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Technologies in the Ukrainian Conflict: Reflection and Perspectives from Viewpoint of Combat Unit's Utilization

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Abstract

The aim of the article is to highlight the technologies, which are somehow new or more widely utilized then in times prior to 2022, when the Ukrainian conflict started. The research has been based on an in-depth study of a wide range sources and analysis. The core of the research has been based on logic, mostly methods of deduction and induction also, based on knowledge of tactics of combat units, knowledge of new tools and processes. It describes how they affected tactical level operations and missions. The article proposes recommendations for tactical level units, mostly combat units up to battalion level.

KEY WORDS: *artificial intelligence, multi-domain warfare, network centric warfare, units, unmanned devices, tactics, technologies*

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1. Introduction

In the Ukrainian conflict have been new technologies utilized, which have influenced effectiveness at all levels of command and control. A number of experts have labelled the character of the conflict as "a drone war" or the "first artificial intelligence (AI) war". At the same time, we can observe more news, tools, applications and processes, which have been more or less successfully utilized. By studying various sources, most of the studies analyses and comments on the overall situation [1] are from a higher perspective and does not go down into "tactical unit" level. This specific article is focused on tactical level and consequences from viewpoint of utilization in higher intensity of armed conflict [2]. The information, data and conclusions were analyzed, defragmented into elements and were linked to specific missions and tasks, which are conducting by combat units according to allied doctrine.

New technologies, processes and approaches can significantly influence results of clashes and battles. Facing over-numbering, there is no other chance, then use technology, smart-approach and something new, creating shock, effect or other devices and processes, to increase the "combat potential".

2. Unmanned aerial vehicles

Unmanned aerial vehicles (UAVs) will be in future widely utilized. The utilization of UGV's, based on their characteristics, can be used for strategic, operational or tactical missions. Focusing on low tactical level, we can mention small and mini UAV' s and drones. From viewpoint of "air layer", it is the lowest layer, operating in altitude couple hundreds of meters and on a distance of kilometers, usually not more than 10 kilometers. Enabling observation and impacting the targets, they are able to deliver devices (explosives, sensors etc.) in amount of kilos. Most of them are radio operated or enabling swarming and partial autonomy.

The drones, in appropriate amount, do the "pin-down effect". The enemy is trying to avoid his detection, therefore he limits his movement and maneuver, in consequence of this is limited in occupying advantageous firing positions. This is

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exactly the purpose of tactical activity “cover”, what is defined as “A security task to protect the main body by fighting to gain time while also observing and reporting information and preventing enemy ground observation of and direct fire against the main body”. UAV’s can be utilized also for tasks disrupt, interdict, block and may be others [3]. Some ground units can be replaced by formations of drones or mixed with drones. The limitation is a distance of remote control, electronic warfare operations, battery capacity and weight of a cargo.

As a theoretical example, the swarm [4] of mini 10 UAV´s, each loaded by cargo from 0,5 to 2 kg means, that is able to deliver hand-grenade on target (theoretically lethally impacting area approx. 50 m-depends on type and surface) or for example 60 mm mortar high explosive shell (theoretically lethally impacting area approx. 100 m-depends on type and surface). It means, that enemy platoon, operating in area not more than 500 x 100 m, could be impacted and enemy neutralized.

From perspective of small unit´s tactics, it seems to be beneficial be equipped by “drone unit” on company (mechanized, motorized, infantry) level and with single drones on platoon level / squad level. Definitely, the major role of manned ground unit, is in-replaceable, but UAV´s can be on low tactical level game-changing: enabling to operate on longer and wider distances, having overview better situational awareness, hit enemy in right moment, saving own life’s.

3. Antitank weapons

Antitank weapons (ATW) played crucial role during first phase in the Ukrainian conflict. Units stopped approaching enemy and were able to block columns of vehicles. In the close past, the antitank units were in western armies reduced. Ukrainian conflict showed their importance.

ATWs mounted on vehicles enables maneuver and damage effect also. The amount of carrying ATWs is limited, usually amount is around 4 shots. Dismounted unit equipped by ATW is limited with speed, maneuver and physical endurance. On the other hand, can be more “hidden” or can occupy the terrain, which is “no-go” for vehicles. Future warfare will be conducted by various types of vehicles. It means, stopping their movement, similarly as in past, will be crucial [5]. The enemy can be equipped by smart protection, where modern weapons can be detected and neutralized. The combat can be adjusted in various types of terrain, enabling utilization or non-utilization of advantages of various types of weapons. Short-distance combat (in urban, forests) will be also actual, most of modern weapons do not enable fight on shorter distance than 200 m. Therefore, combination of various types will be necessary. Light antitank weapons or RPG´s are not sufficient against modern armored vehicles. They can just partially reduce some abilities, what is manageable to fix by self-maintenance or by logistic units on tactical level. Destroying armored vehicles will be challenge for infantry of future, not only for specialized antitank units. One of many ways is also re-arming of units. Equipping wide specter of units by antitank weapons, with both types- for mounted and dismounted units also. Real resisting modern armored vehicles, stopping their maneuvering and denying their advance should be effectively incorporated again to list of abilities of all combat units.

There exist three perimeters for destroying armored vehicles: close distance, up to 300 meters, typically in forested or urban area. The area is saturated by units, being in clash. The quick actions are essential. Therefore, infantry in first echelon has to be equipped by antitank weapons, small, light, effective, penetrating from sides and from the top also.

Next perimeter, to be placed is middle-range distance, what can be from 300 m to 2 km. It is distance, where enemy usually dismounts or fires from vehicles effectively to our positions. His positions are visible or predictable, the antitank weapons are more sophisticated, usually needing 2-3 members crew. Loitering ammunition can be also alternative, but not the only solution.

The last level needs to be solved by specialized antitank units on distance above 2 km. Usually, commanders sort the targets based on priorities. Enemy units can be in columns or holding important positions (for example by tanks). The loitering ammunition and sophisticated weapons are sufficient.

The structure and equipment of combat units has to cover all three levels of anti-tank warfare. Every squad has to be equipped by small anti-tank weapon, neutralizing enemy effectively. Developed ammunition has to be utilized. On the platoon level, has to be incorporated minimally 1 team, operating with anti-tank weapon covering middle-range level and also loitering ammunition is recommended. On the company level, there has to exist minimally 1 squad, being able to operate on longer distances, including loitering ammunition. The unit has to maneuver by vehicles, so mounted and dismounted tools are necessary.

At levels from battalion above, we can speak about specialized antitank units, focused primarily on destroying armored units, utilizing various tactics and tools, based on combination of anti-tank weapons, also engineer devices, joint fires etc.

4. Unmanned ground vehicles

Unmanned ground vehicles (UGVs) do not play decisive role in current Ukrainian conflict. Despite this fact, they have been used mostly as loaders, transporting causalities or material in and out of the front line. The combat UGV´s were most likely utilized also, but not as major weapon or main effort. The barrier is a control of vehicles. It is safe and resistant wireless control needed. Autonomy is not developed to sufficient level, enabling UGV´s are waiting for their opportunity. In close future, it is highly in-possible, that they will be used for fully autonomous missions in typical conditions of front line battle [6]. The micro-relief [7] and combat identification is challenging [8].

Despite introduced facts, the development is going forward and incorporating easily commanded UGV´s will be reality. We can mention missions, based on following men-operated crews, utilization against enemy with not so strong electronic warfare. Typically, observing [9], transporting or un-crewed stations [10] (radio, meteorological etc.) are sufficient tasks.

For combat units, seems to be beneficial to be equipped by transporting UGV´s, delivering material or immobile persons from "hot spot" to unit´s rear, moving on known path. Cooperation between UAV, UGV and controlled by manned team is also possibility. The company can be the right lever, from which can be transport UGV incorporated.

The common tactical tasks can be secure and guard, including lethal effect-which has to be under 100% control of manned crew. Mostly, lethal weapons are small caliber, because of back-impact. On the other hand, un-crewed rocket launchers or grenade launchers can be helpful, when being part of squad or platoon, mounted in vehicle and after dismounting placed after movement to the specific point.

The other approach, deploying UGV´s as full-blown combat vehicle, is not realistic in close future. Firstly, because of electronic warfare, secondly, because of un-sufficient autonomy. From perspective of small combat units seems to be small fire-supporting UGV the right way and meanwhile, upgrading the levels of autonomy based on lessons from praxis. When the mistake happens, the commander can deny operating the UGV without significant limitation of unit´s tactical task.

5. Fusion of vision technologies

Technologies like night vision and thermal vision are in Ukrainian conflict widely utilized. From the very beginning of the conflict, Ukrainian side was donated by amount of personal night and thermal visions, mostly commercially available. Maneuver units made a lesson, that night and thermal vision gives them tactical advantage. Also was practically tested, that combination of a thermal and a night vision is beneficial, each has his own specifics, advantages and disadvantages. Especially fast and precise detection [11] is the key for combat units and the most of middle-cost civil applications [12] is sufficient for tactical tasks.

Especially a thermal vision should be incorporated in wide scale into combat units. Minimally, every section has to be equipped with this device, but as best every team, and also with night vision. There exist foresights, which can be mounted according to the tasks and conditions or scopes, based on fusion of technologies, it means a night vision and a thermal vision in one, where the pictures are combined. The final result is the united output, which takes the best from both. Based on experiences from current conflict and own experiments, the effectiveness of small arms fires rapidly increases, not only low visibility or hidden enemy (typically approaching enemy).

The fusion of technologies in mounted weapon stations should be standard part of new generation of vehicles. The inputs from own vehicle, other vehicles, UAVs and reports from dismounted element should be drawn into electronical overlay and be part of common operational picture (COP).

The challenge is not only amount and price of this devices, but also training equipment. It is necessary to use for practical training and coordination of fires the targets with appropriate thermal image, shape, camouflage and electro-magnetical image also.

6. Real time sharing

The OODA loop [13] (Observe, Orient, Decide, Act), as an approach, can be utilized at tactical level also. Quick interaction between phases enable facing strong enemy, using "hit and run tactics", what is well applicable in distributed battlefield [14]. The cornerstone to this is real time sharing of information, agility and flexibility in physical domains, information space and cognitive space also. From one viewpoint, the mission command is appropriate approach, on the other hand, the centralization and the intrication of networks is necessary and is increasing. Not only own forces, but also enemy will conduct the network cells and network-centric warfare will be reality in modern batteles. Therefore, the combat units will be also utilized to eliminate the powerful tools of enemy, what are not only weapons as effectors, but information and communication centers also. Creating gaps in a network structure will significantly reduce enemy´s combat potential and after it, can be destroyed by own forces. As in "old times" the artillery preparation of battlefield was common, the "disrupting the networks" is a part of new age battles. Meaning in all scales, from platoon level above.

Support from space domain to other physical domains is a reality. The satellite communication and utilization of images as a part of C4ISR support, contributes on a synergy of forces [15] at the battlefield. The specific realization of this mean can be linking via satellites, support by images and adequate intelligence evaluation supported by applications, sharing GPS. The networks have to be resilient.

Mentioned approach can be not used only in high-intensity conflict, but also in lower intensity conflicts, where the enemy is "visible" for a short while, because in a moment is mixed into local citizens. It means the quick OODA process is necessary at low tactical level is appropriate. For this purpose, the company level should be equipped by devices being able to act quickly and do the right low tactical level decisions and actions, because they should have in their structures other assets (UAV´s, anti-aircraft/drone, anti-tank, maneuver, ect.), being able to work with this data both directions-in and out.

The OODA loop based on connectivity needs, for "act" phase, the power and potential of unit. Unit, which is not able to act, from different reasons, does not deliver intended effect, it means the potential of "network" is limited by the weakest element. It means, it is necessary to prepare units for this kind of warfare, keep them ready and capable for "act".

This is related to frequency of missions and sequence of tactical tasks. The rhythm has to be arranged according to METT-TC and also in order to dis-balance enemy´s battle-rhythm.

7. Multi-domain battle

Cross domain and multi-domain actions are starting to be more common. We can observe some characteristics of multi-domain operations (MDO) in Ukrainian conflict [16] and the conflict shows, that small unit's leaders have to understand wide range of circumstances, tactical and technical details including. They interact with tools, which are utilized for multi-domain battle despite fact, they don´t lead them. They are part of multi-domain operations. Synergy across domains and creating common effect on enemy has to be understood by leaders, including low tactical level.

Practically, the realization of multi-domain battles, is related on planning and conducting of synergic effect by various tools. It is the most difficult level of operations and battles. The basics, from viewpoint of maneuvering units, is combined arms, able to cooperate with aircraft, navy, utilize the outputs from space operation-mostly for intelligence and communication purposes, interacts with various types of aircraft incl. unmanned, co-operates artillery and air defense, operates with unmanned systems, participate psychological operations and cognitive warfare, operates with electronic warfare tools, ect.

Small armies, like Czech army, will be most probably part of multinational formation, following "Multi-domain doctrine". Key tenants of Joint Warfighting Concept (JWC) 3.0 include the following [17]:

- Integrated, Combined Joint Force: The seamless integration of all military Services across all warfighting domains, enabling them to function as a unified force.
- Expanded Maneuver: Fluidly moving through space and time, including but not limited to maneuvering through land, sea, air, space, cyber, the electromagnetic spectrum, information space, and the cognitive realm.
- Pulsed Operations: A type of joint all-domain operation characterized by the deliberate application of joint force strength to generate or exploit advantages over an adversary.
- Integrated Command, Agile Control: Seamless command and control (C2) across all domains, integrating sensors, platforms, and decision-making processes.
- Global Fires: Integration of kinetic and non-kinetic fires to deliver precise, synchronized global effects across all domains
- Information Advantage: The rapid collection, analysis, and dissemination of information using advanced
- technologies.
- Resilient Logistics: The rapid movement of personnel and equipment, timed in accordance with operational requirements.

From longer-term perspective should be discussed advanced abilities in multi-domain operation. Inspired by this approach, more armies will develop their forces with "multi-domain" abilities, including small armies [18]:. The "multi-domain approach" [19] has not be only topic for strategic or operational level, but for all levels and all domains.

Above mentioned will directly influence low tactical level. It means, that battalion and company level has to include elements as: JTACs at the battalion level and JFOs at the company level. The S-2 and S-3 groups has to be able to use various sources and distribute them in real time to the units via robust and resilient communication network. The physical instruments have to be agile, quick deployable and re-deployable and doubled / tripled, because enemy will focus on disrupting our communications. The unmanned vehicles have to be part of units from platoon level above (as was mentioned in chapter 4). The artillery has to be effectively utilized, the JFOs and junior officers are the minimal level, who is able to cooperate on targeting. The effect has to be synchronized and the low tactical level is also "sensor". Own air-defense is the priority, in times of increasing utilizing swarms of drones, loitering ammunition etc. Every single unit has to be protected by anti-aircraft "umbrella". The anti-drone and anti-aircraft squads has to be essential part of all units. At the battalion level, cyber-operations and psychological operations has to be supported via staff officers and understood by troop leaders. They have to incorporate above mentioned tools into their missions and TTP´s. It is necessary to stress, that multi-domain battle is not led by company or battalion level, but these units have to understand bigger picture, be able to participate missions and put partial effort into synergic effect. The plug and play approach is essential, starting from company level. The reason is, that as a contribution to multinational (and also maybe multi-domain) corps is brigade combat team and minimal detached level for related tasks is a company level.

The crucial role plays connection and artificial intelligence by supporting quick decision-making. Networking of all elements is crucial. The commander has to see status of his units and in case of loss of some element, needs to fill the gap in the physical domain, but also in electronic domain. Disrupting of connectivity in all domains will be the key for success in the battle. Then, the gaps in physical and non-physical domains can be utilized for enemy maneuver.

Education and training of cadets in this field is necessary and topic of multi-domain battle has to be incorporated into curriculum of education programs. This topic is new, and development of multi-domain warfare is on the beginning, but new generation of leaders has to be educated in this field, being prepared to operate in multi-domain warfare with own MDO task force in the future.

8. Character of an enemy

In close past, the enemy was considered mostly as an army or a guerilla. Starting from 21st century, in the field of tactical level we can see next actors, like private armies and mercenaries [20], [21], which can play significant role form higher perspective also. Their number is growing and number of contract increasing also. Wagner´s group is good example of well utilized private company. They reached abilities, comparing like tactical level formations of modern armies (similar like brigade or division combat team). They are able to incorporate skilled military veterans and experts and mass of poor fighters also. They are able to utilize them effectively. The combat equipment of war experts can be on the best level, of the poor fighters only the very essential.

Above mentioned means, that the analysis of enemy at lower tactical level will be more related to lower tactical units and small intelligence teams, operating in the area. The capabilities, structure, equipment and amount of personnel of private companies is not defined in doctrines and is worse predictable. Also, their commanders and manners are not such well "readable". It can happen, that regular army units will face techniques and weapons, against which are not trained or familiarized with.

Leaders of small units can face from poor fighters to well trained and equipped veterans. This has significant impact on chosen tactics, but also on morale and attitude of leaders. Their pre-deployment training should include various types of enemy. All of this, creates more pressure on the tactical units, their level of training adaptability, equipment etc. Usually, the structure of regular modern armies is more "complex" a "combined". Still will be valid, that is necessary to identify the weaknesses of enemy and utilize them for success of own actions. Typically, from low tactical viewpoint, it can be lack of artillery, limited aircraft, low personal protection or protection of vehicles, connection related on single distributor etc. The complex portfolio of weapons, combined arms structure, utilization of hi-tech, networking and flexibility in decision-making can be a solution, how to face this types of unpredictable enemy.

9. Conclusions

The Ukrainian conflict provided many lessons to all levels and to all branches. It is visible, which technologies plays and will be play disruptive role in close future. The key findings are related mostly to one two words: complexity and networking. UAV´s are phenomenon no. 1. They directly influence tactics of units. Warfighting by drones in combination of UGV s should be part of tactics. The units should consist from UGVs, UAVs and manned crews. The units have to be equipped by anti-tank and anti-aircraft weapons, what has been partially neglected. Combined units, able to cooperate in multi-domain environment were established in Ukrainian conflict and in case of their high-quality future development and creating network structure, this would be significant change at tactical level. Network centric warfare should be trained as a part of nowadays and future battles, it is reality. The operational environment is and will be more uncertain, the role of leaders and their staffs is to try give some level of certainty to their subordinates, which directly face more lethal and sophisticate challenges.

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