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Editor's Preface

Small changes are the enemies of great changes.

Bertolt Brecht

Force design is a process of perpetual change within a military organization – its size, the technologies that serve it, the way the forces are organized during routine operations and in wartime, the missions undertaken and the future missions for which it is preparing. If we accept this hypothesis, it follows that there is virtually no disagreement about the need for a military force to undergo change, to adapt itself to a dynamic environment and to adjust to the reality being created around it. Nevertheless, animated disputes continue to swirl around force design processes over the nature of the required changes, their scale and their intensity.

This volume of The Dado Center Journal for Operational Art is the second (and not the last) in a series of volumes dealing with military force design. The volume focuses on the tension between small changes and large-scale changes, between developing and upgrading existing forces and the development of new and innovative approaches.

This tension is not unique to military forces. Large organizations generally tend to ask themselves whether they should adjust by enhancing existing approaches, by investing in their relative advantage over their competitors, or whether they should “reinvent themselves.”

The advantages of investing in the organization’s existing fields of specialization – its relative advantages – are clear. Nonetheless, from time to time the business environment presents new challenges, which are difficult to adapt to just by enhancing an organization’s traditional “relative advantage.” The telecommunications firm Nokia, for example, was one of the leading companies in the cellular communications field, but its previous advantages were not sufficient when “smartphones”
penetrated our world. Nokia was late to the game with the smartphone revolution, and it had limited capability to deal with the new business environment facing it at the time.

The articles in the current volume can also be understood on the basis of this tension. Col. Alon Paz, a Department Head in the IDF Strategic Planning Division, argues in his article that the time has come for a radical reorganization of the IDF. The IDF, he argues, is the product of the classical military school of thought, which is over 150 years old, but the environment in which it is currently operating is shaped by the post-modern digital age. As a consequence, all of the foundations of the IDF need to be reevaluated – from the structure of the organization and our understanding of the social environment, to the theory of military victory that needs to be reappraised. According to Paz, the IDF needs a revolution, and the “Gideon” multi-year plan is an important step in the right direction.

The next two articles deal with the degree of technological innovation in the IDF, each from a different perspective. Lt. Col. Ori, an officer with extensive experience in key technological units in the IDF, discusses the ability of a military organization to generate technological innovation. Ori explains the difficulties, but he primarily demonstrates the capability of units that identify technological innovation as a key operational need, to implement innovative processes despite the conservative nature of military organizations. The official IDF, Ori argues, is by its nature conservative, but the experience presented in the article proves that a methodical and mindful approach can include structured innovative processes.

Carmel Or, a student in the Strategic Studies Program for Outstanding Students at the Interdisciplinary Center in Herzliya, evaluated the level of innovation in the Israeli defense establishment and the IDF through research into the level of integration of a culture of “open source” within software development in these bodies. Carmel, who also worked for the IDF in the technological field during her studies, provides an important
mirror for the IDF. In the current era, software, more than traditional hardware, is the critical element in technological progress. The level of adoption of open source methodology for software development is an important indication of the degree to which a military organization has internalized this conclusion. Those who are familiar with software development are aware that the use of “open source code” is, in most cases, an essential component for effective, efficient and innovative development. Carmel found that while “open source” initiatives were common at the junior officer level, at the level of official policy, the IDF and defense establishment were far from maximizing the latent potential of this approach. Although the IDF C4I Directorate has gone a long way to creating an “open source” environment in the IDF, even they admit that they have a long way to go. Without an official policy and a collaborative working environment, the junior officer level will be limited in its capability to maximize the advantages of software development using the open-source communities’ method.

Carmel and Ori separately reached the same conclusion that the forces of innovation at the junior officer level in the IDF are significantly limited by existing development procedures; by the traditional project management approach and working environment; by the existing work environment across the IDF; and by the command level, some of whom do not recognize the need for change in the information technology age.

The next two authors present a different perspective on force design. Building on Yoram Hamo’s article in the previous volume of The Dado Center Journal (Volume 6 – Force Design Part A), which focused on force design and strategy, Col. Asaf, Deputy Head of the Research Division of Israel Military Intelligence asks how intelligence has been integrated into this strategy. The author does not hesitate to answer his own question – Intelligence is not properly integrated into force design processes, which negatively impacts the effectiveness of these processes. Asaf analyzes the root causes of the absence of intelligence in this critical discussion and outlines the development channels in the intelligence discipline which would be required in order to improve the situation. A
positive example which he describes and from which we can learn, in his words, is the relationship between force design processes and the fields of operations research and systems analysis.

Lt. Col. (res.) Dr. Haim Assa, a well-known intellectual in the military studies field and former operations research officer, focuses on operations research in his article and argues the exact opposite. As far as he is concerned, operations research is an essential discipline for evaluating the expected benefit of one project or another. However, operations research has become such a key element in the IDF’s force design processes that it constitutes a serious roadblock to the organization’s ability to imagine, dare, renew, and surprise the enemy. The reason for this, according to Assa, is encompassed in the analytical nature of the discipline. The discipline allows for in-depth local optimization in relation to a particular approach – that is, it encourages a discussion of the value of a particular project, but does not allow a discussion on the validity of the conceptual approach itself. It certainly doesn’t allow for discussion of alternative conceptual approaches. Conceptual renewal requires systemic lateral thinking in Assa’s words, and the activation of the imagination, two things which an analytical approach does not encourage.

The closing article of the volume is by Major General (res.) Gershon HaCohen, who chose to analyze what he considers to be the key issue in the recently published “IDF Strategy” Document – “Critical Mass.” While he is not a heretic regarding the critical importance of a qualitative edge and technology on the battlefield, we can learn from him that relative to other writers, he is not convinced that conceptual innovation and technology are the most essential elements in military force design. HaCohen, who focuses on the ground forces, sees great importance in the size and scale of the forces, with scale allowing flexibility, and flexibility allowing learning. The retention of reasonably sized ground forces is a strategic interest of rising importance, according to HaCohen, even with the need for constant modernization. He therefore calls for the IDF to maintain a large-scale order of battle for the ground
forces, even at the price of mediocrity and the building of relatively small, high quality strike force. Technological excellence, argues HaCohen, cannot compensate for the need for scale in forces engaged in defensive actions on several concurrent fronts or for complex warfare in an urban environment. In any case, with these types of missions, according to HaCohen, the contribution of advanced technology is relatively limited. General HaCohen presents, in essence, a worldview almost diametrically opposed to the other writers in this volume. He sees the need for continuity in the IDF in general, and specifically maintaining large forces as being more valuable than technological innovation.

And we in the IDF, have we focused our discussions about force design on the debate between these two worldviews, as is evident in these articles? Have we asked ourselves, on the margins of discussions on the size of our investment in different projects, how we can guarantee constant innovation in the IDF’s work practices? Are the intelligence forces dealing with the question of their relevance to force design? Do the planners engage in self-evaluation and admit that an analytic approach cannot replace the need for setting out a vision? Have we understood the significance of the age of software and internalized this significance organizationally, or do we continue to contract out projects with the same traditional procurement processes, without understanding the extent of the changes. Is the Gideon multi-year plan indeed the first step that Col. Paz intends?

With best wishes for fruitful and enjoyable reading,

Col. Eran Ortal
Head of Think Tank
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The research, understandings and conclusions in this journal reflect the opinions of the authors and do not represent the official positions of the IDF.

Readers who are interested in contributing to “The Dado Journal” are invited to send proposals for articles to the editors at the following email: Dado_journal@mail.idf.il
“There is Hereby Established a Defense Army of Israel”: The effort to recreate the IDF

Alon Paz

Introduction

When was the IDF established? At first glance, this is a simple trivia question with an answer: 26 May 1948, within the framework of the “Defense Army of Israel 1948” Ordinance, which was signed by the Head of the Provisional Government at the time, David Ben Gurion.\(^2\)

However, if we accept that the legacy of the underground paramilitary organizations which existed prior to 1948 provided the basis for the fighting spirit of the IDF, then the IDF was really “established” at the time of the founding of these paramilitary organizations. These organizations left a legacy as Jewish defense forces, and therefore the establishment of the Haganah organization in June 1920 could be considered a reasonable answer to the question. In fact, the starting point of this article is not only that the IDF was not “founded in a day,” but also that it was not established just one time. Here are some additional relevant examples to demonstrate the IDF’s “age”: It is commonly accepted that the IDF is “the People’s Army.” In the modern age, the idea of

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\(^1\) Col. Alon Paz serves today as a head of a department in J5. This article is based on broader research published in: Alon Paz (2015), "Transforming Israel’s Security Establishment". The Washington Institute for Near East Policy.

The author thanks Cpt. Lior Lebed from the Dado Center, and First Lieutenant Eyal Horovitz from J5 for the help in editing and printing the article.

\(^2\) “Defense Army of Israel Ordinance”, Order No. 4, 1948 of the Provisional Government of the State of Israel.

See:https://www.idfblog.com/blog/2012/05/25/the-israel-defense-forces-turns-64/
establishing an army of the masses based on compulsory conscription (Levée en masse) took off after the French Revolution. The idea was closely associated with the birth of nationalism, and was one of the principal tools Napoleon used to build the extensive French military force at the end of the 18th century. Consequently, one of the founding principles of the IDF, “our” people’s army, is over two hundred years old.

“The Chief of the General Staff is the sole operational commander within the IDF. He is the commander of all of operations conducted by the IDF, through the General Command.”

The Commander of the IDF is the Head of the General Staff. Simply put, the idea of a General Command in charge of the combat forces was developed along the lines of two basic models during the 19th century in Germany and France. Both models use a division into Operations, Manpower, Logistics and other services. From there, these two models were adopted by all of the standing national armed forces. In short, the IDF General Staff is a development of the German model with adaptations from the French model (which trickled down through the US Armed Forces) with local adaptations (a legacy of the paramilitary organizations, in particular the Palmach) – therefore the IDF’s staff concept is 150 years old.

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3 It should be noted that compulsory conscription was already introduced at the time of the Greek city states.
DEFENCE ARMY OF ISRAEL ORDINANCE
No. 4 of 5708—1948

An Ordinance establishing a Defence Army of the State of Israel.

By virtue of section 18 of the Law and Administration Ordinance, 5708—1948, the following Ordinance is hereby enacted:

1. There is hereby established a Defence Army of Israel, consisting of land forces, a navy and an air force.

2. In a state of emergency, there shall be introduced compulsory enlistment for all the services of the Defence Army of Israel.

* Published in the Official Gazette, No. 3 of the 22nd Iyar, 5708 (31st May, 1948).

The age of those liable to enlistment shall be as shall be prescribed by the Provisional Government.

3. Every person serving in the Defence Army of Israel shall take an oath of allegiance to the State of Israel, its Constitution and its competent authorities.

4. It is forbidden to establish or maintain any armed force outside the Defence Army of Israel.

5. Orders, declarations, regulations and any other directions concerning matters of the national service which were published by the Jewish Agency for Palestine, the General Council (Vaad Leumi) of the Jewish Community in Palestine, the People’s Administration, the Provisional Government or any of their departments between the 16th Kislev, 5708 (29th November, 1947) and the date of publication of this Ordinance, shall remain in force so long as they have not been varied, amended or revoked.

6. Any act done in accordance with the provisions of this Ordinance shall be legal, even if it is repugnant to any other provision in the existing law.

7. The Minister of Defence is charged with the implementation of this Ordinance.

8. This Ordinance may be cited as the Defence Army of Israel Ordinance, 5708—1948.

17th Iyar, 5708 (26th May, 1948)

THE PROVISIONAL GOVERNMENT

Image 1: Defense Army of Israel Ordinance
Moving on. Staff work in the IDF, like in all armed forces, is characteristic of work methods in the public sector across the globe, and is the outcome of the development of state bureaucracies and the creation of a management class within the financial sector in the 20th century after the expansion of the industrial revolution. The German thinker Max Weber and the American engineer Frederick W. Taylor are the fathers of modern bureaucracy and management. The IDF, therefore functions according to 100 year old norms.

“The IDF will provide a response to two types of demands from the political echelon: The first – the demand that the IDF achieve a full, clear and decisive military defeat [of its adversary].”

The decisive defeat concept of the IDF, as an organizing principle for managing an army during wartime (which in itself developed a “canonical,” ahistorical and almost holy significance in the pursuit of victory in major armed conflict between conventional armies of states), is also rooted in military thinking, mostly from the second half of the 19th century. The organizing principle for the management of the IDF is therefore 150 years old.

Continuing on. The traditional approach adopted by the IDF to defeat the forces of enemy states (by the way, has anyone seen any of these lately?) - focused on the tactic of seeking a breakthrough based on artillery (and not the indirect approach) with the support of infantry and airpower (which matured prior to the 1967 Six Day War) – is just an adoption of the German lessons from World War I. This lesson (Blitzkrieg) was implemented not unsuccesssfully during World War II, and was also adopted by different armed forces in the period after the war. Therefore, the IDF’s decisive defeat concept is 80 years old.

5 Ibid, Page 15 (Hebrew)
Lastly, in practice, the combat approach utilized by the IDF in the last generation – a standoff warfare approach based on shifting the military center of gravity from maneuver to standoff fires – has its source in the vision of the Italian General Giulio Douhet from the beginning of the 20th century, a period when a new technology, the airplane, were being integrated into modern armies. The strategy was demonstrated (with improvements from the precision munitions era) during the first Gulf war in 1991 and during the American-led NATO operation in Kosovo in 1999. The IDF developed its own original methods to implement the idea of decisive force from the air, and has implemented them (with partial success, it must be said) over the last generation, from the Operations Accountability and Grapes of Wrath in Lebanon in the 1990s, during the Second Lebanon War, and including the frequent rounds of fighting against Hamas in Gaza. That being the case, the roots of the current prevailing key concept of operations in the IDF – the prevailing concept of standoff warfare – were set down by thinkers 90 years ago.

In summary – this introductory chapter was intended to establish two contentions that are the starting point for this article: The first contention holds that the IDF was not established close to the establishment of the State of Israel, and that its foundation date in reality, is an amalgamation of 150 years of history, during which ideas and experiences developed within the unique historical experience of Jewish nationalism under fire.

The second contention, and the more significant for us, holds that the IDF was not founded just once, and that the work of “founding the IDF” (and indeed any other armed forces) which takes place every generation or two, is a natural act that needs to be adapted to current and future challenges. This is a necessary process even if it is difficult and painful to achieve.

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7 See for example, Tamir Yaday and Eran Ortal (January 2013) “The Rounds of Deterrence Paradigm – Strategic Patterns and Doctrine in a Dead End”, Ashtanot, Volume 1, Israel National Defense College [Hebrew].

8 Ibid, pp. 67-68.
On the basis of these two contentions, I will present the central argument of this article:

Like any other organization, armed forces are not frozen entities, and they adapt themselves to the changing environment. While necessity is a sufficient condition for a limited process of ‘adaptation’ which mostly takes place far from the organization’s centers of power and is internalized, “re-establishment” or fundamental change in the form of "transformation" is much more complex. It requires a considerable ongoing investment of surplus energy and effort from the senior command echelon to radiate change from the “middle to the outer edges” of the organization. Furthermore, in light of the close attachment of organizations to their strategies, an army that wishes to undertake fundamental changes to its strategy must initiate deep change within itself, such that a different approach to force design is a necessary condition for implementing a different force employment.

And in the case of the IDF: The coming decade must be dedicated to re-establishing and rebuilding the IDF, in order to allow it to adopt a more relevant strategy for future challenges. The “Gideon” multiyear plan which has been publicized in the media in recent months, is the first step – and certainly not the last – on a long road in the right direction. In the coming years the implementation will require from the IDF leadership decisiveness, initiative and stubbornness – capabilities which might be called “organizational generalship.”

In this article I will try to make clear why wide-scale reforms are needed in the IDF, in essence a "reestablishment" of the organization. This will be covered in the second part of the article. In the third part I will describe the reforms that the IDF needs to undertake in the coming decade (and possibly longer). The fourth part will present proposed principles to jump-start a process of change and reestablishment\(^9\) which will increase the chances that

\(^9\) Incidentally, research into fundamental change processes in organizations and armies in particular show a success rate of less than 50%.
this long march will reach its destination – in order that in the future we will be able to look back and say that in the middle of the second decade of the 21st century, a new chapter in IDF history began. A chapter which will be assessed as a "reestablishment."

The Map is No Longer the Territory – The Changes in the Environment that the IDF Operates in

Firstly, with regard to continuity vs. change, it is important to clarify that not everything in the environment has changed, and of the actors that have changed, some may turn on their heels and return to what they were in the past. For the purposes of this article I would like to highlight ten changes. They will be described very briefly, and their entire purpose is to make clear the situation in which the IDF has been operating for some time – a state of incongruence between it and the environment that it operates in.

The international environment – when regional conflicts meet global competition

Fear, honor and interests, opined the ancient Greek historian Thucydides, are what drive the history of mankind. Everything that has been written since in the field of international relations is a development and expansion of this analysis. If we accept Thucydides’s argument, then the international relations system is indeed contains contradictory elements. The specific appearances of conflicts or the collaborations which are influenced by them, changes in accord with social, economic, geo-strategic and

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10 The heading is borrowed from: Michel Houellebecq, The Map and the Territory, 2011.
11 The IDF Strategy document as well as other publications about the development of the force design plan for the coming years. The “Gideon” multi-year plan, allow a broader peek into the way that the official IDF understands its current and future operating environment.
technological characteristics of the time, place and spirit of the particular period.

The collapse of the Soviet Union which took place in the previous generation was a blinding and exceptional event. So were the September 11 attacks which took place a decade later. The supremely dazzling nature of these two events made it difficult for us to recognize the tectonic processes that shaped the current global system – the United States, still the strongest world power, has had its fill of long wars, and the technological gap between it and its competitors on the global and regional playing fields (China, Russian and Iran) is eroding. Moreover, the global economic system which was shaped in the mold of the United States is being weakened. The superpower is evaluating its interests with regard to these changes, and the importance of American interests in the Middle East.

The System of Norms and Value – What is Possible is no Longer Advisable

“Force shall be activated in a determined manner to achieve the political goals, while operating in accordance with international law with an emphasis on the Rules of War while preserving the legitimacy of the State of Israel.”

Israel, including the IDF, has been engaged for over a decade in a diplomatic-legal battle which was initiated by the Palestinians and is being led by them. The struggle against the construction of the security barrier was a sign of the beginning of this battle in the form we are familiar with today. The struggle against this separation fence, as well as against the Goldstone Report which was written after Operation Cast Lead, and the manner in which the IDF conducted the two military campaigns and the legal battle which accompanied them, all demonstrate the deep change which

has taken place at the global level with regard to battlefield norms and values, which Israel finds itself in the middle of. The level of expectations of the IDF has risen dramatically, and is therefore relevant to an article about changes in the external operating environment of the IDF and the entire defense establishment. These changes requires significant adaptations by the IDF.

Extensive criticism of the Israeli government and the IDF was voiced, for the alleged lack of conformity with the basic principles of international law such as ‘distinction’ and ‘proportionality,’ for damage caused to UN institutions, and the alleged use of banned armaments. Criticisms of these types form the foundation for the enemy’s diplomatic-legal “counter-attack,” which begins on the day the kinetic warfare ends. This counter-attack – in doctrine – damages the IDF and Israel in the present, limits its diplomatic freedom of action and the ability of the IDF to maneuver in the next clash, and occupies the attention of the IDF leadership during periods of routine operations.

Also, while Israel has significantly improved its defensive capabilities in this battle, there exists an underutilized offensive potential which Israel could use against its enemies within the international system of norms and values. More so, there is a wide gap in the use of national resources and the mobilization of external resources to deal with this phenomena.

The regional geo-strategic environment – when a superpower meets a non-state actor

The Middle East suffers from a long list of chronic problems (weak or one-dimensional economies, weak infrastructure leading to limited accessibility to electricity, water, food and education etc.). For many decades, these problems have compounded without almost nothing getting in the way. This is due to a wide range of factors including repressive authoritarian regimes, social passivity and relative isolation between the problems which
prevented the development of significant political unrest which could be converted to political power and drive change.

The upheaval which has gripped the region over the last five years is a reflection of an awakening to these problems and a destabilization of the region. This is the result of the convergence of several processes - an accelerated process of urbanization and increased pressure in cities which are natural environments for protest movements; rapid growth in the penetration of technology in the region (in particular satellite TV and cellular phones) which increased awareness of the polarization between the ‘haves’ and ‘have nots’; weakening of national identities which even after a century were not sufficiently deep-rooted; strengthening of competing identities to the national identities – tribal, ethnic, ideological and religious.

If these trends are consolidated, one would presume that the region’s stagnation would naturally end. However, one also cannot ignore the contribution of the two ongoing American wars in Afghanistan and Iraq and the contribution of the drawdown of thousands of American soldiers from Iraq to the public energies that were required to destabilize the region.

This is how the relatively solid foundation which characterized the Middle East for the last two to three generations, was replaced by a fluid and dynamic foundation of continuous competition for control, influence and legitimacy between a number of actors – ethnic minorities, veteran national establishments, political movements inspired by the Muslim Brotherhood, the Sunni Salafist-Jihadist stream and Shiite movements supported by Iran. External actors have also entered into this turmoil, especially non-state actors and regional and international powers, who make use of both military and non-military tools to promote their interests and influence. External actors are joining forces with local actors to tilt the scales in the competition and to shape the region in a way that best suits their interests. In practice the region has become an arena for violent
struggle in the service of a global competition between diplomatic agendas, economic interests and spheres of influence.

Civilian and Military Technologies – When Augustine’s Laws meet Moore’s Law

“The IDF’s technological edge is challenged.”

In 1964 the founder of the chip-manufacturing giant Intel, Gordon Moore, predicted that the number of transistors in an integrated circuit would double every year (later he updated it to every two years; historically the actual number has been in the middle). The significance of the statements is that computing power and storage capability would increase exponentially. Moreover, the costs of computing and storage would plunge at a similar rate. Consequently, computing’s center of gravity has moved from hardware to software, and from software to applications.

Roughly a generation later, Norman Augustine, former CEO of Lockheed Martin and former Under Secretary of the Army in the US Department of Defense published 52 insights and diagnostic conclusions about budgeting and management in the security sector. They were all expressed as aphorisms. According to Augustine’s Law no. 16:

“In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3-1/2 days each per week except for in a leap year, when it will be made available to the Marines for the extra day.”

References:

If we translate this insight into a basic rule, we can say that, the rate of cost increases for military platforms is exponential, while increases in the defense budgets are linear, meaning that states are able to manufacture fewer and fewer platforms. Analysis
of the costs of military platforms over the last hundred years shows that this rule is valid.

The meeting of these two technological phenomena is fascinating as a research topic, but also a recipe for catastrophe from a practical military perspective. While organizations prefer to create networks of cheap application in larger quantities (networked app. centric), states still prefer power based on expensive platforms (platform centric). Furthermore, alongside the constantly increasing costs of developing and purchasing advanced weaponry, the routine maintenance costs of these new systems also keeps rising.

Additionally, in order to derive the maximum from these new technologies, training and exercises are required for the users of these platforms. An army with a fixed budget needs to shrink in order to rearm. In order not to shrink, and to continue to engage in a technological build up, in the past the IDF chose to impair force design in the areas of training and exercises. Now, the IDF must strengthen the personnel element in force design, even at the costs of reducing manpower.\textsuperscript{16} Without adjusting military force design to the wider implications of the convergence of these two trends, traditional state armed forces will struggle to adapt to the future technological environment, and will continue to experience firsthand the erosion of the huge advantages that they had enjoyed in relation to the new networked enemies who now embody the majority of the threats to national security.\textsuperscript{17}

\textsuperscript{16} Finkel, Meir (2013), \textit{Challenges and Tensions in the Force-Building Process}, IDF internal publication, Tel Aviv: Maarachot, [Hebrew], pp. 197-198.

\textsuperscript{17} In the case of Iran, despite the fact that it is a state actor which is affected by the rising cost of military technology, the rise in costs will be offset by its expected economic recovery. This will happen after the signing of the Iran nuclear agreement and its return to the international fold.
The Nature of the Threats – When the Arab Spring Meets the Syrian Storm

“The Islamic 'resistance' movements seek to replace nation-states, and have relentlessly been trying to establish themselves in low-governability frontier areas.”

You only need one grain from the sandstorm that enveloped Israel in September 2015 to describe the change in the nature of threats to Israel’s security. That grain of sand is a metaphoric spark for two factors that have converged to revolutionize the nature of the security threats to Israel.

The decline of Syrian agricultural land, due to a range of factors, is one cause of the sandstorms. The Syrian civil war which uprooted over 10 million people from their houses and carved deep furrows into that land is a second cause.

In the near future Israel will continue to deal with the security implications of the incomprehensible gap between its strength in the fields of economy, energy, water, food and governability and the weaknesses of its immediate and more distant neighbors.

The war in Syria, a kind of “implosion” of international relations, is a global event which is draining into one corner of the globe; it exacerbates the above gap, speeds up the entry of weaponry to the region, reduces the threshold for the use of chemical weapons, causes a massive humanitarian disaster and allows new types of actors to blossom.

The new threats are evading the old classifications of the security organizations. They blur the term and institution of “borders” and thereby obscure the difference between external and internal, they distort the boundary between civilian and military, they erase distinctions between friend and foe, and place complex obstacles to the use of force: If I hit too hard – I’ll break, and if I am too restrained – I radiate weakness and invite trouble. They are too large to be dealt with independently, but they also seep into the region in such a way that it is difficult to define the borders of a coalition that could effectively deal with them.

The Syrian dust that covered Israel is also a metaphor for a new security threat which is developing “on the other side of the hill.” This is the threat of precision armaments being developed by the Iranian arms industry which are making their way to Israel’s enemies, firstly Hezbollah. The precision threat, as distinct from the statistical threat, is a serious challenge to the State of Israel, whose geography increases its sensitivity to damage to national and economic infrastructure or symbols of the state. The precision threat to the entire territory of the state requires new thinking about different potential responses – diplomatic, doctrinal and technology, to note only three of them.

The Nature of War – When Weight meets Lightness\textsuperscript{21}

Military history is interwoven with clashes between heavy, slow and concentrated forces and light, fast, and dispersed forces. The Jewish underground paramilitary organizations in pre-state Israel were light forces that fought the heavy British forces and the equally light Arab forces. “Light” does not defeat “Heavy,” but rather exhausts it or helps achieve diplomatic goals using diverse tools in spite of the lack of heavy power. The change in the nature of the Hebrew defensive forces, which was initiated by Jewish Agency leader David Ben Gurion, after a seminar which took place in April 1948, was intended to develop a heavy force that could

\textsuperscript{21} Kundera Milan, (1985), \textit{The Unbearable Lightness of Being}, pages 10-11.
defeat similar heavy armies. IDF efforts to maximize weight reached their peak in the mid-1980s, and since then enemy heavy forces have gradually left the playing field and been replaced by light forces. With these external changes, question marks developed with regard to the paradigm of defeating the enemy, which was then the key factor shaping force design in the IDF.

In the past the challenge facing the IDF could be expressed through the question: How to mobilize the maximum force in as short a time frame as possible in order to defeat the heavy armies of the enemy? Since then, the enemies have changed shape and combat doctrine on the basis of their understanding that they have no chance of defeating the IDF in a broad scale conventional war. The doctrine with which the IDF must now deal is that of a network of small tactical and operational units which are flexible and adaptable and whose goal is not necessarily to defeat the IDF, but rather to attack the weak points of Israel and the IDF – the civilian home front and infrastructure – and extract as high a price as possible from the IDF. Their strategic concept is to cause physical damage to the army and infrastructure, to exhaust the Israeli public and to “blacken” Israel’s reputation in the eyes of the international community. While Israel thinks of war primarily in military terms, its enemies have learned to use all of the tools available to them during war.

Consequently, contemporary light forces experiment with a wide range of combat ‘startups’, and adapt today’s technologies and exploit our sensitivity to armaments and build state like capabilities, all without becoming a heavy state force. Technological – hybrid adversaries generate challenges of a different type for the IDF that are unlike the conventional challenges for which the IDF was prepared, and are even different from the asymmetric challenges for which it trained in the previous generation.

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National Prioritization – When Quality of Life Meets Defending Our Existence

The changes in Israel’s security environment have strengthened the public feeling that Israel has risen a level and moved from a reality in which it was defending its very existence to a state of defending the quality of its existence. This feeling has been translated over the years to a trend of changing national priorities, a certain degrading of the motivation of different sectors of Israeli society to accept the experience of full service in the IDF and a reduction in the resources made available for defense in order to free up resources to reduce social and economic gaps.

The reduction in the Israeli defense budget is a trend which requires the defense establishment “to do differently with less” and not to “do more with less,” as armies are wont to declare after the axe of budget cuts has fallen. To do “differently” means to make more efficient use of resources – budget, manpower and armaments – and generate more efficient productivity for defense. In business terms, the IDF needs to become an exemplary company within the public sector battles in order to provide security for the state and its citizens, and at the same time to be attractive to and a source of pride for those who serve in it, and the society that they come from.23

Israeli Society – When the Army Meets the Nation

The IDF is still one of the foundation stones of Israeli society and one of the state institutions that enjoys the highest level of public support and sympathy during peacetime and war. Still, military-society relations have undergone significant changes in recent decades. In the age of wars of choice, society expects the IDF to attain significant achievements on the battlefield with a minimal number of losses, not just in the civilian home front, but also among its own ranks. The IDF is opening its ranks to new population groups and is expanding professional horizons to diverse

population groups who serve in it. However, the experience of serving in the military is turning into the birthright of a shrinking percentage of the population.

The IDF continues to serve Israeli society, not only as a defensive force, but also in the implementation of projects with national and societal significance. There are numerous examples of this which include IDF educational projects in schools, involvement in police-type actions including enforcing law and order, and of course, compulsory service which unites the disparate groups in Israeli society. In this field the IDF has many significant challenges in integrating large numbers of soldiers from ultra-orthodox communities, updating the framework for recruiting members of the Druze and Bedouin ethnic groups, broadening the range of professional roles available to women and training new recruits for the increasing number of professional roles needed in the IDF.

National Planning Agreement - When the Master Plan Meets Ben Gurion’s Vision

“The State of Israel cannot tolerate the reality of a desert in its midst. If the State does not destroy the desert – the desert is likely to destroy the state. The thin strip between Jaffa and Haifa which is only 15-25km wide and which includes most of the people of Israel, will not survive in the long term without extensive and fortified settlement of the Southern region and the Negev.”

The combination of the demographic-economic reality in the State of Israel with our developing understanding of the threat around us, validates Ben Gurion’s analysis. As a direct consequence, the State of Israel decided to develop the Negev, and in 2011 the Israeli cabinet decided (Resolution 3161) to instruct the IDF to...

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move units from the C4I and the Intelligence Directorates to the Negev region. As in the past, the IDF is being used as the executive arm of the government to promote national social-economic goals, including increasing the supply of land for housing in the center of the country and development of the Negev.

The transfer of so many bases to the Negev presents the IDF with challenges, but also opportunities. The challenges include the difficulties in financing such a major effort and retaining existing highly motivated and quality personnel, who may see the move to the Negev as a degradation of their conditions of service, as well as the risk of deterring others from joining the ranks of the career army. The opportunities include the possibility of renewing and upgrading infrastructure within the framework of the historic efforts to build new bases in the Negev. Another opportunity for the IDF is the possibility of fulfilling additional social functions based on the understanding that the IDF serves the society that created it.²⁵
The Organization’s Conceptual Outlook and Management – When the Chimney Sweep Meets the Systems Administrator

“Interconnectivity of various capabilities, measures and knowledge. [...] Jointness of the IDF’s arms to maximize its capabilities.”26

The classic organizational outlook which developed in the last century tends to be equated with an assembly line, where each employee has a small and well-defined role to perform. The role of the manager is to supervise the system to ensure that each part of the manufacturing process works as efficiently as possible. In popular culture, this organizational method was accurately depicted in Charlie Chaplin’s movie “Modern Times” (the image most identified with the movie appears on the cover of this volume). This management approach is based on the hierarchical reporting structure (the chimney method) which characterized armies in the modern period, and which was developed over the last 200 years.

There is a deep connection between the ability to effectively collect and distribute knowledge and the management and command approach with regard to delegation of authority and responsibility. One can follow this connection by analyzing the development of governmental mechanisms and the modern bureaucratic organization and the development of armed forces in the industrial age. In general, the command approach and management during the industrial age was based on the model of a “central brain” with one manager at the head of the organization, who would give orders to the sub-units under him/her and they would in turn provide feedback up the chain.

The expansion of the battlefield brought about an enlargement of armed forces, in which horizontal (between units) and vertical (between unit and command levels) communication became more complicated. Armies were forced to deal with the

command-management challenge of maintaining accurate situation assessments, analysis and decisions on the next steps, delivery of commands and supervision of implementation. The German army in the 19th century, for example, overcame these difficulties by developing an approach for command-mission functionality. Briefly, the essence of the idea is that if the commander cannot implement an OODA Loop\textsuperscript{27} during combat, he must take the initiative (before it is too late) in order to create the conditions that will allow effective functioning of the force, even without him, through intensive training and by encouraging initiative. The IDF adopted this approach with great effectiveness in many of its wars.

The development of information technology, from the invention of the telegraph to the most recent generation, encouraged and validated the “controlling central brain” approach, which enabled the “brain” to separately and effectively command, control and supervise, strengthening the bureaucratic model. During the last generation, armies worked energetically to leverage information technology to strengthen the “brain’s” capability to oversee and direct, or in other words – to improve the capability to implement the traditional hierarchical approach.

However, the competitive business environment forced commercial organizations that at first adopted the bureaucratic model to quickly respond to changes and to develop different management models which better maximize the inherent potential of information technology to improve organizational effectiveness. They developed a “flat” model, networked and more dynamic, based on the understanding that the “central brain” should be one organizational brain to which all of the sub units are partners and

\textsuperscript{27} \textbf{Observe, Orient, Decide, Act} – An idea developed by Col. John Boyd, who was interested in approaches to war as a competition between the learning-action loops of the two sides of combatants. The side which had the tighter loop would have enjoy a significant systemic advantage in creating the necessary conditions for victory. For an expansion see: Frans P.B. Osinga, (2007) \textit{Science, Strategy and War: The Strategic Theory of John Boyd} (London: Routledge).
can contribute. They also realized the need to tighten as much as possible the learning-implementation loop described above.

Naturally, the public sector was late to the game in identifying the changes taking place in the link between the ability to know and the ability to act. Armies, as a part of the public sector, also suffered from the same deficiency. Three central factors accelerated the understanding in the IDF of the need to change: The enemies that armies are facing – non-state organizations which operate in an efficient networked manner; the over-bureaucratic nature of military headquarters which increases the inefficiency (especially when compared to commercial organizations); and the dynamic, rapid pace of change which requires constant learning, fast decision making and great adaptability. These qualities demand serious changes in the communication protocols within military organizations, based on the addition of a systematic-networked non-hierarchical communication protocol.\textsuperscript{28}

\textbf{A New Environment: New Forms}

With regard to these ten profound changes in the strategic, security, social and organizational environments I will present five campaigns\textsuperscript{29} to change the basic structure of the IDF which are needed to adapt the IDF to the challenges of the future. The IDF has already formulated their characteristics within the framework of the “Gideon” multi-year work program, the result of a year’s intensive work in 2015. In this chapter I will detail each of these five

\textsuperscript{28} For more detail on strategy of management see the chapter “Strategy from Above” in Freedman, L (2013), “Strategy and History”, Oxford University Press, NY.

\textsuperscript{29} It is common practice to use the term campaign in its military context with regard to the combined efforts over time to change the reality and balance of forces between the IDF and its enemies. In this article, the term is being borrowed for use in the military transformation field, with the loan word intended to highlight the systemic nature of the challenges inherent in changing the structure of the IDF and the extent of effort which will be required to overcome numerous obstacles which any “Champion of Change” will face in their path.
campaigns that embody the IDF’s understanding on how to adapt to current and future challenges.

The Campaign to Change its Territorial Deployment

IDF bases are effectively time capsules that preserve the recent history of the Land of Israel over the last two centuries. The practical approach of the Ministry of Defense with regard to “pre-existing” buildings and infrastructure preserved the Templar structures in Tel Aviv (The Kirya, the historic Prime Minister’s office and the Sarona complex), British buildings across the country (for example the Ramle bases, Haifa, Tel Hashomer and Tzrifin) and the Jordanian buildings from before the Six Day War (for example Camp Schneller in Jerusalem).

The IDF has a significant influence on the geography of Israel. It controls large areas of the state used for bases, storage and training, and has further influence over master plans in other areas due to factors related to intelligence “line of sight”, the ability to maintain constant communications over military channels, and of course the capability to defend the country. As a result, changes in army infrastructure, deployment and in the characteristics of the IDF’s organizational structure have a considerable influence on Israel.

In the coming years, the IDF will undergo major changes in its deployment, and will consequently help drive the momentum to settle the Negev. The process can be described as a national awakening to the importance of settlement outside of the country’s center. The process of concentrating IDF bases, reducing their number and moving to high-rise building will bring about more efficient use of land and allow for the clearing of large land reserves suitable for the building of thousands of housing units. New and advanced sustainable planning and building methods will allow for large energy savings. The transfer of IDF units to the Negev and changes in their deployment in the Galilee will be an impetus to strengthen the periphery and to implement Ben Gurion’s vision,
and will allow for better preparations for war. The geographical reforms will also help stimulate a process of making IDF procedures more efficient and even improve the “user experience” for future recruits and those currently serving.

The Campaign to Change the Structure of the IDF

The IDF is currently on the threshold of a broad structural reform. One of the first steps in this direction, from the last year, was the sensitive decision to close the veteran Druze battalion. Additionally, a gradual multi-phased process was begun to create a cyber service in the IDF to focus all the IDF’s activities in this field with all its components and layers. Much has been written about cyber as a new dimension in combat along with ground, naval and air, which requires suitably tailored and structured preparation. Today, cyber missions are conducted by the C4I Directorate and IDF Intelligence, and in light of the lack of experience in the field the process of forming the service will be done with extra care, while engaging in a closely supervised learning process.

In addition, the IDF will relinquish units that are currently part of the military, and transfer them to civilian bodies, or reduce the number of career personnel in units that are not a central component of military activity. This is planned, for example, for the Military Advocate General, the Financial Advisor to the Chief of Staff, the behavioral sciences department, the Education Corps, the IDF Rabbinate, IDF Radio, and the IDF boarding schools etc.

Also, the makeup of the IDF’s order of battle is slated to change. The IDF plans to retain only five German Dolphin submarines and to relinquish the oldest submarine when the sixth arrives in the coming years; the air force base at Sde Dov is also set to close.

The reduction in the size of the forces will be offset by, among others, closer coordination between the different services and territorial commands and the General Staff. All the IDF’s capabilities and high level intelligence will be fused into a single consolidated network. The fusion trend and networked nature will
strengthen the military “brain” and at the critical hour allow the “muscles” to also function better.

**The Campaign to Reorganize the IDF**

The IDF intends to reduce by dozens the number of career officers from the ranks of Lt. Col. to Brig. Gen. from headquarters and command staffs in order to increase their effectiveness and to reduce bureaucracy. In addition, a new approach was formulated and implemented for the planning and management of the budgets of the directorates and services. This new approach will increase their responsibility for expenditures, including manpower; increase their flexibility; allow them to manage their missions more effectively; and encourage efficiency. The fusion and networked trend are planned to be reflected in combined arms force design processes – within this framework the services and directorates will work together to develop new systemic capabilities for the IDF in the different combat fields.

In addition, the IDF will reduce the number of reservists by approximately 100,000. Aside from these changes, the number of career personnel will also be reduced. However, the IDF does not see this as purely an economic issue, but as a spur to change in the organizational culture and a reduction of the bureaucratic nature typical of a public organization. One of the ways to achieve this goal is to reduce the more senior ranks in order to broaden the span of control to a ratio of one to five. In this manner, for example, a department head (Colonel) who would usually command three officers of the rank of LTC would, after the completion of this process, command five (an additional implication of the process is that if it succeeds, everything in the IDF would no longer be divided into three, but rather five...).

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30 The exact numbers are sensitive and cannot be published.

31 With regard to the need for these changes see: Eran Ortal (2013) “Paradigmatic Innovation in the IDF? On learning with regard to force design, the use of force and what is in between”, Ashtanot, Volume 2, National Defense College (Hebrew).
An additional significant change planned for implementation is the merger of the Technology and Logistics Directorate with the Ground Forces Command. This move is intended to strengthen the Ground Forces and to improve the capabilities of the service to ensure the preparedness of the forces for combat in a short time period as well as force design over the long term. An additional change which is planned within the framework of the plan is to strengthen the capability of the General Staff to serve as a Strategic Command which directs force design with a view to the future and the engagement of force from a combined-arms, multi-dimensional and interdisciplinary perspective.

The Campaign to Adopt a Relevant Theory of Victory

The IDF Strategy Document defines three key strategic diplomatic objectives for the use of force: a) Deferral of the next conflict through routine operations; b) Maintenance or improvement of the strategic situation after violent action initiated by the enemy by changing behavioral patterns and intentions; c) A dramatic change in the state of affairs, potentially including a change in the strategic balance through the neutralization of actors or causing fundamental changes in their capabilities or standing.

During the second half of the twentieth century traditional armed forces encountered the irrelevance of their traditional approaches to the use of force in combat - in which national regular armed forces faced the need to effectively deal with new types of armed foes who enforced a range of asymmetrical warfare. To paraphrase British historian John Keegan, the “techno-war” cannot be the “socio-war.”

After publishing the IDF’s doctrinal response in the form of the “IDF Strategy” document, the IDF will continue to reformulate an updated theory of victory against potential opponents which will

32 Tamir Yaday and Eran Ortal (January 2013) “The Rounds of Deterrence Paradigm – Strategic Patterns and Doctrine in a Dead End”, Ashtanot, Volume 1, Israel National Defense College [Hebrew].
make the best use of its technological, personnel and qualitative advantages over its enemies.

**The Campaign for Quality Manpower**

The IDF requires high quality personnel who are proud of the organization in which they serve, and feel a sense of duty to take part in the defense of the state. Within the framework of the multi-year plan, the IDF understands that it must translate these fancy words into practice with regard to the different groups who serve – soldiers completing compulsory service, career officers of different ranks, NCOs and reservists.

The IDF career officer corps is the experienced and professional kernel of the IDF which is expected to lead the organization in dealing with the challenges it faces. The new model of career army service for IDF officers is intended to prevent a “brain drain” and a decline in morale among young officers of a junior rank. The model determines that captains, majors and lieutenant colonels can remain at the same rank for up to seven years, at which point they will discharged if they have not been promoted or given exceptional permission to continue to serve without promotion. This will mean a younger career army which will stand for excellence. Those who do not find their place within the army’s ranks will be discharged earlier than is customary today, and will be more easily integrated into the civilian job market.

Compulsory service for male soldiers will be shortened, training courses will be shortened and made more focused, and women are expected to continue to increase their involvement in military roles that were closed to them in the past. The plan will also deal with the level of early discharges of enlisted personnel. These and other processes for soldiers engaged in regular service are intended to strengthen the notion of the “people’s army” which despite all the changes will remain relevant even in the coming years.
How to Guarantee Substantive Change (Transformation and not Adaptation)

It will not be easy to realize all of the campaigns for change outlined in the previous chapter, even though they are all essential. Given the constantly changing strategic environment, military organizations live in constant tension between the need to institutionalize the current military strategy and to maximize its effectiveness through structures, procedures, exercises and training on the one hand; and on the other hand the need to maintain organizational and operational flexibility which would allow critical changes when needed. Most of the changes made by militaries, are made within their existing paradigmatic frameworks. They tend to prefer to enhance the way missions are conducted over adopting new missions.

However, sometimes, given dramatic changes in the external operational environment (changes such as the collapse of the Soviet Union or the spread of information technology), militaries are forced to undertake substantive paradigmatic change in their organizational patterns, thought and action to shape a new military organizational strategy. Sometimes, militaries face a challenge and instigate deep change, but mostly internal forces block the change and limit it to minor adjustments in behavioral patterns. The IDF cannot be satisfied with local adjustments (adaptation) in the way it conducts its missions, but rather needs substantive transformation. To succeed, excess energy will be required to overcome internal obstacles to change and to promote rebuilding as the IDF was able to do in the past.

Over the last generation, severe crises of identity befell many armies, certainly the Western ones, due to political, social, economic and technological changes which influence – each in its own way – the nature of the enemy and of armed conflicts. This is one of the reasons for the bourgeoning number of “White Papers” which have been prepared by the security establishments in many countries and the significant development of research into the
theory and practice of change in military organizations, primarily in the United States. This field of knowledge drew on experience from tangential areas such as military history, industry and management, organizational change, leadership and others.

The current century (and less so the previous one) provided much written documentation of successful and less successful change processes in military establishments – changes of military strategy and the systems that implement them. For example, many serious researchers have evaluated the histories of the armies of the great powers between the two world wars. In this period, there were several military organizations that made a quantum leap, such as the American Navy, which adopted the aircraft carrier and developed a matching strategy; or the German Army which developed the Blitzkrieg doctrine. There were also armies that stagnated, such as those of France and Poland. The British army did not realize the latent systemic potential of the new platforms that it itself had developed (the tank and aircraft carrier) and failed to implement the deep changes it needed.

The research on change in military establishments leads to one sharp conclusion: Deep change in military strategy requires deep change in the military establishment itself. In fact, organizational change is a necessary condition for a change in strategy. Not only is does this insight provide a deep connection between the use of force and force design, it clearly defines which of the two are the center of gravity of military strategy. If an army wishes to use force “differently,” it has no choice but to design force “differently.” In current terminology, without substantive change in the firmware, hardware and software, all improvisational efforts will merely amount to new niche applications to provide a diversion through the use of force.33

Despite agreement on the priority of force design over the employment of force, there are disagreements on how change takes place in military establishments. This chapter will present the three primary approaches accepted in the academic literature to describe the keys to success in implementing long-term and sustainable change in military establishments. Each approach emphasizes a different key actor. Finally, we will recommend the approach that we see as most relevant to creating the required change in the IDF of today.

**Looking outside the Box**

According to this approach, militaries change as a reaction to an accumulation of change processes in the external environment. In this manner, changes in the security environment, changes in the nature of conflict and the character of opponents, significant technological developments, social and economic changes and new demands from an assertive political echelon above the army\(^{34}\) - all produce substantial external incentives for military establishments. According to this approach, the interesting events take place outside the military box, and they determine the degree of change, which is nothing but a necessary adaptive reaction, a kind of refocusing.

This approach is based on the premise that armies do not generally initiate future-focused deep change on their own, but rather react to external stimuli, and only do so when they cross an “activation threshold.” Sound logical? Perhaps in theory, but things are not exactly like this in reality. In actual fact, external changes occur through gradual processes which allow militaries to remain indifferent or to make minor adaptations to their behavior. Furthermore, these small adaptations and the improvisations themselves contribute to the perpetuation of the paradigm, and

\(^{34}\) The relationship between the political echelon and the army are described in Elliot Cohen, (2002), *Supreme Command: Soldiers, Statesmen, and Leadership in Wartime*, Free Press.
prove to the army that it is standing on firm ground in terms of doctrine, operations, technology, structure and organization.

The historical research finds no clear connection between failure in war and deep change in militaries. The British army, as noted above, did not undergo a revolution after the failures of the First World War. Later, American ground forces, who were focused on preparing for a war with the Warsaw Pact countries on the European Front, finished the Vietnam War beaten and battered, but after the conclusion of that war, they locked their difficult experience away in a safe under the title, “A Deviation from Military History,” and returned to planning for a war between conventional armies (our Yom Kippur War contributed to this approach). These same ground forces then had to relearn the same lessons as the Vietnam War during the years of war in Iraq and Afghanistan. Even the impressive structural-organizational-operative innovations at the start of the Afghanistan War which were based on combined operations of special Forces, CIA units and aerial capabilities, did not withstand the scope and duration of the war and the patterns of use of armed force returned to familiar procedures.

The IDF also experienced failure during the 1973 Yom Kippur War. After the war a hasty process of evaluating operational and technological adaptations took place. This process only came to fruition as an effective operational response at the end of the 1990s, by which time the army had impressive capabilities for repulsing a surprise armored attack from one of its enemies. Nothing ‘prevented’ the IDF and the Israeli government during the 1980s and 1990s from building an army that could win “anew” the Yom Kippur War. Not the external environment which had changed so as to be unrecognizable, nor the new type of war that the IDF encountered in Lebanon in 1982 and which it has faced without a break ever since.
Thinking “Inside the box”

Which forces drive change within military establishments? The research has identified two potential sources of incentives that could create the necessary conditions for deep change in an army – the material-beneficial source - the ongoing competition for compensation and resources - and the ideological-cultural source.

Material-beneficial forces can drive change through a diverse range of means – promotion of “Young Turks” to senior positions which expands the sphere of influence of those individuals and thereby create conditions for broad change; the deliberate generation of competition between units can refresh patterns of thinking and action; a process of preferential treatment for one organization over another over time can initiate significant cumulative change which can reshape the organization, not in “one blow,” but as the results of numerous small local decisions. The IDF underwent several changes of this type in the transition from being based on infantry to being based on armor; and in the transition from a preference for using ground forces to a preference for the use of air-power (a process, which was partly subconscious, and changed the face of the organization – perhaps excessively).

Material incentives to individuals and to sub-organizations that display flexibility and daring in the search for alternative paths to fulfill their old missions and even invent new missions can be used; at the same time “punishments” can also be used that in essence dry up the resources and attentiveness from the senior commands for individuals and sub-organizations that continue to stagnate. All these constitute an accepted explanation for driving significant and ongoing change in defense establishments. The message is clearly communicated and internalized, appropriate behavior is strengthened and improper behavior is reduced.

Cultural-consciousness incentives are based on the premise that individuals and organizations are motivated by the basic personal need for recognition. In this way, open and trusting “vertical” communication from the command level can increase the motivation of the subordinate level to initiate a flood of new ideas
without fear of dismissal or exclusion. Free and trusting “horizontal” communication between units and organizations can increase cooperation and create a comfortable climate for the free flow of ideas without fear of being copied, taken advantage of or the stealing of credit (sound like a fantasy?). Thus, a command level that cultivates a climate of experimentation, will in exchange received a unit which accomplishes old missions in new ways and creates new missions to fulfill the goals set by the command level.

Encouraging organizational learning and a critical approach will strengthen the willingness of individuals and sub-organizations to engage in self-examination and change without fear of showing weakness or of admitting an error, and without barricading oneself within the institutional comfort zone.

This approach generally identifies the internal mechanisms that drive substantive change in a military establishment, but it suffers from two problems. The smaller problem is the one-dimensionality problem. Neither the material source alone nor the cultural source alone can create the energy needed to cross the elusive “activation threshold,” and a combination of both incentives is required.

Nevertheless, a bigger problem is the non-identification of internal forces that can block change, which, as we learn from the historical research, are stronger than the drivers of change. Without a combined strategy to maximize the latent potential of dynamic forces and the neutralization of blocking forces, the chances for deep sustainable change remain low.

This point brings us to the third approach that penetrates to the micro-organizational fabric of the military establishment.

Thinking about “Micro-organizational Dynamics”

During the Second World War, the British used old field artillery pieces attached to carts which could be moved with the forces. Operations research was called in to evaluate ways to increase the rate of fire. They identified an unexplained three-second delay between each discharge. A deeper analysis showed
that the British army had retained a procedure of waiting until the (now non-existent) horse that was tethered to the artillery piece could calm down.\textsuperscript{35}

American research has evaluated obstacles to change in militaries during two periods between wars: 1872-1914 and 1920-1939. The research showed the following results – excess bureaucracy; intellectual laziness; a reluctance to attempt to reevaluate basic assumptions and operational approaches; a dwindling of quality military education; and hyper-focus on enhancing existing missions over attempting new missions. Organizational and structural roadblocks included – not promoting “Young Turks”; dispersal of army units; underfunding which prevented maintenance of existing resources, and all the more so, prevented innovation and change; translation of existing approaches to dogma, which prevented the learning of lessons and adaptation, even during combat; and underestimation of the strength of the enemy.\textsuperscript{36}

The research conclusion that strengthening dynamic forces does not guarantee innovation and change directed attention to the need to identify factors that block innovation. The literature shows that, at any point in time, both the individual and the unit are subject to competing incentives – to innovation and to stagnation. Thus, a group of interested parties within the organization are likely to work energetically to block change, given the potential for them to lose prestige or resources as a result of organizational change. Other groups of interested parties are likely to see the change proposed from above as an opportunity to promote their own narrow parochial interests which may differ (in some way) from the national interest which the leadership is working to promote. These groups navigate the change process for the good of their local objectives and not necessarily for the greater

\textsuperscript{35} Morison E., (1950). "Gunfire at Sea: A Case Study of Innovation."
good. Additionally, the level of vertical trust between the ranks or the horizontal trust between the units, is not identical in each local environment, and generates different responses to changes processes.

At this point, an analysis from the world of organizational behavior becomes relevant to the challenge of driving change in a defense establishment. This analysis is called in the professional literature the “Principal-Agent Problem” – the problem of the built-in tension between a manager and an agent. In general, the literature dealing with this question indicates that between the two levels of management, there is an asymmetric relationship.

This lack of symmetry is reflected in two key ways:

1. The command level, which is close to the leadership, tends to focus on objectives and directions which promote the organization and therefore their world view is mainly shaped by the question: “What is needed?” While the subordinate level which is responsible for implementation, lives in a world of tools and resources and tends to cling to familiar assignments and existing routines, and therefore its viewpoint is shaped by the question: “What is possible?”

2. As opposed to the prevailing conception that “upstairs” the picture is more complete and clearer, in reality, the entire concept of the chain of command and the reporting channels create a situation in which the upper command is fed by and depends upon information provided by the subordinate level. Accordingly, the subordinate level has a perpetual advantage over the command level. They decide what, when and how to report.

The unchanging nature of the relationship between the levels of command gives an agent the freedom to choose how to respond to each “stimulus” which the upper command provides. In a more

tangible manner, when the upper command proposes an agenda of substantive organizational change, the subordinate level can respond obediently or with resistance, and each of these responses can be expressed actively and openly or passively and secretly. In light of this, it is not enough for the heads of an organization to formulate a vision, demonstrate leadership and place incentives to promote change. They must actively and constantly work to neutralize blocking forces by overcoming the inbuilt lack of symmetry in their relations with their subordinates.

In order to do so, the senior command must balance between three essential core missions for the duration of the change process, even though they will compete for the limited resources of command time and attention and demand strategies which are sometimes opposed to one another. They are:

1. Personal involvement in promoting innovation and change;
2. Engaging efficient oversight mechanisms and obtaining reliable information about the responses of the subordinate level to the dictates of change;
3. Providing appropriate rewards to subordinate levels depending on whether they promote change or block it.

It is clear that in addition to looking inward, which the whole army, and the senior echelon in particular, must do, it is critical to look outwards and to maintain an appropriate level of readiness for the security challenges which the constantly changing external environment may present, and to never let the army focus entirely on itself.

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38 For analysis of the phenomena, see Martin Van Creveld (1985), Command in War.
Conclusion

When we evaluate the level of change that has taken place in Israel’s external environment over the last four decades – global and regional changes, political and ethical changes, social and economic changes, and technological and management changes – and compare them to the level of change which has taken place in the IDF over the same period, we reach the unavoidable conclusion that the IDF is chronically slow in adapting to its surroundings.40

Indeed, comparative research arrives at the conclusion that this is a common phenomenon among defense establishments and not a unique Israeli phenomenon. However, the many dangers that this delay presents for Israel do not convert this common misfortune to a partial consolation.41

Transformation demands resources of two types – material capital to enable the IDF “to bring what is needed,” and organizational capital to enable the IDF “to reorganize what is needed.” The second type of capital is more important but tends to be forgotten. The practical significance of the above is that there are no magical formulae and no decisive processes or simple technical solutions, and therefore substantial intellectual and organizational effort is required. The IDF must discover sources of internal energy for change and to create the mechanisms to precede change, and not make do with faith that necessity is the mother of all invention. Furthermore, the heads of the army must recognize that the key to the success of efforts to drive change involves an approach that combines material, intellectual, ethical and cultural incentives to promote change, together with a working strategy to neutralize blocking forces, as is clear from the research on the complexity of Manager-Agent relations during a period of organizational change.

40 See also Eran Ortal, (2012) “Is the IDF Capable of a Paradigmatic Quantum Leap”, Ma’arachot, Vol. 444. (Hebrew)
This is a unique model of organizational generalship, which is vitally critical in a multi-dimensional campaign to change the shape of the military establishment.
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"Hewing Water from the Rock":
Change and Transformation in the IDF R&D Systems

LTC Ori¹

Technological Force Design in the IDF

Technological force design in the IDF is entirely based on an organized and systematized process, which is anchored in procedure and in most cases takes a medium- to long-term viewpoint. This viewpoint is mainly reactive, based on seeking and analyzing solutions to problems and challenges which develop in the field. Problems in the field are “translated” by ordnance personnel and other agents, and only at the end are broken down into components and presented to the technological developers. The technological developers convert the operational needs which were presented by the agent into technological solutions (off the shelf, from industry or by using tools that were developed independently) and then sit down at the drawing board. At this point, the reverse cycle begins and only at the end (an end that is often distant), is the operational actor presented with the product (usually in the form of a final product).

This magic cycle is long and complex, and often meets the needs only at a very late stage. Additionally, due to considerable conservatism among ordnance personnel and most technologists, a situation exists in which, in most cases, the technology of the previous generation or two is used. Rarely do we encounter a situation where an initiative and an idea from the technological

¹ LTC Ori serves as the Deputy Head of the Coding And Security Center in the C4I Directorate.
developers finds its way to the field, but even in these cases the process is long and convoluted.

The IDF is a hierarchical organization, organized and disciplined with clear delineations between the different services, units and systems. Ostensibly, each unit has its own field of responsibility and field of endeavor, from which it shouldn’t deviate from. Deviation from organizational boundaries and organized processes (such as “J5/Order 10/1 – the process of initiating, developing, equipping and assimilating weapons and systems in the IDF”) is not meant to take place. It is inconceivable that a development unit would approach an operational body to provide a technological solution, as the solution might not be sufficiently generic – and wouldn’t be maintainable. However, at the same time, the organized process has proven again and again that in some cases solutions arrive too late, are not adapted to the field and are not even sufficiently relevant.

The ability to free oneself from the chains of traditional organized work practices is essential in the neighborhood the IDF find itself in today. The world and the Middle East are changing so as to be unrecognizable. The Sykes-Picot borders are disappearing, semi-state entities are popping up, accepted methods and approaches are being changed by new worldviews, and the map of our enemies changes frequently. In light of this, the IDF must also change and rapidly adapt itself to reality and technology, as a force that shapes the modern battlefield and has to be at the vanguard. Thought processes within the framework of research and development (R&D) need to lead to conceptual changes and can help improve work processes and thinking in additional fields.

In this article, I will provide a survey of several case studies in which the IDF adopted different and innovative approaches and work methods for technological force design. These approaches, which are different from those generally accepted in the IDF but are widely accepted in the civilian sphere, were adopted in order to enable a quantum leap in innovative thinking for the organization. As can be seen in the case studies, these processes helped with the
The development of new and unique ideas, some of which were even introduced into operational frameworks.

The case studies which will be briefly presented will focus on three units: two in the Intelligence Directorate and one in the C4I Directorate. It should be noted that these are not the only discoveries of innovative processes in the IDF. Similar processes take place in the air force and additional technological units, in MAFAT (the MOD Administration for the Development of Weapons and Technological Infrastructure) and also in the Israeli defense industries. Furthermore, every year a creativity event takes place for all the technological bodies in the defense establishment whose key purpose is to cultivate and foster creativity (and not necessarily innovation) while promoting cooperation between the units.

A Brief Introduction to Technological Innovation

The hi-tech scene today is replete with innovation. In fact, this is what has turned Israel into a hi-tech superpower, the “Startup Nation,” and to a country that serves as a role model for everything to do with innovation and creativity. Because the hi-tech sector is so innovative, many and varied models of work processes were developed over the last forty years.

Many of us have heard about the innovation at Google that allows its employees to work one day a week on ideas and issues that interest them and which intersect with the company’s goals, but few are aware that this concept was developed at the 3M Company in the sixties.\(^2\) The most famous product that was produced by this work model is the Post-It note, the ubiquitous stickers. 3M championed the issue of innovation, and over the years has been careful to weave this issue into its values and management style, to harness technology to this need, to be

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forgiving of mistakes and “failed” initiatives, to share technological information across the company and to manage cross company innovative processes.³

One can even find additional innovation models in huge organizations such as IBM that attempt to reinvent themselves each decade. One of IBM’s most successful innovation engines has been the “Innovation Jams”, a cross-organization event, from end to end, which allows employees (and partners, customers and families) to turn a challenge from an idea to a solution in a few days. The event takes place over 72 straight hours and deals with a clearly defined content area. During the three days, managers from across the globe moderate online discussion groups, and at the end of the event, the ideas which will be implemented are chosen from among the entrants. At the first event which took place in 2006, 150,000 people from over 104 countries took part – workers, customers and family members – and proposed 46,000 ideas, of which 10 ideas were implemented the following year with an investment of 100 million dollars!⁴

Another large company which has recently turned innovation into second nature is Microsoft. This occurred primarily after the appointment of a new CEO, Satya Nadella, who place innovation at the top of the company’s priorities and in his words: “Our industry does not respect tradition - it only respects innovation.”⁵ One of the key tools that Microsoft uses to create innovation is the

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hackathon. Sometimes these events are focused on one topic, and sometimes completely open. The events allow participants to try and create several prototypes for a problem and due to the short timeframes they will usually be simple prototypes and not overly complicated (MVP – Most Viable Product). Hackathons allow teams that have not previously met one another to work together. They break the organizational hierarchy (in a positive way) and even allow joint work with clients.

Innovation Case Studies in Technological Units in the IDF

Case Study 1 – Innovation in a Technological Unit in the Intelligence Directorate

This Technological Unit in the Intelligence Directorate is a leading technological unit that works with an enormous range of engineering, technological and scientific disciplines. The purpose of the unit is to develop unique technological projects that have no comparison within Israel’s military establishment. These projects require perfect adaptation to the needs of the users and must be able to handle a very wide range of constraints, chiefly timeframe and reliability.

The uniqueness of the unit lies in the rare mix of personnel: veterans with knowledge and experience alongside a young and dynamic population hungry for work, influence and innovation. The focused nature of the unit’s projects completely defines the DNA of the unit. In other words, total focus on the unit’s objectives and “addiction” to the experience in every sense. Another strength of

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6 Hackathon – a word which is a combination of Hack and Marathon, where the concept is a marathon of coding (or development) which generally continues for 24-48 hours (and sometimes longer). It is composed of groups of 1-4 individuals who compete to build a software or other product from zero in the given timeframe and according to the topic of the hackathon (if there is one).

the unit is the ability to focus any number of personnel on a solution for any problem or the implementation of a unique project.

In recent years the output of the unit has rapidly grown as did the workload of the development, integration and production sections, as well as the number of new challenges. At the same time the systems became more and more similar to one another. This situation led, on the one hand, to enormous workloads for each of the workgroups, and on the other to a reduction in the amount of groundbreaking R&D\(^8\) (as opposed to “Tweaking” R&D\(^9\)). R&D activities which were not connected to a specific project and bordered on experimentation and testing of boundaries shrank dramatically.

Why Innovate in the Unit?

This unit exists in a particularly challenging environment, both internally due to battles with counterpart organizations, and due to the regional and technological environment. Approximately five years ago, it began to develop a broad focus on innovation. At the beginning, the question of why the unit should have an interest in the field of innovation arose. After the question was raised, it became clear that there were good reasons:

1. Creating something new before a crisis – Perhaps one of the most important objectives in the process is creating new technologies which are intended to solve a problem before it becomes a crisis. As noted, some of the recent breakthroughs in the unit took place during periods of crisis.

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\(^8\) R&D that creates new concepts and is groundbreaking; and primarily shatters existing paradigms or changes conceptual worldviews or technologies. For example, the smartphone was “groundbreaking” in that it cancelled out a negated the need for a large number of devices that came before it.

\(^9\) R&D that improves the capabilities of a system but does not create new markets or paradigmatic change.
2. A large proportion of the work of the unit was based on a number of core technologies that were developed over the years, with each one constituting a quantum leap at the time. Most of the quantum leaps in technological or operational capabilities happened thanks to these core technologies.

3. A large part of the R&D work of the unit is in upgrading these core technologies.

4. In some cases where a breakthrough took place, the technological breakthrough occurred in response to a need and not due to creativity.

5. The number of brilliant personnel assigned to breakthrough R&D was very small (less than 1% of the total personnel).

6. The unit succeeded in creating new connections between existing technologies in order to create new breakthroughs.

7. Innovation in the unit was mostly “sustaining innovation”, which is clearly a paradox. Even when a unique and innovative product was created, conservative guidelines were immediately adopted regarding the characteristics of the product.

In light of this, the unit understood that the process of innovation, especially today, is essential for a number of reasons as follows:

1. Retaining personnel – In a technological unit the personnel are not seeking operational challenges, but rather technological challenges. Due to their curious and inquisitive nature they are aware of external developments – in technological and innovation processes. The combination of these processes within in the army framework facilitates their retention within the framework.

2. Creating new value from existing building blocks – the unit has many existing technological building blocks
which serve as infrastructure for the unit’s unique systems and for additional technological infrastructures. Creating new products based on these technologies brings a significant “profit” to the unit’s capabilities by shortening timeframes, making development processes more efficient and creating greater flexibility in providing solutions to diverse and sudden challenges.

3. Improving pride in the unit, especially in comparison to the civilian world – The unit’s personnel follow the activities of friends in the hi-tech industry and expect challenging and technologically innovative work and not just “routine” work on everyday projects. The existence of innovation processes shows the personnel that innovation is needed in the unit, and that there is value to new ideas and directions and not just more of the same.

4. Generating dialogue and networking between personnel of different ranks, organizations and disciplines.

5. Creating group knowledge instead of solutions created by individuals.

The Process of Creating Innovation within the Unit

Together with the Knowledge Center for Innovation at the Technion, an organized process was started in several lines of effort. The process started by defining the innovation strategy together with the unit’s commanders, moved on to processes with mid-level commanders, and included work with a specially selected group of leading technologists intended to create new “startups” inside the organization and in practice to deal with innovation.

For the purpose of designing the processes, a group of 30 leading personnel from the unit were chosen with ranks from first lieutenant to lieutenant colonel who were identified by their commanders as having the potential for innovation and who were keen to engage with the issue. Together with the Knowledge Center for Innovation, facilitated by Dr. Iris Arbel, and led by senior officers
in the unit, a work plan was built with five stages. The work plan was intended to stimulate innovation and initially the participants were trained on it. The plan worked around the motif “The Journey of an Idea” and included stages beginning with the definition and refinement of the challenge; studying the ideas that were raised; refinement and prioritization; and included processes of marketing and integration of the ideas to the organization’s leaders. The participants were divided into five groups, with each group given a technological issue or techno-operational challenge which was formulated and approved by the unit’s Strategic Forum. Each group was provided with a mentor who is a graduate of the unit and who has broad technological knowledge and familiarity and experience in entrepreneurship.

The process took six months with close supervision by Dr. Arbel and the author, during which five day-long meetings, a course on inventive-methodical thinking and a concluding meeting of the Strategic Forum of the unit took place. The participants allocated about a day per week for the mission between the different meetings. During this time they implemented what they had learned in the previous meeting, in order to move forward with the initiative. Some of the groups went even further and moved forward faster than expected. They contacted operations personnel with whom they hadn’t previously been in contact, and added intelligence and additional technological personnel to the group, thereby enriching themselves and their technological and operational knowledge. Two of the groups outdid themselves and during the program period developed prototypes to demonstrate their ideas and to make it easier to realize and market the idea.

At the end of the process three of the groups had innovative, original and implementable ideas, of which two were chosen for implementation and were added to the R&D work of the unit. Two additional groups developed ideas which were assimilated into existing projects within the unit. The fifth group developed a database which two years later was used by another workgroup
and stimulated a significant broad scale R&D project within the unit.

The Greenhouse

As a continuation of the above process another new framework for innovation was established in order to create additional impact in R&D within the unit’s areas of responsibility and to transition to a method of “solution seeking a problem” or “technology seeking a problem.” A technological “greenhouse” was created in the form of a new section with five brilliant technologists – each from a different field and with totally different specializations.

The section chose its own research and development areas while maintaining continuous direct contact with intelligence and operational personnel. The section was attentive to their ideas while at the same time, it was updated on many and varied technological fields through meetings with reservists and through connections with industry and academia and through direct connections with all the technologists in the unit. After a period of technological “wandering” and analysis of several directions, the section chose to focus on four key fields, while building laboratory infrastructure for research into those technological fields.

The nature of the unit’s work included detailed testing and independent research in each field, contact with startups in each field in order to upgrade the section’s capabilities, and even included the addition of developers from one startup to the section. This was done in order to create a large and more substantive workgroup for one of the areas. In the framework of this work, brilliant technologists from other sections were integrated into the process, contributing one workday per week to some of the section’s initiatives.

As a result of the section’s work, three key fields came to fruition. One of them was the continuation of the work of one of the technological groups from the previous program, and was assimilated into existing sections in the unit. Another of the fields
became operational last year and the third continues as a development project within the unit.

Without a doubt, though the “greenhouse” was later closed and its personnel dispersed throughout the unit, the stamp that it left on the organization is significant. Today the issues that were developed and researched in the greenhouse are the cornerstones of R&D in the unit, and it is doubtful that these fields would have been researched or surfaced in another form without the greenhouse.

Cast Study 2 – Innovation in Unit 8200

Unit 8200 is not just a technological unit, it is the key SIGINT unit in the IDF, and includes advanced technological bodies and has groundbreaking capabilities. Within Unit 8200 there are a wide range of technological professions from the development of tools and intelligence gathering capabilities (SIGINT and cyber), to the development of production and advanced information extraction capabilities.

The technological bodies in Unit 8200 have a range of organizational cultures, diverse ways of working and thinking, and wide-ranging force design means – some more organized and others less so. The common thread between all of these bodies is a greatly overburdened workload and a very wide range of projects to be implemented over different time frames – from several months to many years.

Due to the entry of the unit into the cyber field and due to the many and varied challenges facing the unit (and all intelligence actors), innovation has become a code word for the advanced processes of generating and analyzing intelligence as well as a way to change the organizational culture itself.

The innovation mission of Unit 8200 was assigned to two personnel who fulfilled it successfully: The CTO of one of the

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technology centers and a “Commissioner of the Law for Preserving Madness,” who together initiated a wide range of innovation processes and conducted organizational “experiments” that eventually led to the full implementation of an innovation plan that itself produced new operational and organizational capabilities.

At first several “standard” innovation tools were tried, including assigning 20% of the time of selected personnel to do as they chose and the launching of an internal “Venture Capital Fund” to evaluate and assess ideas. These work practices did not produce results, primarily due to the high workload of the personnel and the lack of organizational maturity which prevented personnel from being freed up to engage in the “not important” missions of innovation and looking to the future. This lack of capability can be explained by the fact that the intelligence output of each “man hour” is immediate, while the future output of initiative is unclear.

In light of this, the unit launched a new program called: SOOT – SIGINT Out of the Box. This program includes operational hackathons which take place several times a year, with the participants confined to base for their duration. Approximately 30 participants come to each event from across the unit (mostly technological personnel, but not exclusively). At the start, ideas are refined, and then technological prototypes are developed (based on existing technological capabilities brought in from outside and on the basis of raw intelligence information) and at the end of the week the ideas are presented and marketed to relevant interested stakeholders from partners to clients and including the unit’s commanders.

Before each event the ideas are more widely distributed via the unit’s information systems to all 8200 personnel and on the basis of the “crowdsourcing”, the topics which will feature at the hackathon are chosen. This is based on the topics and ideas which attract the greatest number of participants who want to help with an idea (in a somewhat similar fashion to Kickstarter).

Within the framework of the SOOT, a large number of topics and ideas were raised, and many were eventually implemented.
Some of the ideas were not at all related to technological or intelligence problems, but rather dealt with efficiency, bureaucracy and service conditions. These topics were also dealt with through this organizational platform, and improved the service conditions and organizational functioning in many and varied ways.

One of the systems which was developed at one of the first events created “innovative” communications between the intelligence community in the 8200 unit and afterwards across the whole Intelligence Directorate. The idea was to imitate, in certain ways, the style of communication on social media. This manner of communication marketed itself and spread like wildfire, thanks to the fact that it gave the young generation a way to communicate and work which was similar to what they were familiar with “at home.”

Of course, during these processes the leaders faced difficulties, especially in marketing the ideas and in bringing them to the point where they could take shape outside of SOOT.

Cast Study 3 – Innovation in the Lotem Division

Lotem, the C4I Technological Division of the C4I Directorate is the largest technological unit in the IDF. The unit is responsible for a wide and varied range of fields of endeavor at all levels of the computing and cyber worlds. The division deals with the installation and maintenance of the IDF’s computing and telecommunications infrastructure in the operational and combat support fields; provides telecommunications and electronic warfare solutions to actors across the IDF; provides solutions to the operations and combat support worlds; and takes the lead on issues of cyber defense in the IDF and the defense establishment by developing techno-operational tools and capabilities in these many and varied fields.

A wide range of technological personnel serve in the unit – from graduates of programming courses to academic graduates and with access to diverse knowledge centers.
In recent years, at the initiative of then Division Commander, Brig. Gen. Daniel Bren, the unit has changed in nature and it now leads the field of operational ICT in the IDF, while emphasizing a broad perspective and deep analysis of operations and not just on technology. In this framework deep and direct connections were built with operations actors across the army. Looking at operational needs and the desire to be relevant “here and now” and not “there and later” led to an understanding in the unit that current force design processes are no longer relevant. When talking about solutions for operational needs that have recently arisen or for operational capabilities that can be enabled by absorbing and assimilating new technologies in the organization – these are needed today, and no later.

These processes have been accompanied by numerous and diverse processes in the field of innovation, and they are taking place in order to reach a number of objectives, including: Upgrading the abilities of the unit’s personnel; emulating the civilian world; creating shorter technological development cycles, primarily to provide a higher quality operational response and on time; and enabling more advanced capabilities for operational units and personnel.

In this framework, direct contacts were built between officers in the unit and a wide range of operations personnel. These contacts have even begun to yield unique operational solutions, in short time frames and with a high degree of relevancy.

**Hackathons in Lotem**

The key innovative process which was adopted by the Lotem unit is the hackathon. These events are initiated by the CTO body in the unit and by other personnel who are responsible for innovation in the unit.

These events began in Lotem a few years ago, and are divided into technological hackathons and hackathons with an operational objective. The technological hackathons take place
within the unit as “CTOLead” or with the assistance of different technology companies, and their central purpose is to develop unique technological capabilities in a short time frame. Within the framework of these events, which take place on civilian campuses, the unit’s personnel can within 5 days develop any technology product that comes to mind in a range of technology fields, as long as there is a chance that the product or idea will have an operational use in the unit or outside it. Some of the hackathons deal with specific technologies such as mobile or advanced user interfaces and some are of an open nature.

The second type of events are the operational hackathons “OPLead” whose objective is different. These are classified events, meetings between technologists and operational personnel and their objective is to provide solutions to operational challenges. Even in these cases, sometimes technological ideas lead the process
(even when a solution to an operational challenge does not yet exist) and sometimes the operational challenges lead. To date, a number of initiatives have developed from these events, which have become development projects in the division, from projects in the cyber defense field to projects in the electronic and spectrum warfare fields to communications and operations research.

Interim Conclusions from the Case Studies

The advantages of events such as these which are not found in the standard accepted work practices (as we have partly seen in the description of the SOOT events in Unit 8200) are as follows:

1. Separating the personnel from their regular framework and daily life and directing them to work of a different type;
2. Formation of heterogeneous teams made of personnel with different skills who complete one another;
3. A concentrated marathon effort with an expected output which enables the presentation of a genuine “product” and not just a presentation or working paper;
4. The capability to test the final product “in the field” and not just in a laboratory;
5. Generating a feeling of proficiency for all of the participants so that they realize it is possible and achievable to generate fast solutions (although not as a final product, but rather as a prototype);
6. Creating a platform to test new and innovative technologies, and not at the expense of risking large and complicated projects, given that new technologies could put these projects at risk;
7. Breaking the routine of personnel and creating a different type of work environment.

All of these advantages were realized in each of the events described above and therefore enabled the creation of different work practices in parallel to more traditional work practices. These work practices are now diffusing into the traditional work practices. They are causing even the more rigid technologists to understand
that there are other ways to develop and other ways to solve problems aside from in an ordered and organized fashion.

An example of the trickling down of these processes into the day to day functioning of the unit is the creation of a culture that encourages innovation and entrepreneurship within the organization not just in the context of the hackathons. Within this framework, several computerized and organizational platforms were created to enable an “entrepreneur” to marketing and sell their idea, to recruit participants in order to enable the implementation of the initiative (at least initially), thus allowing the production of a prototype even before the idea or issue has been added to an organized work plan. It should be emphasized that these platforms were also initiated from below, by fanatical visionaries, and then built up momentum within the organization. In this way, the culture of innovation and entrepreneurship is enabled in the day to day work of the unit and not just through structured processes directed from above.

Conclusion

We have seen in this article that there is another way. It is possible to create a culture of innovation and creativity, not just in technology companies in the business sector, but also within a military framework. Sometimes these events take place within the existing frameworks, and sometimes they break the frameworks in one way or another. Breaking the existing molds enables the creation of new capabilities; the connecting to new and innovative technologies which are today generally developed in the civilian market and not in the military; and the creation of new and innovative operational solutions and concepts within short time frames which in the past were unheard of.

This culture that has been recently created is only the beginning. As additional operational deliverables come out of these work practices, and as additional senior commanders catch the innovation bug, we will find additional new work practices and different ways of thinking within the technology frameworks in the
army. An unmediated familiarity and direct dialogue between the ranks and between technologists and operations personnel can produce wonders. Likewise, the dialogue between technologists and intelligence officers can produce new and ground breaking intelligence sources.

These new patterns of behavior adopted from the hi-tech sector enable technology bodies within the IDF to operate differently, to be more “agile” (available and flexible) and to provide solutions on time. They have proved that not everything needs to be done by the book and in familiar molds, despite the fact that the IDF is an ordered hierarchical organization.

These patterns of behavior have additional advantages. A very important advantage is preventing a brain drain to the business sector. Developing of familiarity between the ranks and greater freedom of expression for young technology personnel helps keep the highest quality technology manpower within the military framework. The moment that technology personnel see and feel that they have the ability to have significant influence, that there is importance to their ideas and initiatives, and that there is positive friction with new technologies, the chances rise of their staying with the IDF for longer periods.

As we saw with the example from Unit 8200, it is possible to harness unique innovation processes such as these not just within the technological and operational fields, but also for supporting processes. This can lead to improvements, increase efficiency and make the lives of those serving in the IDF more comfortable, better and more caring. The moment that work practices, behavior and process creation changes in these areas too, we can not only improve operational tools and capabilities, but also organizational tools and capabilities.

The capabilities and approaches of innovation, creativity and thinking differently, as we have seen in the technology world, can and should also serve the wider operational world in the IDF. Creative thinking and innovation optimally correspond with the need for subterfuge. The capability to generate subterfuge among
the combat forces and the capability to cope with a challenging and changing environment can only be achieved through the processes described in this article, whose objective is to genuinely bring “something new”.

The field of innovation and the tools within the world of innovation rest on a number of basic cultural principles, whose implementation, in any framework can contribute greatly to the quality of the deliverable:

1. To provide innovation with organizational and physical time and space;
2. To allow wasting of time and resources (within limits) to enable the testing of directions and ideas;
3. To be tolerant of failures and to learn from them;
4. To seek and exalt fanatical devotees;
5. To appoint commanders who are attached to the issue and are leaders in the field.

In summary, the IDF must undergo significant change in its approach to technological development and innovation, in order to remain relevant and to enable significant successes on the battlefield. Technology can and must be the forerunner of change and it can open the way to innovation and change in the organization. This change can be achieved as we have seen from the examples above. While this type of innovation cannot be allowed across the entirety of the IDF, given the challenging regional environment we have no choice but to adopt it.
Bibliography

Open Source Culture:
To what extent has the defense establishment adapted to the software culture, and what does it say about its level of innovation?

Carmel Or

"Given enough eyeballs, all bugs are shallow" 

Introduction
As the basis for their operation, computer programs include a set of commands that define the way that they function. This series of commands is known as “source code,” and they define the way that the computer functions. The source code can be “closed,” accessible only by its software developers or “open” and accessible to the software’s users. A program whose source code is classified as open is referred to as “open source.” Hence, the code is accessible to other developers and can be used, distributed and copied. Developers who make changes to this code can then choose whether to safeguard the changes or whether to republish them to the community of developers. Additionally, open source

1 Ms. Carmel Or is a student in the Honors track in the School of Government and Diplomacy at the Interdisciplinary Center, Herzliya. This research is partly based on interviews conducted with position holders in the IDF and the defense establishment whose names are not approved for publication. The research was read by relevant position holders and found to have a solid basis.

2 Linus’s Law, by Eric S. Raymond quoted from the website: http://www.mil-oss.org/resources/articles-papers-presentations
code can be developed “communally” – with a number of developers working together on the development of an application.

The structure of software can be understood as layered, with each layer serving as the infrastructure for the layer above. This is due to the iterative nature of software development – creation of sections of code, using them to create additional sections of code and so on. The process stops with a “thin layer” of code that is not intended for repeated usage. This layer defines the functional dimension of the product – that is, the lines of code that serve specific functions in one specific product. The layers below the “thin layer” are tools for achieving this purpose, and they may be relevant in the context of other products.

Open source code, by its nature, is intended to serve different software projects, and therefore serves the infrastructure layers. Developers who choose to use open source code presume, rightly, that infrastructure code that serves many projects is ostensibly better infrastructure code than that which is developed for a specific project. Moreover, adopting open source code allows developers to minimize the required investment in non-functional layers of the product and to focus their resources on the final objective.

The rate of change in our world is so fast that one can say that innovation in an organization is to some degree a condition for its success. This increasing rate of change is closely related to the digital revolution that has at its center the language of bits- that is, software. Hence, there is great interest in the level of adaptation in an organization like the Israel Defense Forces (IDF) to the software field (as opposed to the traditional focus on hardware). Furthermore, this level of adaptation, due to the central place of the software field to every aspect of developing military power, also reflects the level of general innovation in the organization. More concretely, and given the understanding that the phenomenon of software development based on an open source culture is the leading trend globally, this research will attempt to reveal the level of innovation in the IDF using this as a prism.
The basis for this research question is the assumption that today, open source development is the correct way to develop software in organizations – for which I will provide support at the beginning of this article.

In order to define indicators that reflect “the adoption of open source” I defined three “measuring scales.” On the basis of these conceptual “scales” I will try and place the Israel defense establishment, including the IDF, in relation to two other case studies – civilian industry and the American military-defense establishment. I believe and hope that the research conclusions can assist the force design bodies in the IDF, MAFAT (the Administration for the Development of Weapons and Technological Infrastructure) and even the different military corporations.

The research method included measuring on three scales with each covering one dimension and then developing a comparative rating for each of the three test cases on a single scale comprising all three of the dimensions:

The first dimension and the most basic is the axis measuring open source usage. This axis ranges between total non-use of open source to the use of open source “as is” and finally to “professional use” where changes and adaptations are made to the code.

The second dimension is the community axis. The intention here relates to the community of software developers themselves. This axis ranges between usage of open code alone to publication of code which was written independently. In the middle, one can find developers who only publish changes and adaptations which were made to existing open source code, a kind of “returning the favor.”

The third dimension is the organizational direction axis. As opposed to the previous axis which focused on the software developer community, this axis focuses on the management level. It is intended to examine the importance of open source code as a significant factor among the different considerations the organization’s leaders take into account, and how this factor is expressed in formal processes.
Accordingly, the structure of the research includes an explanation of open source code and why it is a natural development in the software field; the second section is the comparative discussion – the Israeli defense establishment in comparison to others; and the last section deals with roadblocks and incentives to the adoption of open source in organizations and why there is a need for open source in the military. This research is based on different research sources and on interviews with personnel from the R&D and force design environments of the Israeli defense establishment.

On Open Source Code

This section will define what open source code is and will detail its advantages and disadvantages according to the literature. Source code is the basic code of computer software, and features a series of commands that define how a computer functions. Source code that is developed using the “open source” approach is by definition accessible to other developers and available for use, distribution and replication. Users can make changes to the source code which can then be marketed for free or for a fee. Developers who make changes to a piece of code can choose to protect the changes or republish them back to the developer community so that this upgraded product can be used in other software in the future. This is subject to the source code’s license which defines the legal rules for using it. In open source software, in principle and intention, there is no duty to define or report on the types of usage or to identify the users. The user license for open source code is only for the code itself and is not related to a specific product as a whole. It therefore follows that the connection between a right of usage and between a specific product is voided.\(^3\) Concomitantly, in proprietary software, the users and community of developers

\(^3\) Goldschmidt R., (2014), The Use of Information Technology Systems based Open Source in Government Ministries, Jerusalem, Knesset Research and Information Center.
outside the company which developed it, are not able to view the source code. Accordingly, the end user’s ability to make personal adaptations and changes is limited to the settings defined by the developer company.⁴

At the beginning of the public discourse on open source code, open source was attributed to an ideology that was hostile to intellectual property and rights, due to the view that it was possible to bring a greater social benefit by minimizing the element of intellectual property in software. Today, however, the prevailing view sees open source as a new business model. As opposed to proprietary software companies which depend on sales of user licenses, the business model for open source software depends on the provision of services and technical support. Consequently, alongside the option to download and use software without payment, there are also additional services for which the companies charge.⁵ Richard Stallman, President of the Free Software Foundation said: “Open source is a development methodology; free software is a social movement.”⁶

Open Source software can be developed through a “social” approach where a number of developers cooperate to develop a piece of software. This kind of development, which is done by independent sources, over time generates a wider and more varied perspective than that created by a single company.⁷

In contrast to the development of “closed” software initiated and planned by a particular company, there are several reasons for the trend to use open source development, including: Low cost; an improvement in the quality of the product; the freedom to disconnect from the software provider; and increased security. In

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⁴ Ibid
⁵ Ibid
light of this, open source development provides a response to specific problems in such a manner that 98% of corporations use it in varied ways.8

Many supporters of open source argue that it allows for increased security in an integral fashion, due to the fact that everyone can view the code, edit it, and change it.9 Research which sought to confirm this assertion found that while closed code had 20-30 bugs on average per 1,000 lines of code, in Linux, which is an example of open source software, an average of 0.17 bugs were found for each 1,000 lines of code.10 In this context, we can appreciatively note “Linus’s law” which asserts that if enough eyeballs are checking code, all the bugs will be found, and a way will be found to solve them.11

Another advantage of open code software is relatively fast development speeds due to the fact that more developers are involved in its creation. A further is the fact that open source code allows for an efficient penetration of new markets. Furthermore, companies that offer open source software can set the professional bar in that sector and gain a competitive advantage over other companies. The successes of these companies create a feeling of belonging and loyalty among the developers who worked on the final product.12

12 Srinarayan, Sharma; Sugumaran, Vijayan; Rajagopalan, Balaji (2002)."A framework for creating hybrid-open source software communities". Info Systems Journal 12: 7–25,
There are additional advantages when using open source, such as the reduced cost of marketing and logistical services. Open source software is more reliable, given that in most cases, thousands of independent programmers check it and fix any problems they find. The resulting product is more reliable because modular systems allow programmers to develop interfaces and to add new capabilities. As a result, an innovative product is created - after all, open source is the result of broad cooperation between developers.

Furthermore, the amalgamation of different perspectives, organizational objectives and personal goals among those participating in software development, an amalgamation that is built into open source development, accelerates innovation.\(^{13}\)

However, there are experts who argue that there is a negative side to open source. Among the disadvantages are the facts that sometimes the process of open source development is not clearly defined and that the stages of development, such as systems analysis and documentation, are likely to be neglected. Some software experts and researchers note that open source does not lead to the creation of quality systems, primarily due to a lack of clarity in the development processes, delayed discovery of defects and a lack of empirical evidence.\(^ {14}\) When analyzing the business aspects, there are those who argue that open source development supplies the basic technical requirements, but the requirements of the market remain unfulfilled. With regard to the software security element, open source allows hackers to more easily discover weaknesses and gaps in software than with “closed” software development.\(^ {15}\)


\(^{15}\) Ibid
Open Source is the Natural Development of the Software Field

Software development is an iterative process that creates resources in the form of sections of code and re-uses them for the creation of more complex resources that are also made up of sections of code. The process finishes at the stage when a “thin layer is reached” which is made, as far as possible, of code which is not for re-use. This layer reflects the functional dimension of the product being developed (the Business Logic). Consequently, this layer has full responsibility for the specific requirements of the product, and is not the foundation for other software layers written above it.

In the process of software development, the goal is to focus as much as possible on the functional “thin layer” which reflects the product’s objectives, and to deal less with the infrastructure layers that are only a tool for the existence of the functional layer. That being said, there is a problem - without quality infrastructure it is very difficult to effectively develop the functional layer. Consequently, and despite the desire to focus on the end goal, a constraint arises which demands a significant investment of resources.

The quality and value of code that is re-used (“infrastructure code”) can be measured by the number of times it is used and the range of uses. That is, the more a section of code “wins” by being used in more programs of greater variability, it is recognized as being higher “quality” code or “more infrastructural,” and therefore a higher value asset. Accordingly, the most effective, and indeed

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16 Haniya, N. Interview (2015)
the only way to create and improve high value infrastructure code is through repeated re-use.

Consequently, one can say that a software developer will always use code that was previously written, and in principle, it doesn’t matter if the code was written by him or another developer. Therefore, open source constitutes a potential capability, from a technical standpoint, and is even logical from a financial standpoint given that it allows for a division of labor between several developers. By using infrastructure code wherever possible, a developer can focus his efforts on the functional layer of the product which is, as noted, the end goal, while the infrastructure is just a means.

With regard to the sharing of infrastructure code by the developer who writes it, there are several considerations when deciding whether to keep or share it with the community. On one hand, the code is the product of his work, on the other hand the value of the code is assessed and improved, the more it is used by other users and adapted to their needs. Therefore, if it is important to a developer to write efficient infrastructure code, he should want to share it with other developers in order to improve it. In this way, the developer receives confirmation of the quality of the code, and more significantly, the developer receives better quality code in return. In other words, the infrastructure software development field works on the principle from the Jewish sages (quoted in the Talmud): “He has sustained a benefit, and he has sustained no loss.” This principle is completely different from the intuition of most people who work in creative work or who deal with intellectual property.

The purpose of open source code is to allow the developer to focus as much as possible only on the “thin layer,” the unique component needed for the particular product they are developing. Open source allows software developers to rely on original infrastructure code that is better quality than the proprietary alternative, because it was developed and enhanced by a large community, and has been tested in different contexts. The open
source community generally supplies better quality code due to the “shame effect” - the fact that different developers do not want to be perceived as someone who supplies solutions that are not optimal. Finally, the existence of an open discourse on code created through a joint writing process naturally generates a critical discourse with regard to the most effect approach to development. Different developers from different backgrounds ultimately lead to more effective decision-making and correspondingly better quality code.

These two dimensions – the first represents the psychological-sociological element and the second the use of discourse as a means to enhance knowledge development – are familiar in the field of software development. Examples can be seen in techniques such as Code Review, whereby one developer presents the code that they have developed to another developer and advocates for his work. Additionally, Extreme Programming is another example where two developers work together on the same code. The sociological space that is created during open source development directly serves these two dimensions.

Software development in the framework of open source constitutes, not just a more advanced embodiment of quality software, but seemingly the only way to maximize the unique advantages of the software field in a relevant manner. Therefore, the same importance attached to software must be given to open source.

Consequently, if the army is to enter the software field, it must adapt to open source as well.

After my survey of the open source field and the understanding of the deep logical basis which defines this approach as a condition for basic effectiveness in the software field, you can understand why I argue that there is a correlation between the level of adoption of open source and the issue of innovation in an organization. “Open source” is an elementary process of organizational adaptation to the new digital environment. Therefore, the degree to which the IDF adopts open source and
understands its importance “organizationally”, is an important indication, to my understanding, of its ability to adapt and innovate on a more general level.

Obstacles and Incentives to the Adoption of Open Source Code in Organizations

From an analysis of the business sector we can learn that open source has many positive influences on organizations. It accelerates processes through work practices that “economize” on the need to write large amounts of infrastructure code by starting from scratch each time. Open source code is an inseparable part of the community of developers which enables the utilization of the wisdom of the crowd – which is much greater than the internal resources of any business organization. This contributes, naturally, to long term maintenance and to solving bugs. Even more importantly, open source is fertile ground for new ideas and enhances the innovation in an organization, thereby increasing its competitive advantages.¹⁷

The wave of globalization sweeping the world shows that the problems in software are global problems. The problems that occupy an organization on one side of the globe are also occupying organizations on the other side. Indeed, the use of open source by organizations allows them to engage in broad cooperation which contributes to the optimal solving of problems.¹⁸

Despite all the advantages, there are also obstacles which affect the process of adopting open source by organizations and companies. Among the obstacles are the need for a connection to the internet. There are organizations, primarily security organizations, in which not all employees have free access to the global internet.¹⁹ Especially in these organizations, but also in others, the traditional principles of information security sometimes

¹⁷ Source No. 1: Interview with an actor in the Intelligence Directorate: 29.12.15.
¹⁸ Ibid
¹⁹ Ibid
presents an additional difficulty to this technical challenge.\textsuperscript{20} Another problem relates to open source licenses and obstacles which arise from the lack of formal support and training as well as a lack of long term planning.\textsuperscript{21}

All of these obstacles are also relevant, naturally, to military organizations. In addition, interviewees in security and military organizations bring up obstacles such as the NIH phenomenon (Not Invented Here), which is accompanied by attitudes such as: “Only I know how to develop” or “I know best”, etc.\textsuperscript{22}

**Why is Open Source Code Needed in the Army at all?**

The army faces the same IT problems as industry. However, most of the activity and the technological research focuses on the systems that directly influence combat on the battlefield. Less visible systems naturally tend to be developed at a slower pace due to complex bureaucratic processes which guide the relations between industry and the IDF. Given the nature of militaries, many problems arise in a range of fields. The attributes of open source code allow the re-use of solutions to common problems and also allow the flexibility to develop new solutions and services. Therefore, as in the civilian world, open source can also reduce development costs and significantly shorten development times for military applications, especially for the infrastructure layers of software.\textsuperscript{23}

Furthermore, due to the fact that the source code is open, the dependence of the army on a single contractor is significantly reduced. Open source should allow the army to benefit from competition between contractors and the potential for rapid development and deployment. Besides, open source allows great flexibility. The fact that the source code is open also enables its

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\textsuperscript{20} Source No. 2: Interview with an actor in the Israeli defense establishment: 1.12.15.

\textsuperscript{21} Source No. 1: Interview with an actor in the Intelligence Directorate: 29.12.15.

\textsuperscript{22} Ibid

\textsuperscript{23} [http://www.mil-oss.org](http://www.mil-oss.org) Downloaded on 17.1.16.
adaptation to different needs and users. This flexibility is what turns open source to a practical solution for the army.\textsuperscript{24}

Open source, especially for infrastructure layers, is ready for immediate use, which as noted, enables developers to work efficiently and to focus on adapting the software to the user’s needs, instead of devoting time to developing systems from scratch. Accordingly, open source allows for shorter development times and encourages innovation. Reducing the effort needed for infrastructure tasks enables greater focus of development energies on innovation and solving problems in the real world and not on software. Especially important, to my understanding, is the conclusion that projects that include open source increase cooperation, by developing communities focused on specific fields. These communities are the basis for cooperation, ideas and knowledge. As noted, cooperation expands the awareness and innovation for a particular project.\textsuperscript{25} These are particularly significant benefits for security organizations whose tendency to insularity, even at the price of redundant development, is well known.

Nonetheless, there are those who argue that open source code damages the security of the software, and it should therefore not be used in a classified environment. The security of open source code is based on improving the code and its testing by many developers in many and varied situations. There are circumstances where open source code is less secure, but the open source model has shown that it can fix security problems very fast. Furthermore, hiding the code does not actually prevent attacks on the software.\textsuperscript{26}

The US Department of Defense (!) noted that:

The continuous and broad peer-review enabled by publicly available source code supports software reliability and security efforts through the identification and elimination

\begin{itemize}
  \item \textsuperscript{24} Ibid.
  \item \textsuperscript{25} Ibid.
  \item \textsuperscript{26} Ibid.
\end{itemize}
of defects that might otherwise go unrecognized by a more limited core development team.\textsuperscript{27}

Also, a military organization retains control over the open source code that it adopts, and can closely monitor the results in order decide which parts of the code to add to its systems, and which not. Accordingly, the chances of introducing a “Trojan Horse” through open source code are reduced.\textsuperscript{28}

**Comparative Discussion – The Israeli Defense Establishment in Relation to Others**

In this section of the research we will use various scales in order to measure the place of the Israeli defense establishment in general, and the IDF in particular, in relation to the business sector and the US defense establishment. Given that open source code is adopted by organizations on a wide scale, it would seemingly be possible to analyze it just by measuring its level of usage. However, in order to answer our research question we would like to propose an analysis of three separate indices:

**Level of Usage Axis** – The first index and the most basic is the axis measuring open source usage. This axis ranges from total non-use of open source code to “as is” use of open source code, and finally to “professional use” where the code is edited, modified and adapted. This axis naturally shows whether open source code is used at all in the organization, and it reflects the quality of the usage – whether the organization adopts open source code “as is,” in other words “basic” use or whether the organization engages in further development and adaptation of the existing code, that is “professional” use.

**“Community” Axis** – The second dimension is an axis relating to the community of developers themselves. This axis ranges from


\textsuperscript{28} Source No. 2: Interview with an actor in the Israeli defense establishment: 1.12.15.
merely using open source code to the publication and distribution of original code that the developers have written themselves. In the middle we can find developers who publish changes and the adaptations that they have made to existing code, a kind of “returning the favor.” This axis shows how much the developer organization considers itself a part of a wider community of open source developers. Firstly, this axis indicates whether open source is merely used - that is use of an asset that was produced by a community of developers without providing anything in return.

Further along the axis, the level of cooperation between the organization and the community of developers grows. At the midpoint, the organization returns the changes it has made to existing code to the community, and at the top end of the scale, the organization contributes original code to the community. The contribution of original code to the community of developers, which involves receiving feedback and criticism, is an important indicator of the level of effective adoption of open source code. An organization that has deeply internalized the advantages of the open code approach will not hesitate to present the code that they have developed for review and enhancement by the developer community.

The Institutional Axis – The third dimension and the most significant is the institutional directive axis. This ranges from the implementation levels to the senior management level, including the heads of the organization. This axis shows the degree to which the use of open source derives from an initiative of the junior ranks, who understand at the practical level the advantages of open source, or up to the establishment, as reflected in its formal decisions and management work plans, which might pragmatically promote the use of open source. Consequently, this axis reflects the degree to which open source is an important factor in the organization’s decision making. This axis is of course the engine for promoting the other axes which reflects its importance, especially in security organizations which have a clear hierarchical culture and tendency to insularity due to security concerns.
In the following section we will present research based on the three axes described above, covering the American defense establishment, the Israeli defense establishment and an open source-oriented commercial company.

Before we continue with the article, I would like to emphasize the importance of the institutional directive axis and the reasons that it is, to my understanding, the core of the analysis. In order to do so I will present a number of official analyses which were conducted at the governmental level in Israel and globally: In 2002 legislation was proposed with regard to the use of open source code by former Member of Knesset (MK) Nechama Ronen. The proposal included an amendment to the Mandatory Tenders Law (Amendment – Acquisition of Open Source Code Software),
2002 which proposed to determine that “The state, government corporations and other public bodies as determined by the Finance Minister will not contract to acquire software, unless it was developed by the open source model,” aside from special cases in which the Finance Minister approves an exception. The preamble to the legislation stated, among other things, that:

As a part of our understanding of the software market and within the framework of the free economy, the use of open source code should be encouraged. This code enables immediate solutions to failures and in this way leads to development, upgrading and expansion of different software applications for the benefit of all users, without artificial boundaries and obstacles by bodies that try to perpetuate themselves through their control of source code.”

The preamble continued:
It should be noted that this amendment is a response to general trends in different countries such as the United States (California), Finland, France, Germany, Thailand, Taiwan and China which have all begun legislative processes to encourages public institutions and governments to use open source code.”

The proposal was scheduled for a first reading in the Knesset, but the legislative process on the issue was aborted.\(^\text{29}\)

The British government in April 2012 published another document under the title “All about Open Source.” The document noted that the low level of use of open source mainly derives from a lack of understanding of its advantages and related to a “risk adverse” organizational culture. The document also noted that the low level of use is supplemented by a mistaken perception with regard to information security in open source and its accompanying

services. The challenge, according to the British government, is to offer both proprietary solutions and open source solutions, and to analyze and compare them in an impartial manner according to their quality.\(^{30}\)

**A Comparative Analysis – Measuring the Adoption of Open Source in Different Organizations**

**A Commercial Company with a High Level of Orientation to Open Source**

In the commercial sector we find widespread adoption of open source. As noted, there are many advantages for organizations that use open source, from more efficient processes to reduced budgets. Accordingly, a commercial company that wishes to maximize its profits and has a high level of orientation to open source, should be represented on the three axes as follows:

With regard to the level of use axis, the company would mainly use open source. This reduces expensive development time, enabling the company to divert resources to other uses, and can even improve the quality of the product. The company would use open source code in an orderly and formal manner, both at a “basic” level, with no changes to the existing code, and at a “professional” level where changes are made to the code to adapt it to specific needs.

As noted above, with regard to the community axis, the company would make widespread use of open source and would encourage its developers to distribute the open source code that they have adapted as well as their original code. This would be done, as mentioned, out of an understanding that the publication of the code to many developers contributes to improving it, which results in a higher quality product without any additional financial outlays. In this way, the company can also improve the performance of its employees, given that they would understand

\(^{30}\)Ibid
that their work would be widely publicized, and they would therefore be likely to invest more in its development.

With regard to the institutional directives axis, the company would exhibit signs of the adoption of open source at all management levels, from the developer to senior management. Also, the company would change its business model, in light of the adoption of open source, in order to enjoy its many benefits. It would be noted that other companies in the market are also working to adopt open code, leading management to work to adopt it faster in order to retain the companies standing in a competitive market. From the company’s perspective, the full adoption of open source code by the senior management enables its adoption on both the usage and community axes.

The American Defense Establishment

The American defense establishment went through a process of integrating open source into its development processes, and today it has adopted open source to a degree that resembles the business sector. However, there are a number of differences, including the emphasis placed on compartmentalization between different projects – compartmentalization from the global internet as well as compartmentalization between developers who work on closed sites only accessible to authorized users.

The US defense establishment was exposed to the advantages of open source at a relatively early stage. Research points to initial adoption of open source in the US Armed Forces and the Defense Department (DoD) from 2003 with its prevalence increasing every year. At first the process of adopting open source took place in a pinpointed manner in different places at a low military level. However, in light of the success of several projects, the DoD saw the advantages and created a process for the formal integration of open source into the system. Recently the White

31 Source No 3: An interview with an actor in the Israeli defense establishment: 7.1.16.
House even published a draft policy paper regarding the development of open source in all federal agencies, a paper whose purpose was to increase the openness of the federal government to the use of apps and to reduce costs in the field.\(^{32}\)

During the above process, the regulations for software procurement were changed and different technological forums were established. The DoD produced a booklet which included guidelines, in order to promote the adoption of open source, in which it was written for example:

In almost all cases, Open Source Software (OSS) meets the definition of “commercial computer software” and shall be given appropriate statutory preference in accordance with United States Code [ ] Executive agencies, including the Department of Defense, are required to conduct market research when preparing for the procurement of property or services [ ] Market research for software should include OSS when it may meet mission needs.\(^{33}\)

For the perspective of the developers we can refer to the remarks of Elizabeth A. McGrath, Deputy Chief Management Officer at the DoD to the House Armed Services Committee in 2010:

Our current approach to implementing IT systems takes too long, costs too much, and often fails to deliver the performance improvements we seek. On average, it takes 81 months in DoD from when an IT program is first funded, to when it is fielded. Given the rapid state of improvement in the IT field, this means that we are delivering systems that are outdated before we ever turn them on.\(^{34}\)

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\(^{33}\) DOD, 2009, op. cit. To ensure efficiency and reduce the potential for waste, the Federal Government has enacted legislation directing its agencies exercise a preference for commercial and non developmental items (NDI) "to the maximum extent practicable"

\(^{34}\) Statement by Ms. Elizabeth A. McGrath Deputy Chief Management Officer before the House Armed Services Committee, 2010
The development of open source code in the DoD ranges from the use of a private cloud as a development platform to full public access. The public cloud that is used is called GitHub\textsuperscript{35} and it requires access to and a global internet address. In addition, two models exist in the public cloud: The first includes opening the code to the whole world, without charge; while the second model includes private storage areas, with authorization granted only by the project manager. That is, the code is open to a specific group only or for a fee. On the other hand, the DoD’s private cloud requires a connection to the internet, but its address is not accessible to all. Access to this cloud is available only to authorized users from the DoD and requires identification. This cloud also offers two models: In the first, the development allows all users of the cloud access to the code. In this way the model allows a broad development environment which is both protected and free; the second model includes private development by groups within the cloud, and access to the code depends on authorization by the project managers or for a fee.\textsuperscript{36}

A forum authorized by the DoD, the Mill-OSS (Military Open Source Software) was founded in 2003. The forum’s objectives are to create and maintain an active community of developers, civilian and military, who use, improve and share open source software within the DoD’s framework. Most of the members of the community work directly for the DoD or as contractors and see their work as supporting the United States combat efforts.\textsuperscript{37}

Another model is the forge.mil site which requires authorization on the basis of a social security no. and security classification. This site is unique in that you can find military code on a regular internet server. Furthermore, in order to strengthen

\textsuperscript{35} GitHub is a service for storing code on the internet for open source software projects, which includes the version management application Git. In 2011 it was recognized as the most popular storage service for open source code.

\textsuperscript{36} Source No 3: An interview with an actor in the Israeli defense establishment. 7.1.16.

this community, the DoD created business incentives and decided that any company that uploads code to forge.mil can be certified as an authorized contractor of the DoD without going through the regular long and bureaucratic procurement process.\(^{38}\)

Returning to our measurement scales for the level of adoption of open source in the American defense establishment, we can say that with regard to the usage axis, we can see that there is extensive use of open source in the American defense establishment. The use of open source is organized and formal, and it takes place at both the “basic” level, with no changes being made to the code, and at the “professional” level, where the code is adapted to the different needs of the armed forces.

With regard to the community axis, there is cooperation between the community of developers who are developing open source code for the armed forces, with military and civilian developers working together on different approved platforms. On the one hand, it seems that there is widespread cooperation and full transparency of the code during development, but on the other hand, we are talking about limited cooperation, with most of the development being done on relatively closed platforms which require pre-authorization for use. Furthermore, there are projects which are compartmentalized within closed development environments from the outset. This suggests that the American defense establishment is advanced in the field of community but has not yet utilized the full capabilities. It would seem that the American defense establishment is well aware of the benefits of the open source world and is seeking to maximize them, but at the same time, is restraining itself and engaging in controlled and managed cooperation for cyber defense and information security reasons.

With regard to the institutional directives axis, we can see deep internalization of the value of open source, which had been

\(^{38}\) Source No 3: An interview with an actor in the Israeli defense establishment: 7.1.16.
widely adopted at the senior level. As noted, open source was initially seen only at the level of the developers, but as understanding of its inherent advantages spread, it was disseminated among the entire defense establishment. Additionally, open source influenced force design processes in the American army when procurement and development processes were changed.

The Israeli Defense Establishment and Open Source

The Israeli defense establishment, for the purposes of this article, consists of the Defense Ministry, the IDF, defense industry companies (Israel Aerospace Industries, Israel Military Industries, Elbit and Rafael) and MAFAT. On this basis we will analyze the defense establishment according to each of its components.

The Defense Industry

Israel defense companies adopted open source for their work in a very slow and complicated fashion due to their organizational cultures. These are large organizations with many bureaucratic processes, which makes any type of change a challenge. Second, due to the classified nature of their work, their developers do not have constant access to the internet, as specified above. Additionally, in order to protect the security of their software, information security officers sometimes delay or prevent the adoption of open source. The professional experience of many of the workers in the defense industry does not include the use of open source, which makes it somewhat more difficult to change their work habits. That said, it should be noted that a steering committee on the use of open source in the industry exists, with members from Israel Aerospace Industries (ELTA), Elbit, Rafael and MAFAT. These bodies share unclassified information in order to benefit from the large advantages of building processes to use and adapt open source software. The committee discusses, among
other things, issues that relate to the licensing of software, intellectual property, information security and product support.\textsuperscript{39}

Moreover, the defense industries have experience in cooperating with regard to the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies. Member countries are committed to reporting the sale of certain items, among them software, including their intended end use and the end user. Naturally, this reporting duty sometimes creates difficulties and sometimes even prevents Israel defense industry companies from purchasing and upgrading software. In these cases, the use of open source can be a solution to this problem as one of the basic principles of open source is that it can be shared freely with no duty to report.\textsuperscript{40} In Israel, as in the United States, forums and NGOs were created to promote the use of open source. In the military context, the forum Mill-OSS.il exists. The membership of these forums include representatives of the different corps in the IDF and employees of the defense contractors, among others. The forums organize a number of conferences each year for the defense establishment in order to promote the use of open code among members.\textsuperscript{41}

Within Israel Aerospace Industries (ELTA) there is widespread use of open source code in the place of proprietary code. In addition, as a part of its IT procurement processes, open source solutions are also being considered. Open source is now used at all stages of development.\textsuperscript{42}

Rafael also uses operating systems and development environments based on open source. The operating systems were adapted to the needs of different projects and are used on several

\textsuperscript{40} Source No 3: An interview with an actor in the Israeli defense establishment: 7.1.16; Source No 2: An interview with an actor in the Israeli defense establishment: 1.12.15.
\textsuperscript{41} Source No 3: An interview with an actor in the Israeli defense establishment: 7.1.16.
systems. In addition, the company claims that its level of knowledge on the subject has grown and new capabilities are being added to the company.\footnote{Ibid.}

Similarly to the other companies, Elbit also makes controlled use of open source. The company is even working to develop a clear policy regarding open source, while emphasizing the need for organized work practices and clear definitions of standards for licensing, supervision and oversight. Elbit, in coordination with other defense industry bodies, supports the NGO “Hamakor” (lit. the source) which promotes the use of open source in Israel. The NGO organizes annual conferences on open source for the defense industries.\footnote{Ibid.}

**IDF**

While the defense companies took steps forward to adopt open source, the IDF began its journey into this world relatively late.\footnote{Source No. 3: An interview with an actor in the Israeli defense establishment: 7.1.16.}

The adoption of open source in the IDF, as with the early stages in the American defense establishment, began from below.\footnote{Source No. 7: Interview with Brig. Gen. Daniel Bren, then Head of the Lotem Division}

Young developers came with knowledge and prior experience of the use of open source code, and they are the primary cause of its entry into the armed forces. In 2013, when Brig. Gen. Daniel Bren took over as the Commander of the IDF’s Lotem Division (The Technological Unit for Operational IT in the C4I Directorate), a deliberate effort was made to inculcate a development culture based on the Agile methodology (which uses open source) within the C4I Directorate and later within the rest of the IDF. As in the other cases, the younger generation, at the captain rank, were the first to push for the adoption of the open source methodology. The
mid-level officers – lieutenant colonels – were characterized by a lack of willingness, and they delayed the change process. The obstruction by mid-level officers pushed the Commander of Lotem to formally create a forum of “Young Turks” made up of programmers at the rank of captain which led to the development of processes for development using the Agile philosophy.

The background to the conceptual revolution in Lotem was the clear and conscious understanding of the importance of adaptation to the software world. During Brig. Gen. Bren’s remarks at the Third International Conference on IT organized by the Israel Defense company, he argued that not only is the IDF facing many challenges, but the essence of these challenges is in their speed and intensity. In the past, the rate of change was slower, and was suited to five year plans during which systems could be developed. However, the rate of change today is dramatic and is even faster than the time the IDF takes to change in response. Today, the time needed to develop a system from the presentation of user requirements to integration is between a year and a half to two years. However, integration of a system after two years is not relevant. Therefore, he argued, a change needed to be made to work in a more efficient, correct and relevant manner. The change should include among other items, adoption and inclusion, which constitute the central pillar that enables the business world to remain relevant and to generate a competitive advantage. The term PFE (Proudly Found Elsewhere) is the opposite of NIH (Not Invented Here), meaning that if an off-the-shelf solution exists, it should be adopted if suitable. The IDF is assessed on its speed and relevance and not just on the quality of its development.

48 C4I Directorate, The Technological Unit for Operational IT (Lotem Division), “Summary of the Commander of Lotem’s Remarks During the Presentation of the Output of the “Young Turks” team”, internal IDF document.
49 Bren, D., Address to the Third International Conference on IT organized by the Israel Defense company, 9.11.2015. Accessed via youtube at: https://www.youtube.com/watch?v=5Hkhze3UYuw
Brig. Gen. Bren added that the resource that can most facilitate this change is the human resource, but one must pay attention to the gaps between generations. The way that the senior command thinks is different from the way young soldiers think. On the one hand, there is an advantage to experience and maturity of the older generation and on the other hand, there are many advantages to the networked and technological understanding of the young generation. In an interview, Bren elaborated and said that the key difficulty, at least in the unit he commands, is the intransient middle command level.

Matching Brig. Gen. Bren’s remarks, the C4I Directorate has made great efforts and engaged in considerable staff work whose objective was formal direction, creating standards and encouraging a transition to ‘open source’ processes. Furthermore, efforts were made to create an infrastructure for the open source community on the military intranet. Despite all of these efforts, most of the interviewees for this research were not familiar with these efforts and were not partners to the development of original code on this joint infrastructure. Even in the interview with the Commander of the Lotem unit, Bren noted that at the combined-arms IDF-wide level, the IDF still would “receive a mark of 6” for the level of adaption to the world of open source development. It turns out that the difficulty in implementation is connected to the C4I Directorate’s difficulty in giving active direction including policy on the one hand, and the lack of a joint combined-arms environment on the other.

50 Ibid
51 Source No. 7: Interview with Brig. Gen. Daniel Bren, then Head of the Lotem Division
52 Lotem, Policy on Adopting Open Source in the IDF, internal draft, 2016. Also: IDF Technological Standards Committee No. 22 – Summary of remarks by Lotem Commander, 8.7.14.
53 Source No. 6: An interview with an actor in the C4I Directorate: 6.4.16.
We can say that the adoption and use of open source is widespread among young developers in the IDF and enjoys the support and direction of the senior command, at least in the C4I Directorate. Indeed significant work has been done in the field in recent years, and even a number of hackathons have taken place. With regard to cooperation with writing code, we can see several examples similar in form to GitHub, which are used internally in the Intelligence Directorate, the C4I Corps and the air force among others. However, with regard to cooperation between the community of civilian developers and the army, the field is only at a very early stage of development.

In summary, the IDF is on the way to internalization of the open source world. Training of developers by the C4I Directorate is

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55 See LTC Ori article in this volume.
adding ever expanding circles of IDF personnel to the open source community within the IDF.\(^{56}\) Internal problems within the IDF with regard to accepting the C4I Directorate’s policy by other bodies within the IDF and the issue of joint infrastructure are still significant obstacles in the process.

### MAFAT

MAFAT (the Administration for the Development of Weapons and Technological Infrastructure) is responsible for the connection between the IDF and the Israeli defense industry.

MAFAT, from my perspective, is encouraging the adoption of open source within the defense establishment. It decided to promote software which can serve several users, with each user investing only in the section that is unique to them and not in the infrastructure layers.\(^{57}\) Similarly, MAFAT authorizes procurement plans which use open source. However, unlike the practice in the US DoD, MAFAT strictly adheres to Regulation 10/1 for the procurement of armaments (a J5/IDF Policy and Plans Directorate Regulation) which does not refer to software at all, let alone open source.\(^{58}\) It follows that while MAFAT contributes to the adoption of open source in the defense establishment, it does so passively.\(^{59}\)

While trying to trace the reasons for the delay in developing an official active policy within MAFAT, several of the interviewees for this research raised a number of conjectures and explanations. One of them claimed that the reason that MAFAT is avoiding promoting the issue is connected to the organizational culture and bureaucracy. With regard to organizational culture, MAFAT

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\(^{56}\) Usage data for the C4I Directorate’s Yohanan site shows a gradual rise in the number of users from a few hundred in 2012 to thousands by March 2013.

\(^{57}\) Source No. 3: An interview with an actor in the Israeli defense establishment: 7.1.16.

\(^{58}\) IDF J5 Regulation 10/1 for the procurement of armaments

\(^{59}\) Ibid
apparently does not see software as a key element in measuring the success of its people.\textsuperscript{60}

With regard to the bureaucratic reason, which is pertinent across the defense establishment, information security is still the main bureaucratic obstacle. Despite the arguments of experts who maintain that there is no such thing as “classified code,” due to the separation between code and classified information and using the analogy of code as a table and the information as a computer, the information security officials still tend to see “openness” as a threat. The great emphasis placed on information security reflects, as argued by some of the interviewees, a risk averse culture which prevents the weighing of the expected advantages of open source and exaggerates the weight of the risks.\textsuperscript{61}

The lack of a clear official policy becomes apparent when taking into account approaches made by actors in the defense industries calling for the promotion of open source and in light of the ongoing delays in doing so, according to several interviewees.\textsuperscript{62}

The unique place of MAFAT as an intermediary between the military world and the industrial-technological world increases the significance of the delay in formulating an official policy. While we cannot absolve the IDF of full responsibility for its actions, indeed the IDF “connects” with the external technological world primarily through MAFAT. That is to say, this body is meant to mediate the most up to date technological tidings into the army, and in this context the army is to some extent dependent on it. This dependence is strengthened due to the fact that the army is largely cut off from the global civilian internet. However, in the context of open source, the update from the defense industry arrived late. The reason lies in the fact that the Israeli defense companies and large corporations, such as Microsoft, were themselves behind the rest of the world, and they therefore didn’t have an interest to “tell

\textsuperscript{60} Source No. 3: An interview with an actor in the Israeli defense establishment: 7.1.16.
\textsuperscript{61} Ibid
\textsuperscript{62} Ibid
the army” about the developing phenomenon. As noted, it would seem that MAFAT itself has not yet formulated a clear and consistent policy on the issue, and therefore cannot mediate the gap which was created with the army.

To summarize this section, we can say that with regard to the Israeli defense establishment on our scale, in terms of the usage axis, we can see that open source is used by the Israeli defense establishment. The use of open source in the IDF and defense establishment is widespread and is even expanding. We can even say that there is an informal atmosphere of encouraging this trend and especially within the different internal frameworks – within specific units, within clear projects or specific communities of common interest in the defense industry. However, “open source” is not regulated and formally accepted, and in most cases is only used by developers in its “basic” form, with no changes made to existing code, and only sometimes “professionally” where changes are made to the code and it is adapted to the different needs of the army. With regard to the defense industry, we can see an increase in the level of usage of open source in the most recent period. However, without clear policy directives from the defense establishment, it is used only in a limited fashion.

With regard to the community axis, there is very limited sharing among the community of open source developers for use by the army, where army personnel are aided by civilian personnel to develop code. Nevertheless, there is a certain level of internal sharing, within each corps, of code between different developers. Regarding the sharing of IDF code with the civilian community, the process is largely non-existent today. This is true, as noted, for the defense industry as well – they do not share code among themselves and do not publish code for the community of civilian developers. It is clear that the Israeli defense establishment is

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63 Source No. 5: An interview with an actor in the Intelligence Directorate: 14.1.16.; Source No. 4: An interview with an actor in the Intelligence Directorate: 14.1.16.
behind the times in the community field and is far from maximizing all of its advantages.

With regard to the institutional directives axis, we can only see a limited internalization of the benefits of open source. The existing official attitude is limited and only a few are familiar with it. Among the IDF’s command backbone there are a few commanders that clearly deal with open source, such as the Commander of the Lotem unit. Within the primary practices used to manage projects in the IDF and MAFAT, there was little clear expression of a policy on the topic.

Thanks to open source, development personnel in the IDF reached impressive achievements, but as opposed to the practice in the United States, this did not influence force design processes and did not lead to changes in organizational processes. Consequently, software procurement processes were left unchanged and were not updated. It should be noted that personnel in the IDF command backbone and MAFAT argue that there is support for open source, but it is only passive support in the form of authorizations for specific projects, and has not included a cross organizational comprehensive statement of purpose. That being the case, in the Israeli defense establishment open source has still not garnered clear official organizational standing nor a corresponding implementation policy.

Conclusion

The technical wave of transition to open source cannot be stopped forever. When looking at the business sector for comparison we can say that companies that try and stop the flow will collapse. The army, which lacks business learning mechanisms, needs to procure critical self-awareness, to understand the revolution, and to engage in change.⁶⁴ Indeed, as we found, the IDF

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⁶⁴ Source No. 2: An interview with an actor in the Israeli defense establishment: 1.12.15.
C4I Directorate recognized this need and has begun a process of assimilation, principally through a revolution “from below.”

With regard to the range of adoption of open source, we can now see that the Israeli defense establishment is late to the game, relatively, while the US Armed Forces, at least according to official publications, and the business sector are determinedly overtaking it.

Figure 3: A comparative perspective of the business sector, the American defense establishment and the Israeli defense establishment

This suggests that the Israeli defense establishment, including the IDF, MAFAT and the Israeli defense industry, must
change in order to improve their position, make their work more efficient and maximize their capabilities.

For the level of usage axis, on the one hand the IDF seemingly has no reason to turn to open source for developing software, given that it understands its needs in the best way possible and can meet them. On the other hand, the IDF does not really have the capability to ignore this phenomenon, given that it only develops end user applications and bases itself, also at the level of infrastructure development, on open source. Accordingly, despite the army’s level of understanding of the operational needs and internal development capabilities, it cannot develop everything from scratch, and in practice has not developed completely by itself for a number of years. Accordingly, the use of open source should continue at the developer level and it should even be encouraged by creating openness to the issue and building suitable technical conditions, such as connection to the global internet.

For the community axis, the army can demand from the defense industry that they use open source. It can demand that the defense industry companies base their work on existing open source code, and it can also demand that they release the code that was developed for a specific project, to the other defense companies. Steps such as these would enable the development of better quality code for the reasons outlined above. In addition, the army could establish an IDF GitHub. Just as app stores exists today and consumers can choose what apps to use, a code store could be opened and developers could choose the code they wish to use. This is, as noted, in addition to open source’s role in setting the bar for quality code. More important – if quality code becomes the standard, there will be demand for all developed applications to be based on similar algorithms. In this way the establishment organizations will be able to cooperate in a structured fashion. This will be a major contribution to the never ending efforts to create a genuine joint combined arms digital work environment within the IDF.
As discussed, the changes highlighted above are dependent and influenced by the organizational direction axis.

For the organizational direction axis, it would be appropriate for the IDF to fully adopt the policy that was recently developed, to distribute and integrate it, and to ensure that it is backed up by an appropriate networked infrastructure. The Israeli defense establishment, in its widest definition – including MAFAT and the defense industry – needs to help the IDF formulate this policy and implement the required transformation.

In order to best adopt open source, it could be re-conceptualized as a standard. Open source is of best quality when many people use it. Therefore, open source can be defined as a specific quality bar for future projects. In this way the IDF will find itself in a supervisory role with regard to the defense industry and will require them to achieve appropriate development standards. The adoption of open source can influence cost efficiency calculations when making procurement contracts.

Today there is a preference for granting procurement contracts to large and theoretically stable companies, due to a fear of losing capabilities or services in the future. However, opening the source code would enable the reduction of the dependence of the army on one proprietary company, and as a result lead to efficiency processes and considerable savings. Indeed open source can be distributed to other companies or for internal development, for future development or for support services, and therefore the inbuilt preference for larger companies over others, the customary preference today, will become less relevant and less worthwhile.

Among the required changes is a clear response to the obstacles. With regard to the need for support, from Brig. Gen. Bren’s perspective, an army branch that opens a service and places it on the IDF cloud will need to also support users in the other branches, which would constitute a paradigmatic change for the IDF. Furthermore, the old approach whereby software is naturally accompanied by a guarantee and support needs to change. Open source is usually not bought, and therefore an internal
organizational support capability needs to be created for the code in order to enjoy its advantages. Moreover, there are paid models for code, for support, for complementary products etc. The use of systems that are open between the army’s different branches should be promoted. With regard to information security, Brig. Gen. Bren argues that avoiding implementing technology which is critical to solving operational problems due to the fear of dealing with the cyber defense problem – could lead to losing the war. Also, the trick is to bring advanced technologies and to create for the software a cyber-defense architecture.\(^{65}\) Nonetheless, the information security issue demands a comprehensive institutional and professional response, including aspects of personal security for those serving in the defense establishment.\(^{66}\)

In summary, we can say that our defense establishment, in relation to the United States, is late in formally adopting open source, at least with regard to what can be understood from its official policy. The establishment sees the required achievement for the adoption of open source in accord with the horizontal axis, “level of usage” alone. This, as far as it is concerned, means it is a part of the global current. Nonetheless, as had been argued here, the Israeli defense establishment is missing an enormous spectrum which is realized in the American defense establishment.

There is something to aspire to with regard to both open source adoption by the senior levels across the defense establishment and the external publication of code by the community in order to improve it.

\(^{66}\) In order to be a member of a development community on the internet, you have to be identified as a user and build a positive reputation over time (Source No. 6).
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Intelligence for Force design

Col. Asaf

Introduction

The question this article asks is: “How should we work in order to actively integrate intelligence assessments into force design decision making?” As a starting point for our discussion, I propose to assess the current situation and to compare the place of intelligence in force employment and its place in force design processes. My conclusions from my personal observations over many years of IDF processes from three different perspectives – intelligence assessment, force design and force employment – is that the influence of intelligence on force design decision making processes is greatly limited when compared to its influence on force employment. I am not purporting to back up this argument with a comprehensive comparative analysis and am adopting this conclusion on the basis of my personal experience and numerous conversations I have held over the years.

Is it important to integrate intelligence into force design? In my opinion, the answer is yes, given that if the intelligence assessment infrastructure is missing from force design decision making, a central layer in our understanding of the enemy will be missing in the force design processes.

In the first section of this article I will present a number of examples which will help clarify my argument about the current limited space for intelligence in force design and I will also provide several positive examples from fields in which intelligence

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1 Col. Asaf currently serves as the Deputy Head of the IDF Research Division in the Intelligence Directorate. In the past he served as the Head of the Research Department and as Head of the Operations Research Branch in the Israel Air Force.
assessments clearly and consistently do influence force design processes. Further on, I will propose a number of answers to the question of why this is the situation, while analyzing the differences between the characteristics of force design decision making and force employment decision making. After the discussion of intelligence, I will present a different research discipline – Operations Research (O.R.) – which does generate analysis that greatly influences force design processes. I will attempt to discern the differences between that discipline and the intelligence discipline which could explain the different role that each plays in decision making processes. Finally, I will discuss the question of whether it is worthwhile and how to change the way that relevant intelligence assessments are formulated and assimilated into force design.

The Influence of Intelligence on Force design and Employment

Within force employment processes during combat, intelligence assessments are thought of as critical and are a central component of any situation assessment – from General Staff meetings to the planning teams in the field headquarters. Intelligence officers are a part of the General Staff and Regional Command planning staffs and the strategic staffs and influence their decisions. They provide a critical basis for decision making and present threat analyses, provide alerts, generate targets, present possible enemy actions and analyze the actions and responses of various influential actors.

In recent years the IDF has frequently updated its combat plans for the different arenas in light of the changes taking place in them, and intelligence is closely involved in these processes. Intelligence officers have in important role in shaping updated concepts and formulating their terminology and principles, as well as their role during specific planning processes. The involvement of intelligence in decisions on formulating operational concepts and their implementation stands out in light of the place that intelligence is given, the attention that commanders give to
intelligence assessments' as well as the way that intelligence officers relate to their roles. The intelligence echelon that is involved in these processes comes from among the senior ranks from within the intelligence bodies; the Chief of Staff’s decision-making meetings on operational plans are attended by the head of the Operations Directorate, the heads of the Regional Commands and the different services as well as the head of the Intelligence Directorate, the head of the Intelligence Research Division and the heads of the different intelligence arenas and departments.

The involvement of intelligence and its role in force design processes are completely different. For example, in the design and planning of the “Gideon” multi-year plan, intelligence had a much smaller role (as a supplier of intelligence assessments, not as a force design branch with a force design role in the multi-year plan). Intelligence officers were not involved in shaping the new force design concept. This was done by the Policy and Plans Directorate, which formulated the updated primary capabilities and their subsidiary capabilities, and intelligence officers were not involved in choosing the principles of the procurement program concept. Of course' the designers of the concept and the planners did not ignore the knowledge of the enemy, is expressed in the intelligence assessments, but specialized intelligence assessments were barely provided at all, and there was no close involvement of intelligence officers in the design and planning. This is in clear contrast to intelligence assessments for force employment which are regularly reformulated in accord with operational requirements.

Not only at the senior decision-making level is there a difference in the role of intelligence between force employment and generation, but also in the more junior ranks. In plans for an aerial attack on a building in order to neutralize a group of terrorists, intelligence has a decisive role to play: Intelligence assessments of enemy activity regarding the area, place and time that would enable an attack; assessments of the enemy’s capability to observe the preparations for an attack and to threaten the attacking aircraft or to alert the terror group about the attack are
critical in the formulation of the attack plan and the tools to be used; and assessments of the expected response to the attack are the basis for a decision on whether to attack and how to prepare for after the attack. In contrast, intelligence is only slightly involved in decisions in developing the capabilities that enable the attack – purchasing aircraft, defining the types of armaments which are available for use in an attack or the training of the air crews.

There is a price for the minimal involvement of intelligence in force design processes, and the correspondingly limited influence of intelligence assessments. A clear example is the IDF’s preparations for the “Sagger” anti-tank rocket threat before the 1973 Yom Kippur War. In this case there were intelligence assessments about the emerging threat but they were not integrated into force design in order to develop a response based on armaments, doctrine or training. A similar case occurred in the previous decade, which luckily had only a theoretical price that was never realized. There was delay in identifying the impact of the enemy’s acquisition of modern anti-aircraft systems on Israel’s aerial superiority which caused a multi-year delay in adapting force design to create a response to this emerging threat. These are just a few examples of a wider phenomenon of the notable absence of intelligence from most of the processes during which force design solutions are defined for operational problems.

There are of course other examples of extensive involvement, in particular in the interface between force design and technological intelligence on the enemy’s weapons systems. In developing electronic warfare systems, knowledge of the specific characteristics of the enemy’s radar systems has a decisive role and there is a strong connection between technological intelligence officers and force design officers in this field. Also in the development of missile defense systems, technological intelligence has a crucial role in defining the attributes of the missiles which the systems must deal with.

The connection between technological intelligence and force design shows how intelligence is perceived in force design
processes - as a source of specific and accurate answers needed to characterize a specific capability, but not as something that is worthy of influencing systemic understandings or of shaping the force design concepts which the specific capabilities are a part of. As opposed to force employment, to which intelligence is tightly connected, most force design processes and in particular the design and conceptual layers take place without the support of specific intelligence assessments and without significant involvement of intelligence officers.

**Why Does This Happen?**

In my opinion, we are not talking about an accidental outcome. It is the result of the requirements and demands of force design on the one hand, and the characteristics of intelligence assessment processes on the other. These lead to a situation where, right from the start, there is a certain mismatch between intelligence assessments and the requirements of force design. To this we can add a history of a lack of cooperation, in which as a result, force design personnel became used to managing without the support of intelligence assessments. Similarly, intelligence officers did not need to develop the skills and knowledge needed to provide relevant intelligence assessments to force design and continued to upgrade their assessment tools only to the requirements of force employment.

How are force design requirements different from force employment requirements? Firstly, force employment is characterized by decisions implemented over short time frames – minutes, hours or days. Operational plans are indeed relevant for longer periods – for up to a few years (in the current exceptional circumstances for less) – but they are only plans which are then converted to operational orders shortly before their implementation. On the other hand, force design processes are long term. Many decisions will bear fruit only a few years down the track and other decisions such as the establishment of new bases or headquarters or the acquisition of new platforms and
armaments will be implemented and have an impact on the state of affairs over many years. Intelligence assessments which are relevant to force design needs must describe in a more relevant fashion the expected state of affairs many years ahead, as opposed to intelligence for force employment.

Second, operational plans and decisions on force employment are prepared for a tangible context, and relate to a specific enemy and arena. Force design needs to enable force employment in a wide range of contexts. Advanced munitions are not developed or purchased, generally, in order to be used in a specific arena or against a specific target, but rather to enable their use against a wide range of targets and arenas for the period of up to 20-30 years that they will remain in the order of battle. The acquisition of the Merkava Mark IV main battle tank was not intended for a specific arena, but rather to enable its use in all combat conditions. Consequently, when a decision is made to build a new base, to purchase F-35 aircraft, to develop a new type of shell or to establish a new commando unit, the decision-maker does not have one tangible combat context in mind. These are all intended to be relevant for the greatest breadth of operational contexts as possible.

A story is told that many years ago one senior intelligence officer was asked to present an intelligence assessment for the year 2020 and answered “Ask me in 2019.” What lies behind this approach, which even if it is said jokingly, contains a kernel of truth?

The methodology of intelligence assessments, as defined and implemented today, is more adapted to focused short term questions, and far less to broader questions about the distant future. The customary approach in intelligence assessments is inductive. The intelligence officer gathers information, analyzes it and strives to formulate an assessment derived, as much as possible, from firm facts. In the alternative approach customary in intelligence assessments – the competing alternatives approach – the intelligence officer gathers information, analyzes it and doesn’t
use it to justify his assessment, but rather to reject the options that the information contradicts. Despite the large differences between these two approaches, from the perspective of our discussion, they are similar – both are clearly empirical approaches which instruct the intelligence officer to find solid and reliable information which can be directly connected to an assessment of the future (whether with a methodology of justification or refutation). In order that the assessment about the enemy be perceived as well founded, especially from an intelligence officer’s own perspective, the solid information needs to be perceived as relevant, and it therefore needs to be information specifically about the enemy and information which is close in location and time to the context which led to the intelligence assessment. In addition, the intelligence officer strives to arrive at the assessment through the minimum number of cognitive “steps” in order to rely more on information and less on presumption.

Not only is this methodology directed at responding to focused short term questions, but also the ethical rules for an intelligence officer lead to this result. Intelligence officers know that they work in an uncertain environment, but still they strive, as far as possible, to provide well founded assessments. The ethos of intelligence personnel is to uncover “hard” information – real facts – and to use them in order to formulate a “strong” assessment. Basing oneself on fact is thought to be more appropriate for intelligence assessments than basing oneself on presumptions (this approach, of course, reflects a severe epistemological problem, given that there is no way to decide that a piece of information is a fact without making presumptions about the way it was gathered and its reliability, and there is no way to connect pieces of information to an assessment without making presumptions. However, pieces of information that are perceived as fact enjoy a special status which is then projected on to any assessment that is based on them).

This is the place for a short personal story. In 2002 I wrote two research papers that were based, among other information, on
many presumptions (using an approach that I will describe later in this article). One paper dealt with the way that the Syrian army was likely to use its chemical weapons (which have been neutralized in the interim) during war with Israel, and it was intended to serve as the intelligence basis for an updated operational concept which needed to make presumptions about the enemy. The second paper was about the future Syrian SSM formation (which in the interim was created and then destroyed) – the characteristics of the missiles and their launchers, the structure of the formation and its method of operations in combat – the paper’s purpose was to serve as the basis for force design plans. Both papers were distributed, but the head of the organization where they were written refused to distribute them as regular intelligence updates, but rather they were distributed under the heading “food for thought.”

As the head of a serious intelligence organization, he did not allow himself to distribute assessments that were not based on information, but rather on presumptions. There is a structural problem here: My aspiration to influence force design processes required the presentation of an assessment which was not based on solid information, not because of a gap in intelligence gathering, but due to the fact that the information did not exist anywhere at that time, not even in the enemy’s head. Accordingly, the assessments needed for force design processes cannot be delivered as standard established intelligence assessments.

An additional characteristic of intelligence assessments is that the intelligence officer tries to present intelligence assessments on “red” (the enemy) without integrating “blue” (our forces). ‘What will the blue do?’ is a question which is thought to be outside the area of interest of an intelligence officer. In the typical relations between an intelligence officer and his commander, the first is responsible for describing the red and the second for understanding the blue and undertaking all of the integration between red and blue in order to get the whole picture. The attempt to formulate assessments from the red perspective
alone, without the blue side, drags intelligences officers to primarily focus their assessments on red activity in the first act. Sometimes, an intelligence officer will also describe red activity in the second act, in response to a future action by the blue forces, but this assessment is usually hazy and general. Only in rare cases does an intelligence officer try and describe more complicated developments. This approach makes it difficult, of course, to create intelligence assessments for scenarios in the distant future. Indeed it goes without saying that future scenarios are dependent on both sides – both red and blue and of course when generating combat capabilities one also needs to make presumptions about developments in warfare and it is not enough to describe just the first and second acts.

From the above it is clear why the methodology and ethics of intelligence assessments make providing a response to the needs of force design difficult. Intelligence for force design needs to tell something about the distant future in order to be relevant but it is difficult to find information about the enemy which can help to establish, on the traditional standards of intelligence, an assessment on a future scenario in ten years' time. Of course one cannot tell a relevant story about the next decade without answering the question of what we will do during that time. Even if we have a complete picture of the enemy’s intentions and capabilities, who can guarantee that it will remain relevant to events in another decade, or even to the end of the IDF’s multi-year plan. Even if we have a complete intelligence picture of the Islamic State, who can say if it will even exist in another decade and if so – what it will look like? Indeed, its existence and condition are dependent not only on it but also on those fighting it.

And how will the other organizations that are active in the Middle East and shape our strategic and operational environments look? With traditional methods of intelligence assessment and the way that intelligence personnel understand themselves and their roles, we have little to say about the state of these organizations and the Islamic State in another decade or at the end of the multi-
year plan. However, building the required capabilities to fight them sometimes takes a period of time equal to a multi-year plan or two to develop or acquire the capabilities and to make them operational. As a result of gaps in adapting the intelligence methodology to the requirements of force design, intelligence officers and force design personnel do not usually work together, aside from several specific examples dealing with, as noted above, primarily precise questions and answers about the tangible characteristics of enemy armaments. As a result of the lack of mutual connections, intelligence officers have limited exposure to force design processes and force design personnel have little exposure to intelligence processes.

In contrast, joint work by intelligence officers and force employment personnel has created a rich dialogue based on mutual understandings. In this dialogue intelligence officers continuously sharpen and polish their understanding of the requirements of force employment processes. They better understands the language used by force employment personnel, the requirements that drive them to ask particular questions and not others, their constraints and their assumptions. As a result, intelligence officers know how to formulate an intelligence assessment appropriate to their needs. Similarly, through dialogue, force employment personnel polish their understanding of intelligence assessments, on their capabilities and limitations and the language used by intelligence personnel. Operations personnel learn how to use intelligence thanks to their dialogue with intelligence personnel, and intelligence personnel learn to create more relevant intelligence thanks to that dialogue.

This type of interface is rare between intelligence officers and force design personnel, and as a result the vast majority of intelligence officers – junior and senior – do not understand force design. They do not understand the considerations that drive force design personnel which are derived from the way that projects are managed, from technological and engineering uncertainty, from analyses of future improvements to systems under development,
from contractual commitments and budgetary issues. Consequently, they do not understand the considerations that lead force design personnel to compromise on certain points and not on others or which cause them to either adopt or reject an intelligence assessment as a basis for decision making. Equally, force design personnel are not used to a dialogue with intelligence personnel and mostly, they do not know how to use intelligence assessments sufficiently well and do not know how to best integrate intelligence assessments into their decisions.

The situation is somewhat better in the air and naval forces. In these services intelligence is involved primarily in force employment processes, but intelligence officers also maintain contact with the force design personnel who are located within the same service and are close to the force employment personnel.

The situation is less good at the General Staff level. There is no intelligence officer devoted to the body that plans force design, nor in the ground forces.

Have we reached a dead end, or are there possible solutions to improve the capability to provide relevant intelligence for force design?

Integration of Operations Research and Systems Analysis into Force design as an Example

Operations research and systems analysis bodies exist in the Policy and Plans Directorate, in the air and naval forces and in MAFAT (the Administration for the Development of Weapons and Technological Infrastructure). While they are younger than the intelligence bodies established at the same time as the IDF, they have been in existence for decades. As opposed to the intelligence assessment bodies, they are closely involved with force design processes, which make up a significant proportion of their work – support for acquisition planning as a part of the multi-year plan, assistance in prioritizing projects, assistance in defining operational requirements for armaments and even support for prioritization and compromise during the lifespan of projects. Like intelligence
assessment bodies, they generate assessments about the future and recommendations for action to be taken by the blue side.

Therefore a comparison of these bodies could create a relevant viewpoint to address the question of the connection between intelligence assessments and force design. Like intelligence, O.R. bodies deal not only with supporting force design but also with formulating assessments to support force employment and it is therefore a convenient and effective playing field to compare between the two disciplines. Before the comparison, I will briefly describe the O.R. discipline.

Operations research, in the way it is implemented in the IDF, is intended to support decision making in conditions of uncertainty, by providing tools for the organized analysis of the issue under discussion. A typical O.R. analysis begins with identifying and formulating the right questions and the answers needed to provide a basis for a decision, and in identifying alternatives for the decision-maker.

The purpose of the analysis is to assist in the characterization of the alternative and in reaching a decision on which to choose by evaluating the expected results of the different decisions and what they depend on. For example, evaluating the alternatives for different operational plans in Lebanon in light of expected damage to the home front (even if there are other considerations in choosing a plan). The researcher would formulate several relevant alternatives from the perspective of the operational planner, and then estimate the damage to the home front expected from each of them. How do they do this? They develop a quantitative model to describe the scenario which is expected in the war. They integrate estimates of Hezbollah’s fire plan, the technical capabilities of the different fire systems, the achievements of the IDF fire plan and maneuver, their expected influence on Hezbollah’s plans, the IDF’s defensive capabilities and the behavior of the civilian home front etc.

Of course one cannot know with certainty which plan Hezbollah will choose to use in a future war, which fire systems it
will use, how successful the IDF’s plans will be, how will Hezbollah behave in light of developments on the battlefield and how the civilian population will behave on the home front.

The O.R. methodology responds to this challenge by basing their assessment on a set of presumptions and analyzing the sensitivities to changes in those presumptions. The presumptions are based on different sources including intelligence assessments, the combined experience of different actors in relevant contexts (How did the civilian population behave during the Second Lebanon War and during the operations in Gaza? How did Hezbollah act after our strikes in the past? What were our accomplishments in locating launchers during war and in operational models?) and technical assessments (What is the expected efficiency of the Iron Dome system in light of lessons learned from previous action and the improvements which have been implemented? What was the level of use of SSRs in the past? How resistant are Israeli buildings to warheads?) The varied presumptions make up a model with logical connections between them and enables us to reach conclusions about different scenarios and their sensitivity to changes in the presumptions. In this way the model allows a complex picture, whose results are hard to assess intuitively, to be broken down into smaller pieces which can be analyzed and examined.

Of course, choosing an alternative for an operational plan also relies on intelligence assessments. However, between an intelligence assessment and an O.R. assessment as the basis for decision making, there are significant differences in the nature of the answer and the method of reaching it:

- Intelligences assessments seek to answer the question what is expected or likely to happen (what will the enemy do and what does it depend on?) while O.R. seeks to answer the question what decision should be made and what does it depend on. O.R. personnel try to adopt, as far as possible, the perspective of the decision-maker and to take into account their dilemmas. The intelligence officer focuses his assessment primarily on the
enemy (even if he must, of course, look at the enemy through the blue glasses).

- The intelligence officer asks himself what can be known about the enemy, based on accurate information. The O.R. researcher asks himself what can reasonably be presumed in order enable a correct decision. Focusing attention on the question “What do we need to presume?” and not on “What can we know?” enables the formulation of an assessment even in a situation where we are missing “hard” information about the enemy.

- Intelligence assessments are mainly based on information relating to the enemy, while O.R. personnel allow themselves to use analogies to other information. Let’s take a reasonable question which might need an answer in the framework of operational planning: How long would it take to fill a shaft that leads to a tunnel that was attacked? An intelligence officer would first turn to the enemy’s doctrine manuals and orders and if he couldn’t find an answer, he would file a request to collect the critical information and in the meantime leave the question open. The O.R. researcher would ask the intelligence officer what heavy equipment is available near the site which was attacked and would check with the operators of similar equipment in Israel or would compare it to relevant tests which took place in Israel or elsewhere around the globe.

- Intelligence assessments ostensibly avoid describing the blue side, aside from answering the question of how the enemy would respond to IDF action. O.R. assessments necessarily mix the decisions and capabilities of the red and blue sides together, otherwise it would be impossible to fully describe the scenario.

The O.R. perspective generates a broader and more balanced picture than an intelligence assessment from the decision-maker's perspective. Striking examples of this can be found in joint research that was conducted by intelligence officers and O.R. researchers over the last year. During the ongoing war in Syria, SSRs converted to carry an unusually large warhead have begun to be used. The
rockets are converted (as can be seen in many videos on YouTube) to carry warheads weighing dozens or even hundreds of kilograms, far more than the weight of their original warheads, which compromises the range and accuracy of these rockets. Thus, less accurate rockets with a shorter range were created, but with far greater damage potential. Intelligence assessments pointed out the severity of the threat - if and when they end up in Hezbollah’s hands and if they are used in a future war - in light of the greater damage they are capable of causing when compared to regular SSRs. The conclusion of this assessment was that these extra weight SSRs should be seen as a threat which has the potential to cause significant change and which would require extensive preparations by Israel.

Mistakes in information naturally lead to mistakes in intelligence assessments. A broader view is likely to overcome gaps in the assessment as we can see from the following example. When SA-8 antiaircraft systems appeared in the Middle East, a question arose as to the range of the missiles. A broad analysis, as is the norm in O.R. analysis reached the conclusion that in light of the purpose of the system (mobile protection for forces) and in light of their similarity to other systems around the world (such as the Crotale and Roland) the system’s range would apparently be around 10km. This approach is not suited to the intelligence research methodology which seeks hard information as the basis for analysis and not on reasonable presumptions in a relevant context, but in this case it produced the better assessment.

This analysis of the analogy between intelligence assessments and O.R. assessments is not intended to recommend that intelligence officers engage in O.R. research. That would not be efficient or correct. The purpose of this analysis was to identify what makes the O.R. discipline more relevant to force design personnel than intelligence, with the intention to deduce how it would be possible to make intelligence research more relevant for force design than it is today.
Intelligence retains a different role than O.R. in force design. The O.R. discipline does not fully meet the needs of force design. The main gap is in the systemic discussion about force design. With the O.R. approach, efforts to quantitatively estimate the worthwhileness of different alternatives and the attempt to present an exhaustive and comprehensive analysis of the decision making dilemma conclude with a recommendation for action. This approach creates a process where O.R. research is an independent process and is relatively isolated from the decision-makers who only see its products at the end of the process and after its conclusions have been summarized into an organized thesis. O.R. research is not a dialogue which creates a conceptual framework, but rather it is mainly a research process that examines alternatives within a defined conceptual framework – whether this was defined in advance as one of the working assumptions or whether the researchers formulated the framework themselves. This is the key place that intelligence should join the force design processes, and it is similar to the place that intelligence occupies in the discourse shaping force employment.

**Returning to Intelligence Assessments and Force design**

The argument that intelligence only has a secondary role in force design leads to the conclusion that there is no need to act differently. Intelligence has enough missions, and investing resources in entering force design has an opportunity cost. I will not discuss the question of how much it is worthwhile to divert intelligence efforts to this issue, but I will try to argue why it is important to integrate intelligence into force design processes. How can force design benefit from the involvement of intelligence?

Force employment is based on the attempt to create a systemic analysis of the encounter between red and blue. In contrast, in force design the interaction between blue and red in the strategic layer and the operational layer are analyzed in a superficial manner, in which in many cases the red plays only an abstract role. There is systemic analysis in force design but the
factors which are involved in it are not blue and red, but rather operational forces, resources and technology. This analysis is no less complicated than the systemic analysis used in force employment but it includes different components. As a result, a partial worldview is created that is missing the influence of the enemy on the future battlefield and on the way that our capabilities will be influenced by it in the future. The integration of the enemy viewpoint into the dialogue that shapes force design would enable the formulation of a plan that provides a more considered response to the future. One example of the effect of this lack of integration, which was presented above, dealt with the delay in adapting force design to the development of modern air defense systems in our region. There are also current disturbing examples, but due to information security considerations, I will not elaborate.

The questions that are appropriate to present to intelligence are dependent on the type of discussion taking place in force design. In general, the dominant factor relating to the required intelligence product is the length of the horizon of the topic at hand. Discussions about force design concepts, about the acquisition of platforms or the development of key technological systems deal with timeframes set many years into the future. At the other end of the spectrum are discussions on training, exercises and to a certain extent the acquisition of spare parts and munition stocks, which deal with timeframes spanning only a few years.

Intelligence for formulating force design concepts needs to describe the future battlefield and the expected capabilities of the enemy and the way they will employ force as well as the elements of the future environment (population, foreign forces etc.). In addition, formulating long term concepts for force design require intelligence assessments on the enemy’s force design strategy and their force design infrastructure (industry, academia, resources and international connections) which can teach us about the potential for changes in the trend line of the enemy’s capabilities development – to which technologies are they likely to turn? Is
their academic infrastructure suitable to this? Which acquisition channels are available to them? What budget could they allocate to force design? And many others.

The involvement of intelligence in force design has a special importance when analyzing force design not only as a process that builds future capabilities, but as a process that also shapes the enemy’s decisions – their force design, their level of confidence in their capabilities and the level of deterrence created in their eyes. The enemy’s decisions about force design can be influenced by our actual force design as well as by the way our force design is presented. Without integrating the intelligence perspective in force design it will be very hard to create a comprehensive systemic understanding of the influence of force design on shaping our environment and on our enemies’ approach to us.

Intelligence for assisting in decision making on the characteristics of projects and acquisitions needs to include a description of the future battlefield, specific descriptions of the technical characteristics of the enemy’s weapons systems and a description of the potential scale of acquisitions by the enemy in the future. Currently, the primary contribution of intelligence to force design is concentrated on responding to focused questions about the scale of acquisition and the characteristics of enemy weapons. But the answers to these questions, as important as they might be, provide only part of the broad requirements of intelligence for force design.

Intelligence work focused on force design will lead to information gathering and knowledge development, which will not happen without these leading questions. Thus, for example, our intelligence understanding of the enemy’s force design principles, of their speed of weapons development and operational adaption, of the stage of development at which weapons become operational, and of the usability of their weapons, all these need to influence the development of our response. Similarly with regard to conceptual developments from around the world that are likely to arrive at our region and which could influence the development
of concepts and capabilities in this area. Information gathering and analysis of wars around the globe, like the aerial campaign in Kosovo or the Syrian-Russian-Iranian campaign against the rebels in Syria, need to serve as a basis for our understanding of opportunities and risks and to help create force design that will enable us to better cope with the future reality. In some of these fields important knowledge has been developed, in others it is missing. Without an ongoing and rich dialogue with force design personnel, intelligence cannot know which questions are relevant and which relevant answers could contribute to decisions making.

How can intelligence connect to force design processes? Firstly, intelligence needs to influence the processes that shape the IDF’s future capabilities. As long as intelligence is not significantly involved in and contributing to these processes, its influence on the future will be limited and its main impact will be short term only.

Beyond that, dealing with intelligence assessments of the type needed for force design would make the assessment bodies’ tools more sophisticated for all types of missions. Development of capabilities to formulate long term assessments, based on presumptions and not just what are thought of as facts, integration of non-intelligence information sources and “playing” with complex scenarios of blue and red activity – all these would also facilitate improved capabilities for intelligence personnel to supply intelligence assessments for force employment as well and not just for force design. The type of discourse and thinking that are needed for force design planning are similar to the type of discourse and thinking needed to formulate intelligence assessments for a developing scenario in which the red and blue decisions impact one another. However, current intelligence research tools are only suitable for providing assessments one or two acts forward.

Accordingly, in my opinion it is important to improve our capability to provide intelligence assessments to force design processes. What actions should be taken to achieve this?
In order to provide relevant intelligence assessments, intelligence officers need to adapt their methodology. The current methodology is only somewhat suited to the type of answers that force design processes require. In addition, intelligence officers need to adapt their criterion for “good” intelligence assessments. As long as an intelligence assessment is thought of as good only if it is well founded on solid facts, it will not make a substantial contribution to force design processes which extend over a multi-year plan or two. Assessments about the future require a degree of imagination and extrapolation, and require the formulation of presumptions, which must then be rigorously examined as an alternative to basing an assessment on facts. A new type of methodology is needed to achieve this.

In a similar fashion to the interface between intelligence and force employment, the connection between intelligence and force design personnel needs to be institutionalized, given that the ability to supply relevant intelligence is based on mutual understanding. The integration of intelligence officers in significant force design processes, such as formulating concepts or preparing master plans, would enable the utilization of intelligence insights in the process of shaping force design.

It is important to maintain intelligence officers’ abilities to provide technical intelligence based on solid facts. However, it is also important that the dialogue with intelligence officers in the force design field not be a discourse based on technical questions and answers in which the intelligence officers provide the missing building blocks within a closed and sealed concept such as: What is the missile’s range? Or how many rockets does the enemy have? The discourse with intelligence officers must take place at a much earlier stage in the process in which intelligence officers needs to be a part of the group that shapes the concept and plan.
Another important question that arises from time to time is whether a dedicated intelligence function be created for force design. That is, should intelligence officers be assigned to the departments that deal with force design? It is clear that this would provide a solution to the need to develop an ongoing discourse between intelligence officers and force design personnel. However, this structure would not guarantee that this requirement is met, and the experience of the dedicated intelligence body in the Ground Forces service is an example of this. Therefore, this is not the best solution in my eyes and is certainly not the best solution with which to start these changes. At least at the start, and in my estimation also in the future, it is best to base the connection between intelligence and the force design on intelligence officers who routinely serve within our assessment bodies and who would participate from time to time in defined processes within the force design bodies. This solution can be implemented not only in the services, but also in the connection between the Intelligence Research Division and the Planning Division in the Policy and Plans Directorate and between the Research Division and MAFAT. It would be appropriate to engage in a trial period in which the connection is institutionalized in a systematic manner and afterwards lessons could be learnt for improvement.

The entry of intelligence into force design may lead to costs. In addition to the inputs that will come at the expense of other missions and the changes in methodology and ethics, it is likely that there will also be influences in other areas. In my opinion, there is also the potential for a positive contribution provided that we are able to ensure that intelligence officers maintain their unique “red” outlook for which there is no replacement. There are many “blue” thinkers, and the intelligence officer needs to be capable of seeing the world through the eyes of the enemy. Experience, maturity and mentoring will be needed order to provide intelligence for force design.
Planning Force design: Between Scientific Thinking and Lateral Thinking and Imagination

A Reappraisal

Haim Assa

“It is the age old and unequal struggle between criticism and creation, science and art; the former may always be right, but without gain to anybody”

Hermann Hesse, Beneath the Wheel

Introduction

Over the years, the fields of Operations Research and Systems Analysis became dominant in the Israeli defense establishment’s force design decision-making processes. Every conceptual idea that becomes a practical initiative must go through a long, thorough and systematic process of analytical assessment whose purpose is to evaluate the technological feasibility, utility and expected benefits of the idea as well as other types of evaluations which can help the decision-makers. This is certainly an important process, but over the years it has become a decisive process – a process that almost exclusively defines the framework of the discourse. These systematic analytical processes are also biased towards caution, that is – they prioritize, even if unintentionally, risk reduction over maximizing the chances of success.

\[1\] LTC (Res.) Dr. Haim Assa is the head of the Simulation lab Simlab at the Yuval Ne‘eman Workshop for Science, Technology and Defense, Tel Aviv University.
This article will attempt to make clear the connection between the above trend and the conclusion that the IDF is not succeeding in creating force design that is relevant to the threats facing Israel. In each “round of violence” it is clear to all that the IDF is using the it has at tools at hand, rather than the tools that it should have.

It is widely accepted, almost across the board, that our environment is changing, that the nature of conflict is changing and that many other dynamics are changing as well. The IDF’s force design processes, however, have remained unchanged. In other words, while the environment and threats have changed dramatically, force design planning has remained fixed to the same mathematical and scientific methods. The IDF, to generalize, does not take into account the need to use its imagination in order to generate a ‘thread’ which could lead to an understanding of the enemy’s existing potential. This article will argue that the solution is to be found in a combination of lateral thinking - in the context of the possibilities which may be developed by the enemy and its conceptual and technological potential - together with an operations research methodology whose advantage is local optimization, a type of analysis related to tactical missions.

**When Operational Optimization Meets Subversive Strategy**

The center of gravity of the threats against Israel has moved from states (aside from the Iranian threat) to terror or guerilla organizations. As a result of this change, the question clearly arises as to why Israel is not succeeding in defeating enemy organizations (on the presumption that this is Israel’s strategic objective)? This question becomes more poignant when we analyze the enormous differences in investment and the quantitative and resource advantages that Israel enjoys in this type of conflict. It would seem that what has been is what will be. In recent conflicts, and it would seem in the future too, the lack of a decisive victory is a permanent feature. At a certain point, both sides meet at the UN Security
Council and reach an agreement to implement a ceasefire which neither side is satisfied with, and after a short time period, these understandings are undermined and conflict breaks out again. Within the Israeli security concept, this ritual is referred to as the “rounds concept” or “conflict management.”

Seemingly, the conflict is being managed. But from a broad perspective, the way it is being managed appropriates numerous resources from the State of Israel, primarily in three areas: Human life, the economy and statesmanship. The connections between these fields create a critical mass which extracts a substantial price from Israel in the national security arena. As opposed to the security arena, narrowly defined, which only focuses on security issues, the national security arena covers many dimensions from all fields – from society to the economy, infrastructure and personal security, and to statesmanship; and also includes security. This broader view sees this “rounds approach” of conflict management as damaging to the broad interests of the State of Israel. This is primarily due to the fear that the feeling of instability and skepticism that will likely result from further rounds of violence, play into the hands of the terror organizations, whose objective is to subvert the conflict management process and the feeling of control inherent in it. Actually, we can “crudely” say that these organizations have the opposite function – to erode stability. Not only that, the tools at their disposal are infinitely cheaper, more available and easier than the tools available to the state which is managing the conflict. In addition, the civilian losses that cause Israel to attack these organizations, paradoxically, strengthen these very organizations – they mar Israel in the international arena and build these organizations’ positions within their internal arenas. Essentially, in the event of a war with Israel, all that these organizations need do is hold out while facing the Israeli attack and try to hit the Israeli civilian home front. This “organizing principle” is easier, cheaper and more efficient than Israel’s attempts to surgically hit terrorist actors within crowded areas populated by uninvolved civilians.
The amazing thing is, and perhaps the saddest, that Israel continues to do so, war after war, due to an enduring blindness.

What does it mean to Decisively Defeat the Enemy?

Any discussion dealing with national security must include the term “decisive defeat” (Hachra’a in Hebrew). It is well known that Israel’s security concept is made up of three basic elements – deterrence, early warning and decisive defeat and recently a fourth concept was added – defense. In this article we will focus on the term decisive defeat. I would argue that a decisive military defeat means: “A military campaign that ends with the ability of one side to force a diplomatic agreement at the expense of the other side.” The winning side can dictate the diplomatic situation after the war and the defeated side is coerced into accepting these dictates out of an understanding that rejection of the terms will bring an even more painful price. In reality, since the 1973 Yom Kippur war, no military operation has taken place which led to a decisive defeat, aside from perhaps Operation Defensive Shield in 2002 which ended with a decisive military defeat, but did not bring diplomatic coercion afterwards. In the same context, but from the opposite perspective, there also exists a state of “lack of a decisive defeat.” This means that the two sides reached the conclusion that they have exhausted their capability to achieve further accomplishments or that the investment required to achieve additional accomplishments would be too expensive and therefore not worthwhile. Consequently, they turn to the Security Council, and the conflict ends with a ceasefire.

The Difficulty in Decisively Defeating the Enemy

What are the phenomena that make it difficult for a national regular army to decisively defeat a terror or guerrilla organization, in the way that decisive defeats were achieved in World War II or the Israeli 1948 War of Independence? I will point out four key phenomena:
The first is the terror or guerilla organizations’ lack of sovereignty in the territory of the state in which they operate. They do not have a governmental backbone and clear military centers of gravity that can be identified and attacked. Their principal capability is to extract a price from enemy states, primarily from the civilian population of the enemy state. These organizations are (generally) not seeking to capture territory in order to defeat the enemy state, rather they want to continue to fire at the civilian home front of that state, even while negotiations for a ceasefire are taking place at the UN Security Council. This allows them to control the decision on when they will stop extracting a price from the civilian home front. This is how events worked out in 2006 – The UN ceasefire resolution, UNSCR 1701, came into effect only after Hezbollah’s representative in the Lebanese government gave his approval, and only after Hezbollah understood that the IDF was about to send large forces into Lebanon. In the militarily weakened state that the organization found itself in after three weeks of combat against the IDF, it preferred to agree to a ceasefire on the terms dictated by Israel.

The second phenomenon, the operational approach of these organizations – concealment, camouflage and rapid fire both towards the civilian home front and at the military forces, makes it difficult for regular armed forces to efficiently and quickly attack them and to bring them to a situation where they stop their armed activity.

The third phenomenon’s source is the differing perspectives on civilian casualties. For a guerrilla or terror organization, harm caused to civilians on their side – civilians who live in the same state or civilians who are identified with the organization but are “not involved” militarily – is not a failure. Rather, it is a way to generate support from the population and encourage it to identify with the organization as well as presenting the enemy state as a mutual enemy.

The fourth phenomenon and the last is connected to the ideological motif which led to the establishment of and continued
motivation for these terror and guerilla organizations. They try to achieve political objectives through the use of violence and thus, as long as they are not decisively and totally defeated, they will continue to adhere to their founding values and will continue to use violence. Therefore, even local decisive defeats do not bring about political defeat. We can see, for example, the lack of a decisive defeat against Hezbollah and Hamas reflected in Israel’s attempts to shape the diplomatic situation against despite not achieving a decisive military victory, in the two unilateral withdrawals that took place.

**An Unprofitable Investment**

It would seem that the conceptual discipline that determines that a decisive victory over the enemy will cause them to surrender has lost its relevance over the last decade, to put it mildly. Nonetheless, it is too early to conclude that this concept is dead. In force design planning one must also take into account the possibility that state enemies could return to center stage. We cannot remove the possibility of a Syrian recovery adding to the range of threats facing Israel; for example, a ceasefire could enable the Syrian regular army to once again become a threat to Israel. A state must take into account a wide range of potential threats.

That said, I will return to the issue of decisively defeating the enemy and connect it to the question of investment. Previously I argued that the decisive defeat of a regular army depends on damaging its center of gravity and systematic destruction of its command backbone – air force, armored corps, air defenses, command and control and even the capturing and controlling of critical territory. During the Gulf War, the Americans added an additional element – the governing regime, on which an attack could cause the collapse of the state itself.

This viewpoint is complicated when applied to organizations. They do not have organizational backbones, hierarchical systems or the presence of general staffs and logistics levels. Consequently, regular armies are left to chase rocket squads or guerillas who
constitute low signature targets. Attempts to improve intelligence capabilities, reduce the time needed to “close the loop between sensor and shooter” and increase firepower usually yield unsatisfactory results. In addition, controlling and capturing territory in which the organizations operate will not necessarily bring an end to the fire on Israel, certainly not in the timeframes that Israel sets for ending hostilities of this type.

Due to all of the above, we can argue that the level of investment in casualties, budget, and development by a guerilla or terror organization in order to achieve its strategic objectives is much lower than that needed by a state to “stop, neutralize or decisively defeat” a guerilla organization. This issue is directly exacerbated by the fact that as a guerrilla organization develops and uses older or more primitive technology, its chances of survival rise when facing regular armed forces. “Flying maneuver” – Qassam rockets – boasts manufacturing and usage costs that are negligible in relation to the enormous Israeli investment in the “Iron Dome” system. The cost of building tunnels for Hamas, which constitute a significant threat to Israel, is negligible in relation to the Israeli investment in developing systems to deal with this threat. These two examples are a demonstration of what is apparently to be expected in the next conflict – terror and guerilla organizations that are able to relatively quickly and cheaply develop operational challenges for Israel that will require a much greater investment to develop an adequate response.

The ratio between the investment which the organizations need to make in order to develop systems with high survivability and which can cause significant damage to Israel and the investment that Israel needs to make to develop systems to neutralize those threats is at least two orders of magnitude. For example, if the development of the Qassam system cost around 10 million dollars, the cost needed to develop the Iron Dome system is a billion dollars – a gap of two orders of magnitude.

This gap enables the organizations to engage in combat for a longer period than Israel would like. The range of operational
possibilities for the organizations is enormous and endless. Any solution to the tunnel or rocket issues will certainly cause the organizations to seek another weapon system - cheap, efficient and fast – and while an Israeli response will be found in the end, it will come after a long period and a large investment. Not only that, the ability to achieve a decisive defeat becomes more distant in this case. This gap is well known to the organizations and they rely on it to prevent an enemy state from decisively defeating them. They will continue to operate in the same fashion as long as Israel continue to engage in force design based on identifying gaps based on insights gleaned during previous hostilities and on the basis of Israel’s perception of the current situation.

That is, as long is Israel continues to engage in force design on the basis of the gaps between its situation assessment and its existing capabilities, Israel will always be one phase behind or find itself permanently off balance in relation to the enemies’ capabilities.

Scientific Force Design Compared to the Lateral Thinking of a Street Gang Leader

Force design methodologies in Israel are based on the gap between Israel’s situation assessment – of the threats to Israel – and existing responses to these threats. The military establishment must close this gap through suitable force design planning. The logic behind closing the gaps has been called “Minimax logic” – a cautious and calculated logic that determines that one cannot allow any opening for the enemy, and that one needs to engage in an almost mathematical optimization in order to divide resources among all of these gaps. This is a concept whose origins are in game theory. The Minimax guarantees us that among the worst results possible, we will receive that which is less terrible. Were it not for this logic, a rupture would be likely, and as a result we would find ourselves having to deal with intolerable possibilities.
It would seem that this is a logical and appropriate thought process. However, in reality it has an inbuilt problem – we are engaged in optimization on the basis of events that have already taken place or partial intelligence on the enemy’s intentions. While we are planning based on what we experienced, the enemy is already preparing a new and cheaper threat which in most cases we will initially relate to as a mere curiosity or something which is not serious or threatening. The difference between seriously threatening and not threatening primarily relates to the enemy’s usage strategy which is reflected in the level of usage and its nature. The Sagger missile was well known to the IDF before the Yom Kippur war. The way it was used surprised the IDF. The same is true of the tunnels. They were known to the IDF for a decade before the threat was first encountered in combat, but their conversion to a strategic asset by Hamas – numerous tunnels and offensive capabilities – surprised the IDF.

The use of rockets and missiles is another example. Already in 1991, Saddam Hussein fired SCUD missiles at Israel. Many operations research personnel predicted before the war that he would not fire missiles at Israel due to a fear of a decisive Israeli response. They argued that the expected benefits of firing a number of barrels of explosives – and sometimes they were even filled with concrete instead of explosives – compared to the harsh Israeli response to the launches would prevent him from firing. In the end, Saddam fired 39 missiles at Israel. He did so because he recognized an Israeli vulnerability – the civilian home front. Saddam’s concrete missiles were not meant to cause dozens or hundreds of casualties. Their role was to disrupt the daily routines of Israeli citizens, to impair their sense of personal security and to interrupt the continuous functioning of existing systems. In essence, Saddam thought, these missiles were intended to generate a strategic profit in the form of destabilizing the Western coalition against him and uniting Arab public opinion in his favor. This idea became common knowledge, and for similar reasons the terror organizations have equipped themselves with numerous
rockets and missiles, with great accuracy and which carry standard explosives. A new problems was created for Israel which demanded a huge investment.

Until twenty years ago, Syria had only a few dozen SSMs. During the same period, the researchers who dealt with force design ranked this threat as very low on the ladder of threats. They saw rockets as a restricted problem which could possibly turn into a substantial threat in the future, but at that time there were greater threats that demanded investment. The Israeli brain is guided by operations research tools and follows the rationale – investment in what is clearly seen. What the enemy might do in the future is a low priority. The problem is in the different thought processes of the enemy, its different rationale: I will choose something that will surprise Israel and force it to fight for a long period, preventing it from decisive defeating me, until a ceasefire is imposed. The enemy’s thought process is not military. It is similar to the thought process of a neighborhood crime organization – two enter a bank, two others distract the police, and they all then escape.

Faced with this type of thinking, we have intelligent and talented force design planners who use mathematical models to generate optimization based on the types of conflict that we have become used to. These planning bodies are not able to get into the heads of “neighborhood crime bosses.” This enormous gap can be bridged only when we evaluate the different investment rations that are needed by each side in order to fulfill their goals. Even worse is the fact that if these two lines of thought continue to exist in parallel, then the thieves will continue to have the upper hand – arriving at an imposed ceasefire without the state being able to decisively defeat them.

Where is the problem?

We can usually find the end of the thread, but we can’t estimate its length, significance or shape. In other words, we can identify the beginning of a new threat to Israel but we are not capable of estimating its real significance due to our adherence to
scientific thinking and planning or to thinking that is directed by operations research. It is hard for us to think like the leader of a street gang and we are therefore surprised by the enemy “thief.” We need to be released from our enslavement to accounting/operations research thinking and to start to think “laterally.” To think like them. To invest in possible situations that may develop and are not what we have already encountered.

Operations research thinking is relevant in the context of assessing the force components for a defined mission when all of the enemy components are known and defined. Aside from that, for the complete picture we need a different kind of thinking, outside the box, focused on the enemy’s next step and on a decision to invest in advance in stopping it.

The price of this approach is clear. After finding the “end of the thread,” we need the capability to predict logical steps that the enemy might take, which will then force Israel to make a considerable investment to ensure comprehensive coverage, when in reality it is likely that not all of these steps will be realized. However, it is still appropriate to invest in all of these possibilities. Even if the enemy has not renewed its capabilities, we will create a new field in which we have a preemptive qualitative advantage, not in response to a gap, but in a field of operational capability which will allow us to take the initiative in a way that the enemy has not yet developed a judicious response for. And if the enemy does renew its capabilities, then this option was taken into account in the force design planning. This result is very significant and could even allow for the decisive defeat of an organizational enemy.

Given that the number of “thread ends’ is not large, the investment will always be worthwhile. The logic that is meant to direct this process is as follows: How can the enemy use new capabilities that arise and leverage them to become a strategic platform which can bring it achievements (from its perspective)?

The first element of this logic involves evaluating the capability of the enemy to equip itself with armaments and to train technicians or fighters on those technologies. It is clear that state
intelligence efforts are directed precisely at this issue, but the critical point is this: Even if there is not enough evidence that a new platform will become a strategic offensive element, but there is a possibility that it could be extended to such an extent that it would serve Hamas or Hezbollah, then force design planning should treat the threat as if the capability exists and attempts must be made to thwart it as quickly as possible.

Time and again, the long time period that Israel takes to find a response to new developments by the organizations allows the organizations to hold on, to escape a decisive defeat and to create a situation in which Israel prefers a ceasefire.

The capability of an enemy organization to surprise and to renew could turn into a double-edged sword for them if IDF force design can somewhat reduce the domination of the old scientific approach in its planning processes. Not every investment in force design needs to be supported by solid physical and intelligence evidence such as that required in a criminal trial. The enemy is not “innocent” until proven guilty, and its natural inclination is to use every technological opportunity to make things more difficult for us, without organizational inhibitions and without “risk minimization” processes and “feasibility studies.” Thought processes and imagination have a significant place, and we need to derive from them investment channels for force design. Even if we have learned that there is a need for solid proof – this is the basis for all science expect the science of war - in war there is a place for lateral thinking which also usually wins.
Conclusion

Investment in solutions to innovative new challenges, which the enemy intends to surprise us with, have strategic value even if it turns out that Israel invested in illusory paths. Israel’s capability to neutralize the enemy’s surprise at the beginning of hostilities also has enormous significance to Israel’s ability to decisively defeat the enemy.

The possibility of doing so will not be found in force design processes that rely on operations research but rather in processes based on the ability to be imaginative and to think like the other side. The personnel involved in these processes must adapt themselves to a way of thinking based on a deep understanding of the logic of the enemy system – the logic of the leader of a street gang of thieves. They need to focus on the way organizations that think like a street gang view success in a conflict against a state. There is considerable similarity between this new world and the cyber world. Analysis of what the enemy might do is more suited to ‘hackers’ than to intellectuals from academia. The tools of operations research are critical for force design but they are not the optimal and most relevant to the strategic and operational contexts. We need to limit our use of them to the instances where the mission is clearly defined and most of the issues are known.
IDF Strategy – Force design

Gershon HaCohen

Upon becoming Chief of the General Staff of the Israel Defense Forces, Lt. Gen. Gadi Eizenkot prepared a document “IDF Strategy.” The publication of the key elements of the document are praiseworthy. It provides a response to the expectations of the public to share the basic principles of military force design and force employment and invites the public, even if not explicitly, to engage in a practical public discourse on its conceptual basis.

At this meeting point between the current concepts directing the IDF’s activity and Israel’s citizenry, I will focus on three key issues which are integrally connected to the plane of civilian existence – both physical and in the mind:

1. The basic idea behind the use of ground forces and the logic connecting them.
2. The purpose and character of the ground forces reserve corps within a range of ground combat missions.
3. The IDF’s responsibility for civilian, organizational and organized cooperation in defense efforts, such as territorial defense in peace time and in war.

From the principles which guide force design in the IDF Strategy document, I have chosen to focus on one: Critical Mass:

"Force design shall be carried out while creating or maintaining a critical mass of capabilities. Beside the importance of achieving a qualitative and technological

1 Maj. Gen. (res.) Gershon HaCohen’s most recent posts in the IDF were as the Commander of the IDF Military Colleges and Commander of the Northern Corps.
advantage, the number of means that can be activated is also important. This affects the quality and flexibility of action. Mass together with flexibility is a way of dealing with uncertainty relating to future challenges on the battlefield."

This paragraph is highly significant, and is worth adopting literally. The principle that it directs us to seems simple and familiar, but its practical significance is far from obvious. Of course it emphasizes an eternal question in the use of military force - the dilemma between quantity and quality - and leaves this ongoing tension at the doorway. The question is renewed in every tactical and systemic context and it demands from the army’s commanders, both those who generate force and those who use it, the creation of an updated balance between the two.

Orde Wingate with his Special Night Squads carved into the consciousness of the founding generation of the IDF (Yitzhak Sadeh, Moshe Dayan and Yigal Alon) the model of the biblical character Gideon and his 300 warriors in the war against the Midianites at Harod Valley in the Book of Judges. The simple lesson was understood by them as an unambiguous solution to the dilemma between quantity and quality in its guidance to, in principle, prefer an operational concept based on a carefully chosen small strike force.

However, it is worth reading the story afresh. During the first selection of fighters, which took place in response to the command from God: “The people that are with you are too many [...] Now go proclaim in the ears of the people, saying, whoever is fearful and afraid, let him return and depart in the early hours from Mount Gilead,” (Judges, 7:2-3) the size of the force was reduced from 30,000 to 10,000. After this first selection, a second was needed: “And the LORD said to Gideon, the people are yet too many; bring

them down to the water, and I will sift them for you there” (Judges 7:4). Indeed, 300 chosen ones remained and the first nighttime attack on the Midianite camp took place with a multi-pronged assault, using the creativity and daring of this superior group.

But the story is just beginning. The initial successes developed into a pursuit of the Midianites which required numerical mass. A close perusal of the biblical description makes clear that even after the first selection, Gideon did not actually send home the 20,000 who abandoned the fight, but rather positioned them to wait and “depart in the early hours from Mount Gilead” as a reserve formation. For the pursuit he summoned the tribes of Naftali, Asher and Menashe and dispatched a special call to the sons of Ephraim: “And Gideon sent messengers throughout all of Mount Ephraim, saying, come down against the Midianites, and take before them the waters unto Bethbarah and Jordan” (Judges, 7:24).

It becomes clear that complex tactics were used which combined quality and quantity. The battle opened with a night raid by an elite force but continued with a pursuit in mass with large forces towards the North and West. This was joined by an additional approach from the southeast in order for the tribe of Ephraim to simultaneously block the Jordan River crossings.

The IDF was also built and operated in this way from the time of its founding, by combining small elite strike forces (primarily regular army) with large scale mass. This concept was already developed during the military organizational processes which took place before the 1948 War of Independence.

The issue of the appropriate balance between an elite strike force and a quantitative mass of medium quality, is well known for its significance to all dimensions of military action: On land, in the air and at sea. However, for the ground forces this issue has multifaceted complications, which are uniquely central and which are manifested through several significant variables.

The aspiration to achieve technological superiority - As a critical element for achieving tactical victory, this is the first variable
that distinguishes ground combat from aerial and naval combat. The technical features that define the performance of an aircraft have a decisive influence on the challenge of achieving aerial superiority. It is difficult, for example, to imagine a fair fight between a combat aircraft from World War II and an advanced jet fighter, certainly not if the jet were armed with air-to-air missiles.

Ground warfare, on the other hand, is characterized by a multitude of incalculable variables, such as the characteristics of the land cover and smoke on the battlefield, which would certainly give a World War II tank force a chance against a modern tank force. In the 1973 Yom Kippur War for example, the 9th Armored Brigade commanded by Col. Mordechai Ben Porat, with Sherman tanks, overcame a Syrian force armed with T-62 tanks in the battle of Khushniyah. In a similar fashion, in the breakthrough at the Quneitra salient, the 179th Armored Brigade under the command of Col. Ran Sarig, armed with the Shot Kal tank (an upgraded Centurion), suffered heavy losses from the Syrian defenses which were armed with dug-in T-34 tanks. There is no argument that in ground warfare technological superiority also has a significant influence. However, despite its influence, achieving victory is greatly more dependent on other elements including: the operational concept, combat organization and of course the quality of the fighters and their fighting spirit.

In aerial force design, however, technological superiority has decisive weight in forging the tipping point between quantity and quality. For aerial forces with a large number of low technology craft, there are no realistic operational options against a much smaller but technologically superior force. However, in ground forces force design this issues is several times more complex and is significantly different. I would argue that the difference is categorical in nature. For example, the difference between an equation with two unknowns and an equation with ten unknowns is not a categorical difference. However, the difference between balancing the equation between quantity and quality in an aerial
force and the same equation with ground forces is categorically different.

Evaluating the combat readiness of the fighter and his unit – A significant factor to be considered among the inputs to force design and maintenance, and combat readiness, is the second variable among the unique characteristics of force design for the ground forces. I dealt with this issue for many years, beginning in the 1990s when I served as head of the Combat Doctrine Department in Mahfash (the Field Forces Headquarters) under the command of Maj. Gen. Emanuel Sakel. Lt. Gen. Ehud Barak, then Chief of the General Staff, initiated a systematic process for managing the measurement of combat readiness for the ground forces, similar to that used by the Israel Air Force (IAF). Since then much work has been done on this issue. In recognizing the need for tools and processes to systematically measure the combat readiness of a military force, the ground forces also adopted the basic premise of the IAF’s force design concept. This premise states that the equation measuring required inputs for maintaining readiness given a set of expected outputs, necessarily determines the size of force needed. That is, a force that cannot be successfully kept in an adequate state of combat readiness, deserves to be disbanded. This premise is completely correct for an aerial force but is not binding on ground forces force design.

About a year ago, I participated in an exercise with a paratrooper unit that flew in a Sikorsky CH-53 on a dark night at low altitude. Most of the pilots that night were reservists. Of course

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4 It is worth noting that the Israel Air Force of this period (the Six Day War) worked in a different manner than is accepted today. At that time, some of the missions were completed by directly attacking ground targets using older aircraft (Dassault Ouragan, Mystère, Super Mystère). During the 1967 Six Day War, the IAF even used armed Fouga CM.170 Magister training aircraft for aerial attacks in Sinai and Jerusalem among others. Maj. Gen. Israel Tal told me that he had to answer to a bereaved mother whose son was killed during fighting in the security zone in Southern Lebanon while serving in an older Patton M series tank. She asked why he was sent to fight in a tank with relatively inferior armor. While answering he referred to the above example from the Six Day War.
their readiness had to be suitable to a challenge like this. The cost of an accident would be insufferable. However, an armored force in a nighttime maneuver exercise can develop expertise and readiness while exercising. The cost of a ground accident is far lower. Also during operations, even with the enemy present, the use of an armored battalion is based on the presumption that several tanks will fall into the ditch at the side of the road, perhaps two or three will collide with one another and several others will suffer from technical issues – it is sufficient that most of the tanks arrive at the destination.

On the basis of this difference, different standards are defined for the maintenance of each type of vehicle/aircraft. A technical issue for an armored vehicle or any ground vehicle does not have the same significance as a technical issue in an aircraft. Accordingly, in the air force systems are replaced on the basis of rigid maintenance instructions, with the intention of replacing parts before they fail, whereas the ground forces can employ breakdown maintenance, which is much cheaper of course. The ground forces are built on the basis of this conceptual difference, also with regard to the inputs needed for readiness, and regarding the required size of a force, on the basis of a need for redundancy. In simple terms: For a tank battalion to be able to fight after two-three days of combat with a force of 15-20 tanks, it is structured, using the redundancy principle, on a force of 36 tanks. This numerical redundancy, based on a combat readiness standard accepts imperfection, and which would seem to involve an acceptance of mediocrity, is actually the key to flexible and efficient ground forces operations. In numerous conversations that I held with the Head of the J5/Plans and Policies Directorate, who brought with him the organizational and operational logic of the air force, I struggled to explain the practical justification for ground forces planning on the basis of these different conceptual standards. For years, even ground forces personnel have adopted the air force’s standard of excellence and have neglected the possibility that they are devoted
to a concept which is not suited to a set of conditions and needs which are different in nature.

**Large Size as a Condition for Operational Flexibility for Ground Forces**

As noted above, the Chief of Staff’s document states that: “Mass together with flexibility is a way of dealing with uncertainty relating to future challenges on the battlefield.” Given my comments up to this point, I would argue that mass, in terms of quantity, is a necessary condition for operational flexibility on the ground. Mass and flexibility are connected to one another not just - as the document makes clear – due to the uncertainty that exists regarding future battlefields, but also with regard to current and familiar military challenges. Operational flexibility is the guiding framework for aerial forces and this is what makes the IAF a key factor in the IDF General Staff’s flexibility. This is how force was engaged in 1967 and 1973 when an optimal utilization allowed aircraft to strike in Syria in the Northern arena in the morning and a few hours later to be sent out on an additional sorties over Egypt.

As we know, the ground forces operate in this respect under different time and spatial constraints. The more reliable and capable an aircraft, and as the number of sorties it can fly in a day rises, so aerial forces efficiency and flexibility grows. Conversely, once ground forces are deployed in an arena, including the most advanced and sophisticated of armored forces, moving them to another arena requires a General Staff logistics operation of more than two days. Because of this, at the moment of truth, when operational flexibility is required, the center of gravity between quantity and quality is categorically different between an aerial force and a ground force. It is true that also in the ground forces, a Merkava 4 tank has completely different performance characteristics from a mediocre main battle tank of the 1970s, but this progress, on its own, does not have a dramatic impact on our capability to cope with fewer vehicles. To put it differently: A family in Ra’anana has two working parents and two sons studying at
university with all the family members needing to travel to their work and studies every day. What will give the family the greatest flexibility and independent and efficient mobility, one luxury car or four older vehicles?

Similarly, the operational mobility concept of an armored force which needs to move autonomously across the front, even over distances of several hundred kilometers without depending on transport by tank carriers, is based on the above conclusion. In maneuver of this type some of the vehicles will no doubt become stuck by the wayside, but this is OK, as the main point is for enough vehicles to make it to the deployment zone ready for battle. The vehicles that were bogged down will be repaired and in the future will join up with the initial force as reinforcements. In short, for the ground forces, force design and employment require redundancy and size, even if of an ordinary standard, as the basis for operational flexibility.

Image 1: The Magach 7G – the Israeli version of the M60A1 Tank

5 Source Wikicommons, 20 July 2010
The Combination and Balance in the Ground Forces between Elite Strike Forces and Ordinary Large Size Mass

Given the sweeping adoption of aerial management norms as the standard for organizational and operational excellence, the discourse that I am proposing is likely to be interpreted as a recommendation to accept what Prime Minister Yitzhak Rabin called the “Everything will be fine” culture, during his famous speech to the IDF Staff and Command College - "Don’t worry!"

I am not preaching in favor of negligent mediocrity. I am basing myself on the understanding that excellence is context dependent: There is more than one measure of excellence and therefore the formula for excellence in one field of activity could cause damage in another, if not adopted in a critical manner. For our purposes, one has to adapt and change the basic measures to suit the combat readiness of the ground forces.

Since the days of the Six Day War, the IDF’s concept of force engagement has demanded almost immediate availability and combat readiness of the IAF. Since the outbreak of the 1967-1970 War of Attrition in the Jordan Valley, Golan and Suez Canal areas, ground forces have also been deployed on the front lines on high alert. The surprise of the Yom Kippur War intensified this demand regarding the ground forces. Reservists in the ground forces were also required to maintain immediate availability with regard to their readiness to be called up and the combat readiness of their equipment, armored vehicles and ammunition. The cost of this approach has forced the IDF in recent decades to significantly reduce its order of battle for the ground forces, in particular for reserve units.

In light of significant changes which have taken place around us, including the civil war in Syria and the collapse of the Syrian army, there are those that argue that we face an opportunity to further reduce the IDF’s order of battle, in particular in the ground forces. However, to my understanding, the changes taking place

https://commons.wikimedia.org/wiki/Image:Magach-7c_055.JPG?uselang=he
with regard to the phenomenon of war, in its operational sense, are not the only factors preventing an additional reduction in the size of the forces, but rather there is actually an increased need for engaging large-scale mass.

We have already see that the theater in which war is fought is increasingly being transferred to the urban arena. Civilians are actively and passively now in the eye of the storm. Consequently, even in Paris there is currently an open and concealed presence of approximately 20,000 soldiers and policemen. During the 1956 Sinai Operation, a relatively small force (the 37th Armored Battalion, followed by the 11th Infantry Brigade led by Irwin Doron) which was ably led by a company staff under the command of Lieutenant Jacky Even (later Major General) captured the entire Gaza Strip on its own, leading to the surrender of the Egyptian commander of the strip to the Head of Southern Command, Maj. Gen. Simhoni. The Egyptian soldiers who defended the strip were not locals and the local residents were largely unarmed and certainly not organized for combat. It goes without saying that today an operation to capture and purge the strip would require a force that is many times larger.

In light of new challenges which include the challenge of defending the communities next to the frontlines, in Gaza and the northern theater, the IDF in my estimation will need to return to a method of operations and organization of the ground forces using the approach taken during the War of Independence, which was also the approach of the biblical Gideon: Elite strike forces on high alert supported by broad mass at an ordinary level of combat readiness and preparedness. The division of responsibility will be as needed. On the basis of this idea, the combat readiness and preparedness of the ground forces will be tiered based on three types of forces:

1. Regular army elite strike forces with a high level of combat readiness whose standard inputs for training and maintenance aspire to the standards of the IAF.
2. Elite reserve brigades to complement the strike force at the levels of combat readiness and preparedness that we are familiar with today.

3. A reservist order of battle which is only partly combat ready, with ordinary weapons and with lower inputs for maintaining combat readiness and preparedness, but with a planning commitment to achieve operational availability, after organization and training, in a period of at least a week after call up.

In fact, the IDF has been structured this way for years. However, in light of the aspirations of our forces to reach a uniform standard of excellence in training and equipment, the IDF’s commanders have had difficulty implementing this approach in a way that satisfies the reservists. This is of course a question of leadership, but it needs to be accompanied by a coherent concept. It was my practice to explain to commanders and soldiers that when I participated in triathlon competitions, I made do with a 500 shekel (~USD $125) bicycle. In any case, even if I was equipped with an expensive and fancy bicycle, I wouldn’t be among the first fifty finishers. War is a macro-national event. As with an urban marathon, the tens of thousands of participants who achieve ordinary results have a significant role to play in creating the atmosphere. Given the challenge of defending communities on the conflict lines, for example the communities around the Gaza Strip facing the tunnel threat, a scenario could occur requiring a response to several concurrent infiltrations. In that case, the territorial brigades would need a mobile armored force, and for this mission somewhat older tanks would be perfectly suitable. Using these older tanks for such a mission releases the first line tanks for an offensive concentration of force.

**Strike Force Missions**

Since the First Intifada and during the years of the IDF presence in Lebanon, military commentators argued that these missions diverted the maneuver strike forces from their primary
purpose of leading an offensive during wartime. Military correspondent Alon Ben David recently made this argument again: “As in previous conflicts, and also in the future it will be the regular army that is sent to achieve a decisive defeat of the enemy. But the regular army is worn down from policing missions in the territories and guarding the borders, instead of training to be a force that knows how to quickly maneuver and to win.”⁶

A professional comparative analysis, with the British army as an example, presents a completely different perspective on this issue. During all the years of fighting terror in Belfast, the British perceived the practical experience, including friction in “police missions” to be an opportunity to develop fighting strength, command values and control of the lower ranks. While it is true that in the transition to other combat arenas, adoptions are required, but the British paratroopers in the Falklands did not have a hard time doing so. In fact the exact opposite.

Conversely, we can see the difficulties that the Egyptian army has revealed in adapting to the fight against jihadist organizations in Sinai. From my perspective, since 1973 the Egyptian army was not involved in any real conflict and in the subsequent years it was not forced to engage in a transformation which would equip it to deal with new forms of war. Professionally, the IDF owes its operational relevance to the transformation which was forced on it during the 18 years of conflict in Lebanon and the tests of conflict in the Palestinian arena.

In this regard, a strike force is not the only force which will have to face current operational tests, rather the strike force is there to lead, as they did during the 2002 Operation Defensive Shield, in the development and adaptation of changing combat

⁶ Alon Ben David. (21 November 2015). “Eizenkot’s trap: Assessed all the trees, avoided looking at the forest as a whole,” Ma’ariv (Hebrew). It is also recommended to read Meir Finkel’s chapter on the impact of routine operations on the war machine in which he argues that the influence of routine operations is negative. See Meir Finkel (2013). “Challenges and Tensions in Force design Processes.” Ma’arachot Publishing, pp. 77-117. (Hebrew)
methods in order to hand them down to the mass forces. The foundation of the IDF’s force employment concept is based on a maximization of strength, even in a limited conflict which seems to yoke the army to police missions. This is done to avoid being caught in a situation where we saved the strike force for a ‘real war’ but in the meantime we did not achieve the necessary accomplishments in the current conflict. In addition, we need to apply our full focus on the necessity of positioning the backbone of the junior command and young combatants in such a way that they face the test of real conflict. During combat they can forge their fighting spirit and will encounter a genuine test in the face of the enemy.

**Territorial Defensive Forces – The Armed Nation**

Given the changes in the nature of war, the fabric of civilian life is slowly becoming a part of the combat arena during routine operations and in war. More than once, an efficient, immediate and timely response to a terrorist attack made the difference between a tactical incident and one with strategic-political significance.

The question is: What is the IDF’s responsibility to arm and train civilians, especially in frontier areas. I discussed this issue in Chapter 10 of my book “What is National in National Security?”.

In his book, “In the Loop of Security Problems,” Israel Beer explains the necessity of the territorial defense role:

> Some believe that this part of our defense system is nothing but the fruit of the conditions that existed before the creation of the State, and therefore they should be seen as a passing phenomenon, whose time has passed. However, an analysis of this type is misconceived. The principles upon which territorial defense are based, are the organization of the population into militias in order to confront those that would attack their homes and workplaces. Indeed, the integration of economic

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development and military defense cells, these principles served as a guide to the defense forces of many nations...The benefits of this military framework exist to this day: Economizing on forces on the one hand, and moral considerations which enhance the national ability to withstand adversity.\(^8\)

In simple practical logic, territorial defense is needed in the same way that every house should conduct basic preparation for an emergency situation. This basic readiness releases the organized national forces to focus on their primary efforts. This principle is correct also for mass casualty natural disasters.

This issue touches at the heart of the system of attachments needed for the existence of a democratic state with a liberal orientation. However, the changing face of war enables this issue to be reevaluated. In addition, there is the discontent that accompanies the struggle of thousands of reservists who are demanding to continue serving in their reserve units in the face of threats to remove them from their reserve brigades due to cost cutting. These reservist organizations within an expanded territorial defense system would need minimal inputs in the form of training and weapons. In the emerging reality, this system helps the primary forces focus on their primary missions and, in my worldview, it would help national unity, in peace and in wartime.

**Conclusion**

As is written in the section of the IDF Strategy document that I quoted at the beginning of the article, the IDF needs flexibility that is also dependent on critical mass. The flexibility and operational availability of the IDF, principally the ground forces, is now dependent on a set of requirements which are more demanding than those with which were familiar over the past two decades. Since the Yom Kippur War, the IDF has been active in only

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\(^8\) Israel Beer, *In the Loop of Security Problems*, Am Oved, Sifri’a La’am, 1957, pp. 241-2. (Hebrew)
one arena at a time and has therefore been able to concentrate most of its ground, air and naval forces. In this new period, with developing threats to the Israeli home front from Hezbollah in the north and Hamas in the south, the chances that the IDF will need engage in an offensive on two simultaneous fronts are growing. The focusing of combat on built-up and protected areas including underground fortified formations demands a large and skilled order of battle whose size is greater than we have been familiar with in the past. Responding to this challenge is dependent, as I argued above, on the need to shape a new equilibrium point between a superior elite strike force and mass forces at a middling skill level, which in many frameworks is needed more and more.
About the Authors

- **Col. Alon Paz** joined the IDF in 1995 after completing a B.A. in Middle Eastern Studies and Arabic. He served in the IDF Strategic Planning Department from 1999 in a range of roles. In 2014 Col. Paz spent time as a senior research fellow at the Washington Institute. Since 2015 he has served as a department head in the Strategic Planning Division. He holds a master’s degree in security studies from Tel Aviv University.

- **Lt. Col. Ori** holds an undergraduate degree in electronic engineering and a master’s degree in bio-medical engineering from Tel Aviv University. Over the years he has served in a variety of research and development roles in a technological unit in the Intelligence Directorate, and in his last role there he served as the CTO of the unit. He currently serves in the Coding and Security Center where he leads research and development projects in the cyber defense field and innovation programs across the Lotem Division.

- **Ms. Carmel Or** is a student in the Strategy and Decision Making Honors track at the Lauder School of Government and Diplomacy at the Inter Disciplinary Center, Herzliya. Ms. Or served in the Israel Air Force (IAF) and currently works as a project manager in the Intelligence Directorate.

- **Col. Asaf** joined the IDF in 1988 as a part of the Talpiot program and served in a wide range of intelligence, operations research and systemic planning roles in the Israel Air Force (IAF). In 2012 he was appointed as the Head of the Intelligence Research Department in the IAF, and since 2015 he has served as the Deputy Head of the IDF Research Division in the Intelligence Directorate. He has an MBA and PHD in Philosophy from Tel Aviv University.
• **Lt. Col. (res.) Dr. Haim Assa** served as National Security Advisor to Prime Minister Yitzhak Rabin between 1992 and 1995. He has degrees in mathematics and operations research. He now develops strategic-military concepts and technological systems and is currently the head of the Simulation lab Simlab at the Yuval Neeman Workshop for Science, Technology and Defense, Tel Aviv University. Together with Maj. Gen. (res.) Yedidya Ya’ari, in 2005 he wrote the book *Diffused Warfare: The Concept of Virtual Mass* (Yediot Ahronot) which was translated into English in 2007 (University of Haifa).

• **Maj. Gen. (res.) Gershon HaCohen** joined the IDF in 1973 and served in a range of roles in the Armored Corps. In 1997 he was appointed as the Commander of 319th Armor Division and from 2000 served as the Head of the Doctrine and Training Division. In 2003 he was appointed as the Commander of the 36th Division. In April 2006 he was promoted to Major General and served as the Commander of the IDF Military Colleges and (from 2012) Commander of the Northern Corps until his retirement from the IDF in 2014. He has a master’s degree in philosophy and comparative literature from the Hebrew University.
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