

THEORETICAL ASPECTS OF THE USE OF UNMANNED AERIAL VEHICLES IN THE IMPLEMENTATION OF TECHNICAL RECONNAISSANCE IN TACTICAL OPERATIONS

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Abstract

Characteristic of today's tactical operations is used on a large scale of various military equipment, which is characterized by a high degree of technical sophistication and complicated construction.

Under the current conditions, achieving and maintaining success in combat is connected with the necessity of securing and supporting appropriate technical execution potential, guaranteeing them to perform maintenance tasks, reconnaissance tasks, evacuation tasks and technical supply, in such a way that unlicensed equipment can return to the grouping and be used again in fight.

Correct use of the evacuation and repair potential requires precise data on: the health of the crew; the degree of damage to the equipment; the scope of necessary corrective actions necessary to restore its technical suitability, approaches and surroundings with damaged equipment. Obtaining the necessary information is possible thanks to the activities undertaken as part of technical reconnaissance.

Solutions should be sought that will enable technical operations to be carried out on as many damaged equipment as possible in the shortest possible time and distribution of information to the appropriate components of the technical security system in order to make the best use of their executive potential.

New possibilities in the field of technical reconnaissance are offered by the development of various types of unmanned aerial vehicles, whose role in many armies is constantly growing. In the leading allied armies, the development of unmanned combat and support systems is one of the strategic priorities for the development of armed forces.

Keywords: Military logistics, battlefield maintenance, technical recognition, unmanned aerial vehicles

1. INTRODUCTION

The NATO armies still are looking for new solutions which let improve the possibilities of the maintenance system under combat operations. The analysis of contemporary armed conflicts show that maintenance activities are very often limited to basic actions like technical recognition, recovery, evacuation, expedient repair and destruction of broken weapon systems [1].

Bearing in mind the above and taking into account the fact that tactical actions are carried out in a diverse fighting environment, i.e. in various terrain, atmospheric and climatic conditions, with increased dynamic loads for military equipment and psychophysical loads for soldiers. The rational use of military equipment in field conditions is of special importance.

Correct use of the evacuation and repair potential requires precise data on: the health of the crew; the degree of damage to the equipment; the scope of necessary corrective actions necessary to restore its technical suitability; approaches and surroundings with damaged equipment. Supplying the necessary information is possible thanks to the activities undertaken as part of technical reconnaissance.

The main aim of the article is to analyze the possibility of implementation of unmanned aerial vehicles technology in the process of technical reconnaissance. The technical capabilities available to unmanned aerial

vehicles in combination with the classic solutions used in technical reconnaissance should lead to the synergy effect and, as a result, the efficiency of technical reconnaissance.

2. TECHNICAL RECONNAISSANCE

One of the areas responsibility of technical support is technical reconnaissance, which can be defined as determining the qualitative and quantitative status of military equipment, elements of technical infrastructure and the condition of their immediate environment as part of the assessment of the technical situation and determining the rational division of technical potential [2].

The technical reconnaissance is planned and organized for all types activities at all levels of the organization. They are usually carried out with other endeavors, combining with engineering reconnaissance, reconnaissance contamination and the clearing of approaches and roads, medical support and technical recovery. The main tasks of technical reconnaissance include [3]:

- Determining the degree of wear (destruction) of military equipment and its capabilities use in further activities,
- determining the location of military equipment excluded from combat,
- determination of the reasons for the exclusion of military equipment from the fight, determination of character damage and scope of evacuation and repairs,
- finding suitable hideouts for military equipment and evacuation routes,
- choosing places for the deployment and development of subunits repair and evacuation,
- determination of the use of military equipment left by the enemy,
- providing medical support to crews of damaged military equipment,
- providing technical recovery.

The technical reconnaissance plays a crucial role in the process of weapon system maintenance. It should be executed very quickly and carefully at the same time since it determine further actions which will be taken by logistic elements. It includes evaluating the extent of damage sustained and determining whether deferment is feasible. Scheduled and unscheduled maintenance and minor battle damage, except for necessary lubrication, servicing, and preoperational checks, may be deferred. Unscheduled maintenance, such as the repair of systems and subsystems that have adequate redundancy or are not critical to mission accomplishment, can be deferred. Relaxed inspection criteria for repair and weapon systems performance should also be evaluated and defined [4]. Damage assessment is procedure to rapidly determine what is damaged, whether it is repairable, what assets are required to make the repair, who can do the repair (e.g., crew, maintenance team or maintenance support team), and where the repair should be made. The assessment procedure includes the following steps (**Figure 1**) [5]:

- Determine if the repair can be deferred, or if it must be done;
- isolate the damaged areas and components,
- determine which components must be fixed,
- prescribe fixes,
- determine if parts or components, materials, and tools are available,
- estimate the manpower and skill required,
- estimate the total time (clock hours) required to make the repair,
- establish the priority of the fixes,
- decide where the fix shall be performed,
- decide if recovery or evacuation is necessary and to what location.

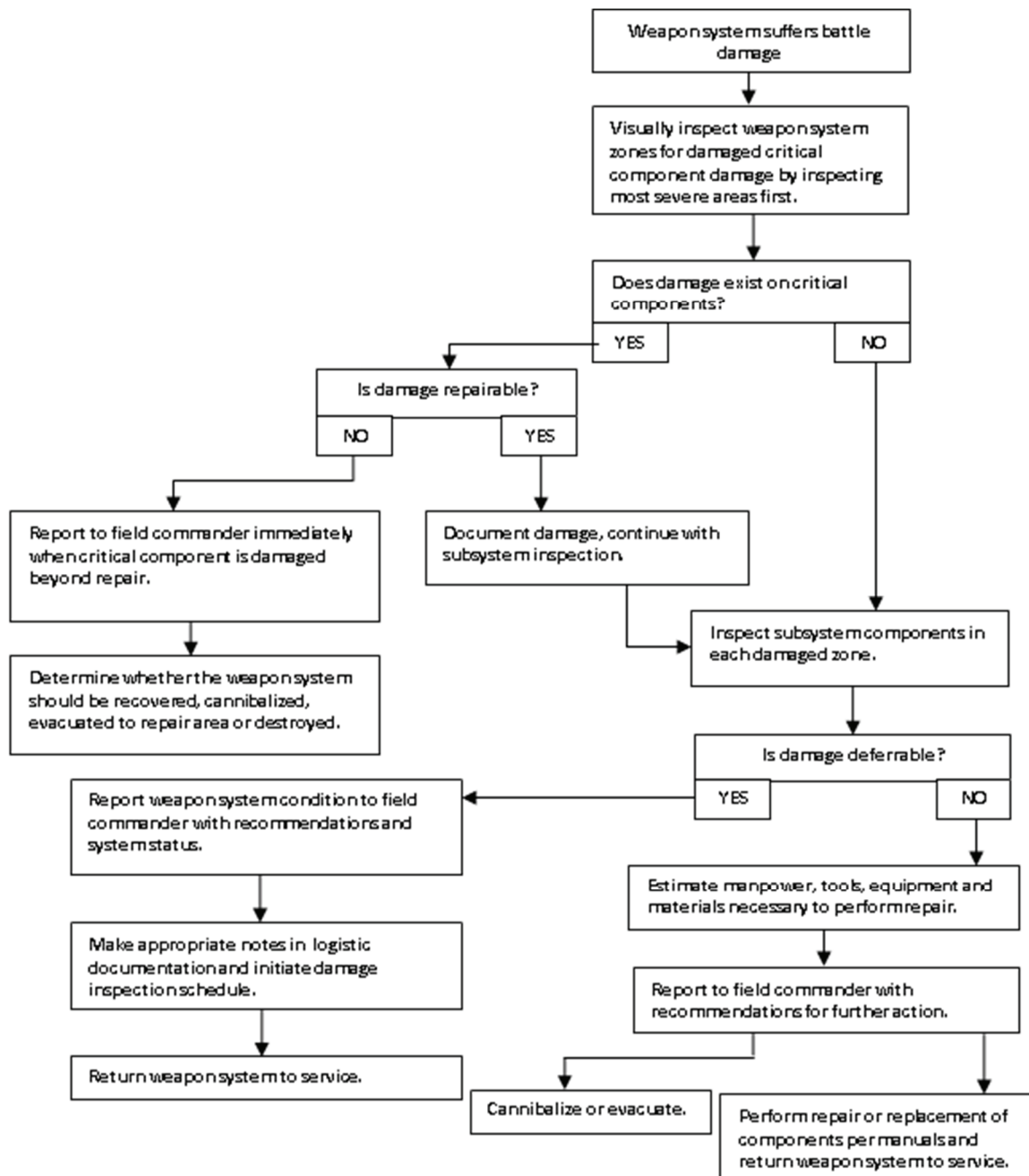


Figure 1 Chart of battle damage assessment [own elaboration based on 5]

The technical reconnaissance tasks are carried out by the designated forces and means of technical reconnaissance and interoperating elements of technical protection. In the land forces component, technical reconnaissance is provided by [3]:

- Patrols of reconnaissance and technical assistance,
- technical reconnaissance patrols,
- technical reconnaissance group,
- evacuation and recovery groups,
- technical evacuation groups.



The above mentioned logistic devices use military vehicles thanks to which the process of technical reconnaissance is possible. In the Polish Armed forces, both wheeled vehicles (**Figure 2**) and tracked vehicles (**Figure 3**) are used for this purpose.



Figure 2 Wheeled vehicles for technical reconnaissance and evacuation. On the left - technical reconnaissance vehicle ROSOMAK WRT [7], on the right - technical evacuation vehicle SCANIA R 730 [8]

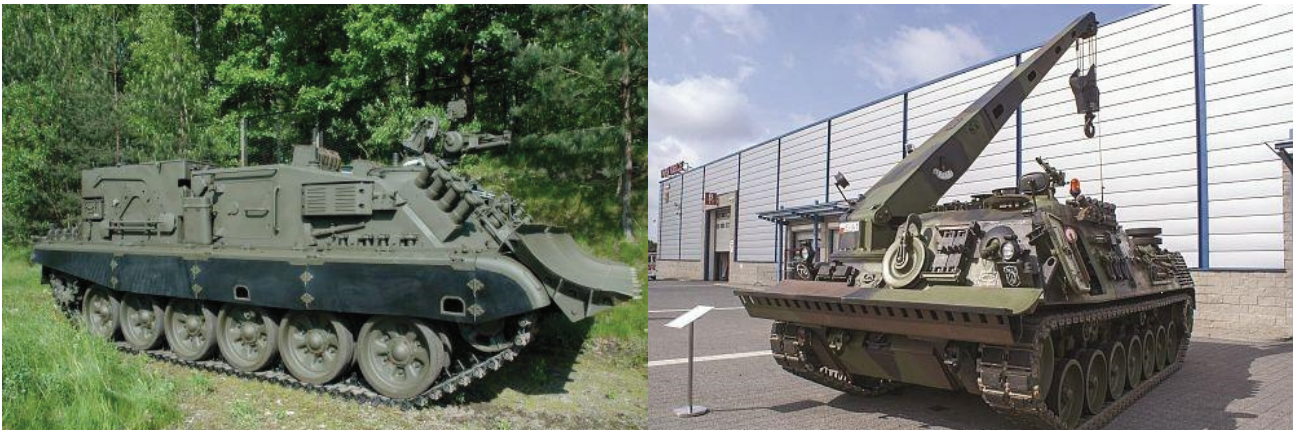


Figure 3 Tracked vehicles for technical reconnaissance and evacuation. On the left - Armored Recovery Vehicle WZT-3 [9], on the right - Armored Recovery Vehicle Bergepanzer 2 [10]

3. UNMANNED AERIAL VEHICLES IN THE TECHNICAL RECONNAISSANCE

The essence of technical reconnaissance is the acquisition, analysis and assessment of information about the technical situation and facilities of the logistics infrastructure necessary to organize and manage the technical protection of troops and subunits in combat. The basic objects of technical reconnaissance in tactical operations at the subunit level should be military equipment excluded from the fight as a result of, for example, immobilization, damage or destruction.

An extremely important element affecting the maintenance of combat abilities of subunits and branches is the response time, as in equation (1), to technical losses arising in battle modules in the area of operations. The decisive factor in this respect is the speed of implementation of reconnaissance and evacuation tasks and the flow of information related to this, both within the subunit as well as between the supporting elements of its operation [6].



In connection with the above, solutions should be sought so that it will be possible to perform technical reconnaissance operations on the largest possible number of damaged combat systems in the shortest possible time and distribution of individual groups of information to the appropriate components of the technical security system in order to make the best use of their executive potential.

$$T_r = \frac{S}{V_{doj} + t_{rozp} + t_{powr}} \quad (1)$$

where:

T_r - reconnaissance time

S - distance from the military equipment (km) - company up to 1.5 km, battalion up to 3 km, brigade up to 10 km

V_{doj} - speed of access (km/h)

t_{rozp} - recognition time (min) - 10 - 15 min

t_{powr} - time to return to previous position (min) - 5 - 60 min

New possibilities in the field of technical reconnaissance are offered by the development of various types of unmanned platforms in the form of remotely controlled flying platforms, whose role in many armies is constantly growing, especially since they are increasingly autonomous. In the leading allied armies, the development of unmanned combat and support systems is one of the strategic priorities for the development of armed forces.

Table 1 Unmanned Aircraft Classification Guide [own elaboration based on 11]

Class	Category	Normal Employment	Normal Operating Altitude (m)	Normal Mission Radius (km)	Example Platform (Polish Armed Forces)
Class III (> 600 kg)	HALE	Strategic/ National	< 20,000	Unlimited (BLOS)	Global Hawk
	MALE	Operational/ Theatre JTF	< 12,000	Unlimited (BLOS)	Predator A & B, Heron, Hermes 900
Class II (150 - 600 kg)	TACTICAL	Tactical Formation Brigade	< 900	200 (LOS)	Sperwer, Iview 250, Hermes 450, Aerostar, Watchkeeper
Class I (< 150 kg)	SMALL (> 20 kg)	Tactical Unit Battalion, Regiment (employs launch system)	< 360	50 (LOS)	Luna, Hermes 90
	MINI (2 - 20 kg)	Tactical Sub-Unit Company (manual launch)	< 300	25 (LOS)	Scan Eagle, Skylark, Raven, (FlyEye, Orbiter)
	MICRO (< 2 kg)	Tactical Platoon, Squad Individual (single operator)	< 60	5 (LOS)	Black Widow, (Dragonfly)

where:

MALE - Medium Altitude, Long Endurance

HALE - High Altitude, Long Endurance

LOS - Line Of Sight

BLOS - Beyond Line Of Sight

The reconnaissance and technical evacuation vehicles presented in chapter 2 may be an appropriate base for placement the unmanned aerial vehicles. For the tasks related to the technical reconnaissance the best choice will be the use of the smallest Unmanned Aircraft class I with a rotorcraft platform (Unmanned Aircraft

Classification is shown in **Table 1**). They will provide imaging recognition of damaged or immobilized military equipment. Unmanned Aerial Vehicles have a vertical takeoff and landing system in an unprepared space and equipped with an observation system operating in the visible band. Examples of constructional solutions is shown in **Figure 4**.



Figure 4 Class I MICRO UAV Vulcan Raven with Anti Vibrations System [12]

4. CONCLUSION

Taking into account the performed studies, following conclusions can be drawn:

- A battle damage assessment plays a crucial role in the process of weapon system maintenance since it determines further actions which will be taken by logistic elements. It includes evaluating the extent of damage sustained and determining whether deferment is feasible.
- The use of a unmanned aerial vehicles to assess the technical condition of damaged or excluded combat equipment will have a positive effect on the efficiency and safety of the technical reconnaissance process.
- The implementation of an unmanned aerial vehicles in technical reconnaissance should be limited to the latest and prospective weapon systems.

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