COMBAT POWER DETERMINATION METHODS FOR TACTICAL LEVEL MILITARY STRUCTURES

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Any military operation must be planned taking into consideration "quantity" and "quality" of forces. These forces must be "set up" and organised and used in operations according to their "combat power" at the specified place and time. Only if there is a correct analysis and "determination" of combat power these forces can have a chance to win.

Keywords: combat power; combat potential; distructive means; informational capabilities.

Combat power is a concept that must be understood and applied from the smallest tactical level military structure to the highest level, the strategic level. Generally, combat power, as a feature of a military force, is usually expressed through an index that is a refference element in relation with a similar military force from enemy forces.

Combat power is that physical condition of a military force given by organization, equipment, trainning level and the approach of tactics, tehniques and procedures applied at this level. A better explanation of the combat power concept is that it represents "the total means of destructive, constructive, and information that a military unit or formation can apply at a given time"[1].

Distructive Means

Combat power has eight elements: leadership, information, mission command, movement and maneuver, intelligence, fires, sustainment, and protection[2]. All these elements are contributing to form and increase the military forces combat power.

The level of military structure combat power refers to the fact that the military forces structures where the combat forces and combat support forces are used, combined, in an efficient manner, they can reach at a specific time or for a specific period of time, a certain physical and dynamic condition that will give the force the capacity of fight and thus it will accomplish its mission. In this way, the efficiency of a military structure can be quantified or evaluated using the *combat power* and *combat potential.*

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Going further, the combat power has an important element that is defining a military structure as a useful force, and this is its potential to fight. Each one of military structure element has a specific weight that is used to form for the force a specific combat potential.

The difference between the combat power and the combat potential is related to the manner they affect the fighting situation. If a military structure element is affecting the combat situation it is contributing to form the combat power, otherwise is just a combat potential.

The combat power of a military structure or force is generated from the right way of using the combat potential in the right moment and at the right place. The combat power must be applied in the weakest enemy point or area.

The combat potential[3] of a military force is an index that reflect in an agregated manner the lethality (the possibility of causing losses and destruction to an adversary force) of all weapons and vehicles from the force organization, taken as amounted and weighted.

The combat potential of a military force, in national and foreign military dedicated books, has two parts: the projected combat potential and the available combat potential.

Designed or *projected combat potential*[4] is a nominal potential based on how a force is designed and the environments and threats it is designed to be used against. The projected combat potential is a phisycally status of a combat capacity or a combat capacity with no damages resulted from an interractions with the enemies or other battle perturbatory events.

Available combat potential[5], incorporates all the real-life degradations to which a force may be subject to. All interractions of the military force with its opposite military force, factors, malfunctions of different systems or interferences among own military forces that may occur in the battlespace influence on its effectiveness combat capacity and most of the time through decreasing its combat power. These can include a large spectrum of variables like shortages of equipment and materials, less effective supplying system, low level of personnel morale, inappropriate way of applying the tactics or techniques in the battlespace and many other kinds. In other words, the available combat potential is the real power that a military force has before the actions, events or environments effects on it start.

The higher the available combat potential the higher combat power of military force is. Any decreasing of it must be avoided and if not possible the commnader must take steps in order to have it at the desired level. These steps can include both resupplying with manpower and equipments at that specific time and the tactics and tehniques that maintain the available combat potential and also the combat power at the planned level for accomplishing the mission.

The combat power level indicates the right time and place to use the military force in the battle and also the enemy force combat power that can be faced or fight against.

All the time of calculating the combat power index for our forces we must calculate or estimate in a realistic manner the enemy force combat power index. There are some risks in calculating the combat power index, especially is not provided the updated information on the enemy force in the time and place we want to fight against.

There are some methods to calculate the comabt power index for a tactical military force.

A tactical military force using the tanks forces and combat support forces in operation leads to an increased combat power for this force and as a result it will be used for a longer time than a usual force. As a plus the morale of this force will be at a higher level. As long as the tanks and the combat support forces are at a higher lever than the enemy ones, the combat power will be at a higher level and the possibility of succes will be higher.

As an example, a superiour combat power of a military force can be obtained trough the combining the tanks with infantry and the combat support forces in the military operations of land forces. Because the tanks, alone, cannot end in victory, they must be used together with other specialities like infantry and combat support forces, so that their mobility and firepower be at the highest value possible and battlespace controled by fire by all own forces.

If, for personnel is more difficult to calculate the potential and the combat power, for equipment and systems have been identified and developped, over time, some specific methods and tehniques.

In the military literature there are methods for determinating the military combat power at a tactical level. I suggest the analysis two of them, the *classical method*, using the *principle of force ratio,* that means the military force are configurated depending on the enemy force quantity. This method is based on the quantitive force ratio that must exist in planning a military force in a military action or operation.

The *principle of the force ratio* refers to the fact that in a military operation you have to "accumulate" or have available a certain number of structures with a certain number of means of fire and military equipment which once used in battle are able to overtake the enemy's, respectively, to overcome the critical point of enemy forces and thus to "survive" those of the enemy, and at the end to achieve success.

A written form that makes a better understanding of the conditions between the superiority or inferiority of forces and the tactics or techniques that can be used in the battle was given by Sun Tzu: "It is the rule in war, if our forces are ten to the enemy's one, to surround him; if five to one, to attack him; if twice as numerous, to divide our army into two. If equally matched, we can offer battle; if slightly inferior in numbers, we can avoid the enemy; if quite unequal in every way, we can flee from him. Hence, though an obstinate fight may be made by a small force, in the end it must be captured by the larger force" [6].

More accurately, we can say that without having in a military operation an equal or greater number of forces and means of fire than the opponent has, we can not defeat the enemy. The defeat of the enemy can not be attributed to the luck, the inspiration of the commanders or the mere presence of the forces on the battlefield; it depends to a great extent on

the number, quality and way of using the forces. Superiority, and above all, technical superiority or, better known, the quality of military forces is a prerequisite for achieving success on the battlefield, and between superiority in forces and means, and achieving success, a report can be established, even if it is at first sight empirical.

When organizing forces for battle, we must not consider exclusively when it comes to achieve success. Regarding the principle of force ratio, which is only a factor leading to victory, Clausewitz stressed that "/.../ This number will therefore determine victory. Now from the number of things above deducted to get to this point, it is shown that the superiority in numbers in a battle is only one of the factors employed to produce victory that therefore so far from having with the superiority in number obtained all,..." [7]. So, military planners must consider this principle as a component part of the use of forces in combat, and not as a main one. Of course this principle has its advantages and disadvantages.

This principle can be successfully used when the technical and tactical possibilities of their own forces are to some extent similar to those of the enemy forces. Here we are referring to the fact that national military forces are endowed with combat technology and weapon systems that perform well and compete with those of an hypothetical enemy.

As an example, we can take an offensive operation in which the enemy forces have at their disposal a number of *n* tanks and anti-tank assets. To be successful when planning an offensive operations we must calculate that for each number *n* of tanks and antitank assets forces of the enemy our force will be a military structure that has at least a number *n*x3 tanks and means of mobile fire antitank. Even so, due to the influence of terrain factors and weather conditions, it is possible that this number *n*x3 or more tanks and anti-tank assets available not be enough to achieve the desired final state. Over the time, several battle reports have been identified.

According to FM 5-0, 2010 edition, the historical reports that are considered in planning by US Army forces in military operations, are as in the Figure 1.

Own forces mission	Position	Own forces/ Enemy forces
Delay		1:6
Defense	Prepared or fortified	1:3
Defense	Hasty	1:2,5
Attack	Prepared or fortified	3:1
Attack	Hasty	2,5:1
Counterattack	Flank	1:1

Figure 1. *The minimum historical reports considered in planning by US Army forces in military operations*

In addition to planning this number of fire assets, we will have to "add" other forces to that force structure to meet our offensive objectives, including engeneering forces, land artillery, and air defense artilery.

As a conclusion, on the offensive operation, it is necessary to ensure the superiority of forces and means of fire in order to achieve the enemy defense breakthrough, and on the defensive operation is required a ratio of forces that allow rejection of the opponent's offensive and taking over the initiative.

In conclusion, the method of determining the combat power by applying the *principle of the force ratio* is used when the military structures of the force are approximately the same as those of the enemy.

The second method for determining the military structures combat power applies *equations* and *mathematical models* to configure the structure of military combat equipment and fire assets, sufficient quantity but, above all, qualitative for their successfully use in combat.

These equations and mathematical models, if properly applied, can guide both planners and military decision-makers in the decision-making

process. These can be used when the parameters or factors to be entered into these equations or mathematical models can easily be determined or are already identified and quantified, and time at the disposal of forces is not enough to go through another planning method. These mathematical relationships can be applied to direct military actions executed by ground level tactical forces and give results based on a logical reasoning that is transposed into them. What is important for military planners is that they must get information about the parameters or factors that are taken into account from safe sources and not by approximation or estimation.

Among these, *the Lanchester*[8] equations that can guide planners and commanders with regard to the organization and use of forces, so that their combat power be greater than that of the enemy.

These equations are mathematically simple and represent the military concept of concentrating the effort and showing what happens when two military forces concentrate their forces and fight.

Thus, a Lanchester equation, modified and adapted by foreign military specialists, can determine at some point, in a direction or in a strip area, the ratio between the amount of tanks forces of their own and those of the enemy. This helps military planners to compare the combat power of their own forces to those of the enemy, and sets up an index called the model *of the correlation of forces*[9]. The size of this index will allow planners to understand better the tactical situation and choose the direction, line or ray where enemy forces are vulnerable, inferior qualitatively and quantitatively, so the enemy can not give effective resistance to own military forces.

This equation also provides an understanding of the benefits of the relative value of quality over the quantity in a battle. It can be applied in the process of mission analysis to battlegroups using tanks due to the fact that the parameters of analysis and comparison are their tanks and their own structures versus tanks and tank structures of the enemy. The value of this index must be, mathematically, greater than number one value in order to plan and successfully use tank-based battlegroups on a particular direction or strip area.

The following equation is a derivation, an extension of Lanchester's N-squared equation, where N represents the military forces that have tanks or other direct aiming firearms in the organization. This equation shows thre result of who will win a fight with a *direct engagement* with forces based on the size and full effectiveness of the opponents. Because it shapes direct fire aiming, it is known as *aimed fire model*[10]. The model of the aimed fire assumes that opponents can see each other, and therefore can engage fire and destroy.

The equation is represented as:

$$X = \frac{(n1 \cdot P1) \times N1^2}{(n2 \cdot P2) \times N2^2}, \qquad (1)$$

where:

- X is the force correlation index;
- $N1$ is the number of tanks for own forces and N2 is the number of tanks for the opponent;
- $P1$ și $P2$ are the opponents' probability of destruction (PK) (they are expressed in percentage form and simplified by 100 to ease the calculation, respectively, 0,8 means that the probability of destruction is 80%);
- $n1$ și $n2$ represent the maximum firing rate of the tanks cannons of each part (expressed as an integer representing the number of missiles executed per minute by a tank).

A calcul on the number of tanks necessary for own forces to be used against the opponent's forces is shown in the table below:

In Table 1, I calculated data for three variants of forces organization and the distribution of their own forces tanks to explain the force correlation index modification and implicitly the ratio of forces. Specifically, the more we increase the number of tanks of our own forces, the higher he index value is. Mathematical modeling and simulations are needed to be done in order to get the most realistic picture.

This index of forces correlation must be, mathematically, overhead number one value to allow the planned action to be performed with a good result. If it is under the value of number one value, the own forces must take actions to make the index positive or greater than number one. These measures consist of additional forces, the execution of maneuvers of forces and means at a higher intensity, long distance fire engagement by artillery with a higher level of accuracy, harassing enemy forces or other actions that diminish the enemy's combat power and the number of tanks. Once these measures are carried out and the value

Table 1

COMPUTATION OF THE FORCE CORRELATION INDEX

OWN FORCES		Offensive			Defense		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
n1	Shooting rate	6	6	6	6	6	6
P1	Probability of hitting	0.8	0.8	0.8	0.8	0.8	0.8
N1	Number of tanks	54	75	108	54	75	108
ENEMY FORCES		Defense			Offensive		
n2	Shooting rate	8	8	8	8	8	8
P2	Probability of hitting	0.9	0.9	0.9	0.9	0.9	0.9
N2	Number of tanks	30	30	30	90	90	90
X – Force correlation index		2.16	4.17	8.64	0.24	0.46	0.96

of the index is above number one value, we can proceed to the execution of the planned actions.

In table 1 we can see that the higher the numbers of tanks of our own forces is, the higher the force correlation index is and thus the possibility of success will increase. This amount of tanks will be increased as much as needed, so this way, we can create the economy of forces. We can also estimate, with the help of this equation the direction, the area of operation where own forces can be vulnerable and the enemy could have an opportunity to exploit. So we will be able to take actions on time to prevent the enemy from changing the direction of his main effort or tactical situation at a specific time.

Using the principles of mathematics, I propose to extend this equation of Lanchester and to introduce another parameter, that is, *the effective firing distance*, which dictates in the case of the aimed firing method. In my opinion, the effective firing distance is that distance in which the aimed fire of the tanks can have an impact on the enemy's tanks and other fire assets. Thus, the fire of a tank will be effective only after the tank has physically entered the limit of this effective firing distance that differs on tanks depending on the performance of the cannon and their ammunition. More precisely, if two opposing tanks have this different effective shooting distance when they can aim directly each other, they can fire but the projectile or missiles of the tank with less effective firing distance will not hit the opponent's tank. This results from the fact that ammunition can only travel some distance to where it can be effective.

I propose to introduce this parameter within this equation in order to have a higher accuracy in calculations and implicitly in getting a result to reality as close as possible.

The extended equation will be,

$$X = \frac{(n1 \cdot P1) \times N1^2 \times d1}{(n2 \cdot P2) \times N2^2 \times d2}, \qquad (2)$$

where:

- X is the force correlation index;
- N1 is the number of tanks for own forces and N2 is the number of tanks for the opponent;
- P1 and P2 are the opponents' probability of destroying (PK) (they are expressed in percentage form and simplified by 100 to ease the calculation; 0,8 means that the likelihood
- of destruction is 80%);
- n1 and n2 represents the maximum firing rate of the tank cannons of each part (expressed as an integer representing the number of missiles executed per minute by the tank).
- d1 and d2 represent the effective firing distances of the tanks of opposing sides (expressed a calculation of the force correlation index with this parameter is shown in Table 2.

As we can see, the introduction of this effective firing distance parameter leads to a reduction in the force correlation index and implicitly to a decreasing of the existing force ratio for that tactical situation.

As a result of introducting this real parameter that dictates on the battlefield for tanks, we can see, in table 2, that the value of the correlation index of

Table 2

COMPUTATION OF THE FORCE CORRELATION INDEX WITH THE EFFECTIVE FIRING DISTANCE PARAMETER

OWN FORCES		Offensive			Defense		
		Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
n1	Shooting rate	6	6	6	6	6	6
P1	Probability of hitting	0.8	0.8	0.8	0.8	0.8	0.8
N1	Number of tanks	54	64	108	54	75	108
d1	The effective firing distance	1.70	1.70	1.70	1.70	1.70	1.70
ENEMY FORCES		Defense			Offensive		
n2	Shooting rate	8	8	8	8	8	8
P2	Probability of hitting	0.9	0.9	0.9	0.9	0.9	0.9
N2	Number of tanks	30	30	30	90	90	90
d2	The effective firing distance	2.50	2.50	2.50	2.50	2.50	2.50
X – The force correlation index		2.16	3.03	8.64	0.24	0.46	0.96
X1 – The force correlation index extended with the effective firing distance		1.47	2.06	5.88	0.16	0.31	0.65

the forces decreases due to the fact that the tanks of own forces are not comparable to those of a hypothetical opponent, meaning that own forces tanks can not effectively fire the enemy tanks, they can fire effectively only at a distance less than the effective firing distance of enemy tanks. Thus, military planners will have to find optimal solutions for organizing and using the forces available to fulfill the objective or mission received.

My argument for introducing this parameter is that although the tanks of own forces can fire with the cannon against enemy hypothetical tanks, this fire is only effective within the distance of tanks and ammunition performances. Thus, if enemy forces have a number of *n* tanks, own forces must supplement the number of tanks over the *n* number of enemy tanks to fulfill the mission. Also, own forces must take tactical actions to reduce the fighting power and the number of tanks of the enemy's forces.

As a theoretical example, we can use the extended Lanchester equation in the case of a mobile defense to estimate the minimum number of tanks required by our own forces to destroy the enemy in the mobile defense area. If the enemy can have a number of 60 tanks when he is stopped before the limit of the defense in the mobile defense destroying area, following this extended equation, our own forces must have at least 89 tanks for the offensive action to be successful and the enemy to be destroyed.

This modified Lanchester equation can also be applied to artillery forces during military action planning, and the result may be relevant due to the fact that artillery largely influences the final state of a military operation.

In conclusion, in order to achieve success in a military operation, we must use all possible methods and ways of determining the *combat power* of military structures. Among these, there are two methods analyzed above, the classical method which involves the configuration of a tactical military structure according to *the force ratio principle* and the method of determining the combat power by using some *formulas* or *mathematical models*. It is necessary to use and, if necessary, adapt the methods and techniques for assessing the combat power of the military forces formulated and used throughout military history by military theorists and commanders. One sequence would be to study and expand the mathematical possibilities, at least at the theoretical level, *of Lanchester's equations* for all the weapons used in current and future military operations, especially

since within these mathematical equations can be introduced those parameters or quantifiable factors that exist in the battlespace that can be exploited by military planners and decision-makers for own forces advantage.

NOTES:

1 Headquarters, Department of the Army, *Field Manual 3-0*: Operations, Washington DC, Department of the Army, December, 2017, pp. 2-21.

2 *The Battle Staff SMART book*, The fourth revised edition, 2015, pp. 1-22.

3 Cpt.eng. Vasile Păun, *Raportul de forțe în viziunea sistematică – Modelul de letalitate*, Editura AISM, Bucharest, 1997, p. 17.

4 Edmund L.Du Bois, Wayne P. Hughes Jr., Lawrence J. Low, *A Concise Theory of Combat*, The Military Conflict Institute, 1997, p. 78.

5 *Ibidem*.

6 Sun Tzu on the art of war, *The Oldest Military Treatise In The World*, Translated from the Chinese By LIONEL GILES, M.A. (1910), Published by Allandale Online Publishing 2 Park House, 21 St Leonards Rd, Leicester LE2 1WS, England, 2000, p. 9.

7 General Carl von Clausewitz, *On war*, translated by colonel J.J. Graham, New and revised edition with an introduction and notes by colonel F.N. Maude C.B. (late R.E.), 2006, p. 88.

8 Frederick William Lanchester, *Aircraft in Warfare: The Dawn of the Fourth Arm,* London, Constable and CO., 1916, p. 48.

9 Maj. James A. Zanella, *Combat Power Analysis is Combat Power Density*, School of Advanced Military Studies, 2012, p. 13.

10 *Ibidem*.

BIBLIOGRAPHY

Headquarters, Department of the Army, *Field Manual 3-0*: Operations, Washington DC, Department of the Army, February 2011.

Col. Bălăceanu Ion, col. Dumitru Daniel, col.(r) Ioana Ion, *Potențialul de luptă al forțelor terestre în context NATO*, Top Form Press, Bucharest, 2006.

Clausewitz Karl von, *Despre război*, Military Publishing House, Bucharest, 1965.

Du Bois L. Edmund, Wayne P. Hughes Jr., Lawrence J. Low, *A Concise Theory of Combat*, The Military Conflict Institute, 1998.

Major Johnson L. Ronald, *Lanchester's Square Law in Theory and Practice,* School of Advanced Military Studies, Fort Leavenworth, Kansas, USA, 1990.

Lanchester Frederick William, *Aircraft in Warfare: The Dawn of the Fourth Arm,* London, Constable and CO., 1916.

Cpt.eng. Păun Vasile, *Raportul de forțe în viziunea sistematică – Modelul de letalitate*, AISM Publishing House, Bucharest, 1997.

Sun Tzî, *Arta războiului* (traducere din limba franceză), Military Publishing House, Bucharest, 1976.

Zanella Major A. James, *Combat Power Analysis is Combat Power Density*, School of Advanced Military Studies, Fort Leavenworth, Kansas, USA, 2012.