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SPACE TECHNOLOGY, PATTERNS OF WARFARE AND FORCE BUILD-UP: BETWEEN A POWER AND A SMALL STATE

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Space Technology, Patterns of Warfare and Force Build-up: Between a Power and a Small State

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Abstract

This article concentrates on the question of how the expansion into space, which was part of the information and space technology revolution, affected patterns of warfare and concomitantly affected force build-up in the US and Israeli military forces . It will describe and analyze the influence of space technologies on the changes that have occurred in military thinking and in warfare patterns and the ensuing effect on the structure of military force in the US and Israel in the last 25 years. This research indicates that the ability to develop space technologies and to attain power in space is not exclusive to great powers. Small countries with relatively modest budgets can also excel and exploit opportunities which were unavailable to them when the emphasis was on size and quantity instead of on high quality as is the case in the information and space age.

¹ This article is based on comprehensive research carried out for my MA thesis. I wish to thank Prof.

1 Introduction

An accepted view in current military thinking defines modern armies at the beginning of the 21st century as those for whom information plays a central role in strategic thinking, patterns of warfare which are established and force build-up. The new strategic concepts from which patterns of warfare are derived are those which place the greatest value on information. The term “information superiority”² is interpreted somewhat differently by various schools of thought, but is central to all of them.

Technologies of space, which are for the most part information technologies, assist greatly in achieving this information superiority. It can, therefore, be argued that there is a direct link between the development of a capability in space and adoption of modern, information-based warfare patterns. The new strategic vision that has emerged in the US in the last decade sees space as a central axis - a theatre of warfare equivalent to Land, Sea and Air.

This article concentrates on the question of how the expansion into space, which was part of the information and space technology revolution, affected patterns of warfare and concomitantly affected force build-up in the US and Israeli military forces . It will describe and analyze the influence of space technologies on the changes that have occurred in military thinking and in warfare patterns and the ensuing effect on the structure of military force in the US and Israel in the last 25 years. This topic has not received adequate attention – in particular with regard to military developments in small countries. This research indicates that the ability to

² This concept, however it may be defined by strategists and military thinkers, depends on a presence in Space. Space permits acquisition of information through means which previously did not exist. It permits dissemination of huge amounts of information from one place to another at enormous speed

powers. Small states with relatively modest budgets can also excel and exploit opportunities which were unavailable to them when the emphasis was on size and quantity instead of on high quality, and information superiority as is the case in the information and space age. This is highly important for small countries whose military forces are relatively small. Here lays an opportunity for them to enhance their power in terms of quality rather than quantity. Space technologies in this respect, serve as force multipliers. This does not mean small states can or should copy what large powers are doing. Rather, they need to find their own way in space.

The decision to focus on the US and Israel stems from a number of considerations. The primary criterion was their development of an independent capability in space. The US has possessed the capability for independent activity in space for almost 50 years. Israel established its space program 25 years ago and limits itself to developing independent capabilities in two major spheres: remote sensing, communications and launching capabilities. The US and Israel maintain permanently engaging militaries, each in its own realm: the US in its role as a global power and Israel in the more narrow theater of the Middle East. Both countries engage in development of advanced technologies, and incorporate them in armies, which are viewed as sophisticated and advanced. The enormous existing difference between a superpower and a small state was also a criterion for selecting them³.

³ There is a huge gap between Israel and the US in terms of level of transparency and access to data and documentation. Any researcher seeking information on processes and trends in the US Military has at his disposal large and comprehensive databases of documents and articles describing the changes that have taken place in strategic and military thinking as well as quantitative statistical information. In Israel, there is very little unclassified material which deals with strategic and military thinking on military force build-up. In order to circumvent this problem, the research is based on an analysis of a broad range of unofficial public sources which, when taken together, create a fairly complete picture of the trends and processes which are involved in Israeli force build-up.

The similarities which can be found between the military and operational concepts of the US and those of Israel in this regard, result, among other things, from the special relations that exist between the two countries and the ongoing dialogue which is carried on between their armies. In both militaries, a great deal of emphasis has been placed on exploitation of space technology in order to attain information and synchronization between the conflicting forces, to achieve dominant maneuver in the battlespace, precision attack capabilities and guiding of forces as well as control or dominance in space.

To summarize we can posit the following:

1. The Space Race facilitated a broad range of technological, military and civilian applications, which contributed greatly to the information revolution and led to changes in military thinking.
2. The change in warfare patterns requires adaptation of force build-up and investment in information technologies including space technologies.
3. The transition from the industrial era in which power was measured quantitatively to the information age, in which power is measured qualitatively, constitutes the essence of this change. The information revolution and the transition into space, which is an essential part of it, affords small states opportunities to enhance their power and better their international position, which were previously unattainable with small budgets and small forces.

Implementing these opportunities involves making a conscious choice of where to focus attention and in which technological areas to invest. An example of this is Israel's decision to concentrate on developing independent capabilities in the areas of

other areas such as navigation and early warning.

The essay is divided into four parts. In the first part I will relate to the existing theoretical literature which identifies the post-Cold War era American military as information age military force, which strive for superiority in attaining information through, inter alia, the use of space technology. This literature lacks the attention on the implications of space for the force build-up.

The second part will deal with the development and changes in military thinking in the US and its implications for force build-up. Section three will concentrate on the process of change in patterns of warfare and force build-up in the IDF. Finally, I will compare and contrast the process of change related to the space, which occurs in two militaries. This important task is mostly neglected by the mainstream of the literature in the field, and consequently a comparison analysis, presented in the paper, constitutes the main contribution of my research. I will end with some conclusions and thoughts on the opportunities for small states as well as ideas for future research.

2 Existing Theoretical Literature

Modern warfare patterns have been the object of extensive research, however, most of the literature has dealt primarily with the United States. While the US sets the tone in military thinking, its place in the international system and its enormous capabilities make it a special case, and it is unclear to what extent it can serve as a model for smaller states. Moreover, very little attention was given to the implications of modern warfare for actual force build-up.

Another issue which has received considerable attention, especially during the years of the Cold War and in connection with the SDI program, is that of war from space. Researchers have also devoted themselves in recent years to the question of Space Power. In these areas as well, the thrust of the debate takes place in the US⁴.

Among modern strategists there are those, who are convinced that the Space Power that was demonstrated in the first Gulf War constituted a milestone and made possible the "Revolution in Military Affairs" (RMA). Others are convinced that Space Power is in itself a revolution in military affairs, while others argue there is no revolution at all. Hays believe that it is more accurate to view the connection between Space Power and RMA in the ability to gather information globally and carry out precision attacks;⁵ and in the potential for arming space.

The existing literature point to several principles which characterize modern warfare patterns that developed in the Western world, and in particular in the US, in the last two decades and which will undoubtedly accompany future warfare. These principles are realized through a presence in and utilization of space.

The research presented here seeks to survey the processes which began in the US and which determine the connection between development of space technologies and their use on the one hand, and the changes that were set into motion in warfare patterns and military force build-up, on the other. The most significant contribution that this research offers is its attempt to make this inquiry outside the framework of the United States, in a small state, in which such a study has yet to be undertaken - the State of

⁴ Gray, C. "Space Power and the Revolution in Military Affairs- A glass half full?" *AeroSpace Power Journal*, Vol. 13 No. 3 (Fall 1999); Lupton, D. *On Space Warfare- A Space power doctrine*, (Maxwell Air Force Base, Alabama: Air University Press, 1998); Hays, Peter L. *United States Military Space: Into the Twenty-First*

these processes develop in a small country vs. a large power.

3 American Strategy in Space

At the beginning of the Space Race, the two superpowers formally related to this pursuit as a scientific, technological, economic and even ideological struggle – but not a military one.⁶ In practice, military activity was a part of space exploration from the outset.

In the 1960s, the ability to observe and gather information on what was transpiring in enemy territory without violating a country's sovereignty proved to be highly important and gradually turned reconnaissance and surveillance satellites into a central tool of the Security Services and the military of both superpowers. At about the same time, satellites came into use for weather forecasting and communications.⁷

The failure of the United States in Vietnam led to new thinking about American patterns of warfare and recognition of the need for change. As part of this process, the military studied the lessons of the fighting in the Yom Kippur War, in particular the combat between Israel and Syria in the Golan Heights⁸. During the same period it became apparent that space was showing signs of becoming a medium of warfare on a par with sea, land and air.⁹

⁶ Shaw, J. "The Influence of Space Power upon History (1944- 1998)", *Air and Space Power Chronicles*, (16 March 1999), Available At: www.airSpace.maxwell.af.mil/airchronicles/cc/shaw.html

⁷ Moulo, M. *AU- 18 Space Handbook- A War Fighter's Guide to Space* (Alabama Air Force Base: Air University Press, Maxwell, December 1993), Available at: <http://www.au.af.mil/au/awc/awcgate/au-18/au180001.htm>

⁸ Toffler, A. & Toffler, H. *War and Anti-War- Survival at the Dawn of the 21st century*. (Tel Aviv: Maariv Press, 1994 – Hebrew version of the book), pp. 65

⁹ In the 1970s that time, 38% of the Space budget in the US had been designated for the military. *Carter- Mondale, Transition Planning Group Report*. (January 31, 1977), Available At: www.hq.nasa.gov/office/pao/history.htm

In May 1978, President Carter signed a document outlining American policy with regard to space. One of the document's innovations was a claim to "the right of self defense in space". This marked a very significant change in American space policy.¹⁰ Up until that time, the US had emphasized that space was a demilitarized zone. From that time onward, it became clear that the US viewed space as a legitimate theatre for military activity.¹¹

This change in the American vision was fully expressed at that beginning of the 1980s. In March 1983 President Reagan announced a highly ambitious program, "The Strategic Defense Initiative" (SDI), the aim of which was to provide the US with defense against intercontinental ballistic missiles. This program, which was dubbed "Star Wars" was based largely on developing the most advanced capabilities in the area of intercontinental defense, in order to establish American superiority, deter the Soviets and break the deadlock between the two superpowers.

Gradually, the military became dependent on space systems for implementing its tasks on the ground. Thus, by the beginning of the 1980s, more than 70% of American military communications were transmitted through and by means of space. In the same period, the Americans developed GPS, and it was predicted at the time that its implementation would lead to a revolution in warfare, since it would improve

¹⁰ This can be explained by the fact that the change was the product of Soviet activity in the field of anti-satellite systems. The American military forces carried out experiments in nuclear anti-missile systems at the end of the 1950s and the beginning of the 1960s. In 1967 the Russians also began to develop Anti-Sat means. Barry Watts writes in his book that apparently, in the months of October and November 1975, the USSR used high-powered radiation to disrupt the activity of three American satellites. The official explanation given by the US for the disruptions was forest fires and /or volcanic eruptions. In: Watts, B. D. *The Military Use of Space: A Diagnostic Assessment*, (Washington: Center for Strategic and Budgetary Assessment, 2001), pp. 10

In 1979, the Americans discovered through satellite photographs, a Soviet base in Kazakhstan, that was used for testing Space weaponry. In the photographs, the Americans detected a Soviet capability for transmitting long range laser beams. These discoveries constituted a considerable threat to the US. In response, the Americans began working on their own system to achieve this capability. In: Parrington, A. J. "US Space Doctrine, Time for a Change?", *AeroSpace Power Journal*, (Fall 1989), Available at: www.airpower.maxwell.af.mil/airchronicles/apj89/parring.htm.

changes were carried out and, in addition to the Central Space Command, space commands were set up in the Air Force, Navy and Ground Forces.¹³ The predominant view towards the end of the decade was that military activity in space would constitute a significant component in future conflicts around the globe.

The collapse of the Soviet Union and the end of the Cold War compelled the US to engage in a comprehensive assessment of its national defense, including in the realm of space. The thinking regarding its military conduct following the Cold War was influenced by the Gulf War in 1991, where, for the first time, satellite communication systems and GPS navigation and guidance systems were employed, which contributed much to combat activity.

Eliot Cohen has asserted that the first Gulf War marked the beginning of a new era - "The American Hegemony".¹⁴ The crushing victory together with the small number of American losses and limited quantity of weapons used, reinforced the desire among the political and military echelons, to try to recreate the conditions and pace of conduct in this war, in any future conflicts in which the Americans were required to use force.¹⁵ Cohen defines this as a watershed in the history of warfare, in which the dominance of air power in operational activity, constituted the primary innovation on an operative level. Cohen also points out the Gulf War can be seen as a milestone in the process of inculcating the concept of space technology as a key factor in warfare.¹⁶

¹² Parrington, A. J. (Fall 1989).

¹³ Moulo, M. (December 1993).

¹⁴ Cohen, E. "Gulf War 10th anniversary – the lessons learnt", *Maarachot*, No. 374-5 (February, 2001), pp. 42 (In Hebrew)

¹⁵ The conditions Cohen lists are: a distinct and coherent system of objectives, public support, a coalition which supported but did not limit American activity, a considerable amount of lethal power and operational battlespace.

¹⁶ *Ibid*, pp. 45

About two years after the 1991 Gulf War, Vice-President Dan Quayle submitted a report to the President of the United States on the Star Wars program which included lessons drawn from the conflict. The superiority which the US demonstrated in the War, Quayle wrote, was a direct consequence of its capabilities in space in the fields of communications, navigation, weather forecasting, intelligence, remote sensing and early warning. These capabilities were critical to the success of American vs. Iraqi forces in 1991 and, he argued, should be viewed as a “force multiplier”. The systems in question shorten the duration of combat, render it more efficient, and permit a reduction in the number of forces deployed.¹⁷

The message from the Gulf War was clear. Space constitutes a central component in America’s strength as a superpower from a civilian and certainly from a military perspective. This was reflected in, among other things, an entire vocabulary of concepts which evolved, placing space at the epicenter. The strategic concept which is most closely identified with the new thinking in the US is known as the Revolution in Military Affairs (RMA). It is the basis for most of the military doctrines which followed.

The emphasis in the outlook of the RMA is placed on increasing military capability through the quality of the force, and not necessarily through an increase in quantity. The RMA has four components: information warfare, precision strike, dominant maneuver and control of space. The development of this thinking subsequently led to concentration on a central concept which is today termed C4I (Control, Command, Computer, Communication and Intelligence), where the emphasis is on digitalizing the battlefield.

of communications, information, navigation and guidance. Intelligence from space was attainable already in the 1960s, but the great revolution in the US military in the realm of space occurred 30 years later, when communications and rates of transmission of information underwent changes and enhancements, resulting in the fact that today, large quantities of information can be transmitted anywhere in a very short time. Only via space, the *Army Space Policy (Filed Manuel 100-18)* asserted, can the vast quantity of information needed to ensure victory, be transmitted in the shortest possible time and to any place on the globe.¹⁸

3.1 System of Systems

Admiral William Owens, former Deputy Chairman of the Joint Chiefs of Staff, coined the central RMA phrase “System of Systems” in the middle of the 1990s. The super system to which he was referring is one based on information, which demands control and information superiority through integration of C4I systems, or what Owens called Dominant Battle-Space Knowledge. This system is made up of a number of layers, of which the outer layer, located in space, gives whoever controls it, the ability to prevail militarily in any combat environment.

The ability to process information and disseminate it at great speed creates dominant situational knowledge in battlespace and leads to asymmetry between the side that controls the information and the side which lacks that information in any region or combat theater. Another product of information superiority is the ability to create superior battlespace awareness, which aids in reducing risk in warfare and thus

¹⁸ Sullivan, G. *Army Space Policy – Field Manuel 100-18*, (July, 1994), Available at: www.globalsecurity.org/space/library/policy/army/fm/100-18/f0018_1.htm

the number of injuries and casualties.¹⁹ The focus is on the qualitative change in military capability which occurs through integration of Intelligence, Surveillance and Reconnaissance (ISR) systems, C4I, and guided precision munitions. This integration is the expression of a super system of the systems, i.e., the System of Systems.²⁰

The conceptual patterns of RMA evoked a debate and a process of conceptualization which extended in a variety of thinking directions²¹. Each of these concepts places its emphasis on different ideas and principles. However, in the final analysis, they have one important thing in common: they start from the assumption that the primary resource in today's world is information or knowledge. Practical applications of these concepts were visible in Kosovo, Afghanistan and, in particular, in the War the Americans conducted against Iraq in 2003.

3.2 Warfare Patterns

Patterns of warfare which rely on achieving a capability in space and on information superiority are comprised of a number of characteristics: A change in terminology has occurred over the past decade, which clearly reflects changes in the nature of modern warfare as it relates to space. In the past, the term battlefield was used widely. However, in recent years a new term has entered military terminology: **battlespace**. The term relates to the all-encompassing field of combat. Warfare no longer takes place on the battlefield, but in the entire expanse of air and space. Other terms and expressions which similarly seek to describe innovative thinking on this subject include the following:

¹⁹ Williamson, M. "Clausewitz out, Computer in – US military culture", *National Interest*, (Summer 1997), Available At: http://www.findarticles.com/p/articles/mi_m2751/is_n48/ai_19657028.

²⁰ Williamson, M. "Clausewitz out, Computer in – US military culture", *National Interest*, (Summer 1997), Available At: http://www.findarticles.com/p/articles/mi_m2751/is_n48/ai_19657028.

emphasis on quality as a basis for successful war. This qualitatively oriented concept is focused on great precision in pinpointing and hitting targets and reducing inflicted damage and destruction the results are a reduction of manpower, platforms and ammunition needed for war²²

Defeat through Firepower rather than Maneuver

The ability to destroy targets with precision and efficiency significantly increases firepower. Consequently, firepower, which in the past was perceived as an aid to maneuver in achieving military defeat, has become a central factor in its attainment.

Dominant Maneuver - In spite of the significance attributed to firepower, land maneuver has not been abandoned and has not lost its importance. Information dominance in battlespace permits the application of maneuvering force with great flexibility and with a decrease in risk and uncertainty.

Air Power Superiority - In modern warfare, air power has taken center stage, owing to the firepower at its disposal. This transformation from a supporting force to a central one in deciding the outcome of a conflict emanates, among other things from space-based capabilities.

Jointness - The ability of all military forces (air, sea, ground and space) to operate cooperatively or in synergy. The integration is both technological and organizational, i.e. organization of the force in a network rather than a hierarchical formation. This notion, according to which all forces are interwoven into the same communications network and feed off the same battlefield awareness, developed in response to the lessons of the first Gulf War.²³

²² Toffler, A. & Toffler, H. *War and Anti-War- Survival at the Dawn of the 21st century*. (Boston: Little Brown and Company, 1993)

²³ Owens, W. "The once and future Revolution in Military affairs". *JFQ*, (summer 2002), pp 57.

Information Warfare - Attaining information superiority by means of intelligence and all its component parts, and utilization of mass media. Here as well, space comes into play in its ability to gather and transmit information which it supplies to the mass media as well as in the support given by communications satellites.

To this must be added the great enhancement in the ability to operate anywhere, day or night, and in all weather conditions, with increased flexibility of force and increased range of combat.

Space systems support these principles of warfare and enable them: first, by providing the intelligence capabilities for tracking and pinpointing targets; second, in providing capabilities for guidance and positioning, as well as communications to forces engaged in combat and weapons systems.

In conclusion, all the patterns of warfare presented here point to the fact that modern warfare in the information age, in contrast to warfare in the industrial age, is based on *quality rather than quantity*. Quality, in this case, means better knowledge and information. The various approaches that have been presented concentrate on information and attaining information superiority as a basis for modern warfare. However, what does this information consist of and how is this information superiority created? Information superiority can be created and understood as a result of presence in space and by the use of space technology. Space, of course, is not the only factor, but it is a central factor on the road to realizing concepts of warfare based on information and knowledge.

3.3 Force Build-up Emanating from Concepts of Warfare

An army which seeks to operate based on the warfare patterns discussed above, and

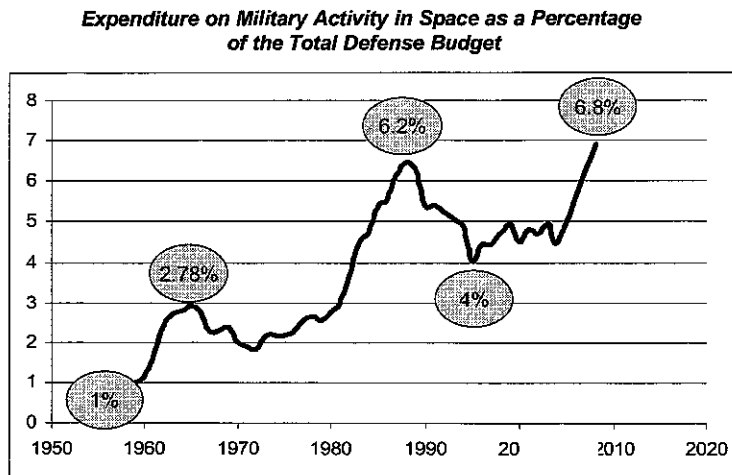
platforms in the two armies. It also becomes apparent that firepower, air power, intelligence and space systems receive priority and precedence over traditional power systems and components which give pride of place to ground maneuver. There is a growing preference for organizing forces in a network – rather than employing a hierarchical structure. This allows them to operate jointly and with greater efficiency and effectiveness.

3.4 Force Build-up of the American Military

This section sheds light on a number of directions of development which relate to the application of modern warfare patterns. Future research needs to address itself in greater depth to the problem of force build-up in the US.

Figure 1 depicts changes in Defense Department expenditure on military space systems, showing the increase in priority given to these systems²⁴.

Figure 1



²⁴ The data presented in this section are taken from the report submitted to the President of the United States by NASA.

*Order of Battle*²⁵ (ORBAT)

It is generally accepted that the ORBAT of military personnel consists of 0.5% of the population.²⁶ During the Cold War, and primarily after Vietnam, the proportion of military personnel to population in the US was much greater. The fear was that reduction or cuts in personnel would diminish American strength in the Cold War.

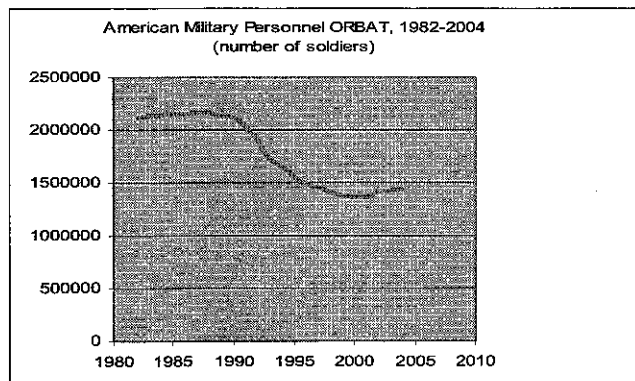
Figure 2

Source: *Military Balance* – IISS, London

	Population	Number of Soldiers	Soldiers as % of population
1988	244,000,000	2163200	0.886557
2001	283,000,000	1,367,700	0.483286
2004	290,000,000	1,433,600	0.494345

The graph in Figure 3 shows a decrease of almost 40% in military **ORBAT Personnel**²⁷ in the years after the Cold War ended. The concept of De-massification contributed to this process and sustained it even when the US got engaged in Afghanistan and Iraq. As the graph shows the size of ORBAT remained the same.

*Figure 3: Change in the American Military Personnel ORBAT*²⁸, 1982 - 2004



²⁵ Total Size of the Force

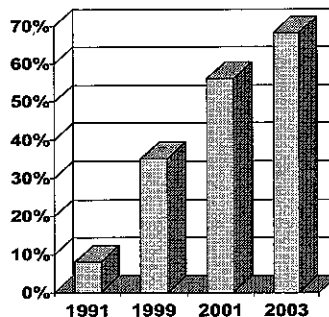
²⁶ Ben Israel, I., "Technology and defeat – thoughts and reflection following Kosovo", *Maarachot*, No.

This reduction is also a result of the strategic concept which no longer sees the tank as the main tool in the battle-space. The main tasks, according to the American perception, are entrusted to the Air Force and precision guided munitions together with special infantry forces. This is why we only detect a 30% decline in the **Air force aircraft ORBAT**.

Figure 4 charts the development of precision guided munitions in American operations from the beginning of the 1990s.²⁹ Satellite navigation systems are installed today in various types of smart bombs, the most widespread and well known of which is the Joint Direct Attack Munitions (JDAM).³⁰

Figure 4

Precision Guided Munitions in American Operations



Ben Israel, I., "The RMA in Iraqi Freedom Operation", In: Sh. Feldman and M. Grundman (Eds), *After the War in Iraq* (Tel Aviv: IDF publishing house and the Jaffee Center, 2004), pp. 69-91, (In Hebrew)

The use of precision guided munitions which are based on a platform in space leads to "cost reduction in War". In the Iraq 2003 war, 80% of the precision weapons deployed by the Americans (approximately 16,000 bombs) were JDAM and laser-guided bombs (LGB). The cost of one bomb of this type is about \$30,000. In other

²⁹ Ben Israel, I., "The RMA in Iraqi Freedom Operation", In: Sh. Feldman and M. Grundman (Eds), *After the War in Iraq* (Tel Aviv: IDF publishing house and the Jaffee Center, 2004), pp. 69-91, (In Hebrew)

³⁰ This is a generic term for different types of bombs.

words, the cost of deploying 80% of the precision guided munitions in Iraq amounted to about half a billion dollars. On the other hand the cost of deploying 7% of the munitions (cruise missiles – cost per missile 1.5 million dollars) cost over 2 billion dollars.³¹ It can thus be asserted that the use of advanced precision guided munitions which rely on space capability, lowers the cost of the war. To this statistic one must, of course, add the cost of the infrastructures required to use these types of munitions. However these infrastructures serve numerous civilian and military functions.

The cutbacks and the changes in ORBAT since the end of the Cold War and the change in the perception of threat to the US, were enhanced by the new concepts of warfare highlighting quality of force over its quantity. To this were added economic considerations and savings trends which were on the rise from the end of the Cold War.³²

4 Strategic and Military Vision in Israel

The Yom Kippur War constituted, in many ways, a turning point in Israeli strategic doctrine and security vision.³³ After the war a process of technological change got underway in the IDF. One of the examples of this is the appearance of precision guided munitions.³⁴ The lessons learned from the war, were implemented in weapons systems that were developed in Israel and operated by the Air Force against Syrian anti-aircraft in the first War in Lebanon in 1982.³⁵

The 1982 Lebanon war encouraged the continuation of the process which the IDF began to undergo after the Yom Kippur War. The capability which the Air Force demonstrated over the Bekaa Valley against Syrian anti-aircraft through the use of

³¹ Moseley, M.T. (April 30, 2003); & www.fas.org.

³² *Joint Vision 2010*, (Washington DC: Pentagon, Joint Chiefs of Staff, 1996), pp. 8.

advanced means of combat. In parallel, a process of shared communication and exchange of ideas was taking place between military personnel and strategists in Israel and their cohorts in the US. The Americans, who arrived in Israel after the Yom Kippur war in order to learn its lessons, assimilated them in formulating the doctrine of the American Military. Thus there is a visible similarity between the new ideas which developed at that time in the US and those which developed in Israel during the same period.

In those years, a debate arose in the IDF regarding the essence of the future battlefield and the resulting changes which were required in planning force build-up. Many officers and top brass in the IDF continued to argue that the IDF's fundamental strategic vision, which gives the greatest priority to ground forces, should not be changed. They viewed the primary role of the Air Force as paving the way for decisive action on the ground. Opposing them were those who insisted that the battlefield was changing and that the IDF had to adapt itself to those changes in order to maintain its advantage relative to other armies. Gradually, the winds of change gained momentum and found their way into the long range planning of the IDF.

The First Gulf War evoked, throughout the world and in Israel as well, a debate over the significance and implications of the change. The questions which underpinned the discussion were: Was the Gulf War relevant to Israel's situation? Could Israel find itself in similar circumstances, i.e. in an asymmetrical war between two sides of unequal strength? Could Israel create such a situation and turn it to its advantage? At the same time, the US fought at a great distance from home, while the theater of war in which Israel engages in combat is close and immediate and this alters

the face of things. The Israeli debate focused also on the implications of the blow Israel had received from the 39 Scud-missiles that fell on its territory.

In an article on the lessons Israel had to learn from the Gulf War, General Yaacov Amidror wrote a decade after the events, that caution must be taken when comparing the US and Israel, because the geo-strategic position in which Israel finds itself is fundamentally different from that of the United States. In addition, there are certain things Israel must avoid. In his view, the war proved that a broad-ranging discussion was in order regarding the relative weight of precision munitions. He argued that in the fields of intelligence gathering, communication and navigation, the Americans demonstrated significant progress and could be used by Israel as a model. In terms of support systems, he felt that the primary lesson Israel had to learn concerned the importance of communication and navigation satellites. In this sense Amidror argues the dependence on the good will of the US to provide GPS systems service must be taken into account³⁶.

In contrast to Amidror, there are those who see the main issue in the attainment of superiority in information and intelligence. Lt. Col. Eyal and Major Doron wrote in a joint article entitled, "From Vision to Reality in Real-Time Intelligence", that they viewed the attainment and establishment of information superiority on the battlefield as a critical condition for achieving victory in a manner consistent with the RMA. Superiority in or control of information is achieved, in their view, by developing the ability to receive data directly from all the sources engaged in gathering it, by defining the scope for examining and processing the information, and by employing tools to reduce the quantity of material. At the same time, there is a need for developing the capability to expand intelligence knowledge by layering and creating cross sections of

various gathering bodies in order to assemble a comprehensive picture.³⁷

The war that the US carried out in Kosovo in 1999 also gave the Israeli military much food for thought. In an article published in 2000, General Isaac Ben Israel, then director of the Directorate of Defense R&D (DDRD), proposed that one of the lessons for understanding the modern battlefield was “the fine distinction between victory on land – but not necessarily from land”. Indeed, in Kosovo, victory was ultimately achieved from the air, even though it was realized by the introduction of ground forces.³⁸

Ben Israel is convinced that the modern war is a war of firepower. In a war of this type, one side tries to force its will upon the other through the massive use of fire – rather than territorial conquest³⁹. Since Israel shares borders with countries whose military doctrines are based on size and quantity and deciding conflicts on and from the land, it must remove this kind of warfare from the realm of possibility. As for conflicts with countries with which Israel does not have contiguous borders, Israel must develop methods of operation and invest in its force build-up based on the principles of a war of firepower which conform to principles of modern warfare.⁴⁰

Brig. Gen. Eyval Giladi has insisted that the IDF must assimilate the technological revolution and adapt itself to its operational concept. In a lecture given at a conference dealing with new security paradigms for Israel, which took place several months after the War in Iraq, Giladi spoke about the lessons Israel must learn:

³⁷ Lt. Col Eyal and Major Doron, “From vision to reality in warfare supporting intelligence”, *Maarachot*, No. 373, (November 2000), pp. 32-37 (In Hebrew)

³⁸ Ben Israel, I. (July 2000), pp. 35

³⁹ *Ibid*, pp. 36

⁴⁰ *Ibid*. pp. 38.

*“We must move from a concept of preemptive targeting to a concept of operation design. ... reality must be shaped from within this framework”.*⁴¹

Giladi's words are an expression of ideas that call for the development of a capability to influence the formulation of the adversary's perception of reality and his battlefield awareness. Such a capability leads to what Giladi terms the “Empty Battlefield” phenomenon - a situation in which, because of the ability to influence and redesign the reality of the battlefield, the multitude of excellent sensors which are positioned and which relay information in real time, and advanced communications systems for command and control which process and disseminate information rapidly, it is possible to pinpoint the location of the target and transmit the information and data very quickly to the attacker. The result is highly efficient destruction of targets. In such a situation, the battlefield will empty out for two reasons – technological and psychological: The technology permits destruction of targets without a need for actual entry onto the battlefield. Recognition of this capability for technological destruction will neutralize the will of the adversary to enter the battlefield - i.e., it will have a psychological impact. The implications of this process for force build-up, Giladi believes, will be a significant reduction of the number of tanks – to a point where in the distant future, they will become completely obsolete.

4.1 Changes in Warfare Patterns and Their Influence on IDF Force Build-up

These concepts are manifested in the IDF's force build-up as well. In the IDF's long-term planning since the beginning of the 1990s, there has been a trend towards cutting

advanced systems – among them space technology-based infrastructures.⁴²

At the end of the 1990s the new IDF Chief of Staff Lieutenant General Shaul Mofaz claimed the IDF will become smaller, more organized, more professional and more efficient: “We must toss out old systems and with the money we save, invest in advanced systems.” In accordance with the plan, it was decided to increase expenditures in those areas in which the IDF had a qualitative advantage over the Arab States and in particular in technology and satellites.⁴³ Mofaz’s program gave top priority to the Air Force, Intelligence and advanced technology to the ground forces.

In the years to follow the IDF went through many changes in its force buildup and organizational structure. For example, in 2003, the C4I Corps of the IDF was established. This decision testifies to the great importance attributed in the IDF to the revolution in information and communications⁴⁴.

Under Mofaz’s successor, chief of staff Moshe Ya’alon, the IDF implemented the so-called “Target (*kela*) Program” which was aimed at planning the force build-up of the IDF for 2003-2008. The program contained a requirement to reduce the order of battle and make changes in operational doctrine. This was the outcome of a combination of processes which occurred almost in parallel; first, changes in the strategic map of the region following the war in Iraq and the fall of Saddam Hussein’s regime; second, the conflict with the Palestinians; third, budget constraints and the need to impose cuts; fourth, the American experience in Iraq which demonstrated that with advanced technology it was possible to reduce the order of battle and achieve

⁴² Eshet, L. and Caspi, Y., “Small and Smart”, *Bamahane*, (5 Feb. 1992), pp. 16-21 (In Hebrew); Ben, A., “It is still not the time for a small and wise army”, *Haaretz*, (25 April 1993) (In Hebrew) ; Schiff, Z. “IDF 2000”, *Haaretz*, (19 Sept 1997), pp. B1 (In Hebrew)

⁴³ Limor, Y. and Bender, A. “Personnel will decrease In favor of Investment in technology”, *Maariv*, (13 January 1999), pp. 2-3 (In Hebrew)

⁴⁴ From the Internet site of the C4I Corps: <http://www1.idf.il/tikshuv/site/templates/controller.asp?>

better results in a shorter time and with reduced risk of injury. The “Target Program” led to dramatic changes in the force build-up of the IDF, including broad cuts in ground forces and large expenditures in the Air Force and Intelligence.⁴⁵

In conclusion, from the middle of the 1980s a significant change occurred in the mix of force build-up of the IDF. The disposition of tank forces was reduced considerably as was the order of battle of aircraft. The supply of precision guided munitions of various types increased.⁴⁶ Through the use of F16-I aircraft and with the aid of satellites, the range of the IDF's operations increased. These changes were accompanied by broad organizational changes, among them a cut in personnel, the establishment of new bodies and the assimilation of new warfare patterns and modes of operation.

4.2 Space in Israeli Strategic Vision

Control of Space is essential to us... and I am convinced that we must establish this as an objective to which we must aspire⁴⁷

Defense Minister, Gen (res.) Shaul Mofaz 2003

From the early days of the State, Israel's security vision was based on the understanding that it was at a disadvantage relative to its neighbors according to all quantitative parameters. The solution was found in “quality”. This was implemented by developing science and technology and turning them into central components of Israel's strength. Thus, investments were made in developing technological

⁴⁵ Haaretz Service, (23 May 2003), “Chief of Staff to Jane's: IDF will reduce ground forces”, *Haaretz* (In Hebrew)

⁴⁶ Ben Israel, I. (30 December 2003). Lecture given at the conference, “A New Security Paradigm”. Tel

knowledge in the world, including capabilities which later enabled it to develop Israeli satellites and launch them into space.

The Israeli space program, motivated primarily by intelligence needs, was established in the framework of the peace accords with Egypt. The agreement did not neutralize the fear of hostile Egyptian aspirations. There was a clear need for intelligence on what was happening in Egypt without violating its sovereignty. The Israeli Space Agency was founded in 1983 and in September 1988, Israel launched its first satellite Ofeq 1.

4.3 Intelligence and Communication

The main emphasis in Israeli strategic thinking in the field of space research focuses on the areas of intelligence and communication. Israeli intelligence satellites provide it with *an independent intelligence capability*, whose enormous implications go beyond the intelligence field per se. It enhances the power of the state and the image of Israel in the eyes of its opponents as well as its allies and increases its flexibility, both from the perspective of its ability to gather information as well as the resulting autonomy in decision making. In addition, independent capabilities permit the state to conceal its areas of interest and to gather information unhindered. Intelligence capabilities in space permit the State of Israel to attain essential intelligence information without violating the sovereignty of other countries and without risk to human life.

An example to this way of thinking may be found in a parliament report which was published in March 2004. The members of the Steinitz Commission recommended stepping up the development of an Israeli reconnaissance satellite

system as infrastructure for long distance Visint intelligence. "This system should be built in such a way that it has the ability to respond to threats to the State of Israel in near and distant "tires of threat"⁴⁸, and the capability to track down, identify and monitor technological, industrial and military infrastructures"⁴⁹.

4.4 Deterrence

The capability of launching a satellite into space testifies to the existence of additional advanced technologies. It also exhibits capabilities which do not escape the attention of Israel's adversaries. There have been numerous examples in the Israeli and world press in recent years of the reaction of Arab countries to Israel's proven ability in space.⁵⁰ In this connection, it should be noted that those states with whom Israel is in conflict are developing space programs as well, and seek to attain for themselves similar and other capabilities in space⁵¹.

4.5 Precision Guided Munitions

A great emphasis has been placed on precision guided munitions and clear evidence of this can be detected in the acquisition of Joint Direct Attack Munitions (JDAM)

⁴⁸ "Tires of Threat" is Israeli security jargon for describing the potential and actual regional sources of threat. The first tier includes the terrorist and insurgency activities from PA and Lebanon; the second tier stands for the conventional menace from Syria, Egypt, Jordan and the third tier includes the over-the-horizon Iraq and Iran.

⁴⁹ Report, Vol. A (unclassified). "The Committee to Investigate the Intelligence Network in the Wake of the War in Iraq", (Knesset Foreign Policy and Security Subcommittee, March 2004). "Tires of Threat" is Israeli security jargon for describing the potential and actual regional sources of threat. The first tier includes the terrorist and insurgency activities from PA and Lebanon; the second tier stands for the conventional menace from Syria, Egypt, Jordan and the third tier includes the over-the-horizon Iraq and Iran.

⁵⁰ See for example, Rosenblatt, Y. and Gabai, Sh. "Saudi Arabia: Arabs are checking how to jam Ofek 1's activity", *Maariv* (29 Sept. 1988) In Hebrew; Gabai, Sh. And Cohen, A. "Israeli spy satellite – comments", *Maariv* (6 April 1995), In Hebrew; Granott, O., "Arab states secretly concluded: will act against Israeli satellites", *Maariv*(8 April 1998), In Hebrew; Peri, S. and Egozi, A. "Arab league is afraid of Ofek 5", *Yedioth Abaronot* (25 Aug. 2002), In Hebrew; Blanche, E. "Israel Seeks New High Ground

American government to acquire GPS equipped JDAM bombs⁵². In the offensive realm, Israel does not possess independent space capabilities, but it does utilize American GPS navigation systems. Because Israel does not have independent capabilities in this field, it does not rely only on GPS systems but on a mix of methods in the areas of navigation and precision guided munitions.

4.6 The Central Role of the Air Force

The role of the Air Force has been greatly enhanced in recent years. The name was recently changed to the Air and Space Force. An additional elevation of its status occurred with the appointment of Deputy Chief of Staff and Air Force Commander Dan Halutz to the position of Chief of Staff in June 2005. When Defense Minister Shaul Mofaz informed Dan Halutz of his prospective appointment as the next Chief of Staff of the State of Israel, he told him that he expected him to step up the effort to make the IDF a multi branched combined arms and joint military which would integrate not only unmanned air vehicles, but also satellites and activity in space.⁵³

4.7 Strategic Depth

The orientation toward space assists Israel in coping with the problem of lack of *strategic depth*. Throughout the years, this was an issue which greatly concerned Ben Gurion, and had a major impact on Israel's security vision. It. In his view, Israel's narrow borders necessitated a search for solutions to avoid the element of strategic

⁵² The data is taken from the site of the Federation of American Scientists, <http://www.fas.org/asmp/profiles/world.html> and AIPAC, 16 October 2003, as published in an article of *Haaretz*, which reported that Israel was trying to prevent the US from selling this technology to Egypt and Saudi Arabia. The data is taken from the site of the Federation of American Scientists, See <http://www.us-israel.org/jsource/US-Israel/jdam.html>.

⁵³ Schiff, Z. "the nomination will bind change in the general staff", *Haaretz* (23 Feb. 2004), In Hebrew

surprise and sudden attack. Hence, Ben Gurion developed a security doctrine, which demanded rapid transfer of engagement to enemy territory.

Today as well, Israel's narrow borders demand solutions to the problem of early warning. The opportunity to observe enemy territory from space is a scientific and technological solution to the military problem which Israel faces. Observation from space enable Israel to cope with threats from Arab countries in the first, second and third tires.

5. Summer 2006 War

The war between Israel and the Hezbollah in the summer of 2006 raises many questions regarding the function of Israel's leadership and IDF's warfare and force build-up. Although this is not in the scope of this article, one emphasis on RMA ideas and implementation should be made in short (while further discussion of these issues should be made in future works). The concept of RMA changed the balance between fire power and maneuver in achieving campaign goals in favor of fire power and the use of air force over ground forces. This however, does not dismantle the role of maneuvering ground forces from the equation. On the contrary, the military force must be combined and operate in a jointly manner in greater flexibility and dominance over the adversaries. This idea was not fully implemented by Israel in the last campaign. The main role was given to the Air force, while ground operation was not ordered until a later stage of the war, some say too late to reach objectives. Israel's strategic environment, character of adversaries and neighbors does not allow it to neglect the ground option. Israel must rely on a mixture of tools combining fire and maneuver capabilities.

Many similarities can be found in the approaches of the US and Israel towards Warfare and space. In both cases changes began taking root in the middle of the 1970s. From that time until the present, the two countries underwent a similar process of evolution in military thinking, assimilated the notion of an information revolution and even applied warfare patterns dictated by it, but the disparity between them (and in fact the disparity between a superpower and any small state) means that they can not operate in a similar fashion.

6.1 Activity in Space

There is an essential difference in the American military approach to space and that of Israel. This emerges primarily from the different positions of the two countries in the global system. As a superpower, the US relates to space as great powers related in the past to the sea or the air. The power that ruled the seas or the skies was the one that led and guided the conduct of the rest of the world. Thus, the US sees space as its domain and as a means to establish and strengthen its status as a global and space power. As a result, the American discussion regarding space concentrates on the question of space control.

In contrast, Israel is a small country in the global system, which is striving to establish its position and power there, but above all, in its own region. Israel does not have America's global interests, nor does it have its global challenges. In addition, it suffers from an acute lack of resources and has been in an economic crisis for several years, which has forced it to make urgent cuts in the state budget and in the defense budget as well.

The national and security interests of Israel demand an orientation toward space, since it must relate to a broad circle of states which surround it, beyond its immediate neighbors. However, Israel's presence in space does not require the kind of control to which the Americans aspire. This is the crux of the divergent approaches that the two countries demonstrate toward space and Space Power. While the Americans strive for dominance and control of space, Israel seeks a presence in space and perhaps regional dominance there.

In order to achieve control in space, the US pursues every possible opportunity to exploit space and achieve Space Power. Thus the US operates early warning systems against missiles, independent navigation systems, intelligence systems, reconnaissance, communications systems, weather and more. On the other hand, Israel builds its strength in space in accordance with priorities which correspond to its national and security needs. Generally speaking, these consist of the capability to reach distant theaters from an intelligence and operational point of view. Hence, it needs an independent capability in the fields of intelligence and communications and that is the main thrust of the Israeli space program.

The Israeli space program does not undertake to build missile warning systems, navigation or weather systems. In these fields it makes use of existing systems. Both states began their journey into space in search of increased intelligence capabilities but their paths subsequently diverged.

6.2 Investment in Space

The character of US and Israeli activity in space reflects its place in their respective strategic visions. In the US there is more or less a consensus regarding the importance

completely taken shape and while there is increasing recognition of the need for a significant Israeli presence in space, the road is still long. Accordingly, the budgets which Israel allocates to space are very small relative to the US and other countries. As was noted above, the US spends about 40 billion dollars a year, of which 20 billion is for military activity – which is 4.5% of the total Defense budget. According to foreign and unofficial sources, Israel invests \$50-60 million a year in Space,⁵⁴ which constitutes 0.7% of the shekel Defense budget of the State of Israel.

The United States is approximately 50 times bigger than Israel in population and has a GDP which is 90 times greater. Based on these ratios, if the US spends \$40 billion a year, Israel should have expenditures of about \$750 million for a ratio of 50:1 (ten times more than it currently invests) or about \$400 million for a ratio of 100:1 (six times what its current expenditure).

The US is a superpower and its national security challenges are significantly greater than those of the State of Israel. Therefore future research should examine Israeli space expenditures in general and with respect to other states of similar size.⁵⁵

6.3 Jointness

With respect to the issue of jointness, Israel has a certain advantage over the US. The United States has a very large military force made up of three separate branches (Army, Air Force and Navy). Applying the idea of jointness in a military organization of this type is not simple and requires enormous resources and effort.

⁵⁴ *Space 2030- Exploring the Future of Space Application*, (Paris: OECD publication Service, 2004); *Aeronautics and Space Report of the President*, (NASA Publications: Historical Tables, Budget of the United States Government, 2001); *Executive Office of the President of the United States*, (Washington: US Government printing office, 2004); Nardon, C. "World's space systems - Disarmament forum, In: *Making Space for Security*, (2003), <http://www.unidir.ch/pdf/articles/pdf-art1885.pdf>; *Jane's Space Directory* 2004-2005;

⁵⁵ The source of statistics on population and GDP cited are based on the CIA World Fact Book available at: <https://www.cia.gov/cia/publications/factbook/index.html>

7 Conclusions

A discussion of the influence of space technology on warfare patterns and force build-up of a superpower and a small state, using the US and Israel as case studies, raises important questions about the strength of small countries in the global system. The conclusion which obtains from this research is that development in the direction of modern warfare patterns and the use of space are not restricted to the domain of great powers alone. Small states which operate on modest budgets can also make significant achievements if the quality of the force is emphasized over quantity. In other words, the information revolution and the expansion into space which is an integral part of that process, gives small states which exploit its features, opportunities and capabilities to enhance their power which they would otherwise not possess. This fact is good news for small states which find it hard to keep pace with the big powers, in an era in which quantity and mass play such a big role. It also sends a message to large states interested in continuing to stand at the forefront of technology – that they must maintain the gap they have created. Those players that succeed in expanding into space in order to achieve technological and scientific gains and determine reality - even if they are “small countries”- are those that will lead and shape the global system.

Space has indeed been perceived as a force multiplier and its primary significance lies in the opportunities that it provides in the areas of communication and navigation. Today, more and more middle-sized and small states seek to attain capabilities in space. However, space programs are expensive projects which small states have trouble maintaining independently. For this reason, small countries that are

technologies which are important to their national interests. With this in mind, they should take into account as well the civilian and economic advantages that can be gained from investment in this area. The decision to develop a space program in Israel, for example, was based on Israeli human resources and contributed to the wealth of the state. To a great extent, the civilian infrastructures of space and large portions of the Israeli hi-tech industries are a byproduct of the decision to develop high-tech military programs, including the space program. Many of those who work in those areas today in the civilian sector were among the high-quality personnel who worked in these fields in the military sector. The contribution of this human resource is critical not only for defense per se, but also finds expression in civilian aspects of national security on an economic, social and scientific plane. Thanks to the space program, academic, industrial and human infrastructures have been successfully established, and serve as points of departure for future excellence. A comprehensive discussion of the economic and social implications of a space program for small countries such as Israel requires greater study. Such an examination is beyond the scope of this particular essay, but deserves to be addressed in future.

Working and Position Papers

- 1) Peled D, Ben-Haim Y, Ben-Gad M.: "Allocating Security Expenditures under Knightian Uncertainty: an Info-Gap Approach" Economy of National Security Program (ENS) Working Papers Series ENS-WP-1 February 2007.
- 2) Amiram Oren and Zalman F. Shiffer: "The Economic Consequences of The Use and Control of Land Resources by the Defense Sector in Israel" Economy of National Security Program (ENS) Working Papers Series ENS-WP-15 June 2007
- 3) Paikowsky D. , " Space Technology, Patterns of Warfare and Force Build-up: Between a Power and a Small State" Economy of National Security Program (ENS) Working Papers Series ENS-WP-3



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The ENS Program, established in late 2003, is an inter-mural program aiming to initiate, encourage, and facilitate high quality academic research and policy position papers on the interconnections between economics and defense. The close links between economic strength and development on one hand, and defense capabilities and security on the other are well recognized. Nevertheless, there is little theoretical and empirical research on these links by the academic community in Israel available to support policy making in these critically important matters. The Program holds periodic research meetings, organizes workshops on defense economics, and provides financial support on a competitive basis to proposals by researchers and graduate students submitted in response to widely circulated Calls for Proposals. Program participants include economists and researchers in other disciplines from various universities in Israel, research departments in the Bank of Israel and other government agencies, and some current and past officials in government and defense related organizations and industries. The Program Director is Prof. Dan Peled and the Coordinator is Col. (Res.) Moshe Elad.



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