Revolution in military affairs - The operation mole cricket 19 as a case study for the technological race during the cold war

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Abstract
The article reviews the development of the modern idea of Revolution in Military Affairs (RMA) whose buds appeared after the First World War, matured during the Cold War and demonstrated in 1982 in the First Lebanon War by the Israeli Air Force, and in 1991 in the Iraq War by the American Army. After analyzing the essence of RMA, with reference to the concept of both evolution and revolution of military technologies and doctrines, the article suggests that two types of revolutions should be distinguished. The first is a revolution in military affairs in the broadest sense in which a paradigm shift in the nature of war is occurred, and it is possible to apply it mainly by superpowers. The second, is a limited revolution that is essentially an approach of solving a military problem, suitable for small countries. The article examines these ideas and shows that Operation Mole Cricket 19, in which Syrian missile batteries made in the USSR were destroyed by the Israeli Air Force in 1982, is a revolution in military affairs of the second type.

Keywords
cold war, revolution in military affairs, IDF, israel, lebanon, syria, strategy, regional empowerment, technological revolution

Introduction
After the Yom Kippur War (1973), Maj. Gen. (Res.) Ezer Weizmann coined the saying “The missile bends the wing of the plane” (Weitzman, 1976, p. 329), after the Israeli Air Force’s failure in the Yom Kippur War to deal with anti-aircraft missile batteries Type SA-6 from Egypt and Syria, made in the USSR. In this war the Air Force lost 102 aircrafts − 98 aircrafts were shot down by anti-aircraft missile batteries, and four aircrafts were shot down in air battles (Shoham, 2009).
About a decade later, in 1982, during the First Lebanon War, the Israeli Air Force destroyed the SA-6 anti-aircraft missile batteries deployed in the Lebanese Beqaa Valley. The destruction of the missile batteries was the culmination of a long process that began late in the Yom Kippur War in 1973. This process was made possible by the maturation of military technology for precision-guided armament, among other factors that will be discussed later. This action caused astonishment in the Western world and the Eastern bloc, and some claim that it was a catalyst for the fall of the USSR in 1989 (Schlein and Ofir, 2002).

What does this operation mean in the context of changing the nature of warfare and the perception of the use of force? Was there a natural and continuous development here in relation to the events of the Yom Kippur War, or was there a revolution and a leap in thinking that changed the nature of warfare? Discussion of changes in the nature of war, either via an evolutionary process (continuously) or through a revolutionary leap in thought, has employed military experts around the world since the middle of the last century, especially in regard to effects of technological innovations on weapons, as well as concepts of operation and power building. The military professional discourse often involves terms such as Military Technological Revolution (MTR), military revolution (MR), and revolution in military affairs (RMA). Some argue that the concepts are the same and some find differences between them. Another concept that developed in this context in the early 2000s is the Transformation.

The revolution in military affairs is essentially an intellectual process for creating a strategic advantage over the enemy, using multidimensional strategic surprise based on a new doctrine and technological innovations, and leading to a transformation in the nature of warfare. It is a lengthy process that requires enormous resources, so that even powers like the USSR and the U.S. have found it difficult to meet the budget needed to implement the change, as small countries with poor means certainly have.

This study claims that Operation Mole Cricket 19 in 1982, in which the Israeli Air Force destroyed the Syrian army’s SA-6 anti-aircraft missiles batteries in the Lebanese Beqaa Valley, and the process that preceded it in 1973–1982 was an event of a certain kind of revolution in military affairs (RMA), which is suitable for small countries and the motive for it is a security need: an unresolved threatening military problem. The Operation also maintains the model of stratagem.

The study consists of three parts. In the first part we review the origins of the revolution in military affairs that began in the 1990s, and we present different conceptions of it (Marshall, Hundley, and Gray). At the end of this chapter, we present the revolution in military affairs as a strategic stratagem. In the second part, we describe Operation Mole Cricket 19, and in the third part we perform a qualitative analysis to examine whether the characteristics of the operation pass the RMA test. This analysis reveals that the RMA that occurred in Operation Mole Cricket 19 was of a limited type, suitable for small countries.

The revolution in military affairs (RMA) in the 20th century

Background: The cold War

The search for military victory has occupied man since the dawn of time and stems from various motives such as survival and domination, as well as greed, faith, and religion. The search for a new theory to explain victory consciously and in terms of modern warfare yielded results in the twentieth century. Michael Tukhachevsky’s “Deep Operation” idea, which emerged in the late 1920s, was the fruit of intellectual thought that sought a way out of the stalemate of static World War I battles. The “Blitzkrieg,” demonstrated by the Germans in World War II,
based on the theory of “Deep Operation” — although it penetrated to the strategic, rather than to the operative, depth of the opponent.

In the 1960s, during the Cold War, Soviet military leaders had to deal with two major conflicting issues: The first was the dispersal of their forces due to the threat posed to them by NATO from tactical nuclear bombs with deadly destructive power and the ability to strike deep into the Soviet home front. The second issue was the concentration of forces for the purpose of penetrating the NATO array. The doctrine developed by the Soviets called for dispersing their forces in rear-line arrays deep into Soviet territory and concentrating them immediately after the offensive began, near the line of confrontation, so that tactical nuclear weapons against them would also endanger NATO forces (Odom, 1998, p. 73).

In the mid-1970s, U.S. military personnel were exposed to the new Soviet doctrine, and to counter it developed the doctrine of depth attack, known as ALB – Air-Land Battle – published in the FM 100-5 field manual in 1976. This doctrine evolved along with the advent of technologies that enabled accurate remote attack capability. The operational idea was to stop by fire the Soviet arrays moving to the front in the depths of Soviet territory, and to prevent them from reaching the front where NATO forces were deployed. After the containment phase, the Americans planned to launch tactical nuclear weapons at the Soviet arrays that were blocked far from the front line.

European countries developed a similar doctrine called FOFA – Follow-On- Forces-Attack, which did not include the use of tactical nuclear weapons. The emergence of Western doctrines ALB and FOFA greatly troubled the Soviets, who saw in them the potential for denying Soviet defense and offensive capabilities. By the late 1970s the Soviets began to focus on finding a solution to the implementation of these doctrines without the use of nuclear weapons. Adamski notes the extraordinary professional level of Soviet military intellectuals in understanding the new Western doctrines in the context of operational arts and their ability to block and undermine Soviet operative systems, a capability that meant a revolution in the nature of warfare. The Soviets’ understanding was deeper than that of their Western counterparts who viewed their doctrines primarily as technological upgrades (Adamsky, 2010, pp. 25–33).

**USSR: Military technological revolution (MTR)**

The Soviet response to ALB and FOFA joined another process that had begun previously in the Soviet army in the early 1970s. Soviet military experts identified that dramatic technological developments in microelectronics, laser, electronic optics, and other fields are penetrating the military field and leading, in their view, to a third technological revolution. The first revolution took place in the 1920s and 1930s and was a result of the mechanization of land and air warfare, and the second was in the 1950s with the advent of nuclear weapons and missile technology. The main fruit of this (third) revolution was increases in range and accuracy of future fire systems and the communication between them (Adamsky, 2010, p. 27).

The intellectual activity for the development of a new concept of operation was led by Marshal Nikolai Ogarkov, who was the Soviet chief of staff from 1977–1984. Soviet military intellectuals realized that American developments of guided ammunition, cruise missiles, and stealth aircraft could undermine the conventional advantage of the USSR (while the balance of nuclear deterrence led to a draw). The conclusion was, therefore, that the dramatic improvement in the quality of weapons systems as a result of new technologies made it possible to see and strike deep into the enemy’s rear and threatened the Soviet doctrine of deploying the operative echelon in a rear formation. In an interview with the Red Star in May 1984, Ogarkov explained that these innovations “make it possible to sharply increase (by at least one order of magnitude) the destructive power
of conventional weapons and they bring it closer, so to speak, to weapons of mass destruction in terms of efficiency” (Knox and Murray, 2001, p. 3).

The Soviets recognized that these technological innovations had the potential for a military revolution that they called a “technological-military revolution” (MTR), and the use of the term “revolution” came to express the idea of breaking the developmental sequence (evolution) and leap-frogging in military affairs. These were reflected in the capabilities of the “cycle of discovery and destruction,” combined with the cycle of “planning and decision,” so that the fire output will be significantly improved in range, intensity and accuracy, and increase the erosion of the enemy. This will improve the fire output, which will largely replace tactical nuclear weapons. This insight reinforced the need to develop an appropriate operating concept and doctrine. The impact of the military technological revolution at the strategic level, in Soviet eyes, was that it shifted the possibility of a nuclear confrontation to a conventional confrontation based on technological power multipliers. Another effect was that the ability to fire with such unprecedented intensity obscured the distinction between offensive and defensive combat, as defensive arrays can also hit enemy depths (Adamsky, 2010, pp. 26–30).

In analyzing Western military doctrines, the Russians drew three conclusions. The first is that the ability of the precise armament combined with the intelligence systems endangers their second (rear) operative tier; second, the conventional stage in the future war has expanded significantly at the expense of the tactical nuclear part; third, the chance of an only conventional confrontation increases. The Soviets also understood that the ability to see and strike from a distance is a revolutionary sequence breaking that constitutes a leap in the development of warfare (Adamsky, 2010, p. 32).

The working assumption of the Soviets was that both sides would be equally equipped with the required systems; therefore, supremacy would be achieved for the side that develops a concept of operation more quickly and comprehensively. The doctrinal response that the Soviets developed was operational theory (at the operational level), based on the “deep operation” developed by Tukhachevsky in the late 1920s. This theory consisted of two basic conceptions of accurate fire and maneuverability. The accurate fire for the tactical level was called the “fire complexes” (ROK), and for the operational level it was called “reconnaissance-strike” (RUK). The maneuvering would be done by the Operational Maneuvering Group (OMG). Its plan was to launch an accurate attack from both the front and the operational depth, while at the same time maneuvering into the operational depth of the enemy to destroy it, while maximizing coordination between fire and maneuverability. The new doctrine was documented by General Danilevich in five abundant volumes (Adamsky, 2010, pp. 33–37).

USA: The military revolution (RMA)

New technologies and their impact on the nature of war. In the 1950s, during the Cold War, the United States adopted the First Offset Strategy, a nuclear deterrent designed to address conventional quantitative asymmetry in favor of the USSR and the threat of an invasion of Europe. When the USSR developed its own nuclear capability, a new offsetting strategy was needed. The military thinkers planning the new, second strategy sought advanced technologies to accurately attack Soviet forces deep into Soviet territory to block a possible invasion. The technological research was focused on laser, micro-electronics, electro-optics, as well as inertial and satellite navigation (GPS).

In 1972 during the Vietnam War, the Americans demonstrated the fruits of their first development efforts and first used a laser-guided bomb that destroyed the Tan-Hua Bridge in North Vietnam, following 871 previous attacks with iron bombs, which failed in this mission. The
destruction of the bridge was a milestone in the development of accurate guided armaments (Grant, 2016, p. 2).

In the first half of the 1970s, Stephen J. Lukasik, Director of ARPA, and Fred Wikner, representative of DNA, initiated the establishment of a committee to conduct research, later known as LRRDPP, to examine new technologies that developed at the time, such as microprocessors and information processing for military applications such as precision armament and satellite navigation. This study laid the first seeds for a revolution in military affairs later. The committee consisted of Albert Wohlstetter, one of the electives of experts in nuclear strategy during the Cold War (Wohlstetter, 2009, p. 52). In an article published by Wohlstetter in 1974, he wrote that the microprocessor revolution, sensor technology, along with data processing and communications could bring about a dramatic change in warfare. Accurately guided armament would increase the effectiveness of warfare and limit secondary damage to casualties and property, caused by ordinary armament. In 1983, in another article he published, Wohlstetter explained that improving the accuracy of ammunition to a target tenfold is equivalent to an increase in the intensity of the explosion above the target a thousand times. Deputy Secretary of Defense Paul Wolfowitz noted in 2003 that Wohlstetter was one of the first to recognize the dramatic change that the precise armament could bring about (Beccevich, 2005, p. 161).

The CIA followed the military technological revolution in the USSR and had a great deal of information about what was happening in it. In 1974, the Central Intelligence Agency translated the groundbreaking Soviet work, “Scientific-Technical Progress and the Revolution in Military Affairs” into English. However, despite the wealth of information held by the Americans, they did not understand in depth Russia’s conceptual innovation in the context of Operations Art, and credited it mainly with technological innovation, not identifying elements that would lead to a revolution in modern warfare (Adamsky, 2010, pp. 62–64).

In 1976, the doctrine of Air-Land Battle (ALB) first appeared in the FM 100-5 field manual, which identified the Soviet quantitative advantage as the combination of air-land forces and new technological means (FM 100-5 Operations, 1976, pp. 8–1). This doctrine laid the foundations for the operational level in American military thinking. The theory of operation, in which firepower and maneuvering were given equal importance for the first time (FM 100-5 Operations, 1982, pp. 7–1) appeared in the 1982 version of FM 100-5.

In 1978, William Perry, the U.S. Deputy Secretary of Defense for Development, stated that accurate armament could revolutionize the nature of war. Proper utilization of technology could enable Americans to deter the Soviets without competing quantitatively with them. In the same year, Perry commissioned DARPA, the Agency for the Advanced Research of Defense Projects, to coordinate and lead the development of required technologies, such as intelligence and automatic target acquisition; accurate long-range guided armament; GPS-based navigation and guidance (GPS); means of command and control; and stealth technology. DARPA has consolidated these projects under one integrated project called the Assault Breaker (DARPA Technical Accomplishments Volume II, 1991, pp. 5–5).

Secretary of Defense Harold Brown, who wanted to emphasize the importance of conventional force in an era of nuclear deterrence, said in Congress in 1980: “Nuclear deterrence (U.S.) alone will not deter Soviet forces from invading Western Europe, we rely on conventional forces” (Grant, 2016, p. 2). In 1987, the Department of Defense established the “Long-Term Strategy Committee,” headed by Albert Wohlstetter and Fred Ikle. In the report, the committee noted that the Soviets were at an advanced stage in understanding the implications of military application for advanced technologies, primarily in terms of range and accuracy. Among other things, the committee recommended that U.S. strategy must combine technology, concept of operation, and power building for all types of conflicts (Fred C. Ikle, Albert Wohlstetter, 1988). In 1988 the committee set up a
working group led by Andrew Marshall and Charles Wolf which issued a report reiterating the committee’s findings emphasizing that in the next twenty years technological revolutions have the potential for fundamental change in the nature of warfare (Andrew W. Marshall, Charles Wolf, 1988, p. 26).

Operation Desert Storm, which began on February 17, 1991, served as an experimental laboratory for all of the new military technologies developed in the previous two decades: intelligence and target acquisition, synchronization and communication between forces, and precision-guided armament. It also demonstrated a new concept of synchronized attack operations from the entire operational depth, and attack on strategic enemy centers of gravity.

William Perry, in his article “Desert Storm and Deterrence,” explains that the “second offset strategy” was essentially based on a technological advantage, while the ALB doctrine applied in “Desert Storm” was based on an operational concept that effectively operates systems with superior technology. Three such systems were reflected in the Gulf War: C3I, air defense suppression systems, and precision-guided armament (Perry, 1991, pp. 68–69).

Office of Net assessment (ONA). Since the late 1970s, the Office of Net Assessment (ONA), a section of the U.S. Department of Defense (DOD), has been following with great interest the military publications from the USSR that have been circulated in the American intelligence community. In early 1991, shortly after Andrew Krepinevich joined the Office (ONA), Andrew Marshall, the head of the office, instructed him to prepare an assessment report that would examine whether Soviet theorists were right in their assessment that technological developments would lead to major changes in warfare.

The conclusion reached by Department officials, as the report shows, is that the Russian theorists were right and that technological developments do indeed lead to changes in the nature of warfare and necessitate changes in the concept of operation and power building. In the opening remarks of the 2002 edition of the report, Marshall states that the Americans were the first to develop advanced technology-based weapons systems, but the Soviets were the ones who developed a theoretical intellectual infrastructure for the technological changes they identified on the American side, and first understood that these changes were causing a revolution in military warfare (Krepinevich, 1992, pp. i-ii).

The importance of this report is that it formally introduced into and established the concept of military revolution in the American security establishment after a long process begun in the mid-1970s. This idea means that the effective implementation of military technological innovation requires changes to the point of revolution in the concept of operation and power building.

Theorists of RMA. In 1993, Andrew Marshall, as the head of the ONA, published an internal memorandum considered to be the founding document of the US RMA, which contained his insights into the nature of the military revolution. Marshall argues that technology is necessary, but is not the point. For Marshall, the main thing is the primacy of finding an intellectual solution to the military challenge and implementing it in an innovative way with the help of technology (new or existing), and by changing the doctrine and concept of operation. These usually also lead to a change in the organization and structure of power. Marshall bases his arguments on the fact that throughout history, with a given technology, countries have faced different challenges and have therefore produced different solutions (Marshall, 1993, p. 1). Marshall further defined the revolution in military affairs as follows:

A Revolution in Military Affairs (RMA) is a major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine
and operational and organizational concepts, fundamentally alters the character and conduct of military operations (McKitrick, et al., 1998, p. 65).

In 1999, Richard Hundley presented his ideas and conclusions in a report published by the RAND Institute. Hundley opens the discussion on the essence of RMA with a definition:

An RMA involves a paradigm shift in the nature and conduct of military operations, which either renders obsolete or irrelevant one or more core competencies of dominant player, or creates one or more new core competencies, in some new dimension of warfare, or both (Hundley, 1999, p. 9).

Hundley’s definition is based on characteristics he had identified in revolutions in military affairs in the past For example, the revolution is usually developed not by the dominant player in the field but by the one threatened by him. The first one to implement the new technology in the revolution is usually not the one who developed it. In his analysis he concludes that the main motive for the revolution is an unresolved military challenge, and that in the process of revolution there must be breakthroughs that result in new technology, new devices, new systems, new concepts of operation, and new doctrines. (Hundley, 1999, p. 22).

In 2006 Colin Gray added his own insights into the meaning of RMA. Gray identifies RMA-like events prior to the great debate over the nature of RMA that began in the United States in the 1990s. Examples of such events or developments include: the use of laser-guided bombs in the Vietnam War; an “assault breaker” project for the development of long-range guided bombs to stop the Soviet armor far from the front in the depths of Russian territory; the Soviet theory in the context of the “Revolution in Military Technology” (MTR); aircraft stealth technology and missile accuracy as they appeared in the 1991 Gulf War (Gray, 2006, p. v).

Gray prefers a minimalist definition of RMA: “RMA is a radical change in the character or conduct of war” (Gray, 2006, p. 5). He emphasizes the context in which the revolution takes place. Examples include: Socio-economic context – is there a budget? Is there a social willingness to invest in military projects? Technological context – are technologies available? Geographical context – is the country threatened by enemies around it? Political context – the nature of the administration and its ability to make decisions for the realization of long-term projects. Given all this, a revolution may occur. Gray does not contradict Marshall but emphasizes other conditions (Gray, 2006, p. vi).

Following the discussion of the essence of RMA, Gray examines whether military change is made by way of revolution (non-gradual and dramatic change) or by way of evolution (gradual change), and explains that after RMA, the conceptual revolution, comes a long process of implementation, meaning transformation, a concept that largely replaced the concept of RMA (Gray, 2006, p. 2).

Donald Rumsfeld. In May 2002, Donald Rumsfeld published an article in The Journal of Foreign Affairs following a visit to U.S. forces deployed in Afghanistan. Rumsfeld was deeply impressed by the special American forces he encountered during his visit, especially their ability to adapt to the terrain and assimilate into the environment. They were bearded, covered in gallows, riding horses with their equipment carried on mules. From Rumsfeld’s point of view, this is the essence of the transformation: adapting to the environment and threats and providing creative and effective solutions, combining advanced technology like laser-guided bombs, old technology like the B-52 bomber (equipped with modern systems), and horses and mules as a means of mobility. The challenge facing the U.S. military in the 21st century is to protect the United States from the unknown, the uncertain, the invisible, and the unpredictable. According to Rumsfeld, the U.S. military needs
to change its approach, and instead of preparing for confrontation with potential enemies such as Russia, it must prepare to defend itself against threats to U.S. vulnerabilities. One of those threats is the terror that struck the U.S. on 9/11. Such a change requires a profound change in thinking and necessitates resources. Systems developed against the old threats, especially the nuclear threat, must be reduced, and new, high-tech means must be developed to deal with the new threats, centered on terrorism of various kinds. The transformation is not a point event but an ongoing process that in fact never stops. The importance of Rumsfeld’s article is that he to some extent restored the processes of military change from revolution back to evolution (Rumsfeld, 2002).

Between revolution in military affairs (RMA) and military revolution (Mr). Gray refers to the distinction between military revolution (MR) and revolution in military affairs (RMA) and explains that behind a revolution in military affairs there is a theoretical background – but emphasizes that there is a minor difference between these two terms (Gray, 2006, p. 4). Andrew Krepinevich’s definition of a Military Revolution (MR) is also very similar to a Revolution in Military Affairs (RMA):

What is a military revolution? It is what occurs when the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptation in a way that fundamentally alters the character and conduct of conflict. It does so by producing a dramatic increase – often an order of magnitude or greater – in the combat potential and military effectiveness of armed forces (Krepinevich, 1994, p. 1).

Compared to Gray and Karpinewitz, Murray and Knox find a significant distinction between military revolutions (MRs) and a revolution in military affairs (RMA). According to them, the great military revolutions originated in technological revolutions that led to social and political changes, along with less comprehensive changes, each change being realized as a revolution in military affairs. For example, the Industrial Revolution led to a military revolution with associated and resultant RMAs: a technological revolution in land warfare and transport, such as the telegraph, railroads, steamships, quick-firing smokeless-powder small-arms and artillery, and automatic weapons. (Knox and Murray, 2001, pp. 12–13)

Intermediate summary. Indeed, the concept and essence of the Revolution in Military Affairs are complex, and there are different approaches as to how to relate to the concept and what should be emphasized in it. For example, Marshall emphasizes “significant change in the nature of warfare,” Hundley emphasizes “changing the paradigm” and eliminating the opponent’s core abilities, Gary emphasizes the context in relation to factors such as society, economy, and politics, and Karpinewitz emphasizes the dramatic increase in combat potential and military efficiency of the armed forces. However, each characteristic of the revolution in military affairs has three components on which there is agreement: (1) a groundbreaking technological means, (2) a change in the concept of operation accompanied by a change in doctrine, and (3) a change in the organization accompanied by a power building.

Between a revolution in military affairs and a military stratagem

Stratagem. Probably the most famous stratagem in the history of human warfare, which is partially documented, is the story of the Trojan horse in the Trojan War that dates back to 1193 – 1184 BC. The Trojan War is narrated in Homer’s work, “Iliad.” (The Iliad, 1923) This story of the horse that was led by the residents of the city of Troy to their city when the Greek warriors were hiding inside
is also mentioned in Homer’s second work, “Odyssey” (The Odyssey, 1946). Another famous stratagem is Hannibal’s intrusion into northern Italy at the beginning of the Second Punic War (218–201 BC). Hannibal attacked Italy from its northern border, which was considered protected, after crossing the Alps with his army, a route considered impassable (Livius, 1823, p. 237).

The stratagem, according the IDF definition, is a clever way of waging war by exploiting enemy weaknesses or by causing them, using surprise, deception, or tricks – all to get the enemy off balance and cause him to collapse. In any situation and at any level, the stratagem is the central idea of the method of execution, not an addition to it. The stratagem is a principle in the IDF’s list of war principles (IDF, 1998, p. 640). In other words, the stratagem is an operative plan to gain an advantage over the enemy using surprise, deception, or trick aimed at the enemy’s weak point, and the exploitation of this advantage to achieve the plan’s purpose. In the context of this article, the relevant means of creating the advantage over the enemy is the surprise, in particular a technological surprise. Surprise and technological surprise are key elements in the revolution in military affairs. The change in the nature of warfare leaves the opponent taken aback and helpless in his ability to respond.

**Surprise.** The American Field Manual definition for surprise:

> Strike the enemy at a time or place or in a manner for which he is unprepared... Surprise can decisively shift the balance of combat power. By seeking surprise, forces can achieve success well out of proportion to the effort expended... The enemy need not be taken completely by surprise but only become aware too late to react effectively. (FM 100-5 Operations, 1993, pp. 2–5)

With the advancement of technology, it is increasingly difficult to surprise by large forces. However, even if the enemy is not completely surprised, the test is that the enemy will not be able to respond effectively to the surprise. Factors that contribute to the surprise are speed, effective intelligence, deception, use of unexpected force, various tactics, and methods of action. The surprise can be in the pace, timing, size of the force, direction, and location of the main effort. The IDF definition is similar:

> action against the enemy that is evident in the timing, place, power, method of action and means he does not expect. Surprise is one of the means of stratagem (IDF, 1998, p. 153).

In other words, surprise is a situation in which the target of surprise finds himself as a result of the action of surprising, which has an unexpected component for the surprised party in one or more of the following dimensions: intention, time, space, intensity, method of action, technological means, or other. The surprise can be classified according to the levels of war. The surprise can be tactical at the battle level, aiming to surprise enemy forces actively involved in the battle. An operational surprise at the theater level aims to surprise the enemy in the context of a particular operation planned to be carried out. Finally, strategic surprise aims to surprise in the context of goals, intentions, strategies, and capabilities.

**Technological surprise.** A technological surprise occurs when (a) there is no full intelligence about the enemy’s weapon systems and their features, or (b) when there is full or partial intelligence about them but no proper reference to the existing intelligence. In cases where (a) there is no full intelligence, the following alternatives are possible: (1) The enemy has new, unfamiliar weapon systems with unknown performance. (2) The enemy has familiar weapon systems but with surprisingly unknown performance. (3) The enemy has known weapon systems, but
it is not known that these systems are in enemy hands. In both cases where (a) there is no intelligence on the weapon systems in the hands of the enemy, or (b) there is intelligence but no appropriate reference, a technological surprise will occur. The source of surprise is the unexpected or the inability to cope with the expected.

The test case: Operation mole cricket 19

Lessons from the Yom kippur War (1973)

After the Yom Kippur War (1973) and the Israeli Air Force’s failure to deal with anti-aircraft missile batteries, especially the SA-6 missile, the Israeli Air Force (IAF) conducted a self-examination and began the process of drawing lessons and finding a solution to the problem. An analysis of the missile batteries problem that was done after the war led to the conclusion that the main problem was the mobility of the missile batteries. An attack round of missile batteries lasted about 24 h: aerial photo shoot, development of the film, locating targets on the aerial photograph, planning and coordinating the attack, and finally the attack. During these 24 h the missile batteries changed their positions, and the attacking aircraft had difficulty locating the targets. The proposed solution was an attack round in a closed circle. This meant continuous observation of the targets and an ongoing update of their location in real time, to a control center that updates the attack aircraft in the air. The solution posed two problems: How to maintain continuous observation over the targets? Answer: Use of unmanned aerial vehicles (UAV). How to manage in real time the huge amount of information that would come from the continuous observation, and update the attack planes? Answer: A dedicated command and control system must be developed (Ben-Israel, 2016).

During 1974, the IAF formulated a founding document to address the problem of missile batteries. The document referred to a multi-functional combat system that included observations and collection of targets data, control and monitoring, weapons, intelligence, communications, and training program. The document was signed by Brigadier General David Ivri, who was at the time chief of air staff group (Deputy Commander of the IAF). Work teams were established, and the development process continued until 1981, and at the end, the IAF had a solution to the problem (Ivri, 2007, pp. 68–71).

David Ivri was the ninth commander of the Air Force, from 1977 to 1982, and the period when he was in command is considered a successful period for the Air Force. Notable events during his time: Operation Opera, in which IAF fighter jets destroyed the “Osirak” nuclear reactor in Iraq, and the First Lebanon War, which included Operation “Mole Cricket” 19; subsequently, IAF fighter jets shot down 82 Syrian planes without a single loss. Ivri was the first to identify the threat of surface-to-surface missiles to Israel. As early as 1990, about four months before Saddam’s invasion of Kuwait, he warned that Israel was not prepared to face the missile challenge. For Ivri, the highlight of the IAF since 1973 had been the destruction of missile batteries in Operation Mole Cricket 19. Ivri says that during the attack of the missile batteries, dogfight developed in the skies of the valley. The commander of the operation made an intelligent decision to evacuate the arena to avoid the attacking planes and to allow the interceptors to deal with the Syrian MiGs. At the basis of the decision was the rationale that the purpose of the operation was achieved and there was no need to risk the lives of the pilots (Lapidot, 1997).

Development of a new aerial doctrine and related weapon

In 1974, Colonel Aviam Sela, an officer in the IAF’s Operations Department, was assigned the task of developing a central command and control system for the IAF. Within about six months, Sela
and his team presented the first version of an innovative computerized command and control system called “Periscope,” which was installed in the IAF’s command pit at the “Kirya” in Tel Aviv. At the end of 1974, the system was tested with great success during an IAF exercise (Sela, 1994, p. 50).

In October 1977, David Ivri was appointed commander of the IAF. According to his document from 1974, he changed the IAF’s operating concept and doctrine. The first strategic goal he set was to achieve freedom of action for the IAF, that is, the ability to destroy threats like missile batteries that endanger the freedom of action of the IAF. Air superiority – by destroying the enemy Air Force on the ground, which had been given first priority, shifted to second priority (Ivri, 2007, pp. 68–71).

As part of the new operating concept, the IAF was looking for suitable armament to eliminate the batteries of anti-aircraft missiles, and especially the SA-6 missiles. At that time the IAF was equipped with AGM-45 “Shrike” missiles that provided only a partial solution. The “Shrike” can track radiation-emitting targets like the anti-aircraft battery’s radar if they emit radiation. The limit of the “Shrike” is that if the enemy turns off the missile battery’s radar, the “Shrike” loses its tracking ability (Marinko, 1993, p. 5).

In 1975, the Americans offered the IAF the AGM-78 missile, which was able to overcome the tracking problem and remember the location of the source of the radiation from the missile battery’s radar after it was turned off. This missile model was operated by the Americans from Phantom F-4 aircraft, on which a special system for operating the missile was installed. This system was very expensive and did not align with the IAF concept. The IAF decided together with the manufacturer General Dynamics to convert the missile so that it would be autonomous and could operate without a special operating system on the plane. In 1976 the IAF began to receive the first missiles developed specifically for it. The Hebrew name given by the IAF to the upgraded AGM-78 was “Purple Fist” (Marinko, 1993, p. 5).

The IAF decided that the Phantom 105 Squadron would be the squadron that would operate the “Purple Fist” missiles, and this would be its main mission (dedicated force). A training system was set up in the squadron to operate the missile against missile batteries, and the pilots were trained for this task (Marinko, 1993, p. 5). Simultaneously with the construction of the air power, the IAF established a surface-to-surface missiles battalion. The battalion was equipped with the “Kachlilit” missile, based on the AGM-45, which was converted from an air-to-surface missile to a surface-to-surface missile, and its range was extended to 70 km (Shoham, 2009). Subsequently, the “Kachlilit” missile was replaced by the “Keres” missile, based on AGM-78 (Merom and Schuster, 1992, p. 5).

In addition, in 1976 the IAF purchased GBU-8 electro-optical bombs. The bomb consists of an iron bomb Mark 84, weight one ton, on which is mounted an electro-optical guidance kit made by “Rockwell.” The bomb has an electro-optical guidance mechanism that allows optical locking of the missile on the target during the day and locking on the target at night using infrared imaging. The bomb was called “Gray Fist” in the IAF (Ben-Israel, 2016).

Destruction of missile batteries

On June 3, 1982, two terrorists from Abu Nidal’s organization assassinated the Israeli ambassador to Britain, Shlomo Argov and fatally wounded him. During the next two days, there was a fire exchange on the Lebanese border between IDF and PLO forces. On June 6, the IDF invaded Lebanon with the aim of keeping PLO terrorists away from the Israeli Lebanese border. From the beginning of the operation, the Israeli government had stated that it did not intend to confront the Syrian forces deployed in Lebanon unless they threatened IDF forces. As the IDF forces advanced, it was clear that a confrontation with the Syrian forces was inevitable. The Syrian threat was mainly to the freedom of operation of the IAF in the skies of Lebanon, due to the batteries
of SA-6 anti-aircraft missiles that were deployed in the Lebanese Beqaa Valley. Therefore, Chief of Staff Major General Rafael Eitan asked the government for permission to attack the Syrian anti-aircraft missile batteries.

On June 9, the government approved Operation Mole Cricket 19 to destroy the missile batteries deployed in the Lebanon Valley that threatened the IAF’s freedom of action (Ivri, 2007, pp. 68–71). The operation began with Squadron 2000 launching “Telem” and “Shadmit” types of Unmanned Aerial Vehicles (UAVs) toward the missile batteries (Lambeth, 1984). Their goal was to entice the Syrians to use the missile batteries to intercept the UAVs. The Syrians did identify the UAVs and operate the missile batteries. The attack on the batteries began with firing surface-to-surface missiles of the “Kachlilit” and “Keres” types at the missile batteries. After the missile batteries were attacked by surface-to-surface missiles, the air attack began with about twenty “Phantom” planes from Squadron 105 that launched “Purple Fist” missiles at the tracking radar of the anti-aircraft batteries to destroy it. Air-to-surface missiles were fired while the attacking aircraft were out of range of the anti-aircraft batteries (Marinko, 1993, p. 20). “Phantom” aircrafts from other squadrons, also outside of the batteries’ range, launched subsequent attacks, firing “Gray Fist” missiles at the batteries. (Ben-Israel, 2016).

All the while, F-15 and F-16 interceptors were in the air defending the attacking planes. In addition, there was a Boeing 707 electronic warfare airplane (Ivri, 2007, pp. 68-71) that shielded the area of operation from the Syrian radar, and an E-2 Hawkeye control and early warning aircraft (Hurly, 1989). Within about 20 min of the start of the attack, 13 missile batteries were destroyed, and six additional batteries were neutralized. The Syrians were in shock and sent MiG-21 and MiG-23 fighter jets to intercept the IAF planes. During the dogfights, 26 Syrian planes were shot down, but not a single Israeli aircraft was hit. The entire operation was conducted by Colonel Aviam Sela from the command pit in the Kirya, using the Periscope system (Ivri, 2007, pp. 68–71).

**Analysis**

**The RMA test**

Based on the review and discussion presented above on the military revolution, we will propose, below, a test for the existence of a revolution in military affairs. This is a test that can be refined in further studies; it lays down basic characteristics for identifying the revolution in military affairs. The characteristics listed in the test are such that they can be identified and determined whether they occurred or not, in relation to any test case (below we will see which characteristics must exist). The following are the relevant characteristics: (1) a paradigm shift characterized by rendering obsolete or irrelevant one or more core competencies of the dominant player, or by the development of a basic capability in another combat dimension, (2) a groundbreaking combat system based on new technology or a new groundbreaking application, (3) A new concept of operation that is accompanied by a compatible doctrine and (4) the building of military power accordingly. To these four characteristics it is appropriate to add another characteristic that has a degree of subjectivity: a perspective in terms of time is required to evaluate it: (5) The revolution was tried in the battlefield and was significantly successful.

**The meaning of paradigm shift**

Here is the place to clarify the significance of a paradigm shift in general and of a revolution in military affairs in particular. Thomas Kuhn argued that science evolves and changes not in a linear way of accumulating knowledge, but in a revolutionary way (Kuhn, 1996). The existing
paradigm in a particular field includes a series of rules, assumptions, theories that enable prediction, measurement tools, and observations that validate the theories. At some point, an abnormality is noticed in the observations. If the deviation expands to the point of undermining the intellectual infrastructure of the paradigm, and if at the same time another intellectual infrastructure arises, a process of scientific revolution takes place. The previous paradigm is thrown into the dustbin of history, and the new paradigm takes its place (Kuhn, 1957).

In the context of military theory and the nature of warfare, a change in paradigm can be described and explained in a way similar to the above. For example, the development of firearms rendered cold weapons obsolete or irrelevant to the battlefield, and led to a paradigm shift that changed the nature of warfare. Other examples of paradigm shift that may materialize in the future, would be developing a new weapons system that would render anti-aircraft missile systems obsolete or irrelevant against aircraft attacks. Or a shift in paradigm could be the result of a weapons system that neutralizes ballistic missile systems and renders them obsolete or irrelevant. During President Reagan’s administration, the U.S. Department of Defense formulated ideas for a strategic ballistic missile defense project known as Star Wars (SDI). The success of this project would have rendered ballistic missile warfare – and, in the specific case at which the project was aimed, the Soviet ballistic missile array – obsolete or irrelevant. During Operation Iraqi Freedom, this technology was used. In practice, this ammunition is not effective enough, and it does not make armored warfare redundant.

To the idea of paradigm shift in warfare and rendering core capabilities obsolete or irrelevant must be added the “weapons and counter weapons circle” that exists in the modern age. The meaning of this circle is that for nearly every innovative weapon system that develops after a learning process, there will be a weapon system capable of dealing with or acting against it. To exaggerate, for each aircraft, a missile that will knock it down will be developed, and for each missile, a plane that can destroy it will be developed. Therefore, rendering core capabilities obsolete or irrelevant is usually temporary, so that does not necessarily change the nature of warfare forever.

The RMA test for operation mole cricket 19

We will examine Operation Mole Cricket 19 according to the test we proposed above, and check whether this operation can be considered a revolution in military affairs:

1. A paradigm shift characterized by rendering core capabilities of a dominant player obsolete or irrelevant or by the development of a basic capability in another combat dimension. The solution developed by the Israeli Air Force was groundbreaking and addressed the SA-6 anti-aircraft missiles problem. It rendered the Soviet SA-6 anti-aircraft missile array obsolete or irrelevant and came as a complete shock to its national security establishment. But the solution did not provide a sweeping answer to all existing and future anti-aircraft systems, nor did it render the anti-aircraft warfare obsolete or irrelevant. Therefore, there is no paradigm shift here. If the solution developed by the IAF had made air defense warfare obsolete or irrelevant, there would have been a paradigm shift in our case. In practice, what happened was that the destruction of the SA-6 missiles in the operation exposed the vulnerability of the Soviet anti-aircraft missile system for several years. In response, the USSR developed a new and
more advanced generation of anti-aircraft missiles: The S-300 and the S-400, which have a range of up to about 400 km and are probably immune to the technology and doctrine that caused the destruction of the SA-6 in this operation.

2. A groundbreaking combat system based on a new technology or a new groundbreaking application. As part of the planning and preparations for Operation Mole Cricket 19, a number of military systems were planned and developed. In the field of targets identification: UAVs above the targets for continuous observation. In the field of attack: precise air-ground and ground-to-ground armament systems. In the field of control: a computerized Command and Control system.

3. The design of a new operating concept accompanied by a compatible doctrine. The basic operating concept was changed from aerial superiority to freedom of action. The doctrine of warfare was updated accordingly and included three new components: (1) the process of locating targets continuously and attacking them in a closed circle. The process shortened the duration of the IAF’s response and addressed the mobility of Syrian missile batteries; (2) a Command-and-Control system for continuous data acquisition, processing, and transmission as targets to the attacking force; (3) attacking outside the range of the missile batteries by accurate long-range guided armament.

4. Appropriate power building. The power building included the allocation of a Phantom 105 Squadron dedicated to the mission (to operate a “Purple Fist”), the establishment of a dedicated ground-to-ground missile battalion (“Keress” and “Kachlilit”), and the reorganization of the Command-and-Control pit in the “Kirya” – the headquarters of the IDF (“Periscope” system).

5. The revolution was tested in the battlefield and was significantly successful. The realization of the revolution that took place in the IAF in 1974–1982, in the context of the new operating concept of freedom of action, was realized in Operation Mole Cricket 19 with extraordinary success.

To summarize the test, Operation Mole Cricket 19 maintains four of the five characteristics we have defined. The first characteristic that we defined – “a paradigm shift leading to a change in the nature of warfare” – is not present.

**RMA for small countries – the Israeli model**

Military change as part of a revolution rather than a gradual and continuous (evolutionary) one requires a lot of funding, for the reason that there is a leap forward in the nature of warfare and the natural developmental sequence is broken. In addition to funding vast development processes of new technologies and their application to groundbreaking combat systems, there is a need to fund the acquisition of new means, to fund the design and writing of the new operating concept, and to fund the change of organizational structure and power building accordingly. Roughly speaking, this amounts to hundreds of millions of dollars a year over several years. In addition to the intolerable funding, the chances of a revolution in military affairs stand at about 50% (Hundley, 1999, p. 15).

This is a heavy burden that a non-world power cannot withstand, and that even a world power would find difficult to withstand. A prominent example of this is the USSR, which failed to fund the military revolution (MTR) conceived by its military experts, due to its precarious economic situation that later led to the collapse of the USSR. This fact raises a number of poignant questions about changes in the nature of warfare: Who needs a revolution? And why not continuous change (evolution)? What is the scope of the revolution required? And why not replace the revolutionary approach with a problem-solving and solution-finding approach?
The findings and facts presented so far lead to the insight that it may be possible to characterize a different kind of operation as a revolution in military affairs. Here are the findings and facts: (1) Operation Mole Cricket 19 presented four of the five characteristics but did not lead to a paradigm shift in the nature of the war. (2) A revolution in military affairs as described above and as characterized by the feasibility test requires an investment of billions of dollars that even strong powers have difficulty dealing with. See the case of the USSR in the 1980s. (3) The Israeli Air Force, a small country force, managed to surprise and destroy the SA-6 anti-aircraft missile batteries made in the Soviet Union, and neutralize for several years the USSR’s core capability in this field, which until then had been invincible.

The motive for a revolution in small countries is a security need: an unresolved threatening military problem, in contrast to the classic military revolution that stems from technological developments, intellectual thought, or rivalry between powers. This kind of revolution does not lead to a paradigm shift and consequently to a change in the nature of warfare, but it does hold four of the five characteristics of the RMA test we proposed: characteristics (2)—(5). As part of the process of finding the solution to the military problem, the developer is looking for existing solutions, technologies, and weapons systems. What exists and is available for use is purchased and integrated into the solution, and what is missing is ordered as part of a development project.

**Operation mole cricket 19 as a stratagem**

We have shown that Operation Mole Cricket 19 maintains the characteristics of RMA for small countries as defined above. The process that began in 1974 and ended in 1982 can be divided into two stages: stage A - preparations, and stage B - realization. In the first phase, the infrastructure of the revolution in military affairs was developed, which included innovation in weapons systems along with the design of a new doctrine, an appropriate organizational structure, and power building. At this point a technological surprise was built to gain an advantage over the enemy. The surprise was that the enemy did not know about the preparations or the means and did not assess the Air Force as having a weapons system that could destroy its missile batteries. In the second stage – the realization, the Air Force realized at the start of the operation the advantage it had and destroyed the missile batteries. This is exactly the model of a stratagem, creating an advantage in the first stage against the enemy’s weak points and realizing this advantage to achieve the goal of the stratagem.

In general, it can be said that in a revolution there is an element of surprise whose goal is to gain an advantage; and the realization of the advantage will lead to the achievement of the goals of the revolution. It should be noted that it is not always necessary to realize the advantage on the battlefield; it can be realized in the dimension of deterrence when the enemy recognizes the advantage in front of him and is deterred.

**Summary**

In the study, we reviewed the development of the Military Technological Revolution (MTR) concept in the 1970s in the USSR, resulting from analysis done by Soviet intellectuals, as well as the effects of technological developments that appeared in the West on the nature of warfare and as part of the Soviet Cold War strategy. It was the Soviets who were the first to realize that the new technological developments that first appeared in the West had the power to revolutionize military affairs, but that a theoretical infrastructure and appropriate doctrine were needed to bring about a revolution that would change the nature of warfare.
The Americans, who were looking for a second offsetting strategy after the first collapsed, developed technological means in response to the quantitative asymmetry with the Warsaw Pact. It was not until the late 1980s, after the Soviets had understood the implications, that Americans began to recognize that new technological means, such as C3I, precision-guided armament, information warfare, and stealth, had the power to revolutionize and change the nature of warfare. For the revolution to be successful it takes intellectual infrastructure, doctrine development, power building, and organizational change.

In the analysis chapter we proposed a test to examine whether a particular process is a revolution in military affairs, which includes five characteristics to test for. From the findings and facts, it emerged that Operation Mole Cricket 19 fulfills characteristics (2) - (5) and does not fulfill characteristic (1): paradigm shift of the nature of warfare by rendering core competencies of a dominant player obsolete or irrelevant, or by developing core competencies in another military dimension. Combining the results of the RMA test with the rest of the findings led us to the conclusion that in Operation Mole Cricket 19 there was a revolution in military affairs of a different kind suitable for small countries and originated in a need or unresolved security problem.

Prof. (Maj. Gen. Res.) Yitzhak Ben-Israel sees the process that the IAF underwent in the years 1974–1981 as a Revolution in Military Affairs (RMA). He claims that the American RMA demonstrated in the Gulf War is based in part on Israeli thought and lessons from Operation Mole Cricket 19, a fact that confirms the claim that the process in the Israeli Air Force was indeed a kind of RMA. In the field of UAVs, Israel preceded the United States by about 20 years, and prior to the Gulf War in 1991, the United States purchased from Israel UAVs that were used during the war (Ben-Israel, 2016).

Dima Adamski came to a similar conclusion. He claims that in the years 1973–1982, an RMA process did take place in the IAF, culminating in Operation Mole Cricket 19, but he claims that the IDF was not able to generalize the RMA process from the IAF to the entire army and the land army’s warfare paradigm did not change, due to the organizational culture of the IDF (Adamsky, 2010).

Conclusions

1. A small country cannot carry out a revolution in military affairs due to the enormous resources required and to limited chances of success. But a small country can revolutionize military affairs for small countries limited in scope, and the change does not have a paradigm shift leading to a permanent change in the nature of warfare. This is a process that begins with defining a problem / need and designing a focused and effective solution that has a high chance of succeeding. This was the case in Operation Mole Cricket 19 in July 1982.

2. A successful revolution in military affairs has an “expiration date” when, over time, the products of the revolution - the weapon systems that changed the nature of warfare, are available in the market and finally come into the hands of the adversary. This point raises the questions of whether and when investing in a revolution in military affairs is worthwhile.

3. The idea of transformation or gradual change, as suggested by Secretary Rumsfeld, is probably the correct idea, based on ongoing threats and designing solutions for them as to resolve unresolved threatening military problems.

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Notes
1. The exact terminology: Military Technical Revolution
2. See, for example, a report by the CSBA Institute: "Revolution in War" by (Vickers & Martinage, 2004, p. 1).
3. See, for example, "The Dynamics of Military Revolutions" (Knox & Murray, 2001, pp. 11-12)
4. ARPA – Advanced Research and Projects Agency
5. DNA – Defense Nuclear Agency
6. LRRDPP – Long Range Research and Development Planning Program
7. Threats and Promises of Peace
8. Paul Wolfowitz: U.S. Deputy Secretary of Defense 2001-2005 in President George W. Bush’s administration.
9. Harold Brown - Secretary of Defense of the United States from 1977 to 1981, in President Carter’s administration.
10. Mutual nuclear deterrence has effectively prevented the use of nuclear weapons on both sides.
11. C3I- Communication, Command, Control & Intelligence.
12. Andrew Krepinevich - Senior Adviser to the U.S. Government on National Security. Served in the Army for about 21 years as a strategic consultant and analyst. Was a senior official of the Office of Net Assessment (ONA) under Marshall. After his release he headed the Center for Strategic and Budgetary Assessment (CBSA).
13. “Some Thoughts on Military Revolutions”
14. Richard Hundley (1935 - 2012) - was a Ph.D. in physics and engaged in national security research at the RAND Institute for about 40 years. Among other studies, he analyzed the RMA process, in the U.S. Army.
15. "Past Revolution Future Transformation"
16. Colin Gray - Professor and researcher in the field of international relations and strategic studies. He worked at the British International Institute for Strategic Studies and the Hudson Institute in Washington, D.C. He founded the National Institute of Public Policy in Washington D.C.
17. Donald Rumsfeld - U.S. Secretary of Defense from 1975 to 1977 in President Gerald Ford administration and from 2001 to 2006 in President George W. Bush administration.
18. Transforming the Military, Riding into the Future
19. Homer - one of the greatest poets of ancient Greece from the eighth century BC. His works "Iliad" and "Odyssey" date to this period. Little is known about the character of Homer, and the veracity of the text of his works is unclear.
20. Surprise - Using the unexpected
21. Distortion of reality’s perception
22. Trick - Maneuvering the enemy into an inferior position
23. The solution was proposed by Yitzhak Ben-Israel, head of operations research section at that time.
24. In the team with Sela were Zvi Lapidot and Menachem Krauss from the Weizmann Institute and Yitzhak Ben Israel from the IAF (Later Maj. Gen. and Professor).
25. “Kachlilit” - A kind of butterfly (in Hebrew).
26. “Keres” – hook (in Hebrew).
27. 'TELEM' - the Israeli nickname for an Unmanned aerial vehicle MQM-74A made by Northrop. The UAV was upgraded according to IAF specification.
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