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UNMANNED AERIAL VEHICLE INFLUENCE OF TROOPS LEADING PROCEDURE

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Abstract: Unmanned aerial vehicles, drones and other similar equipment are having a boom nowadays. Moreover, the usage of those modern technologies is also significant within armies. Unmanned aerial vehicles are extensively use within most of the military activities all over the world mainly on the battalion level and above. This paper is focused to discuss the usage of this technology on tactical level, particularly by squad and squad size units. The paper deals mainly with influence of unmanned aerial vehicles on troops leading procedure. The main methods of this paper are outcomes from the realized experiment. It shows on examples specific impact on all steps of the troops leading procedure. The experiment revealed interesting data and some possible conclusion were made. The primarily target of this paper is experience military personnel dealing with this topic. The paper should open broad discussion focused on all steps of troops leading procedure and outline the possible way of troops leading procedure update. Unmanned aerial vehicles, drones and other modern technology providing almost online information to the squad leader could significantly influence all steps of the troop leading procedure, safe preparation time as well as lives of the troops.

Keywords: unmanned aerial vehicle, troops leading procedure, small unit tactics, mission. squad

1. Introduction

The troops leading procedure is the only way how the squad leader, or leader of the similar size of unit, achieve desired goal. It is broadly accepted procedure to fulfil the tasks on squad, platoon and company level. The most important for team leader are information which he/she has to consider in order to fulfilling a task on given time. The accuracy, up to dates and certain details of this information are crucial. That information has vitally important role. Especially during the planning phase squad leader has to consider all aspects which could influence squad's mission. That is why the troops leading procedure was introduced. Unmanned aerial vehicles (UAV), drones or other similar modern technology are currently very fashionable.

Moreover, these technologies are very important since they are able to provide accurate information essential for decision makers. UAVs are already extensively used on strategic and operational levels within all multidimensional almost operations. There are also some armies who used this technology on the tactical level. However, do we know how UAV influence planning procedure of small units? Is there any guide in which steps of the troops leading procedure we can, or we should use UAV to collect almost online data? Do we need any additional specialist to operate UAV or drones on the squad level? How UAV influence the preparation time? There are many similar questions which could be asked. Authors of this paper tried to find the answers some of them. I order to do so;

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authors used an experiment to compare missions conducted squad equipped by this technology. The experiment was realized on simulator Virtual battle space 2 (VBS2) by squad without and with UAV assets and. Experiment description and condition of it is described in chapter 4. As a very important the readers should understand the basic of the troops leading procedure.

2. Troop leading procedure (TLP)

Basically TLP could be defined as the process a leader goes through to prepare a unit to accomplish a tactical mission.

However in a literature and also within some open sources is possible to find more definition. For purpose of this paper above mentioned definition is sufficient. TLP has steps which are depicted in figure 1. First steps of the TLP are normally in a depicted order; however the other steps do not have to be. For example particular situation could force leader to start necessary movement sooner or to completely skip this step. In order to understand all aspects of this procedure it is necessary to have basic imagination about the content of steps of TLP.[1]

TLP STEPS

- 1. Receive the Mission
- 2. Issue a Warning Order
- 3. Make a Tentative Plan
- 4. Initiate Movement
- 5. Conduct Reconnaissance
- 6. Complete the Plan
- 7. Issue the Order
- 8. Supervise and Refine

Figure 1: Steps of troop leading procedure

2.1. Receive the mission

Squad leader could receive the mission by operation order (OPORD), warning order (WARNO) and fragmentary order (FRAGO). The leader immediately begins a mission analysis using the factors of METT-TC, depicted in figure 2, and this will provide information for the WARNO for squad members. METT-TC would be also use later during the step three. In this step the analysis would be more detailed. To analyse the mission using METT-TC factors is crucial for mission understanding. Leader analyse step by step all factors which could influence mission accomplishment. The main outcome from this step is mission understanding and rough time calculation. It should be mentioned, that time planning must be done by backwards calculation. It is generally accepted that whole TLP should take 1/3 of given time to accomplish the mission. [1]



Figure 2: Factors of METT-TC

2.3. Make a tentative plan

After a leader gives all necessary information to his/her squad, he/she can focus on detailed analysis of the mission using again METT-TC factors. Based on its outcomes squad leader could develop multiple options how to achieve the goal of the mission. In reality squad leader would create mostly two variants of the solutions. Based on the available information a leader could update made options accordingly. To make a tentative plan leader uses OPORD format and simultaneously could start preparing of his/her OPORD. [1]

2.4. Initiate movement

As it was mentioned above, this step may occur in any point of TLP. This steps as well as steps 4,5 and 7 are interchangeable. Leader can also delegate the responsibility for this step to any squad member mostly his deputy. Step 3 includes movement to positions closer to line departure, initial inspections gather necessary equipment, reconnaissance, battle drill rehearsals or SOP items.

2.5. Conduct reconnaissance

Leader especially small unit's leaders must conduct commander's reconnaissance for any mission. Reconnaissance operations seek to confirm or deny information that supports the tentative plan. This step focuses first on information gaps identified during mission analysis. Situation and time available dictate the type and detail of reconnaissance. It does not have to be on ground, but it could be on map, terrain model, aerial photo act. [2]

2.6. Complete the plan

During this step of the TLP a leader should complete the OPORD based on tentative plan. reconnaissance and additional deflect guidance. In order to from commander's intent leader should revise his/her plan and ensured that commander's needs are satisfied. Leader also should think about possibilities how new information could influence his plan and how his/her squad could react to such changes. Basically there are still a lot of variables.

2.7. Issue the order

The order itself can be issued orally or in a written form. Especially on squad level leader should ensure perfect understanding of his/her plan by all squad members. To do so, a leader should use as much supplements as possible. Some possible supplements are:

- terrain models,
- sand tables,
- map boards/overlays,
- sketches,
- satellite photos,

- films,
- fire support matrix act.

In order to ensure, that all squad members fully understand, leader should ask all soldiers questions which prove their understanding. [1]

2.8. Supervise and refine

The TLP is a complex procedure and squad commander is not mostly able to do it by himself/herself. That is why leader should delegate some responsibilities to subordinates. This is done before issuing WARNO. However squad leader must supervise all his subordinates and provide guidance. Very important during this process is rehearsals focused on:

• practising of essential tasks,

• reveal weaknesses and problems in plan,

• coordinate the action,

• improve soldiers understanding.

Squad leader also must conduct inspection in order to ensure readiness of his/her squad. The inspection could have a form of pre combat checks (soldier's essential items) and pre combat inspection (mission especial equipment).

As it was mentioned, the TLP is complex process. It could have been written more about it focusing on deep details. However for basic understanding of this paper is sufficient to know just basic of it. Each steps of TLP later during the experiment underwent some evaluation and UAV impacts were considered. [2]

3. Virtual battle space 2

As it was mentioned to verify impact of UAV on TLP and mission accomplishment authors used simulator Virtual battle space 2 (VBS2). In order to fully understand outcomes from experiment it is essential to introduce this simulator. VBS2 is fully interactive tactical virtual simulator. It could be added to the simulator groups called "serious games". VBS2 is currently focused on the training of all members of the infantry, airborne, mechanized and tank units and marines from the shooter after the company commander (Battalion) to perform tasks in current (and future) operations. It allows very realistically simulate different movements, other situations. tactical activities. The simulator is focused also on the most realistic simulation of the conditions the operating environment. of Open architecture lets add more content of various kinds (terrain, vehicles, weapons, the behaviour of entities scripted functions) and modularization according to the nature of training (Fires module, the module Strike and others). Some of the capabilities of VBS2:

• realistically simulated day and weather conditions,

• when the simulation is continuously calculated the exact position of the sun relative to the current time of day and on a specific date, as well as the geographical location of the site where the simulation runs,

• emitters sounds (eg. Barking dogs, pets sounds) and others,

• realistically simulated and the endurance of the practitioner as such. Shortness of breath and fatigue during prolonged exercise (slow reactions and more)

• it is possible to use a virtual magnetic compass and a GPS device,

• simulator is equipped with a tool for evaluating feedback during workouts so called "After Action Review, AAR",

• there is "online editor missions",

• simulator includes a tactical radio network, "CNR Sim" to simulate the conditions of implementation processes the command and control for radio stations.

As it is apparent VBS2 is a simulator which could be used in a various way. Since VBS to could be also operable without assistance of any operator, using artificial intelligent, it allows authors to conduct below described experiment. Especially on the tactical level the VBS2 is very useful tools to not only conduct training, but also to realized experiment which is hardly ever manageable to realize as a live exercise with troops.

4. Experiment design

As it was mentioned authors would like verify how usage of small UAV or drones influence efficiency off squad missions and UAV impacts on the TLP.

That was the reason why authors define the hypothesis as follows:

"UAV usage on the squad level significantly diminishes losses during the mission and shortened the troop leading procedure".

In order to prove or not to prove this hypothesis authors design following situation and mission.

4.1. Task organization

Infantry squad composed of commander, driver of BMP2. gunner. deputy commander. two marksmen. RPG marksmen, sniper and machine gunner. This task organization is common organization of infantry squad. Moreover for purpose of the experiment the squad was additionally equipped by drone Phantom 4. The assault team leader had a drone with permanent monitoring of the scanned image from his commandobservation post during the preparation and execution phase of the attack.



Figure 3. DJI - Phantom 4 Pro [3]

Only team leader operate the drone and no additional operator was needed. The drone was used within whole mission from movement to line of departure (LD), attack duration (from LD to enemy destruction), losses of lives as well as material losses. The drone was also used during the TLP especially for information gaining and information update. It was also used to conduct commander's reconnaissance. [3]

4.2. Enemy situation

Troops of enemy are form by military and paramilitary units, whose are experienced in conducting of battle in urban area and forest area. Within the platoon attack zone there were identified forwarded combat units in the GAULA village (see figure 4 and 5).



Figure 4: Attack objective



Figure 5: Attack objective in 3D

There were identified two enemy troops with one civilian vehicle. Main equipment of enemy soldiers is 7,62 mm AR AK-47 and reactive antitank grenade launcher RPG-7.

4.3. Squad mission

The 1^{st} squad of the 1^{st} platoon attack on order enemy forces in village Gaula as an objective 1 not later than H+2 in order to create condition for the 1^{st} platoon attack on village Corazol as the objective FOX.

Based on the given condition the squad

leader played by authors conducted all steps of TLP and VBS 2 artificial intelligence conducted attack ten times using Phantom 4 and ten time without this technology.

5. Experiment results

As it was mentioned the experiment was conducted ten times with drone and ten times without drone. The followed values were:

• Movement to LD duration – there was placed one obstacle on the approaching road in order to evaluate reaction time of squad. The obstacle had to be spotted and squad commander had to find bypass (the obstacle was not possible to remove).

- Attack duration there were certain activities made by squad a a commanders reconnaissance, observing a the objective, exact enemy location atc. The time was measured from LD to enemy destruction.
- Overall duration obviously it was movement duration and attack duration. However there was also included time needed to secure the area.
- Losses of lives only killed soldiers were taken into the consideration.

• Numbers of wounded – all wounded

soldiers were counted. Only injury related to combat action were considered.

- Material losses in this value only loss of BMP 2 was considered. The level of damage was not relevant. Only capability to move and conduct fire support. Therefore only when the BMP 2 was not able to move and simultaneously was not able to conduct fire support, was considered as a loss.
- TLP duration this value was limited by capability of VBS 2 simulator. Authors had to supply TLP of squad leader and some figures were calculated using a mathematic model.

Results of experiment are depicted on the figure 6.

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	Experiments without Phantom 4							Expeiments with Phantom 4														
Followed values	EXP 1	EXP 2	EXP 3	EXP 4	EXP 5	EXP 6	EXP 7	EXP 8	EXP 9	EXP 10	Avarange	EXP 1	EXP 2	EXP 3	EXP 4	EXP 5	EXP 6	EXP 7	EXP 8	EXP 9	EXP 10	Avarange
Movement to LD duration (with obstacle)	15	16	16	20	14	15	18	15	16	17	16,2	11	12	17	13	14	15	12	14	13	15	13,6
Attack duration (from LD to ENY destruction	35	45	42	45	47	52	41	45	42	47	44,1	35	42	40	38	39	38	37	32	37	34	37,2
Overal duration (include area securing)	58	72	65	78	70	78	66	68	68	78	70,1	45	67	64	59	60	59	56	54	55	54	57,3
Losses of lives	2	3	2	1	3	2	4	2	1	2	2,2	1	1	0	2	1	2	1	0	2	1	1,1
Number of wounded	2	1	1	2	0	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0,8
Material losses (BMP2)	1	0	1	1	1	0	0	1	1	1	0,7	0	0	0	1	0	0	0	1	0	1	0,3
TLP duration	25	24	23	27	21	26	25	24	22	23	24	20	15	17	22	21	19	18	19	18	15	18,4

Figure 6: Experiment results

5. Conclusion

As it is apparent from figure 6 usage of drone for squad mission has significant impact on all followed values.

From absolute numbers the result does not seems to be very important, however the

language of the percent revealed significant reduction of all values. The percentage decline in some cases drop to 50% which is apparent from figure 7.

Followed values	Without drone	With drone	The percentage decline				
Movement to LD duration (with obstacle)	16,2	13,6	-16,049%				
Attack duration (from LD to ENY destruction)	44,1	37,2	-15,646%				
Overal duration (include area securing)	70.1	57,3	-18,26%				
Losses of lives	2,2	1,1	-50%				
Number of wounded	1	0,8	-20%				
Material losses (BMP2)	0,7	0,3	-57,143%				
TLP duration	24	18,4	-23,333%				

Figure 7: The percentage decline of values

As a very important is the percentage decline of losses of lives. 50% is possible to consider as a significant. The similar result is the percentage decline of material losses,

which was the most remarkable.

Based on this data is possible to conclude that usage of small UAV or drones on squad level is apparently useful and remarkably increase efficiency.

The TLP was also very significantly influenced. The time to make a decision was reduced by more than 23%. The saved time is possible to use for rehearsal or other activities needed to successfully fulfil a mission Moreover even unexpected problems, like the obstacle on the route, could be identified in advance and squad commander could solve it without time schedule changing. As it was mentioned during the TLP steps UAV or drones provide essential and in many cases vital information. It is possible to identify particular steps where UAV and drones would be possible to use. Mainly it is:

- Step 4 movement as it was proved by the experiment thanks to the drone the movement time was reduced by more than 16% and problems on the road were solved quickly and safely.
- Step 5 reconnaissance during this step, especially during commanders reconnaissance the drone was able

to provide online imagines. Moreover the drone significantly reduced danger of any unnecessary movement of squad to the spot from where the commander could observe the objective.

To conclude by the experiment the usefulness of UAV and drones on the squad level was proved. It is evident that usage of this modern technology should by discuss in detail.

The experiment also opens a new door to discuss upgrade of TLP. It shows possibilities to direct next steps of experimentation from computer assisted exercise to live exercise. However and most importantly it should open discussion and considerations to equipped battle units by drones or small UAV up to squad level. It could be costly at the beginning, but as it was proved finally it saved not only materials, but lives.

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