

The Sky is no Longer the Limit: The Need for a Ground Forces UAV Fleet and Multi- Dimensional Warfare Capabilities

Kobi Barak

Introduction

The battlefield is constantly changing. In recent years, these changes have accelerated dramatically as a result of the rapid pace of progress in the 21st century, a tempo that also makes its presence felt on the battlefield. During the 1973 Yom Kippur War, the Arab armies discovered that despite the advantage of surprise at the beginning of the war and numerical advantage, the war ended with Israeli forces threatening Arab capitals. Since then, in response to the dramatic changes that have taken place in the Middle East over the last four decades, the characteristics of the battlefield have changed. These changes were so dramatic that they forced the IDF to closely examine and alter its operational activity in all realms. The changes have affected not only the IDF's operational systems, but also, perhaps especially, the force design system.

The key change took place in the field of ground combat, and this change is intensifying. It leaves the ground forces with no choice but to discard several key assumptions relating to the way the ground forces deal with the challenges they face and to their ability to engage in significant and effective ground maneuver that seeks to execute missions in a precise and efficient manner.

This article is based on two premises. First, the airspace immediately above the ground serves the enemy as a new combat realm. The importance of this dimension is no less significant than the underground dimension. Second, this threat is also an opportunity. The low-altitude air dimension holds important potential that, when realized, would enable the maneuvering

forces of brigade combat teams to increase their operational effectiveness in all fields.

Moving forward from these two premises, I will argue that the ground forces need independent air and anti-air capabilities to enable them to implement three critical objectives, three capabilities for these three objectives. The first capability is a fleet of micro UAVs to identify the enemy and its infrastructure that allows it to hide. This objective can be achieved by using miniature aircraft that could serve a single commander, or a pack of aircraft that would enable greater systematic control of an area.



American Bombing Runs During Vietnam War

Second, new defensive capabilities that would facilitate the interception of air and rocket threats to the maneuvering forces,

and the immediate destruction of enemy sources of fire. Finally, maximization of a new air combat dimension that includes UAVs and robotic autonomous drones for critical support roles such as combat logistical supply to the forces.

Part One – The Emergence of a Spherical Challenge to the Ground Forces

Over the past four decades, processes have taken place on the battlefield that have changed ground combat. These changes are generally well known, but, a short survey is worthwhile to emphasize the bottom line for us today – the emergence of a spherical challenge.

From Regular Armies to Semi-Military Organizations – The growth of terror organizations (principally Hezbollah and Hamas), the collapse of the Syrian army and stable peace agreements have created a situation in which IDF operations from the 1982 First Lebanon War through the 2014 Operation Protective Edge targeted terror organizations organized in a semi-conventional fashion, and not conventional state armies.

From Open Areas and Dirt Fortifications to Built-Up Areas – Our enemies understand well the defensive advantages of fighting in urban areas, given the limitations that constrain an attacking force when fighting in these areas. The enemy has chosen to fortify itself within population centers and uses streets, alleys and even houses to neutralize the attacking force, causing the attacking forces to disperse and preventing them from concentrating force.

Strengthening of the Rocket and Mortar Array – From the enemy's perspective, cheap and widely available rockets and mortars have changed the balance of power against IDF forces and the Israeli home front. In the context of the ground forces, rockets and mortars enable the enemy to refrain from large offensive battles and to skip over the IDF's defensive lines, striking the military and civilian home front directly. Recently, the enemy has improved its rocket systems in terms of area saturation (a quantity of rockets and missiles which greatly reduce the effectiveness of

the defensive systems) and accuracy, the operational importance of which continues to grow.

The Increasing Tactical Use of Rocket and Mortar Fire – At the end of Operation Protective Edge, the enemy identified as successes (from its perspective) its strikes on the ground forces while they waited in assembly areas, traversed essential crossing points or were deployed prior to an assault, among others. Influenced by the fighting in Syria and Iraq, as well as the lessons learned from Operation Protective Edge, there is an increasing trend to develop heavier rockets that can cause greater damage, whose purpose is to strike IDF forces engaged in combat. The significance of this (and in additional areas that will be expanded upon below) is that appropriate operational conduct is no longer sufficient. A ground forces defensive capability is required, a type of mission-specific Iron Dome that could provide tactical protection for assembly areas, for forces preparing for an assault and for forward command centers and others.

The Enemy's New Air Force – The combat techniques used by ISIS and other Sunni militias active in Iraq allow us an important glimpse into the future. The combatants there have raced to adopt small and cheap commercially produced aircraft, both multi-rotor drones and fixed wing. This is not a niche or trivial trend. What we are witnessing in Syria, Iraq and other places is a sign of a revolution in irregular warfare. For the first time an air dimension is also available to combatants who are not regular state armies, and these forces are maximizing this opportunity and taking advantage of the robotic aircraft available to them for observation, propaganda filming and even assault missions. This is a trend that will grow, and there is no doubt that we will encounter it in future wars against Hamas and Hezbollah.

The Diffuse and Disappearing Enemy, or What Is a Pacified Area? – As opposed to the wars of the past in which the capture of a particular piece of territory would lead to the retreat or destruction of the enemy, in modern warfare the enemy adopts the method of disappearing as its primary combat tactic.

There are two key implications to this phenomenon:

Locating the enemy has become increasingly complicated. We can no longer identify the clouds of dust raised by the reserve or main force of the enemy when moving from place to place as we could in past wars. When we use conventional methods of combat intelligence collection, the result is a failure to locate a disappearing enemy hidden in houses, under the ground or in dense brush. This situation leads to an inability to generate an intelligence picture of the enemy or an intelligence picture for targeting and it prevents an assault on the enemy or the use of fire against it. The significance of this is that different techniques, technologies (ground and air) and organizational structures are needed to deal with this challenge.

Even after a mission has been completed the enemy remains in the field, sometimes in large numbers. The significance of this is that relatively (very) large forces are required to clear an area in order to keep logistics channels open and to guard the flanks and the home front, as well as to prevent attacks on the rearguard and the less well-defended forces.

The Underground Dimension – The underground phenomenon is not new. Throughout history guerrilla forces have used the underground realm against regular armies (eg., the Vietcong against the United States during the Vietnam War). However, in our region the phenomenon gains another dimension, a combat dimension that has become so significant that we can identify a trend to move most of the enemy's weapons underground. The disappearing enemy phenomenon described in the previous section is based partly - even mainly - on the underground dimension.

The Cyber Dimension – Cyber is a new dimension in both human activity and in combat. Of course, important opportunities are inherent to this new dimension, alongside new threats to ground forces operations. It has become acceptable to discuss the implications of cyber warfare on the strategic and operational dimensions within the State of Israel and the IDF. No less significant is the possible threat to the technical capabilities in the possession

of and used by the different ground forces. The more sophisticated the weapon systems used by a ground force, the more exposed it is to cyber-attacks which could neutralize its capabilities. The enemy has identified Israeli technological dominance as a great danger. At the same time, it has understood that this dominance is also an opportunity to cause damage to a modern army that is highly dependent on modern C4I systems (Digital Ground Army) and some of the leading weapon systems in the world.

To summarize, I have noted that the enemy has not stagnated over the years and has succeeded in creating solutions in response to the IDF's new capabilities. The enemy has succeeded in transforming "the strength of the weak" into an art form and in finding the vulnerable points in the Israeli military and civilian systems. Furthermore, as will be discussed in the next section, the enemy has also made progress in new fields and disciplines that have developed in the last year or two, alongside new capabilities that are transforming into a new and unknown combat dimension. This process, which is taking place before our very eyes, is similar to the process that turned the underground realm into a combat dimension that greatly influences the nature of ground combat.

Part Two – The Israel Air Force's Air Superiority, a Necessary but not Sufficient Condition

Israel's security concept assigns a critical role to air superiority. A strong Israel Air Force (IAF) is perceived, and rightly so, as an essential condition for blocking Arab armies and removing the threat of the Arab air forces from the home front and our forces. In this manner, air superiority enables the *hachra'a*, or decisive defeat, element within our traditional security concept to move the fighting to the enemy's territory using a large ground-based assault force.

Over the years, the role of the IAF has changed repeatedly within the IDF concept, both deliberately and unintentionally. These changes have emphasized the critical nature of airpower to

the IDF's combat capabilities on the one hand, and the centrality of the IAF as virtually the only Israeli force capable of utilizing airpower. The IAF also operates the helicopter and transport functions of the IDF, and the air and missile defense systems – elements that in other militaries are the responsibility of the ground and naval forces.

Both the changes in the nature of warfare described above in part one and the inherent opportunities compel us to assign new meaning to the terms airpower and air superiority. In this new era, it is wrong to continue the old organizational tradition of conferring exclusive control of operational dimensions to one body (the Intelligence Corps in the field of intelligence, the Air Force in the air dimension, the cyber body in the cyber field, etc.). On the contrary, technology enables and reality requires force design directed at enabling tactical forces to be capable of directly and independently influencing all the dimensions that are relevant to their mission. In the US military, this principle is called Multi-Domain and Cross-Domain.¹

Operation Focus (*Moked*) as the End of an Era – Operation Focus, the air operation that opened the 1967 Six-Day War, guaranteed the IDF's air superiority at the beginning of the war, and was a major factor in shaping our concept of airpower, even to this day. Since Operation Focus, we have become used to thinking about air superiority as a stand-alone military mission that must be achieved at the beginning of combat and constitutes an essential condition for ongoing operations. If we critically evaluate these assumptions, we will discover that in fact Operation Focus was the end of the era of stand-alone air superiority. During the 1973 Yom Kippur War, in effect, air superiority above the combat zone was not achieved for most of the combat period. Nevertheless, the ground forces fought on two fronts, engaged in a holding action and then counterattacked. Egyptian and IAF aircraft periodically

¹A multi-domain battle means a joint forces battle taking place not just in the domains of air and land but also in the domains of sea, space, and cyberspace. Such a force might employ infantrymen with cyberspace skills, innovative air defense systems to deter enemy aircraft, and even ground-to-ground missiles to target enemy ships.

were involved in the battlefield in the Suez Canal area. However, neither significantly changed the results on the battlefield. During the 1982 Operation Peace for Galilee, the IAF enjoyed total air superiority after the destruction of the Syrian SAM batteries in the Lebanese Beqaa Valley and the downing of dozens of Syrian combat aircraft. Nevertheless, the ground forces suffered costly assaults by Syrian attack helicopters while they advanced.

In the transition from the threat of the Arab armies to combating terror organizations, we found new ways to maximize the quality airpower we had developed. The IAF's aircraft, thanks to accurate and quality intelligence, would repeatedly attack numerous high-value enemy targets at the beginning of each war. The destruction of the Fajr rockets during the Second Lebanon War and the air strikes during the opening stages of Operation Protective Edge and the 2012 Operation Pillar of Defense in the Gaza Strip are examples of this.

However, while the destruction of the Arab air forces at the beginning of the Six-Day War had a dramatic and direct influence on the Arab armies' resilience during the ground war, it does not seem that the equivalent attacks during the opening stages of these operations had a similar effect. It seems that the new enemies have prepared for war with the clear assumption that the skies would be ruled by the IDF; that some of their secrets would be discovered; and that some of their units would be destroyed in the opening stages of combat.

The IAF's air superiority is a strategic asset for the State of Israel and it is right to safeguard it. Furthermore, a conventional threat is likely to return in the future and once again become dominant in our region at some point in the future. That said, when facing today's key challenges, traditional air superiority does not necessarily translate into a decisive operational advantage on the ground battlefield.

Part Three – The Meeting Between the Spherical Threat and Contemporary Air Forces

What happened to us? The enemy understood that the IDF has total conventional superiority in all dimensions of combat and has chosen not to compete with us anymore. Instead of maneuvering and threatening the territory of Israel, the enemy has chosen to hide itself and to fire rockets at the Israeli homefront. In doing so, the enemy has managed to undermine many of the basic assumptions of the IDF combat concept, principally the IDF's reliance on air superiority, at least as we currently understood it.

This is reflected in several dimensions:

Defending the Home Front – The air superiority that was built with much effort over many years struggles to provide the necessary level of protection from enemy bombardment of the Israeli homefront. The active defense systems built over the last two decades are impressive and unique in the world, but they cannot provide the same level of protection that was provided to the homefront during the 1990s.

Destabilizing the Enemy – The impressive air attack capabilities that were developed do not translate to a decisive advantage on the battlefield. In the past, the ground forces could presume that the armored forces held in reserve by the enemy would be destroyed or delayed on their way to the front. Today, as noted, it is not at all clear how an air bombardment influences the combat capabilities and motivation of the enemy at the front, despite the impressive scale of the attacks and the intelligence and operational accuracy that they entail. In the operations that took place over the last decade it has become clear that both Hezbollah and Hamas displayed significant combat motivation even after devastating opening air strikes.

Depth and the Front – In the past, we could allow most of the air force to operate deep within the enemy's territory. The impact of these attacks on the combat at the front was clear. The combat support capabilities at the front – ground forces artillery, ordinance and more – were sufficient to provide tactical superiority

for our forces. On the new battlefield, the enemy reveals itself to our forces only for very short time periods. IAF aircraft on the one hand, and the ground-based sensors on the other, struggle to be effective before the enemy has disappeared again. As a result, the ground forces at the front are left with fire support whose effectiveness is greatly limited.

Defending the IDF – In the past the IAF retained a significant anti-aircraft array to defend IAF bases and the ground forces. Over the years, the presumption of total air superiority over the Arab armies led to a gradual neglect of the array, until its complete closure (and conversion to an active defense array). In November 1987, a terrorist on a paraglider penetrated the northern border. The enemy proved its ability to reinterpret the air dimension in a creative manner that suited its needs. However, the “Night of the Gliders” attack did not impact the trend of neglecting the tactical anti-aircraft array. Recently, we have been experiencing the significance of this neglect during several incidents in which UAVs managed to enter Israel’s airspace. In the combat arenas in Syria and Iraq we have already witnessed attacks by UAVs that were developed by ISIS, Hezbollah and others. The IDF has significantly diminished its capabilities in the field of local, tactical anti-aircraft systems.²

Low-Altitude Air Threats to the Ground Forces – In the past, destruction of the enemy’s air forces more or less guaranteed clear skies for our forces. Furthermore, the IAF’s ability to participate in the destruction of the enemy’s artillery batteries located deep in enemy territory provided significant protection for the ground forces against this threat. Today, we are witnessing the development of a new air threat against the ground forces. As noted, in Iraq and Syria, all the sides are experimenting with the use of UAVs and multi-rotor drones of different types to engage in air reconnaissance and even to attack targets. Capabilities such as

² For more on the Active Defense world and the IDF’s new tactical air defense concept, see Shazar Shohat and Yaniv Friedman, “From Tactical Anti-Aircraft Defense to Systemic Air Defense,” *Dado Center Journal*, Vol. 4.

laser targeting from the air for ground-based weapons including precision mortars or advanced anti-tank rockets are becoming common. The artillery threat from powerful rockets fired over short ranges has once again affected the freedom of movement of our forces.

It is clear that in the next war, capabilities such as these will be turned against us in significant quantities and varieties. As opposed to the past, attacks by the IAF, or control of the skies, are expected to have limited influence on the scale and effectiveness of this threat from the perspective of the ground forces.

Close Air Support for Our Forces: The Need for Improved Jointness -The IAF has always provided close air support to the ground forces via direct attacks. Given that the process of coordination between a combat aircraft and a force on the ground is complicated, attacks of this type are quite uncommon. In an era where the enemy relies on infrastructure that is built-in, dug-in and even underground, this is precisely the moment that there is a greater need for the incredible destructive power that a combat aircraft can bring to the ground battlefield. Ground forces fire, as well as the developing concept of an air force belonging to the ground forces, cannot compete with the IAF's capability to fire accurate bombs weighing hundreds of kilos at reinforced targets.

Therefore, alongside the independent capability that needs to be developed for the ground forces in certain air dimensions, great effort must be invested in the continued improvement of the coordinating mechanisms and the "jointness" between the ground forces and our traditional air force. This is true also for another need – the need to transport forces to the battlefield. The principles of surprise and flexibility require us to engage in a more creative and dynamic ground maneuver. Air assault transport of ground forces and the protection of operations conducted by ground troops deep within enemy territory were and will remain a critical mission of the IAF for the ground forces, a mission whose centrality within our concept keeps growing.

Air Reconnaissance – In the past, IAF aircraft could identify enemy forces from above and provide relevant intelligence for the

combat. This intelligence was highly valuable to the forces at the front even if hours had passed between the surveillance flight and the arrival of the analyzed product at the front. Today, the enemy operates from built-up and complex spaces, prepares hidden combat infrastructure and refrains, as a rule, from long and conspicuous movements in the battlefield. Today, relevant air reconnaissance must be much more precise and agile in order to identify the minimal and brief intelligence signatures emitted by the enemy. The reconnaissance must also enable operational maximization of the information within very short time frames. Ongoing air reconnaissance conducted during periodic sorties by combat aircraft needs to be replaced by an intensive and permanent presence of multi-sensor tactical reconnaissance capable of making a precise identification of the enemy.

The maneuvering ground forces experience a spherical battlefield, as described in part one. Despite the enormous superiority of the IDF in the air, in maneuver, intelligence, in the cyber field and at sea, the nature of the enemy and the trends described here enable the enemy to operate in each of these dimensions against our forces. The complete pacification of combat zones characterized by dense brush or built-up areas is almost impossible and therefore maneuvering forces remain exposed from all flanks to a hidden enemy. The ground forces must maneuver within enemy territory. They must identify and destroy the enemy and its combat and launch infrastructure. Our forces must achieve this while achieving tactical superiority on the battlefield.

The IAF, the Intelligence Directorate and the cyber capabilities maintained by high level command headquarters far from the battlefield, are essential to IDF action in general. However, the spherical challenge requires action that is intimate, close, rapid and adapted to the pace of developments by the enemy - a sudden appearance, an attack and then disappearance. In this situation, the capability to respond to this challenge depends on an organic air force that works primarily under the

direct subordination of the commander of the brigade combat team.

Part Four – The Need for Air Capabilities That Belongs to the Ground Forces

In recent decades, the IDF found itself at the apex of the intelligence and precision munitions revolution. This revolution, whose foundations were in the 1980s and 1990s, enabled us to build impressive intelligence collection and strike capabilities whose power is to generate comprehensive systemic influence on the battlefield. Or, to be precise - influence on the battlefield where we thought we would be fighting in the coming decades. This precise fire and operational intelligence collection is complex and expensive. The specific intelligence collection equipment fitted to the underbelly of an aircraft (*Metad*³) is heavy and energy-intensive. The solution that was developed involved the building of area coverage capabilities that generate broad influence and are managed centrally. A cross-service radar, IDF UAV array and joint intelligence and planning teams made up of representatives of the IAF and the territorial commands, are a few examples of these.

We built operational-level capabilities based on a relatively small number of platforms that could enable broad influence and are activated in a centralized fashion by high-level headquarters. The enemy adapted, left behind its tanks and APCs, and stopped engaging in long movements on the battlefield. Combat was transformed to take place during a multitude of small tactical combat encounters that occur in impenetrable and complex territory and are characterized by very short outbursts of violence.

The ground forces, which are affected by all the dimensions of the sphere, must be capable of influencing all of these dimensions. A significant proportion of these capabilities are connected to the ground force's need to once again defend itself from the vertical dimension. More importantly, the ground forces

³*Metad* – Mission Specific Payload – IDF terminology for mission specific payloads carried by combat aircraft for imagery, tracking etc.

must maximize the lower air tier in order to regain a decisive tactical superiority on the battlefield against the enemy that was described above.

Accordingly, the ground forces must work to implement three key aspects. First, the creation of a force of micro UAVs to locate the enemy and its hidden infrastructure. Second, the development of new defensive capabilities that would enable the interception of air threats and rocket fire on the maneuvering forces and the immediate destruction of the enemy's sources of fire. Finally, maximizing the new air dimension made up of robotic and autonomous UAVs and multirotor drones for additional critical support missions such as combat logistical support to the forces.

Ground Forces Air Intelligence Collection— The vertical dimension of the battlefield always served commanders' need to see and understand the enemy, before any other purpose. For this purpose, commanders tended to place themselves on a hill. Ships placed their lookouts high up on the mast. The first air lookouts had already taken to the air during the American Civil War using hot air balloons. The air forces during World War I were primarily used to map enemy emplacements and to identify reserve forces placed at the rear. Today's enemy has managed to hide itself from the large intelligence collection payloads in the skies and from the commanders' binoculars on the ground. First and foremost, we must regain the capability to see the enemy.

An Air Intelligence Collection Force – The new potential of small, relatively cheap, robotic aircraft must be utilized by the IDF to create a mass and diverse air layer to support the tactical forces' missions. Aircraft of different types could, for example, enable a commander to observe and attack a street or alleyway at the exact location where an enemy is preparing an ambush for the commander's forces. Aircraft of these types could also enable observation within buildings and underground infrastructure without endangering our forces. Larger aircraft, but still small enough to be operated by a battalion or brigade, could serve as a platform for different sensors that would provide coverage of the

immediate area around the forces for different collection purposes. A multiplicity of diverse sensors would enable the forces, with a high chance of success, to identify short movements on foot by the enemy, the enemy's communication signatures and its firing and launch activities, among others. All this could be achieved over an area around the forces that was sufficiently large.

A Networked Air Force— The development of a vertical dimension (air) that is rich and varied within the framework of a brigade's battalions would constitute the basis for a revolution which would be no less important than the sensory revolution. The vertical dimension would enable the ground forces to base themselves on highly reliable, resilient and fast communication networks. These networks would enable sensors to complement one another and to improve the precision of one another in an automatic manner based on the "Internet of Things" approach.⁴ These networks would enable commanders and combat platforms to be connected to a network of sensors and to feed it with data from their own systems.

Why would a ground forces UAV fleet achieve goals that the larger IAF could not? The IAF is based on an array of combat aircraft, assault helicopters and UAVs which will continue to bear most of the burden of air combat for the IDF, operational-level attacks, intelligence collection and transport duties among others. There is no dispute over this. However, the ground forces need supplementary support that the IAF's large platforms and centralized force employment concept are simply unable to provide.

"Accurately and On Time": A Direct Connection Between Sensor and Shooter— A group of autonomous aircraft working as a coordinated flock could control a brigade's area of responsibility in terms of communications and sensory systems. Given that they would be working under a unified command, that of the brigade commander, they could also be connected to the weapons systems

⁴See also Aharon Haliva who coined the term TIOT (Tactical Internet of Things) in Bein Haktavim Vol 9, "More of the Same – The Need for Conceptual Dialogue in Force Design."

within the force. In this manner, a direct and local connection could be made with great speed, between the identification of the enemy, while firing a rocket at our forces for example, and an immediate and accurate strike on the enemy. Accurate sensing of this type, and the automatic connection of accurate fire systems to the network of sensors to enable immediate fire, can take place only in conditions of local and precise optimization of the network of sensors and the unified command.⁵

“Deciphering the Enemy”: Maximizing Rapid and Local Information – Not every piece of information revealed by the enemy to the network of sensors would enable an accurate strike. Much of the information, such as electronic emissions, launch history in the area, among others would not enable such strikes. However, the copious information that the enemy does omit while engaged in serious combat against our forces could, when combined, provide a very broad indication as to how the enemy is deployed in the area and the specific combat infrastructure it is using.

The IDF Intelligence Directorate devotes a significant proportion of its resources to deciphering all the information that has been gathered and turning it into an intelligence picture of the enemy for our forces. It is clear that the Intelligence Directorate’s expertise cannot be replaced. And still – a computerized capability to process the copious information and draw conclusions from it (Big Data and Artificial Intelligence) could enable our combat forces to develop a greatly improved picture of the enemy in very short timeframes. In other words – a combination of numerous sensors and a fast network, with the addition of local information processing technologies would enable the maneuvering forces to achieve a new tactical superiority.

For example: The forces could make assumptions in real-time and with relatively high proximity about the location of the entrances and exits to underground enemy infrastructure in the

⁵Eran Ortal, “An End to Repression – A Sixth Era for Ground Warfare”, *The Dado Center Journal*, Vol 6.

area. The significance of this capability is that our forces would have a chance to surprise the disappearing enemy, whose entire combat concept is built around achieving surprise in the opposite direction.

Area Defense in the Tactical Environment—The enemy has already identified the potential of robotic and semi-robotic aircraft. The ground forces must be able to identify enemy aircraft in the skies, to distinguish between them and our air platforms and to shoot them down. The nature of the new air threat requires a tactical air defense to be constantly available and to cover a wide area. The traditional approach, which has disappeared in the meantime from the IDF, concentrated anti-aircraft defenses on key intersections, important HQs or on the axes on which the enemy was expected to penetrate.

This type of defense is no longer relevant. The need for constant availability demands an independent interception capability at least at the division level and perhaps even at the brigade level. The principal mentioned above regarding a direct connection between sensory capabilities and attack capabilities would enable the ground forces not just a rapid attack solution, but also area defense interception solutions. The combination of area defense interception capabilities and rapid attack capabilities would also enable the forces to return to dominance when facing the upper dimension of the spherical threat.

Border Defense— Everything discussed in this article is also relevant to border defense. As a junior officer serving in the South Lebanon security zone, I remember the pair of attack helicopters that waited on high alert at the IDF's Biranit outpost, on the Israeli side of the Lebanese border. While we have withdrawn from Lebanon in the interim, the potential threat to our borders has become even graver. The incidents that took place on the Sinai border at Ein Netafim in 2011 and Nitzana in 2012 are evidence of this. Our intelligence warning capabilities about the relatively new terror organizations in Sinai and the Golan Heights have also been eroded. The defense of long borders with forces of a reduced size is a significant challenge in terms of time and space. In future terror

attacks, it can reasonably be assumed that the enemy will use its fire and air capabilities in parallel to attempts to conduct a ground-based incursion.

The spherical threat is also relevant to our borders. An air force that is not permanently based in the defensive area of responsibility will struggle to be relevant to this challenge. A ground forces air force will be needed for border defense missions as well as multi-dimensional capabilities at the level of the tactical forces.

Independent Air Logistical Capabilities– As noted, the ground-based threat to the air forces has grown greatly with an emphasis on shoulder-launched MANPADs of varying types that are widely available in the region. The ability to utilize air support from transport aircraft and helicopters for medical and logistical purposes will be limited in many scenarios. Logistics will always remain a challenge given the dependence on open supply lines and on the transport of heavy and large items. However, autonomous logistical aircraft have a significant potential to provide critical logistical support within short timeframes and to places where continuous open supply lines cannot be guaranteed. The well-known drones being developed by Amazon are just the harbinger in this context.

Implementation

First, it is important to emphasize that the relative advantages of the IAF should continue to be invested in and developed. The IAF is capable of transporting forces deep in enemy territory, of attacking targets on a scale and at a rate that has no equal, and of supporting the ground forces with accurate attacks on targets that ground force warheads would struggle to penetrate. The IAF has many other advantages, all of them essential to the IDF when supporting the ground battle.

In parallel, the ground forces must develop their own independent relevance in relation to the spherical battlefield. The

rate of anti-tank and mortar fire, the intimate nature of combat in narrow alleyways and the critical need to develop a real-time and up-to-date picture of enemy infrastructure demands this. These qualities can be achieved only by combining a rich and varied vertical dimension operated by the ground forces themselves and supported by advanced network capabilities.

To implement this vision, we need to abide by several principles:

Distinguishing Between Different Types of Needs– Use of the vertical dimension by the ground forces should be divided into the four key fields that were outlined in this article: floating observation posts for the commander, flocks of UAVs to control territory, ground-based fire capabilities and support missions such as logistics. Each one of these fields requires weapons systems development, an organizational concept and an independent doctrine.

Aircraft of the first type have varied needs that should be developed in the attacking corps as an integral component of the capabilities of the attacking forces. A system of coordinated robotic aircraft (a flock) that would enable sensory and networked control of a particular area, is a new and clear need. The third, attack capabilities for built-up areas (and other areas) that implement a capability to overcome an enemy that hides on high floors and/or accurately target dark areas with low collateral damage and over a wide area due to the low cost. The last innovation is in the field of support missions and logistical UAVs. The last three fields demand specific thinking both with regard to force design and with regard to solutions for combat organization, for example, by upgrading existing observation and reconnaissance units to reconnaissance and air reconnaissance control units.

Coordinating the Air Dimension– In the past, we would coordinate “operational boxes” with the IAF, or create a division of responsibility for different altitudes. This is an established technique whose essence is not to disturb one another. Its disadvantages include a wasteful division of the air dimension due to the need to create especially large safety margins. When control

of the vertical dimension is conducted by national control centers and radars there is no other choice. Today, when every aircraft can broadcast its three-dimensional position, it is possible to both enable the IAF to fly very low and for the ground forces to fly as high as needed. A coordination system is required based on an advanced and functional networked air picture that could guarantee that ground forces aircraft fly in an automatic mode in the event of any danger to a manned aircraft. The brigade aircraft, for example, could be programmed to automatically move aside if a personnel recovery helicopter were to enter their area of responsibility.

Maximization of Resources— Waste is not the consequence of the existence of similar capabilities in two different bodies. Waste is the non-exploitation of existing capabilities within two bodies to the benefit of those who need them. We must continue to integrate tools in the fields of traditional “jointness,” and to develop the new capabilities described here. More importantly, the sensory capabilities, the interconnectedness and information processing that would enable the maximization of the air realm for the benefit of the ground forces should also be exploited for the needs of the IAF, intelligence and others. Exceptional networked interconnectedness is just one way to guarantee this. No less important is the promotion of a process for developing a “ground forces air fleet” that is conducted cooperatively and not in competition or opposition.

Networked Armaments— The Internet of Things concept is likely to enable us to not only connect sensors to sensors in order to develop accurate intelligence area control. It is also likely to enable us to connect the networks of new sensors with attack missiles. Networked armaments would also enable the implementation of a new level of lethality that is necessary for the ground forces and could also enable the interception capabilities for defending the ground forces that were described above. Air coordination based on advanced communication networks would greatly minimize the danger to friendly aircraft in the area.

Survivability - The new air domain for the ground forces, and the new capabilities to deal with air threats, will be critically dependent on the field of advanced communication networks. We need to build these systems while taking into account their survivability as a foremost consideration. More importantly, communications and cyber survivability must become a significant component of ground warfare.



Iraqi Soldier Holding an ISIS Drone

Organization of the Ground Forces Command– The ground corps and their staff bodies were built to guarantee the superiority of the IDF ground forces as defined in the past. We are excellent at developing ground forces combat platforms, personal and battalion-level weapons and advanced command and control systems. Our corps prepare and train most of the existing infantry, armored forces, artillery, engineering and reconnaissance combatants. An operational-level and sophisticated air dimension linked to autonomous technologies, flocks of UAVs and advance information processing – to date this dimension has not been

included in the areas of specialty of the Ground Forces Command. We must undertake a serious, conscious and specific organizational effort, while also bringing in external experts in order to begin this process.

Summary

While we have built impressive operational-level intelligence and attack capabilities operated by high-level headquarters, the enemy has dragged the IDF into different combat scenarios. In these scenarios, which are conducted at close quarters and are intimate, rapid and geographically limited, the lower tactical levels are of prime importance – the company, battalion and brigade. While we have improved the precision of our strike capability from GPS coordinates of eight digits to 10, 12, 14 even 15 digits (altitude), the enemy, in contrast, has succeeded in frequently escaping from these targets before they could be attacked. We destroy GPS coordinates, but struggle to hit the actual enemy.

The air dimension remains a critical element for combat. The analysis that I have presented here points to the growth of its importance. However, the notion that the air dimension is the IAF's sole area of responsibility, in a way that is close to proprietary, can no longer meet the needs that have arisen.

The IDF must return to offensive, fast, deep and dynamic ground maneuver. This is an essential condition for returning the fighting to enemy territory and stopping the growing trend of attrition warfare. To implement this, the ground forces must themselves become multidimensional and spherical, much like the battlefield that has been created.

Today, technological potential enables us to strive to implement the vision that I have presented here. Miniaturization, automatization, robotics, fast communications networks, analysis and artificial intelligence – we must not waste the opportunities that these developments offer us. In the long-term, it is possible

that a ground force supported by an independent, tactical, rich and varied air fleet will not only be stronger but also cheaper. It may be possible to do more missions using fewer expensive and heavy combat platforms.

The IAF, Intelligence Directorate, and Israel Navy all have special ground force units that support their activities. Why should the ground forces not have their own multidimensional capabilities? In foreign armies, the trend to multidimensionality is also growing. The ground forces must operate in the air, from the air and towards the air.

The ground forces must develop their own air dimension and in parallel continue to maximize high quality combined arms jointness. For this, a ground forces air fleet is essential. Facing a spherical threat, a ground forces spherical response is required both for the underground domain and for the new low-altitude air domain.