TECHNOLOGIES IN
THE CONDUCT OF MILITARY ACTIONS

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Abstract: *The technologies of weapons and means of combat must be studied very carefully in different eras to understand the military art of those periods in human history. The military art of antiquity, the Middle Ages, capitalism and our time is a way of creating and using weapons to achieve the goals and objectives of the wars of those times.*

The study of technologies leads to the understanding of the philosophy of confrontation, the philosophy of combat actions and the strategy of wars.

Keywords: *study, technologies, strategy, warfare, military art.*

From the point of view of weapons technology and combat actions imposed by the means of combat, antiquity and other eras have their own philosophy. The technologies of antiquity must be seen as weapons that have influenced not only the conduct of combat actions (battles) and the military art of the time but also human behavior towards the weapons created by those technologies. The weapons and means of combat created by the technologies of antiquity are: 1) individual weapons (for close combat and for remote combat); 2) war machines; 3) means of protection (individual and collective); 4) camping equipment; 5) means of transport (land and naval); 6) means of siege; 7) fortifications; 8) artillery armament (catapult, bombardment).

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For centuries, the core of the army was the phalanx, which was a formation adapted to the weapons of the time. Cavalry played an important role in Alexander Macedon's army and Mongol army but not in the armies of ancient Greece and ancient Rome. Chariots played an important role in the army of ancient Egypt (for example, in the army of Ramses II). The artillery of antiquity launched various projectiles at a distance (stones, arrows, spears, etc.). Mobility played an important role, especially after the invention of the horseshoe (after the 4th century BC). Logistics also played a key role in the armies of the sedentary but also in those of the nomads. The leadership of the forces played a key role in achieving victory. The general was the one who led the troops and achieved success in combat actions (in battles).

In the Middle Ages, gunpowder technology marked the beginning of the revolution of the means of combat, a revolution that did not occur suddenly, but gradually. At first, gunpowder was obtained by mixing sulfur, coal, and saltpetre in China in the year 500, in the form of fire spears (a kind of flamethrower). Between the 7th and 10th centuries, some fuzze (a kind of cylinder) were made to increase their beating. The cylinders were made of paper, around the year 970. In the ninth century, Marcus Graecus gave the recipe for gunpowder (one part lime charcoal, 6 parts sulfur and 6 parts saltpetre). The optimal recipe is: 2 parts charcoal, one part sulfur and 6 parts saltpetre[1]. Therefore, in the Middle Ages, firearms appeared and the armor was perfected (from the armor made of cut plates to those made of links that weighed about 25-40 kg). These weapons had "about the same characteristics given the technological level it had reached."[2] The helmets were made by hot bronze processing or by joining isosceles triangular plates[3]. The individual shield was in the shape of a pointed arch, but there

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[1] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1,* Bucharest, 2004, p.131.
[2] *Ibidem*, p.133.
[3] *Ibidem*, p.134.

were also large shields that were arranged on the ground and moved according to needs. Collective protection was provided by fortified castles and fortified cities, but the appearance of explosive cannons led to a decrease in the importance of these fortifications. Land mobility has increased as a result of horseshoes, saddles with arches and two ladders, as well as harnesses with ladders. Increased mobility was also due to road reconstruction.

Maritime mobility was increased by the development of navigation and warships (in China). Around the year 1500 appears the caravel (50 - 500 tons) that sailed fast (due to a system of sails). Figure 1
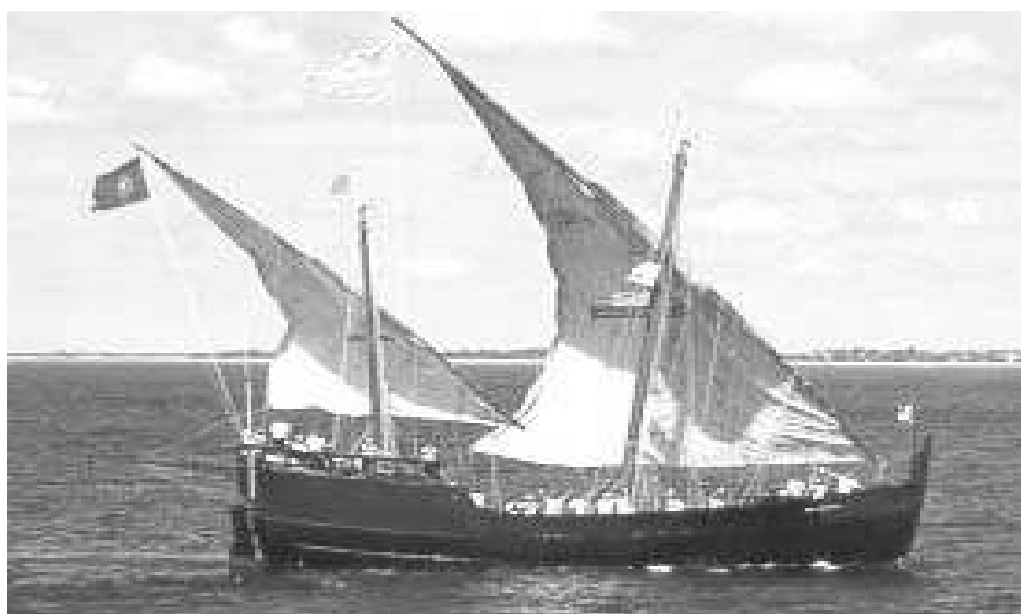
Fig. 1 Portuguese caravel with latin sail
(source:https://upload.wikimedia.org/wikipedia/commons/thumb/5/5b/Cara
vel_Boa_Esperanca_Portugal.jpg/154px-
Caravel_Boa_Esperanca_Portugal.jpg)

Various procedures were used to cross or force the watercourses: 1) to conquer a permanent bridge; 2) building a bridge on pillars; 3) building a bridge on pontoons. Due to the advent of firearms, the role of the cavalry diminished, but it continued to exist until the beginning of World War II

(1939). The arch, which existed in antiquity, will continue to be used in the Middle Ages (in the battle of Hastings in 1066 a body of archers was used). The British carried out precise mass shootings with devastating effects. In the battle of Crecy (1346) 6,000 archers were used to shoot an arrow every 5-10 seconds, which was equivalent to a curtain of 36,000 arrows / minute. At the end of the century X appeared the crossbow - a Western technology - high precision.

The artillery of the Middle Ages had bronze cannons that fired projectiles with the help of gunpowder.

In 1346, in the battle of Crecy, the British used firearms (three bombers), which decided the success, but also thanks to the 6,000 archers who fired 300,000 arrows in a few minutes. In the 13th century, the Mongols used fireballs prepared by the chinese[4].

The firearms used in combat actions imposed new tactical procedures. In the sec. VII the Arabs used as tactical procedures archery and surprise attack with light cavalry units, as an expression of the strategy of rapid actions. The Byzantine Empire frequently used heavy cavalry in combat operations, but this was ineffective in rough terrain, where only light cavalry could be used.

In the West, feudal armies based on heavy cavalry appeared. The nomadic peoples attacked in a "triangle with the tip in front" formation by the process of the frontal blow. Victory was assured by the quality of the fighters, the armament (technology), the maneuver and the quality of the leadership of the troops. The Mongol cavalry was clearly superior to the Western one (figure 2).

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[4] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1,* Bucharest, 2004, p.150.

Fig. 2 Mongol cavalry
(source:https://upload.wikimedia.org/wikipedia/commons/thumb/5/5f/Mong ol_cavalry.jpg/640px-Mongol_cavalry.jpg)

The fighting actions of the Mongols took place over large areas, at a fast pace, in accordance with the strategy of rapid actions. Their cavalry was light, without armor and armor. The Mongols compensated for their lack with movement, that is, with the speed of their actions. Each rider wore a helmet on his head, ropes and ropes for tying horses, and a leather bag containing the horse's oatmeal ration as well as the bow and arrow. It also had files for sharpening the arrowheads. To cross the waterways, the Mongols used the oatmeal bag, which they sealed and inflated to keep them afloat. They had several categories of cavalry: 1) reconnaissance cavalry, which was sent forward on various itineraries to discover the presence of the enemy; 2) light maneuver cavalry, which acted on the flanks; 3) safety cavalry, for the safety of marching and parking; 4) attack cavalry - a kind of heavy cavalry that penetrated deep into the enemy's device, splitting it and

destroying it in parts. The inn (general) was always accompanied by a guard cavalry which was a general reserve that entered the battle for victory.[5]

In 1211 Genghis Khan attacked China with several research and spy detachments, movement detachments and a vanguard of 30,000 horse fighters (3 divisions). The main force had 100,000 horsemen (10 divisions) and two wings (100,000 fighters). Genghis Khan had a guard of 1,000 fighters on black horses[6].

In 1219, Muhammad II had an army of 400,000 fighters, and Genghis Khan had 300,000 soldiers. He conducted reconnaissance in the Tian Shan Mountains to be crossed by his army. The Mongols crossed the mountains (2,000 m altitude) in winter, on columns with herds in front of them, soldiers in the middle, and supply convoys at the end. His army had an incredible number of half a million animals and 300,000 fighters. He marched only during the day, and at night the soldiers slept in tents. The fighters each had a ration of dried or smoked meat and condensed milk. The mountains were crossed in the fall of 1219 and until the spring of 1220. After this amazing crossing, Genghis Khan's vanguard collided with the troops of Muhammad II, the Mongols attacked with bombs throwing stones and incendiary bombs. The Mongols systematically attacked the cities of the Muslim Empire and behaved cruelly in that campaign. Maneuvering was the essence of Mongolian military art. This art will always remain in military history. In 1227 Genghis Khan died at the age of 73 and the huge empire did not survive. He paid special attention to the connections provided by the rider-arrows (they covered 1,400 to 1800 km per week in any weather and any terrain)[7].

In the sec. XV begins the Renaissance and the revolution of science. On this basis, the means strategy is being developed, and the generative

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[5] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1,* Bucharest, 2004, p.164.
[6] *Ibidem*, p.165.
[7] *Ibidem*, pp. 170-172.

strategy (which generates the means) is beginning to become increasingly important. In earlier times it did not matter much because making bows, slingshots, spears or arrows did not require too much technology. Prior to this period, blacksmiths made as many swords as needed. But in the new period the issue of the means of combat will be as important as the strategy of the forces. Weapons will be produced in factories, ie in an armaments industry. War has become a potential issue. This stage continues the development of military art in the latter part of the Middle Ages. The second stage meant the development of military art characterized by the creation of permanent armies of states endowed with new, effective and efficient weapons, such as: muskets, arquebuses and cannons. In this new stage, the strategy of the forces is also developed. The armies were revolutionized, as were those of Gustav Adolf and Frederick II. In the next stage, new tactics are developed and the great tactic (operative art)[8] appears, which today is called the operational strategy. It deals with the realization of the necessary forces and means, the elaboration of the concept of carrying out the war and the way of carrying out the operations. It was also necessary to translate this operational concept into a process of waging war, ie in devices, communication lines, logistics systems but also in command and command structures[9].

Although weapons technology was in its infancy, the military revolution had begun with the advent of firearms. The armed forces are massing (becoming mass) and their destructive power has increased, but mobility has slowed down, it has not progressed. The machine guns dethroned the cavalry and put the infantry back in the lead.

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[8] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1,* Bucharest, 2004, p. 268.
[9] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1,* Bucharest, 2004, p.269.

In modern times, the number of armies has increased as a result of increasing contrasts and the proliferation of war constructions as a means and as a military solution to political disputes. This led to an increase in the production of weapons and ammunition, in other words the emergence of the war industry. Also, the fronts widened and the duration of the wars increased (if at Austerlitz the front was 15km, at Jena it had reached 60km). The command and command systems increased in complexity, which led to the decentralization of the commands (orders were no longer given to the infantry, artillery, etc., but to the divisions and later to the army corps). Artillery mobility increased. The role of the cavalry was diminished by huge losses, but in the American Civil War the Southerners used cavalry in deep raids behind enemy forces. Napoleon developed the operative level of military art. The development of railways and the telegraph revolutionized military art at the end of the century. XIX and the beginning of the century XX by facilitating strategic maneuver.

In the Contemporary Age, although tanks and planes appeared, the whole infantryman had to put his foot down to end the war.

In the Franco-Prussian War, Prussia had a superiority in the training of fighters, in modern weapons, in rail transport and in logistics, but also in communications (telegraph). The First World War is the first industrial war based on an unprecedented technical revolution. No war until then has brought so many inventions and innovations in the field of means of combat. Approximately 67% of the artillery was lost. France had about 10,800 pieces of artillery and 18.000 machine guns. At the end of the war, France had 3,400 tanks (Figure 3). The air division had 370 fighter jets and 230 bombers.

Fig. 3 Schneider Tank (CA1)
(*source:https://upload.wikimedia.org/wikipedia/commons/thumb/5/55/Schneider_C*
A1_%28M16%29_tank.jpg/640px-Schneider_CA1_%28M16%29_tank.jpg)

However, in this war, "the technical revolution did not have the necessary respite to produce adequate ammunition in the field of strategy or tactics."[10] Regarding the endless stationing of the Western Front, it can be stated that "for the first time in history, nolens volens, a strategy of mutual siege was used, obviously, of a trench siege"[11].

In World War Two from a strategic point of view "started from the shortcomings of the first" The Germans understood that the next war can no longer be reduced to large masses of soldiers facing each other "barricades in fortifications or trenches, more or less efficiently sheltered from projectile

[10] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1I,* Bucharest, 2004, p.224.
[11] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1I,* Bucharest, 2004, p.229.

rain"[12]. Success in the next war will be given by the shock of the blow, by the development of the offensive with impetuousness and hitting the back of the enemy device and the disorganization of the enemy's leadership, communications and logistics. Guderian understood the role of the mechanized or armored force in a war of movement. He quickly realized that such a tactic required perfect coordination of armor, aviation and logistics, and a well-functioning transmission system. The first German armored division appeared on October 15, 1935!

The advent of aviation brings three-dimensionality to the war theater through the vertical component of the battlefield. "Mankind is on the threshold of an aeronautical era in which the destinies of all peoples will be decided in the air.[13]" In addition to land and sea personnel, flying personnel also appeared. This is how the air strategy appeared at the end of World War One. It concerns the preparation and use of air forces (air force strategy) and air means (air strategy of means), the design and conduct of attack and defense actions against ground, air or sea attacks (air operational strategy). (figure 4)[14].

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[12] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. II,* Bucharest, 2004, p.230.
[13] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. II,* Bucharest, 2004, p.169.
[14] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. II,* Bucharest, 2004, p.169.

Fig. 4 Spitfire LF Mk IX, *MH434*
*(source:https://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Ray_*
Flying_Legends_2005-1.jpg/330px-Ray_Flying_Legends_2005-1.jpg)

An interesting comparative study of the two world wars from a strategic point of view is interesting. After World War One, the applications of electronic warfare appeared, namely the use of radio waves in detecting obstacles and targets larger than the wavelength[15]. Radar, jamming and electronic countermeasures played an important role in the Battle of the Atlantic. German submarines were equipped with radars but Allied ships detected (located) and destroyed them. The Russians used the "Katiușa"

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[15] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.233.

(reactive projectile launcher) which caused a great deal of panic among enemies. Magnetic mines played an important role in the naval warfare.

It appeared in this war, 1935-1945, the combined operation in which practically all categories of forces were used. The mechanized forces were supported by aviation, strategic and tactical. So the operation became air-land, and the operation (landing) in Normandy was an air-sea-land operation. Through the strategic maneuvers of envelopment and return, the continuity (coherence) of the front disappeared. Germany used the concept of lightning war. France used the tanks for infantry support and not for the "iron fist". The French strategy and tactics were defensive, which was a big mistake. In World War II, German tactics had the following characteristics:

- Use of surprise, concentration of forces and speed of action;
- Neutralization of the enemy by strong artillery fire;
- Armor protection and the use of explosive shells;
- The siege maneuver;
- Use of the second echelon for the development of the deep offensive;
- Using paratroopers behind the enemy.

With the huge number of tanks, armored vehicles and artillery pieces, the Soviets used 180 infantry divisions and 27 armored divisions, a reserve of 90 divisions and tactically - the frontal strike, and at the strategic level the double envelope. They benefited from a number of 250 pieces of artillery / km. The Americans used 5 tons of bombs per square meter (m2) to conquer some islands, and they dropped 2 atomic bombs to destroy two Japanese cities (figure 5).
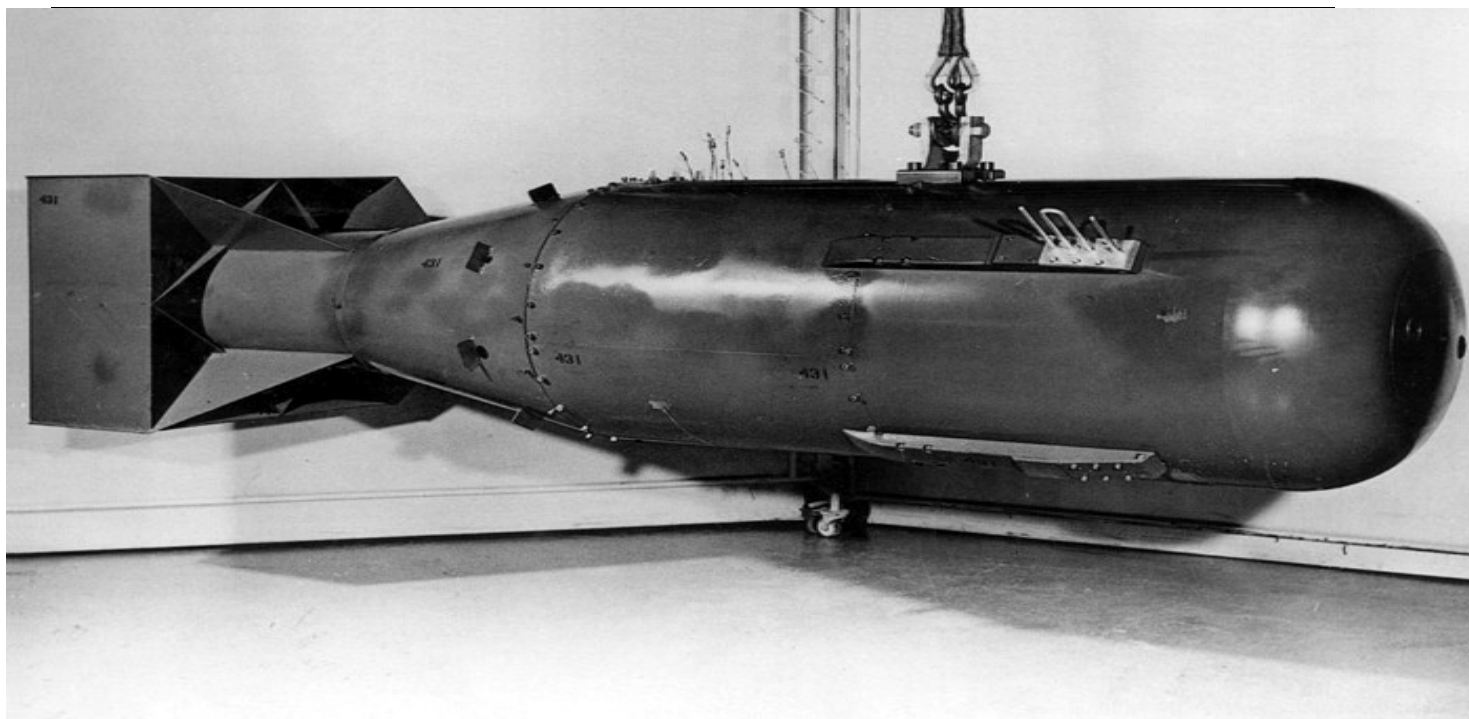
Fig. 5 „Little Boy"
(*source:https://upload.wikimedia.org/wikipedia/commons/thumb/6/6a/Little*
_boy.jpg/250px-Little_boy.jpg)

Since 1954, the United States and the USSR have had a hydrogen bomb (a hundred times more powerful than a nuclear weapon.) This highlights the absurdity of a war between the two superpowers[16]. Nuclear deterrence was developed in 1960. In 1968, the United States and the USSR began negotiations to limit strategic weapons SALT (Strategic Arms Limitations Talks). Weapon systems and C412SR systems also developed, which underpinned the Network-Based War (RBR), and many of the regional wars were during the Cold War, one of which was the Vietnam War in North Vietnam. A communist regime was established, and in the South a dictatorship against which the population revolted and in 1957 a

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[16] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. II,* Bucharest, 2004, p.248.

resistance movement appeared. supported by North Vietnam and the USSR. In 1964, Americans sent troops to support the dictatorial regime in South Vietnam. Due to the heavy losses suffered by the American troops, the negotiations began in 1963 under the pressure of the American citizens, and in 1973 the armistice (ceasefire) was concluded. In 1976 the Resistance forces (guerrilla movement) invaded the capital of South Vietnam (Saigon) and in the same year Vietnam was unified and the country was renamed the Socialist Republic of Vietnam. This war pitted two completely different strategies against each other. The US strategy was to attack Vietnam's vital centers, which did not even exist, and to destroy guerrilla forces. The guerrilla strategy was aimed at exhausting American forces, trapping them in the jungle in a series of traps, exhausting them, and forcing American and world opinion to end the war and withdraw from Vietnam. So this war was an armed clash between regular forces and guerrilla forces, between American units and Soviet-backed Vietnamese resistance. American units (troops) were neither prepared nor motivated for such a war. The Americans did not prepare for this war politically, strategically, tactically and militarily.

The war caused a great deal of excitement among the American people and a dissatisfaction among the American military who had suffered heavy losses of war. That is why measures were taken to prepare the troops in order to carry out the missions with minimal losses (this is how the concept of "zero losses" came about). Wars similar to the one in Vietnam represent a resistance to invasion as it is now the War in Ukraine invaded by Russian troops.

The terrorist attacks of September 11, 2001 in the USA marked a radical change in the reconfiguration of the security environment and the war. The US-led war in March 2003 (in a coalition of more than 40 countries) against Iraq is part of a new concept related to the war of the future. This war is part of the military strategy of the future as it implements such a strategy by digitizing the theater of operations and integrating operations. Thus, the United States D.41. was the first digitized division in

the world. It operates with weapons systems and equipment trained at CTC (Combat Training Center), JRTC (Joint Readiness Training Center) and NTC (National Training Center).

Terrorism is a continuous, asymmetrical and atypical war that manifests itself in various forms and formulas (bombings, kidnappings, NBC attacks, cyber attacks, etc.). Thus we are witnessing vengeful, pathological, political, economic, NBC, genetic, cyber, terrorism[17]. It manifests itself as a mosaic war, networked, random, generating chaos and at the same time generated by chaos[18].

The war against Saddam Hussein went through four phases: the beheading operation, the "shock and horror" operation, the step-by-step operation and the assault on the localities (figure 6)[19].

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[17] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.290.
[18] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.290.
[19] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, pp. 291-292.
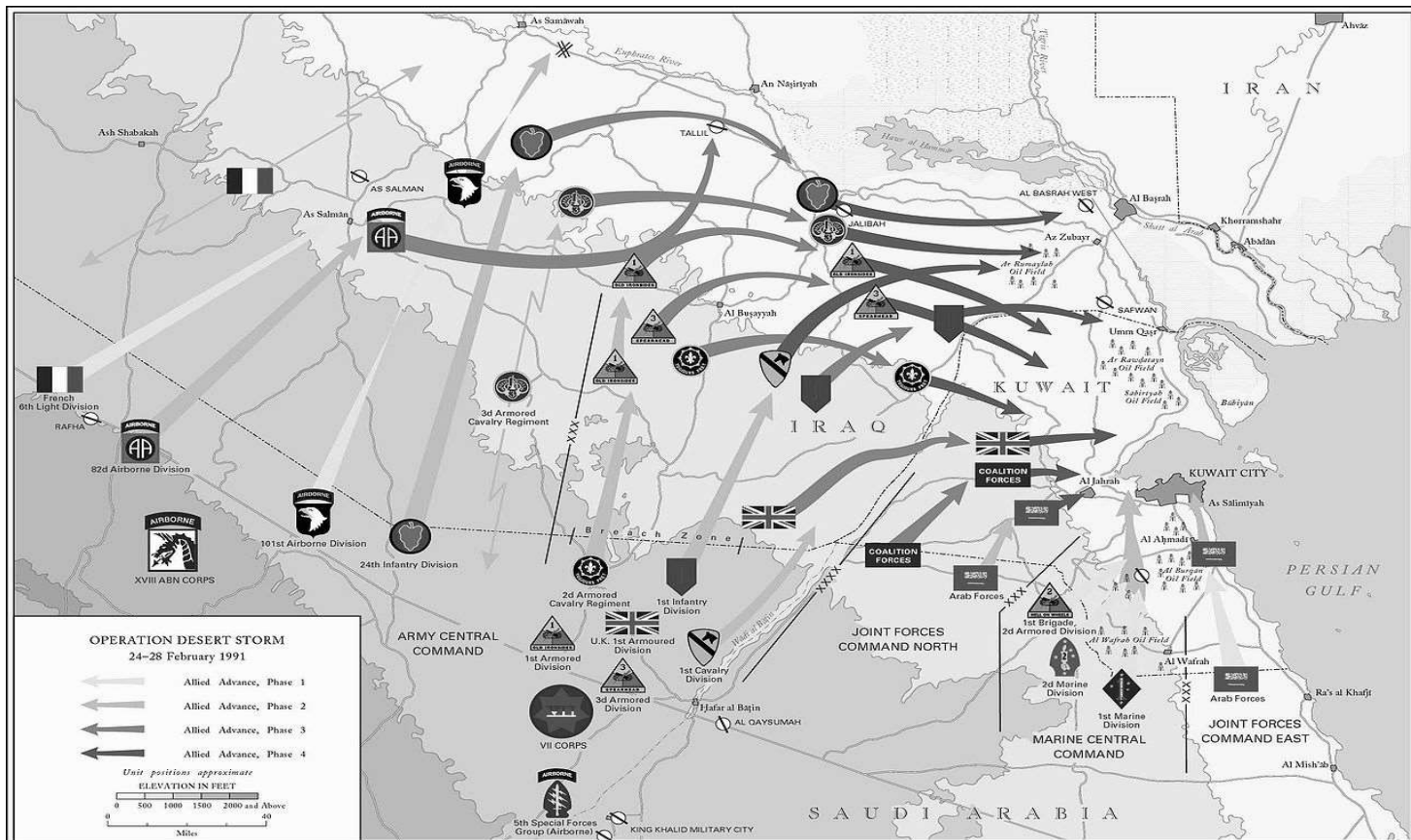
Fig. 6 Conflict scheme
(*source:https://upload.wikimedia.org/wikipedia/commons/3/31/Desert_Stor
m_Map.svg*)

The Americans had enough time to identify and locate all the strategic targets. At the start of the 1991 war, the Americans knew all about Iraq's defensive system and then hit them. The performance of the US intelligence and surveillance media was quite high, and yet in 1991 the Iraqis managed to hide their fighting devices with a good strategic disguise. In the February 1991 battle, an entire Iraqi division was killed. The Iraqi army's transmission system was then shut down within 24 hours. However, the Iraqi army operated according to the doctrine of the people's war,

fighting on successive (intermediate) alignments, in localities, in guerrilla actions and special detachment actions[20].

The Land Force that acted in the Gulf War (March-April 2003) was based on 3 important elements: the information shield, the integrated (joint) action that made an air shield (fire), the establishment of the ground device around the 1,000 high performance tanks. The American ground device was influenced by:

- Information supremacy;
- Air supremacy;
- Strategic initiative;
- Actions of Apache combat helicopters and A10 aircraft for the use of Land Forces and Navy Force;
- Presence of mines and ambushes;
- Exceptional strength of the M1 Abrams tank shield.

For the sake of mutual safety, tanks and fighting machines acted together, as in 1993[21].

The tanks did not advance in maximum speed directions into the depths of the enemy device. They represented the heavy nuclei of a combined (joint) force that advanced behind shields (informational, firearm, psychological, diversionary, etc.). In this war, the Americans applied the concept of Network-Based Warfare (RBR). The American armored vehicles acted as a conquest force behind the 3 shields (informational, air and fire). Figure 7

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[20] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.294.
[21] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.297.
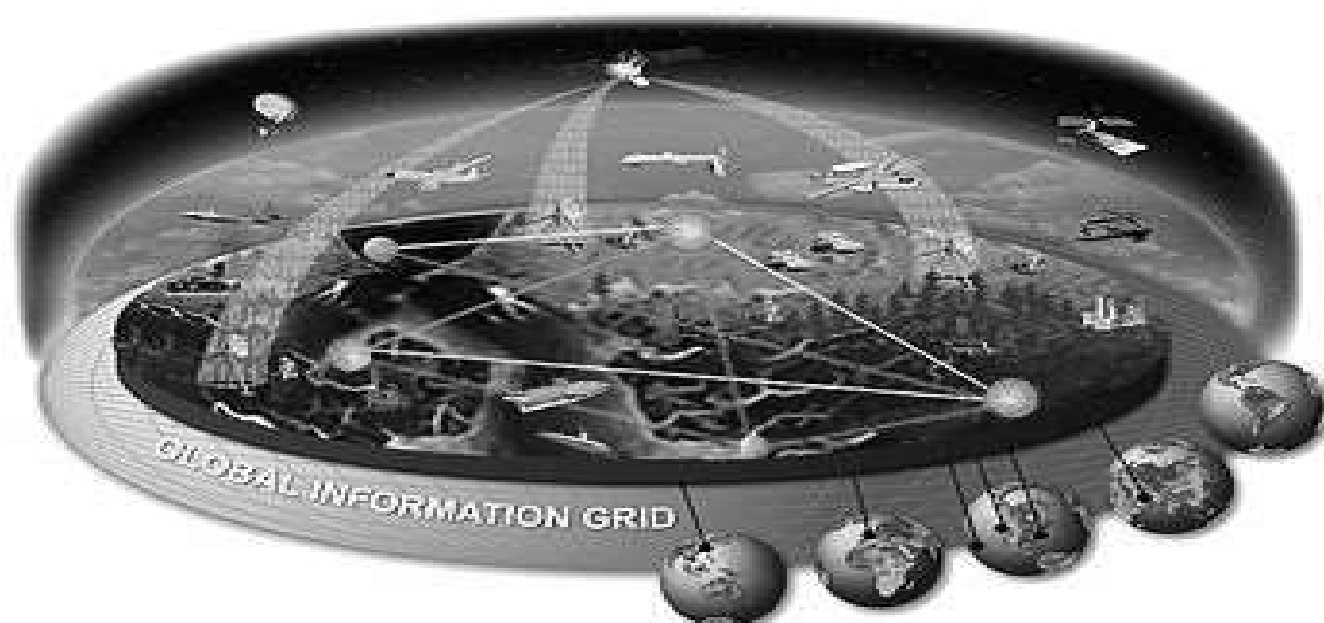
Fig. 7 Global network
(*source:https://upload.wikimedia.org/wikipedia/commons/0/00/Gig_ov1.jp*)

The concept of RBR is based on the concept of Revolution in Military Affairs, on the circulation of information in real time and has the following characteristics: it is modeled by nonlinear equations in chaos theory, based on complex dynamic systems, extracts models from the performing economy, smart weapon systems and network-based information and communication systems, tools of war are products of the market economy[22].

RBR is a modern warfare in which C4I2SR systems are used which are organized in a central network, a network of sensors and another of combat platforms. They use information technology, advanced weapon systems and modern technical capabilities. This war represents the

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[22] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. I1,* Bucharest, 2004, p.301.

materialization of RMA (the new revolution in the military field), is based on the integration in real and virtual networks of information collection and processing systems, command and control systems and battle platforms ensuring the acceleration of the driving cycle so that the gap between information and impact to be minimal, the reaction (action) becoming instantaneous.[23]

Conclusion

Technology has generated and can generate added value and stability but at the same time problems of instability, confrontations and terrorist manifestations.

Albert Einstein:

"I'm afraid of the day when technology will be more important than human relationships."

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[23] Popescu M., Arsenie V., Văduva, G., *Arta militară de-a lungul mileniilor, vol. 1I,* Bucharest, 2004, p.302-303.