

Battlefield of the future

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The Information Age has brought primary changes into our whole life. This is the age, when information and knowledge are the most important factors. The new age has changed military affairs as well. A new kind of warfare – the Information Warfare – has appeared that is the reason why this paper intends to introduce some aspects of this new warfare and its place – the Information Battlefield.

The main aim of this paper is to draw the readers' attention to the changed circumstances of warfare. The new circumstances require a new way of thinking, which can be developed only by keeping up with the latest information about what is happening in these fields. Today it is impossible to see clearly the future, however, the main trends, social, technical and technological positions and results determine a comparatively wide way, which can make good progress along the new way of thinking. If we would like to make this broad way into the future narrower, we have to map the most determinative factors that will change and develop the future as accurately as possible. This paper wants to give help for this work.

*“Whoever is first in the field and awaits the coming of the enemy,
will be fresh for the fight; whoever is second in the field
and has to hasten to battle will arrive exhausted.”*

(Sun-tzu: The Art of War)

Introduction

When we talk about future warfare and the battlefield of the future, we have to realize that we are living in a new age. This is the Information Age. In this age information is everywhere. The most powerful things in these circumstances are information and knowledge. It is true both in the civilian life and in military affairs.

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Warfare in the Information Age consists of characteristics that distinguish this age from the previous ones. These characteristics affect the capabilities that are brought to battle as well as the nature of the environment in which conflicts occur. Often in the past, military organizations pioneered both the development of technology and its application. The case is different today. Major advances in Information Technology are being driven primarily by the demands of the commercial sector. Furthermore, Information Technology is being applied commercially in ways that are transforming business around the globe.

Although there are many terminologies, strategies and definitions of the information society and information warfare we are obviously far from reaching full understanding of the impact of information warfare on tactics, strategy and doctrines. However, the explosion of information in societies all around the world and the associated technology determine that we have to find a way to measure the impact, and we have to change our way of thinking. We have to figure out and we should determine main characteristics which will determine future warfare and its place: the Battlefield of the Future.

Today, there are only a few armed forces, which can already “fight” in the new battlefield, however, most of the armies prepare themselves for the new challenges.

The aims of this paper are to describe some characteristics of the Information Warfare; to identify the challenges of the new age; to find new techniques and tactics that will occur in the Future Battlefield and how these influence future tactics, strategy and doctrines.

Although, many techniques and technical assets will be involved in the future air force and, as a matter of fact, the future air force will play principal role in every military actions, this paper’s goal is not to examine the strategy of the future air force, because this question would be the topic of another article. That is why this paper wants to introduce only those things and questions that could characterize ground warfare of the new age.

To accomplish the aims of this paper, at first the information age, the new threats in this age and the main roles of information in warfare are shown. The next part of this paper introduces the main characteristics of the new battlefield, and its main tactics and techniques.

This paper cannot be complete, because as it was mentioned before we cannot forecast absolute clearly the future or its battlefield either. Furthermore, the information revolution produces newer and newer assets and processes every day and the influence of them is not discernible beforehand.

The information age

The revolution in the information technology and the information techniques has changed the whole world since the 1950s. This revolution offers newer and newer techniques, devices and methods from the everyday life to military affairs each day. The Information Age is changing the creation of wealth; it is altering the distribution of power; increasing complexity; shrinking distances around the world; and compressing time, which increases the tempo of our lives.

Although we are at the very early stage of the Information Age, we are experiencing profound changes in the nature of our world. Wealth and power, for so long the providence of the few, are being created with new time constants and distributed far more widely.

There is another serious thing that we have to take into consideration. This is the fact that we cannot see and forecast clearly how future economy will act in ten or fifteen years. It means, for example, that in the early '80s, governments could not realize beforehand the economic situation for the new century, that caused a lot of financial and economical problems when we walked into the new age.

Science has a very important role in the Information Age. Information Technology is unrealizable without science that is a real basis for research and development. That is why knowledge as well as information are in the center of the Information Age, and the development of them also has an important role that can be supported by science.

Information Technology is the backbone of the Information Age. The underlying trends in Information Technology are coalescing to create orders of magnitude increases in the ability of human beings to operate in the information domain. At the most basic level, the primary observable of this quantum improvement in the information domain can be observed in the dimensions of speed and access.

There are many activities and operations, the time required by individuals to access or collect information relevant to a decision or action have been reduced by orders of magnitude, while the volume of information that can be accessed has increased exponentially.

In the Information Age more and more organizations, institutions and companies are becoming international or global and in this way the Information Age reduces the importance of location, and the interests of these organizations, institutions and companies are becoming less aligned with the governments, that could play an important role in a conflict.

We call the society of the Information Age Information Society. Information Society is not a special kind of form of state, but it is the social projection of the accelerated age.

As it was mentioned before, Information Age and its Information Technology offer countless devices, methods, techniques and tactics for the everyday life. It is also true in the military affairs. There are many new kinds of weapons by the Information Technology that we can use with more effectiveness, accuracy and preciseness as before the history of war. But weapons are not only instruments of power in the Information Age. Information is the real power in this age. Information technologies are greatly improving our ability to collect and store data, process and analyze it to create information, and distribute it widely. Information is being transformed from a relatively rare product into a plentiful one; being turned from an expensive commodity into an inexpensive one; and being freed from the control of a few to make it almost universally accessible.

Threats in the new age

Manuel W. Wik said in an article “information and knowledge have always been – and are now more than ever - part of the economy of a nation, of a corporation, and of a family. In the information society “*knowing*” becomes more important than “*owning*”. As information age evolves, society will be threatened in new ways.”¹

We are using so many information systems, but we do not realize our significant dependence on them. This is one of the most dangerous threats in the new age.

We have a very complex and hard work when we would like to understand, analyze and follow the accelerated changes in our world. As Alvin Tofler, the famous American futurist and scientist mentioned in an interview “We were not only saying that accelerating change is hard to adapt to, but that acceleration itself has effects on the system. The ability to adapt is not dependent entirely on whether you are going in what you would regard as a happy direction or an unhappy direction. It is the speed itself that compels a change in the rate of decision making, and all decision systems have limits as to how fast they can make complex decisions. That takes us to the computer. The early assumptions were that the giant brain was going to solve our problem for us, that it was going to get all this information together and that therefore life would be simplified. What it overlooked was the fact that computers also complexify reality.”²

However, there are many other kinds of threats but in new ways than before during the human history. These have also close connection with this age, and its technological revolution. Just some examples: We have already experienced many “weapons”, which

are products of this age and which could be used against the information systems, computer networks, etc. These are computer viruses, worms, logic bombs, Trojan horses, software backdoors. As we have seen during the last years, these became real and considerable threats.

Information in warfare

The importance of information and its role in warfare is not new. We have many examples from the history of military affairs that emphasize these facts. Sun Tzu, the famous Chinese strategist analyzed in his book – *The Art of War* – the role of information in war. He underlined that information is essential to forecast, to analyze and to evaluate the conflict or a war.

He wrote that information is critical in processes of surveillance, situation awareness, strategy development, and searching of alternatives and risks for decision making. He wrote about information a very surprising thing, namely that the use of information has a special role when we use information to deceive the enemy. He wrote “All warfare is based on deception. Hence, when able to attack, we must seem unable; when using our forces, we must seem inactive; when we are near, we must make the enemy believe we are far away; when far away, we must make him believe we are near. Hold out baits to entice the enemy. Feign disorder, and crush him.”³

In *Understanding Information Age Warfare*⁴ the authors expressed that to understand how information affects our ability to perform military operations it is necessary to think about three domains – the physical domain, the information domain, and the cognitive domain.

The physical domain is the place where the military seeks to influence on the enemy. It is the domain where strike, protect, and maneuver take place across the environments of ground, sea, air, and space.

The information domain is where information lives. It is the domain where information is created, manipulated, and shared. It is the domain that facilitates the information flow among warfighters. It is the domain where the command and control of modern military forces is communicated, where commander’s intent is conveyed.

The cognitive domain is in the minds of the participants. This is the place where perceptions, awareness, understanding, beliefs, and values reside and where, as a result of sense making, decisions are made. This is the domain where many battles and wars are actually won and lost.

Information warfare – Information dominance

As we have seen above, information is very important in our age, and it also has a special meaning in military affairs.

Before we specify a definition for information warfare we have to realize that in the new age a country will be competitive only if it is successful in the area of information superiority, information dominance and information supremacy.

The information warfare is to reach information dominance over the adversary. It means that we have more information than the opposite forces, and it is more accurate, precious and more useful for us. As a matter of fact there are numerous definitions for the information warfare, but only a few of them are in such a compact form as Edward Waltz drafted, who collected many definitions from the United States Joint Chiefs of Staff's Joint Publication 1-02, and he gave a representative definition: "Information Warfare includes actions taken to preserve the integrity of one's own information system from exploitation, corruption, or disruption, while at the same time exploiting, corrupting, or destroying an adversary's information system and the process achieving an information advantage in the application of force."⁵

In general, information warfare could appear in numerous ways. Just some examples:

Net warfare (Netwar): it is a very dangerous form of the information warfare because it can be an attack against the highest information systems of the society, against the whole nation, while the attackers may have no physical force. The weapons of net warfare include diplomacy, propaganda campaigns, deception or false information, viruses using computer networks.

Political warfare: it is a special meaning of information warfare when a nation uses its policy, diplomacy and threats to enforce its interests.

Economic warfare: a nation intensifies its political warfare to turn into economic influence.

Command and control warfare: "The most intense level is conflict by military operations that target opponent's military command and control."⁵

The new place of war: The information battlefield

During the evolution of military affairs, we accustomed to the four dimensions of place where wars can usually take place. However, the information age brought a new – the fifth – dimension beyond the traditional land, air, sea and space area, which is the information or digital battlefield. Certainly, in the future, real war will take place in the

physical dimensions but information will be more valuable there, that means the information dimension will be parallel with the traditional fields. The war we fight for getting, keeping and processing the information will occur in this fifth dimension simultaneously with the fight in the another four battlefields.

Information collection, information processing and dissemination use digitization to reach their goals. For this reason the information or digital battlefield uses all kinds of real or virtual areas, devices, equipment or systems where information occurs.

The information or digital battlefield is a special part of the global information environment,* because it uses many information systems, which are parts of the global information environment.

The structure of the digital battlefield is shown in Figure 1.

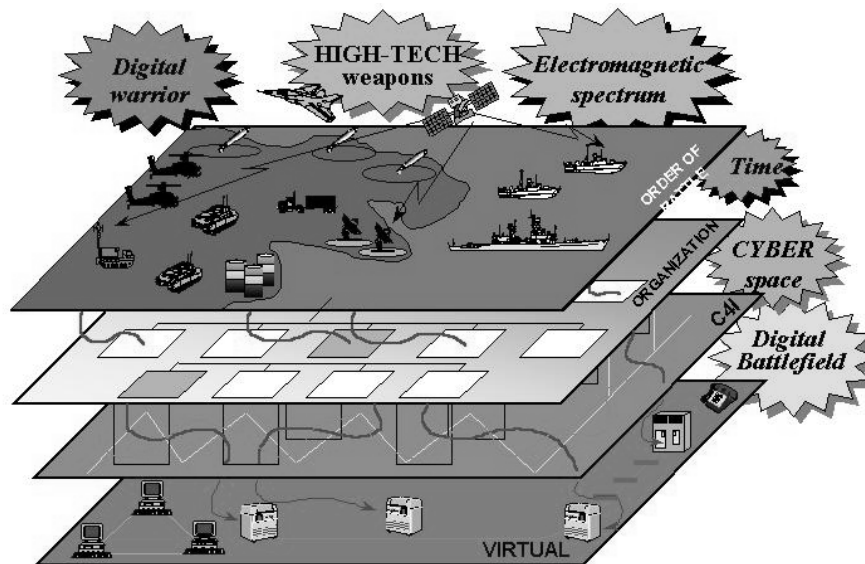


Figure 1. The structure of the information battlefield

* The global information environment includes all kind of international and national information environments

Digitization is also essential when we talk about the role of armed forces in the new ages' battlefield, because digitization is the only way to gain information superiority, win information operations and provide deciders, shooters, and supporters with information.

“Digitizing the battlefield is the:

- application of information technologies to acquire, exchange, and employ timely information throughout the battlefield;
- tailored to the needs of each commander, shooter, and supporter;
- allowing each to maintain the clear and accurate vision of the battlefield necessary to support mission planning and execution.”⁶

The digital battlefield will be a multidimensional area of war, where the traditional military actions and information operations will occur simultaneously. This battlefield will be a distributed field where the military forces will use precise and “smart” weapons, and the weapon systems will be integrated with each other. Modern military forces will not be effective in the new battlefield without surveillance in depth; accurate target location; identification and tracking; links to joint capabilities; shared situational awareness; information dominance; battle management and force tracking; and maximum protection of the forces.

Tactics and techniques in the new battlefield

Intelligence

Intelligence plays very important role in the new battlefield, because this is the main tool to collect all information needed for the area of decision making or execution. Intelligence according to the JP 1-02 is “1. The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas. 2. Information and knowledge about an adversary obtained through observation, investigation, analysis, or understanding.”⁷

The information technological revolution offers more and more new technical equipments and devices every day for using them in the intelligence. Just some examples:

IMINT – imagery intelligence: there are new infrared and electro-optical cameras, which provide higher resolution and intelligence distance than ever;

RADINT – radar intelligence: SAR – Synthetic Aperture Radar, MTI – Moving Target Indicator has appeared, which can give a picture quality resolution with radar intelligence;

SIGINT – signal intelligence: there are numerous new SIGINT devices that can receive the new communication radio emission modes and which are able to identify their locations automatically.

During the last decades many new platforms have appeared that are able to carry the modern intelligence devices. One of them is the family of Unmanned Aerial Vehicles (UAV). UAVs operate without pilot, that means they do not risk human life when they accomplish their mission behind the enemy lines.

However, because of the fact that in the digital battlefield there are a lot of new kinds of intelligence systems, devices and equipments, we have an enormous amount of information. As they provide so large amount of information during the information collection process, it can cause very serious problems in the phases of information processing and analysis. These phases require hard based collection management, processing and analysis techniques. One of them is the data fusion technology.

Situational awareness and battlefield visualization

Situational awareness gives the commanders at all echelons near real-time information about the current situation. At first, the commander has to know the disposition of his units without having to visit each unit on the ground. Technology must provide information that can be displayed electronically, depicting the accurate location of critical systems and units in the battlefield. During the battle, commanders have to know the physical position of enemy forces. Visualization of the enemy forces must include awareness of the enemy's speed of advance, their current operations and known vulnerabilities. Total mission awareness requires that noncombatants like refugees, evacuees, prisoners of war, or members of nonmilitary organizations are considered in the commander's vision of the battlefield. Technologies must provide information about the environment including geography, hydrology, weather, seasonal conditions, vegetation, and terrain for the battle commander. The commander must know immediately when the conditions of environment change. Environmental effects must be represented within the common relevant picture to ensure battle commanders consider their potentially dramatic effects during planning, rehearsal, and execution of operations. The commander requires the ability to see the battlefield where his forces and the enemy will deploy, maneuver, and fight. Terrain visualization includes both natural and man-made features to include impacts of terrain on vehicle speed, maintenance, river-crossing operations, and maneuverability. Terrain visualization provides common terrain background for all users and all applications.

“To be successful in battle, the commander must apply experience and intuition to sort through the myriad of information available on the battlefield.”⁸ There are three aspects of the commander’s vision on the battlefield.

The first is understanding the current state of friendly and enemy forces. The commander has to know the physical location of forces, he must have information about the environmental factors and combat readiness.

The second aspect of the commander’s vision is the ability to clearly discern a desired end state.

The third aspect of visualization is the ability to see and understand the dynamic relationship between the opposing forces as the commander leads forces through the sequence of activity from current situation to final end state.

Visualization of the battlefield requires the use of operational tools. These operational tools are mainly technology tools. However, technology alone cannot provide the commander with full visualization of the battlefield. Technology must be used together with the commander’s experience, wisdom, knowledge and intuitive sense to enhance the visualization of the battlefield. Technology tools focus on four areas: total mission awareness; mission planning, rehearsal, and execution; future technology requirements; and technology integration.

During the last years a very interesting kind of technique appeared for battlefield visualization as a result of advanced researches. Many researchers think that a special kind of virtual reality tool will be a good solution for battlefield visualization. One of them is called Virtual Command Post. “For survivability, future command posts will be established and operate in a dispersed configuration. These command posts will consist of small, highly mobile elements. The commander and his staff officers will each operate from one of these elements. Face-to-face communications will be effected through the use of audio and video teleconferencing, data distribution and virtual reality. Audio, real-time video, three-dimensional visualization of terrain, and images of maps, overlays, functional equipment, and participants will be combined into the virtual reality space of each commander and staff officer. The virtual reality space of each conference participant will reside in his own local computer. The commander will have complete freedom to move about the battlefield, interfacing with his subordinate commanders and staff via a virtual conference. He will have the same facilities immediately at his disposal whether he is dismounted at a forward observation post, seated in his command vehicle, or being briefed in a face-to-face session at his main command post.”⁹

Command and control, and the C4I systems

We have seen that in the new age the essential factors are information and knowledge to reach our aims. In the new battlefield the commander's knowledge and experience will play critical role. To execute his tasks the commander requires many organizations, troops, processes and systems that enable him to understand the current situation and provide intent, plans and directions, and give him real decision support information. Moreover, the new age has brought some new problems into the command and control. For example, the commander uses more information systems and it is a difficult task to create the right conditions for making interoperability among them. Another problem is that the new battlefield is more complex, its structure has more levels and the commander has to organize the required flow of information in these circumstances.

To help the commander's work in the new battlefield there are command, control, communication, computer and intelligence systems – C4I systems – to support the required information flow. Shortly after when the C4I systems appeared we had to complement this concept with surveillance and reconnaissance, that is why we call these systems C4ISR. The main missions of C4ISR systems are: battlespace monitoring, awareness, help to understand the current situation for the commander, sense making, command intent, battlespace management, synchronization, and provide the essential information and communication systems to support these tasks.

Identifications, navigation and location report systems

In the battlefield the question "Where am I?" has a very serious meaning. To know where the friendly forces are, and to know where the enemy is are always essential tools to survive the war. We have already had satellites as GPS (Global Positioning System), Glonass (the Russian made satellite positioning system), which can provide us exactly positioning data. These systems will complement in the near future with the European made Galileo satellite positioning system.

But what happens when the commander wants to know where his forces are. Today we already have a good example representing the modern location systems. This is the American Enhanced Position Location and Reporting System – EPLRS. This is a line-of-sight (LOS), data-only digital radio system. EPLRS is a command, control and communications radio system that provides the United States Army with the ability to avoid fratricide through situation awareness, in the form of battlefield data distribution, position location, navigation and reporting. The digital system uses spread spectrum radio waveform and embed cryptography to protect the data.

EPLRS provides rapid, jam-resistant and secure data transfer among the information systems. It provides services such as position/navigation (POS/NAV) coordinates and battlefield control measures that significantly enhance the force in its conduct of operations in all tactical environments. EPLRS enhances the combat unit's ability to rapidly and decisively control and execute operations by transmitting data and maintaining real-time situation awareness. When using EPLRS, collecting position data is automatic and commanders can accomplish it in seconds. Current position data allows commanders at all echelons to use available combat power efficiently. EPLRS communications and POS/NAV capabilities support FBCB2 (Force XXI Battle Command Brigade and Below) to accomplish the maneuver sub-functions.

Soldier of the new battlefield looks like a "digital warrior". His personal equipment includes numerous state-of-the-art devices such as personal computer, GPS receiver, tactical data and communication system, body-LAN, night vision device, infra-red binoculars, battlefield identification system. With these systems he is able to reach the latest picture of the recent battlefield, intelligence data and computerized mission plans.

New weapons

I have already mentioned some new kinds of "weapons" in the new age. These are computer viruses, worms, logic bombs, Trojan horses, software backdoors. However, these are "soft" weapons.

Moreover there are some "harder", but not lethal weapons, for example the Electromagnetic-bombs (E-bomb). Since we use many electronic devices and systems and our dependence on the electronic devices is so high, the E-bomb can cause inestimable damages, because this weapon attacks all kinds of electronic devices.

The E-bomb concept is based on the Electromagnetic Pulse effect. "The effect is characterized by the production of a very short (hundreds of nanoseconds) but intense electromagnetic pulse, which propagates away from its source with ever diminishing intensity, governed by the theory of electromagnetism. The Electromagnetic Pulse is in effect an electromagnetic shock wave. This pulse of energy produces a powerful electromagnetic field, particularly within the vicinity of the weapon burst. The field can be sufficiently strong to produce short lived transient voltages of thousands of Volts (ie kiloVolts) on exposed electrical conductors, such as wires, or conductive tracks on printed circuit boards, where exposed."¹⁰

According to these facts electronic devices will not operate in case of an E-bomb attack. Could you imagine your life without properly working electronic devices?

Just imagine a day when there are no working computers in your office, no public transportation, no working cars, no electricity, no heating systems, etc. This kind of weapon is especially dangerous in our everyday life, but it can cause serious situations in the modern battlefield.

Conclusions

We are living in the Information Age. The last decades have brought primary changes that occurred in everyday life and in military affairs as well.

In this age information and knowledge are the most important factors. Information will have determinant role in a future war. It means that we have to pay more attention to the role of information in the military affairs and in war. We should continue the research of the newest field and latest military concept, the research of Information Warfare.

The main goal of the Information Warfare is to get information dominance over the enemy. But it is not an easy work. At first, we have to get as much information about the enemy, friendly forces, weather, environment and these effects on the battle as we can.

When a commander is in battle, he wants to know everything. The information age's technology gives us a lot of new kinds of intelligence, reconnaissance and surveillance devices. If we use these devices, platforms and applications we can ensure the commander enough information.

We can use intelligence sensor platforms as satellites, unmanned aerial vehicles, many kinds of airplanes and we use many intelligence devices such as optical or electro-optical, synthetic aperture radar, laser devices etc.

These sensors give us large amount of information. Moreover, this amount of information is too big for handling it in an easy way. It means that at first we have to process this large amount of information and after that we have to change it into a special kind of decision making support information.

The structure of the information on the digital battlefield is very complicated and it has many levels. To accomplish the commander's mission on this battlefield under such hard circumstances we have to use all kind of information systems, devices and equipments that are offered us by the Information Age.

Although the Information Warfare and its place – the information or digital battlefield – are very new topics in the area of military affairs, I think it is necessary to continue the research, because these factors will be dominant, and just those will be able to reach the last victory in the future who are prepared for the new kind of warfare.

This paper tried to introduce the place where the war of the new age (the Information Age) will take place. New technologies assets and tactical processes were shown which will have important roles in the future battle. To understand and develop our armed forces to this battle and to the new kind of warfare we need to analyze and study those technical, technological and philosophical methods and processes which will determine the warfare and all military affairs in the Battlefield of the Future.

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