiness, mobility and protection as the forces provided. Medical care is provided adequately, continuously and progressively, ranging from first aid to comprehensive specialized care and rehabilitation. The means of evacuating victims must allow for continuity of care during transportation. Medical activities in wartime operations, as well as in crises, are as close as possible to the standard of medical care in peacetime. Medical care is provided in the shortest possible time: first aid within 10 minutes; medical care within 1 hour and surgical care within 2 hours. Achieving the “golden hour” for providing surgical care implies the most favorable outcome of the treatment of the victim. The wounded and sick are sorted into categories, depending on the urgency of treatment, the need and the method of evacuation [3].

Medical intelligence (MI) is a type of intelligence (activity) whose product is intelligence information obtained from medical, bioscientific, epidemiological and environment-specific information, as well as other information affecting human health and lives. This information also includes an assessment of the medical capabilities of the military and civilian sectors of potential hostile parties (opposing forces) or other entities in the area of intelligence responsibility/interest. The specificity of this intelligence information, which is of a specific nature, requires the necessary medical expertise during both stages of the intelligence cycle - planning and processing.

Medical intelligence as a subgroup of intelligence works within the same framework and uses the intelligence cycle to ensure that all available information is processed to make assessments. Medical intelligence as phenomenon should be totally coordinated with the planning of the operations of the tactical and operational level of national armed forces in national operations and as a joint effort in NATO. The cycle must be synchronized with the decision-making process, troop leading procedures and operational requirements of the commander in order to successfully influence the outcome of the operation. [4] The MEDINT (medical intelligence) cycle provides a process for understanding and sequencing the activities involved in MEDINT products and is useful as an aid to understanding the

interrelationships that exist between the different phases. The MEDINT process may not continue throughout the entire cycle and there are no hard boundaries delineating the points at which each stage of the cycle begins and ends. [5]

The stages or steps in the medical intelligence cycle are:

- Direction,
- Collection,
- Processing,
- Dissemination.

Medical evacuation (ME) is part of medical support and includes transportation, supportive treatment, medical control and care for medical casualties from the place of their occurrence to military medical (civilian) medical facilities or between them. Medical evacuation, depending on the means used, is ground, air and sea. It is carried out in three phases: forward (from the place of injury to the first point of treatment within the area of operation), tactical (within the TO) and strategic (outside the TO). The means of NME are ambulances and ambulance buses equipped to provide medical care. There are also tracked medical evacuation vehicles, as well as wheeled armored personnel carriers (APCs) for medical evacuation. Some of the most famous medical variants of infantry fighting vehicles (IFVs) nowadays are: AMX, AMX-10, Bradley, BVP M 80-A, KIFV, Kurganets-25, MLVM, MT-LB, Tulpar. Similarly, the most common APCs, used for medical purposes are: AIFV, Bandvagn-206, Boragh, Bulldog, FV-432, Stormer, Wiesel. [6]

From the other hand, ambulances are the most common type of ground transport vehicle for medical evacuation. There are variations in their capacity and capabilities. For evacuation from the front end, protected ambulances with limited (for supporting basic vital functions) capacity for providing medical care are used. For evacuation between medical facilities, ambulances (resuscitation vehicles) equipped with high-tech medical equipment and trained personnel are used. Primary MEDEVAC provides transport of patients from the site of injury to the initial place of providing assistance to the injured. This is required by operational circumstances in order to meet clinical deadlines and is therefore increasingly carried out by rotational teams in the front areas. MEDEVAC referrals can be to medical facilities of any role and should be made whenever possible to the most appropriate level of care within the time frame, not necessarily to the nearest medical facility. Primary MEDEVAC should be configured to meet similar levels of force protection as the forces in the area they are required to enter. Similarly, since primary MEDEVAC may provide evacuation of casualties prior to initial resuscitation, primary MEDEVAC teams should be equipped and trained to provide appropriate pre-hospital care. [7]

II. MATERIALS AND METHODS

The current model was developed based on experiments conducted at the Vasil Levski Military University during complex tactical exercises using a drone. During the exercises, medical reconnaissance tasks were performed, such as searching for wounded on the battlefield and directing transport vehicles to the assembly points for the wounded and supporting ground medical evacuation. The analysis conducted at the end of the complex tactical exercises is the basis for developing a model for the use of unmanned aerial vehicles by the medical posts of military formations.

The essence of the experiment is as follows.

The experiment was carried out using a DJI Mavic Pro 2 unmanned aerial vehicle, and tasks related to the logistical support of a mechanized battalion in field conditions were planned and executed. After completing the tasks, an analysis was made for the performance such as time, data transmission, difficulty of performance. During the execution of the tasks, the information from the UAV is transmitted to live data in a deployed logistic support control center (LSCC). The UAV is managed by a specialist operator from the control center, and the received data is recorded and processed by officials in the composition of the LSCC.

III. RESULTS AND DISCUSSION

For the use of drones in the medical support of military formations, it is necessary to open departments at medical posts. The personnel of the departments will consist of three drone operators, who will work from a deployed post in the area of the medical post under the direct control of the head of the medical post. They must be trained in the operation and maintenance of unmanned aerial vehicles.

Unmanned aerial vehicles must have the following minimum technical characteristics:

- Speed (near sea level, no wind) 72 kph (S-mode),
- Takeoff Altitude 6000 m,
- Flight Time (no wind) 31 minutes (at a consistent 25 kph),
- Hovering Time (no wind) 29 minutes,
- Flight Distance (no wind) 18 km (at a consistent 50 kph),
- Wind Speed Resistance 29–38 kph,
- Pitch Angle 35° (S-mode, with remote controller) 25° (P-mode),
- Angular Velocity 200°/s,
- Operating Temperature Range -10°C to 40°C,
- Operating Frequency 2.400 - 2.483 GHz 5.725 - 5.850 GHz,
- GNSS GPS+GLONASS,
- Hovering Accuracy Range

Vertical:

± 0.1 m (when vision positioning is active)

± 0.5 m (with GPS positioning)

Horizontal:

- ± 0.3 m (when vision positioning is active)
- ± 1.5 m (with GPS positioning),

- Internal Storage 8 GB.

In the model described above, the medical point will have the following elements:

- sorting post - it is where examinations of the injured are carried out and the levels of medical care are determined. If medical interventions can be performed within the MB, they are accepted for treatment. Otherwise, they are stabilized and prepared for subsequent evacuation,
- places for receiving and accommodating injured people,
- isolator - a place for treating infectious patients,
- places for resting the personnel of the BMP,
- a place for those waiting for subsequent evacuation,
- a workplace for a psychologist - activities are carried out to prevent combat stress and work with those who have suffered combat stress,
- a site for partial sanitary treatment,
- drone post - a place for drone operators to work.

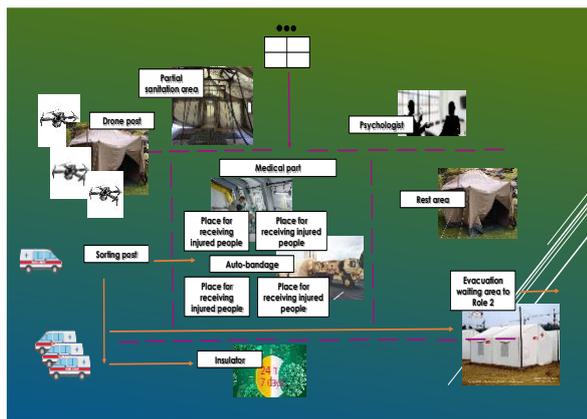


Fig. 5. Medical center

Main tasks of the deployed drone post:

1. Conducting medical reconnaissance, which includes:
 - searching for wounded on the battlefield,
 - reconnaissance of routes for evacuating wounded with medical transports,
 - monitoring and directing vehicles carrying medical supplies and materials,
2. Directing medical transport vehicles to the nests for collecting the wounded.
3. Processing and analyzing data received from unmanned aerial vehicles.

Necessary material resources to ensure the uninterrupted operation of the drone post:

- drones – 4 pcs. – 3 for performing medical support tasks and 1 in reserve,
- spare propellers for the drones – 2 sets,
- power batteries – 12 pcs. (x 3 per drone),
- laptops – 3 pcs. (for each operator),
- radio means for communication with the drivers of the sanitary transport vehicles.

IV. CONCLUSIONS

The use of unmanned aerial vehicles in the medical support of military formations greatly increases their capabilities, especially when performing medical reconnaissance tasks. The described model needs to be applied when conducting complex tactical exercises.

V. ACKNOWLEDGMENTS

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