

ELECTROMAGNETIC SPECTRUM DOMINATION

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Abstract: *In this paper the importance of electronic warfare is presented taking into consideration the information age environment. In order to understand the electronic warfare in the information age, first we should understand how the electromagnetic spectrum is used today. Electronic warfare actions aim at the employment of electromagnetic spectrum for its own use while limiting its use by the enemy. In this context, any device involving the use of electromagnetic energy is important in terms of electronic warfare. In the information era, military relies heavily on the use of the electromagnetic spectrum for communications, electronics, surveillance, research, navigation, weapons systems, own protection, etc. After the land, sea and air battlefield we should add the electromagnetic spectrum and cyberspace battlefield. And to control in an efficient way these new battlefields we should have a special structure with a specific mission. This structure is vital also because a lot of operations are conducted during the peace times as electronic support operations.*

Key words: *Electronic warfare, Electromagnetic spectrum, Electronic attack, Electronic support, Electronic defense*

I. INTRODUCTION

Today the electromagnetic spectrum is used in an increased number of military systems.

Without electromagnetic spectrum we cannot imagine network centric warfare in information age. We use a lot of sensors based on electromagnetic spectrum in order to obtain a live image of the modern battlefield.

In the same time we use electromagnetic spectrum to transmit information between our military systems in a flexible way. For this reason the access to electromagnetic spectrum is vital for modern military operations.

The electromagnetic spectrum is the new battlefield of our age. Electronic Warfare (EW) – is defined as the operating military action involving the exploitation of the electromagnetic spectrum which presupposes the emission interception and identification, electromagnetic energy engagement, including the directed energy, while reducing or preventing hostile actions within the electromagnetic spectrum.

In order to understand the electronic warfare in the information age, first we should understand how the electromagnetic spectrum is used today.

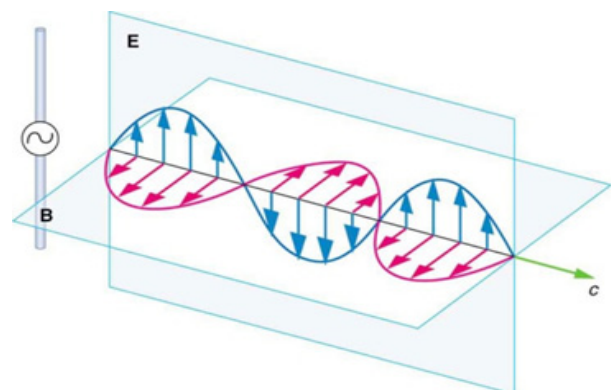


Fig. 1 Electromagnetic waves

First let us go back in history when all these things started.

The information age is deeply rooted in the industrial age, when James Clerk Maxwell (1831-1879) proved theoretically the existence of the electromagnetic field. In 1865, he published his work “*A dynamical theory of the electromagnetic field*” where he demonstrated that the electric field creates magnetic field and the magnetic field creates electric field and both travel in space in form of waves, at the speed of light.

He told us that we are surrounded by an electromagnetic spectrum.

The next big step was taken by Heinrich Rudolf Hertz (1857-1894) who practically demonstrated the existence of the electromagnetic waves. This research gave us the possibility to communicate over very long distances. For the very first time in history, we were able to communicate over long distances at the speed of light.

Electronic warfare actions aim at the employment of electromagnetic spectrum for its own use while limiting its use by the enemy.

In this context, any device involving the use of electromagnetic energy is important in terms of electronic warfare. In the information era, military relies heavily on the use of the electromagnetic spectrum for communications, electronics, surveillance, research, navigation, weapons systems, own protection, etc.

It becomes obvious that the dominance of the electromagnetic spectrum is a crucial component of military operations in the information age, based on intensive use of information systems and electronic communication in general.

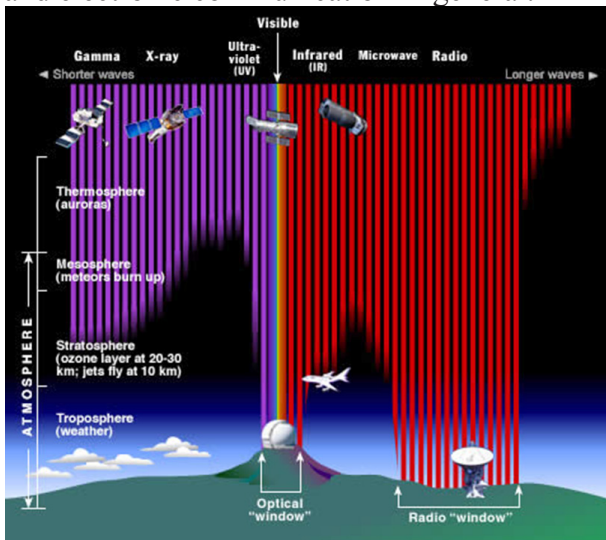


Fig. 2 Attenuation of electromagnetic waves in atmosphere

In order to dominate the electromagnetic spectrum both offensive action (electronic attack EA) and defensive actions (electronic defense ED) are needed.

These two actions always require informational support provided by electronic surveillance actions (ES).

Electronic warfare is an important form of strategic, operational and tactical insurance which is organized and implemented in all forms of combat actions in all types of armed forces.

Considering this, it is necessary that electronic warfare actions to be synchronized in all types of armed forces to the efficient exploitation of the electromagnetic spectrum itself. To get a clear-cut picture of how the earth's atmosphere attenuates the electromagnetic waves, according to their frequency, it is necessary to analyze Fig. 2. It is noted that most of electromagnetic waves from outer space, do not reach the earth because they are attenuated by the earth's atmosphere. However, there are two "windows" which provide the minimum attenuation of electromagnetic waves, for radio waves, and a part of the visible and ultraviolet spectrum.

According to the standards, the radio and microwave spectrum is divided into several frequency bands according to Fig. 3.

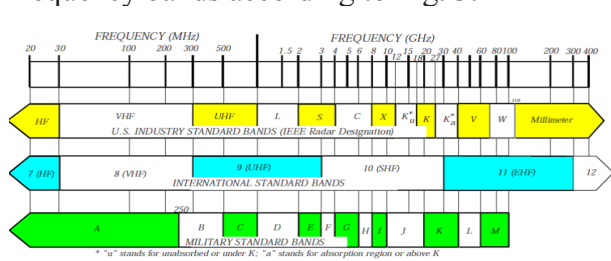


Fig. 3 Frequency bands according to standards

II. SPECIFIC ACTIONS OF ELECTRONIC WARFARE

Electronic warfare actions are electromagnetic operations specific to electronic warfare that produce effects in the electromagnetic environment and provide operational support.

These actions are:

- Electronic Surveillance – ES
- Electronic Attack - EA
- Electronic Defense - ED

Electronic warfare is that military action based on exploiting electromagnetic energy to obtain situational awareness and offensive and defensive effects.

Together with the conduct of electromagnetic operations, it represents warfare in the electromagnetic environment.

Electronic surveillance – ES – represents the activity of exploiting the electromagnetic energy for situational awareness and for information gathering.

Electronic surveillance is focused on providing knowledge of the electronic situation at any time and of cues and warnings on the activities of the electromagnetic environment.

Electronic surveillance includes monitoring of electromagnetic environment with the purpose of immediate threat recognition in support of electronic warfare operations and other tactical actions such as avoiding threats, directing their weapons to combat and target selection.

Electronic surveillance actions include configuration and allocation of resources for electronic surveillance missions, the modality of sending the operational commander of data gathered from the electromagnetic environment and using them for tactical decision making.

Electronic defense – ED – represents the action of using the electromagnetic energy to protect own and allied forces and the effective use of the electromagnetic spectrum by them.

Electronic Defense – ED represents the actions taken to ensure effective capacity utilization, for self-interest of the electromagnetic spectrum when EW specific means are used by the enemy.

ED consists in those passive or active measures taken to protect personnel, facilities or equipment from the effects of enemy electronic warfare actions or friends that reduce, cancel or destroy their combat capabilities.

Directed energy weapons DEW are weapons of defense-electronics, when used for defensive purposes.

Most modern combat systems using electromagnetic energy from own forces or NATO endowment, have working modes designed to resist the effects of enemy electronic attack.

As with ES and EA components of EW, ED use is a way to obtain a military advantage in a given conflict situation.

The essential difference between these components is that, while ED is an integral part of the design or operating methods and means of electronic systems, the ES and EA implementing requires special equipment, operation governed by a number of specific rules.

Naturally, from the definitions accepted for EW components, it results that ED virtually opposes the other two, with different purposes. Therefore, any development or modification of ES and EA technologies involves an immediate reaction from ED technologies and vice versa.

Electronic attack – EA – represents the action of using electromagnetic energy, in offensive purposes.

Electronic attack involves the use of electromagnetic energy, of directed energy or anti-radiation weapons to attack personnel, facilities and equipment intended to degrade, neutralize or destroy the enemy's fighting ability, being considered a form of "fire". Electronic attack is used to hinder, interrupt, misinform, or prohibit the destruction of command and control capabilities and of the enemy's fight and to reduce its ability to model and exploit the electromagnetic environment. Electronic attack / EA includes directed energy weapons / DEWs, high power microwaves / HPM, electromagnetic pulse / EMP and radiofrequency devices / RF, having an important role in destroying the opponent through joint operations and combined kinetic and electromagnetic attacks. To ensure maximum efficiency, the performance of an efficient electronic attack is performed only after understanding how to use electromagnetic environment by the adversary.

CONCLUSIONS

Taking into consideration all this elements it is obvious we need a single structure to control the access to electromagnetic spectrum.

After the land, sea and air battlefield we should add the electromagnetic spectrum and cyberspace battlefield.

And to control in an efficient way these new battlefields we should have a special structure with a specific mission.

This structure is vital also because a lot of operations are conducted during the peace times as electronic support operations.

For this structure the mission cannot be splinted in peace, crises and conflict mission. This structure must be operational 24/7/365.

Otherwise without this structure when the conflict occurs we will lose the fight because during the peace time our systems were compromised.

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