Aerospace & Defense

Journal of the Elrom Center for Air and Space Studies at Tel Aviv University

No. 2(2) | December 2025

ELROM CENTER FOR AIR AND SPACE STUDIES
TEL AVIV UNIVERSITY

Aerospace & Defense

Journal of the Elrom Center for Air and Space Studies at Tel Aviv University

No. 2(2) | December 2025

Aerospace & Defense is a multidisciplinary academic journal published by the Elrom Center for Air and Space Policy and Strategy Research at Tel Aviv University. The journal serves as an exclusive platform for scholarly discourse on critical issues pertaining to air, space, and security. It actively promotes the dissemination of research articles that offer rigorous, critical, and innovative analytical perspectives. Our mission is to foster a comprehensive understanding of these domains, particularly in the context of contemporary advancements in technology, strategic frameworks, geopolitical dynamics, military operations, and policy development.

ELROM CENTER FOR AIR AND SPACE STUDIES
TEL AVIV UNIVERSITY

Elrom Center for Air and Space Studies
Tel Aviv University

ISSN: 3080-020X

Graphic Design: Michal Semo Kovetz,
TAU's Graphic Design Studio

Table of Contents

Aerospace & Defense
Journal of the Elrom Center for Air and Space Studies at Tel Aviv University
No. 2(2) | December 2025

Editorial Note

Approximately two years and two months have passed since the outbreak of the Swords of Iron War. The strategic and operational challenges of the current era, alongside preparations for further rounds of escalation, have placed the security of the aerial dimension at the center of security and research discourse. Against this backdrop, learning from the war continues to occupy a central place in the four articles of the current issue of *Aerospace & Defense*. These articles present various theoretical, methodological, and practical aspects of air security, offering a rich and evidence-based discussion for understanding this evolving dimension.

The opening article by **Eviatar Matania** proposes a new methodology for learning from the October 7th scenario to crisis-surprise scenarios in general, utilizing a topology of scenario space deployment. Preparedness for these scenarios, or combinations thereof, will enable the Air Force to function semi-automatically during a fundamental surprise, minimize the enemy's achievements in the first hours of a fundamental surprise attack, and reduce the current reliance on early warning.

Following this, **Assaf Heller** discusses aerial support for ground forces during the two major surprise attacks on Israel. He points to an ongoing conceptual failure rooted in reliance on ad-hoc requirements rather than joint and coordinated force design. He suggests reviving an approach prevalent in the 1980-90s that would assist in the proper direction of force design and promote a mutual understanding based on the needs of ground forces.

Next, **Alex Dan** examines the theory of Ambidextrous Leadership in military aviation. Through a comparative analysis of the Yom Kippur War and the October 7th attack, he demonstrates how an imbalance between *exploitation* and *exploration* led to failures in the initial response and offers a framework for improving the organizational and leadership readiness of the Air Force.

Finally, **Sarah Fainberg, Yuval Peleg, and Tomer Fadlon** broaden the perspective beyond Israel, comparing its coping mechanisms with ongoing aerial threats to those of Ukraine. They propose a three-layered framework of offensive, active, and passive defense, showing that national and social resilience is built from cohesion and the interplay between these layers, which allow a state to function relatively normally even in prolonged emergency situations.

We wish to thank everyone who took part in the production of this issue, and especially the peer reviewers for their important contribution to the enhancement of the articles.

Sincerely,

Eviatar Matania, Editor-in-Chief
Nir Hassid, Editor

Aerospace & Defense
Journal of the Elrom Center for Air and Space Studies at Tel Aviv University
No. 2(2) | December 2025

October 7th – Learning Beyond Debriefing: A Topological Framework for Laying Out Crisis-Inducing Surprise Scenarios for the Israeli Air Force

Eviatar Matania[1]

Abstract

The purpose of this article is to lay the groundwork for learning from the October 7th scenario for future, unknown scenarios that may differ in their manifestation yet share the core element of a surprise attack that prevents the Air Force from realizing its full potential for at least several hours—a situation this article defines as a *Crisis-Inducing Surprise*. To this end, a unique methodology has been developed to move from the particular—the specific incursion that occurred on October 7th—to the general: surprise attack scenarios accompanied by an operational crisis for the Air Force lasting at least several hours. This is achieved through a topology that maps the space of crisis-inducing surprise scenarios along two axes, following the rationale of "from where and to where": the dimension in which a surprise incursion might occur and the primary target of the attack. The article clarifies how this topology is both suitable and complete for a learning process and demonstrates its application. It subsequently proposes the following: (1) Utilizing the proposed topology for force-design and preparedness for nine extreme scenarios, according to the rubrics of the mapped space, will enable the Air Force to be ready for nearly any combination thereof, allowing it to function semi-automatically in the initial

[1] **Eviatar Matania** is a Full Professor at the School of Political Science, Government and International Affairs at Tel Aviv University, where he serves as the Head of the M.A. programs in Security Studies and in Cyber, Politics and Government; Head of the Elrom Center for Air snd Space Studies; and Editor-in-Chief of the Center's journal, *Aerospace & Defense*.

To cite this article: Matania, E. (2025). October 7th – Learning Beyond Debriefing: A Topological Framework for Laying Out Crisis-Inducing Surprise Scenarios for the Israeli Air Force. *Aerospace & Defense*, 2(2), 5-22. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

hours of a surprise attack and thereby significantly mitigating the crisis during a future fundamental surprise. (2) In order to avoid irreversible damage during a surprise attack stemming from a situational surprise, the Air Force must forgo its reliance on early warning for the protection of itself, its capabilities, and its assets.

Keywords: Israeli Air Force, October 7th, Surprise Attack, Fundamental Surprise, Situational Surprise, Crisis, Scenario Space.

Introduction

It is indisputable that on the Black Sabbath of October 7, 2023, the Israeli Air Force failed to realize its might and to thwart, or at least significantly curtail, Hamas's surprise attack and its invasion of Israel's western Negev. This failure is particularly conspicuous in light of the Air Force's subsequent operations in Lebanon against Hezbollah, especially during September and October 2024, as well as its exceptional performance in June 2025 during the attack on Iran.

According to the Air Force's debriefing,[2] the morning of October 7th began with a complete surprise. In the initial stages of the events, the Air Force was still operating under the assumption that these were isolated terrorist incidents rather than a full-scale invasion. Consequently, soldiers and crews were sent to shelters during "Code Red" alerts, and only later did the bases transition to an absorptive (wartime) posture. Shortly after 07:00 a.m., the Commander of the Air Force declared a state of war, yet the Air Force was still far from being effective on the ground. The first UAV strike was carried out at only 07:15, and the first combat strike occurred around 08:00 a.m.

This was due to several reasons: at this stage, the IAF commander had very few aerial forces at his disposal; the lack of both an intelligence picture and a situational picture meant that the Air Force command had not yet grasped the scale of the raid or what exactly was happening on the ground and where; and the

2 Several caveats are in order. First, as of this writing, neither the Air Force debriefing nor any part of it has been made public. The analysis here is based exclusively on what has been reported about the debriefing, which has been nearly identical and repetitive across various Israeli media outlets. Second, it is unclear whether the Air Force debriefing truly addresses all the root causes of the failure. Criticisms regarding omissions—whether because insufficient time has passed to investigate the issues without the emotional proximity to the events themselves, or for other reasons related to the nature of the debriefing, such as its conductors or timing—have yet to be definitively clarified. These criticisms include claims of irrelevant attacks, overly centralized command, and delays in the arrival of reserve personnel. Nevertheless, the author posits that for the purposes of this article—which focuses on learning from the events of October 7th rather than on the specific debriefing itself—the core failure, as reflected in published reports, is rooted in a crisis of preparedness and function in the face of a surprise attack that constituted a fundamental surprise.

absence of effective guidance from ground forces, primarily because they were engaged in a difficult absorptive combat posture following the overwhelming of the IDF Gaza Division, and because they too had not yet constructed a complete situational picture. According to the IAF commander, as cited in sources quoting the debriefing and its summary, even if more forces had been available to him at that point, the Air Force would not have been able to stop the invasion but perhaps only mitigate its damage (which is also not insignificant): "Whatever we would have done, without intelligence and prior preparation, we could not have prevented the disaster, only reduced the damage," he said.

At 09:30, the IAF commander gave an order to "iron" the border fence area—meaning to bomb everything within a one-kilometer range on both sides of it—apparently understanding that this was the most effective measure at the time to block additional Hamas forces or to prevent their safe return to Gaza. However, at this stage, apparently by order of the high command, the force's aircraft were still focused on bombing targets inside Gaza, which were far less relevant at that time. Furthermore, the IAF commander ordered the decentralization of control (direct communication between Air Force assets and those who could operate them on the ground) and more permissive rules of engagement. All these actions, it seems in retrospect, were indeed somewhat effective, but they were insufficient to stop the invasion itself and the ensuing disaster. Nor did they prevent Hamas from continuing its actions and the massacre, from sending additional waves of terrorists and civilians into Israeli territory and communities, and from returning to Gaza with hostages throughout most of October 7th (Bohbot, 2025; Maniv, 2025; Nissani, 2024; Sadan, 2025; Shapira, N., 2025; Shoval, 2024; Zitun, 2025). In other words, the Air Force was not truly present and effective for most of October 7th and was far from realizing its full power.

The Air Force has already begun to learn the lessons of the failure. For example, the Participation and Helicopters Group was upgraded to the Participation and Borders Group, which will be responsible for preparing the Air Force for future ground invasions, including offensive action within Israeli territories (Ashkenazi, 2025a; Ganor, 2025). The Air Force is also working to expand and renew its fleet of attack helicopters, procure reconnaissance and defense aircraft (Ashkenazi, 2024), and upgrade the defense of its bases against the threat of a ground breach or conquest, which nearly materialized on October 7th (Ashkenazi, 2025b). Additional lessons from this failure to inform future engagement have also been proposed by other actors. These include, for instance, addressing the infiltration of powered paragliders, which the Air Force was

unable to effectively counter on October 7th,[3] and which in the future could cause significant damage across a wide range of scenarios, such as blocking intersections, halting reinforcement forces, or infiltrating bases (Langer, 2024); increasing the Air Force's effectiveness in dealing with a future large-scale (particularly mass) ground invasion by changing its force design, structuring it to meet ground support needs based on the new Group (Heller, 2025); or implementing structural changes that would allow the Air Force to operate almost independently for the containment effort, "a shift from a reactive border defense doctrine... to a proactive one...," based on air power and distinguishing between routine security operations and military attacks (Dan, 2025a).

The debriefings and their subsequent processes, aimed at analyzing the specific failure of October 7th to build better preparedness for a future similar invasion of the country's borders, represent a classic investigative process for failures, errors, and near-misses within the context of a single scenario, which must be studied repeatedly in the pursuit of operational excellence. However, addressing the issue of ground invasion alone is too narrow and does not constitute the complete and comprehensive learning process that should accompany the events of October 7th, which is the aim of this paper.

The purpose of this paper, therefore, is to lay the foundations for a comprehensive and rigorous learning process regarding potential surprise attack scenarios, with a focus on the Air Force, in the spirit of "let's prepare for the next war, not just the last one." The goal is to learn from the October 7th scenario, not only about similar cases of a ground invasion, but also about those that may be fundamentally different in their manifestation yet share the core element of a surprise attack that prevents the Air Force from realizing its power for several hours, during which the surprising side succeeds in inflicting significant damage on Israel (whether on its civilians or its military). This is analogous to what Hamas did during the initial hours of October 7th, when it overwhelmed the IDF Gaza Division, conquered parts of Israel's Western Negev, and murdered and abducted civilians and soldiers. Additionally, beyond establishing a rigorous process for the layout of surprise attack scenarios the Air Force must prepare for, the paper proposes two important conclusions stemming from the analysis of the learning space.

The paper focuses solely on the events of October 7th and not on the Air Force's performance in the days, months, and years that followed, in the Gaza arena or elsewhere. Furthermore, it does not aim to address the overall resilience of the Air Force or its ability to maintain functional continuity over time. This

3 On October 7th, the use of powered paragliders and their impact on the overall picture of the invasion were minor.

paper proposes a learning process designed to improve readiness for the critical initial hours of crisis-inducing surprise situations. Such scenarios involve (1) a surprise element, (2) significant harm to the state or its military (including the Air Force), and (3) take place within a short timeframe. These fundamental elements are similar to those of October 7th attack, and to some extent also to those of October 6th 1973.

The article's focus on the brief timeframe, from hours to a day, stems from the fact that during the initial hours of a surprise attack, the attacked party—in this case, Israel—is at its most vulnerable. It is during this period that the enemy seeks to maximize the advantages afforded by the element of surprise. The enemy's objective is to secure gains that would be unattainable without the element of surprise, and which could potentially be sustained over time, at least in part. This timeframe is particularly relevant for the Air Force, whose very nature—along with its planning, force design, budgeting, training, alert schedules, and force accumulation—allows it to transition from routine to an emergency posture in a relatively short period compared to other forces, provided it is not significantly damaged in the surprise attack. This transition period is on the order of hours to a day. In other words, this is the estimated timeframe after which the Air Force, assuming no hindering factors in its organization, can be prepared for an emergency posture of operational continuity under attrition.

It should also be noted that the term "crisis" implies the Air Force is operating in a crisis environment; that is, it is not at full capacity but only partially functional due to the surprise. This may be for a variety of potential reasons. These include not yet having fully mobilized its forces, a lack of situational awareness or intelligence, significant damage to its capabilities, or the cognitive state of the command and personnel for various reasons, as well as a combination of these factors.

This paper's importance stems from several factors. First, focusing on ground-based surprise attack scenarios akin to October 7th, however important, overlooks the opportunity for a deeper understanding of the factors that led to the failure and their potential implications in a broader context. This approach is particularly crucial for learning how to prepare for various types of crisis-inducing surprise attacks. Second, some scenarios within the proposed topology indicate the potential for significant damage to the Air Force itself. Such damage could prevent it from subsequently leveraging its full power to meet the comprehensive needs of the state and the military. This contrasts with the October 7th scenario, in which the Air Force itself remained almost entirely unscathed. Furthermore, some of these scenarios suggest a more comprehensive threat to the entire nation, one exceeding that of October 7th. As a strategic component of Israel's

national security, the Air Force must diligently learn from and prepare for such scenarios—perhaps even more so than for those resembling the October 7th attack. Finally, the force buildup and readiness required for some of these scenarios differ from those focused on an invasion modeled after October 7th. In an environment of scarce resources where prioritization is essential, it is prudent to consider all these scenarios before making decisions regarding the direction of force buildup.

Consequently, the proposed learning process seeks to establish a comprehensive intellectual framework for a mindset that prepares not for the ”war that was,” or a similar one, but rather for the one that may come in a multitude of forms—and to do so in a systematic, methodological fashion.

Methodology

This paper does not simply present another set of possible surprise attack scenarios. Such scenarios are numerous, and the imagination can conjure up an endless array of them. Doing so, however, can lead to an overwhelming number of possibilities that are impossible to fully accommodate or prepare for, or, conversely, to the omission of plausible ones. Instead, the paper proposes a structured methodology for moving from the specific to the general. The specific is the particular invasion scenario that occurred on October 7th; the general comprises surprise attack scenarios accompanied by an operational crisis within the Air Force lasting for at least several hours. We will term these scenarios *Crisis-Inducing Surprise*.

The methodology of this paper consists of three consecutive steps. First, the paper focuses the learning process and defines a ”Crisis-Inducing Surprise”, thereby specifying the intended learning process and its scenarios of interest. The second step involves mapping the general space of possible Crisis-Inducing Surprise scenarios by expanding from the specific to the general, using a topology of two axes: The first is the axis of the dimension in which a surprise invasion might occur (its origin)—air, ground, or another dimension. The second is the axis of the target (its objective)—whether the attack focuses on the Air Force, a specific region or sector of the country, or the nation as a whole. Together, they map out a complete space from the perspective of the Air Force, which is therefore the primary subject within this space. The rationale for choosing this particular topology and the degree to which it is comprehensive and represents the required lessons will be presented later. The third step points to two initial conclusions derived from analyzing the space mapped by the chosen topology.

Crisis-Inducing Surprise – Definition

The article focuses on the key factors that run as a common thread through all attempts to explain the Air Force's failure on October 7th—surprise, intelligence, and operational readiness, and the connection between them—as the Commander of the Air Force himself linked them: "Whatever we would have done, without intelligence and prior deployment, we could not have prevented the disaster, only reduced the damage" (Shapira, N., 2025). There is no particular novelty in any of these factors, whether in the general context of surprises or in the specific context of October 7th. However, sharpening and emphasizing these factors is crucial as a foundation for the learning process, as we must connect them to successfully transition from the unique, specific case of October 7th, to the general case.

Accordingly, the article defines a *Crisis-Inducing Surprise* as one of two possibilities: (1) A fundamental surprise, due to which the Air Force is entirely unprepared for the surprise scenario, or (2) a situational surprise, due to which the Air Force does not arrive ready for the event despite its principled readiness for the surprise scenario.[4]

A *Fundamental Surprise* is one that undermines the surprised party's perception of reality and basic assumptions (Lanir, 1983), similar to what Taleb termed a "Black Swan", meaning a phenomenon that does not exist on the spectrum of expected threats as perceived by the surprised party (Taleb, 2009).[5] In the case at hand, the fundamental surprise was Hamas's very *ability* to execute an invasion on the scale it did, according to an orderly plan it had labored over for years, which was contrary to the prevailing perception of reality within the Israeli defense establishment regarding its capabilities (Shapira, I., 2025); as well as the very *decision* to execute this invasion contrary to the (erroneous) Israeli perception of reality that Hamas had been deterred (Lupovici, 2024; Shapira, I., 2025). When the surprise is fundamental, one must assume that the operational readiness for it will also be deficient because according to the surprised party's perception of reality, the event is not supposed to occur. Furthermore, the shock from the very occurrence of an event not on the spectrum of expected events is great and creates a non-trivial crisis for the surprised

4 It should be noted that to avoid this article becoming a theoretical treatise or a review on the subject of surprise, and on the assumption that the intuitive definition of surprise is clear to the readership, the article will confine itself hereafter to a very brief explanation of fundamental versus situational surprise alone. This distinction is essential for defining a "crisis-inducing surprise" and for the subsequent analysis.

5 In his book, "The Black Swan", Taleb coined this term to denote an event perceived as impossible or having a minimal probability of occurrence, yet which, should it transpire, has a profound impact on history. See:, Taleb, N. (2007), "The Black Swan: The Impact of the Highly Improbable".

party due to the collapse of basic assumptions regarding the state of the world. Correspondingly, the recovery time from such a surprise depends heavily not only on the extent of the damage experienced by the surprised party and its ability to organize in response, but also, and even more so, on the ability to recover from the crisis itself generated by an event that "was not supposed to happen as it did"—both in the pure aspect of preparedness and in the human aspect—i.e., the ability of people to change their perception of reality quickly, to improvise, to be creative, and to act according to the new situation (Dan, 2025b; Razi and Yehezkeally, 2013).

A *Situational Surprise* is a surprise that does not undermine basic assumptions but rather a specific intelligence picture at that time. For example, had the IDF, and the Air Force within it, been prepared for the possibility of a Hamas invasion on the scale that actually occurred—but were surprised regarding the timing—we would say this is merely a situational surprise, one that is easier to cope with after it has happened, rather than a fundamental surprise that undermines all basic assumptions (Lanir, 1983; Shapira, I., 2025). When the surprise is situational—meaning the surprise is not regarding the very existence of the scenario but regarding its timing, scope, or another aspect of it—then the Air Force's response capability depends on its alert level: to what extent it relies on precise early warning regarding the event and its nature, or alternatively, to what extent it maintains a high threshold of readiness even in the absence of early warning of an attack. In such a case, one should expect the Air Force's recovery speed to be greater than in the case of a fundamental surprise.

In both cases, it is important to note that the Air Force's ability to overcome the crisis and the time required to do so are contingent upon the intensity of the damage it and its forces sustain. The greater the damage to the Air Force itself, the longer the recovery time will be, depending on the severity of the impact. Conversely, the more a surprise scenario is primarily directed at other elements (as was the case on October 7th), the more quickly the Air Force is likely to be brought to bear. This critical point is well understood by the nation's adversaries, who recognize the Air Force as a linchpin of the operational capabilities of both the IDF and the State of Israel, crucial for both the speed and subsequent power of its response. Consequently, it is reasonable to assume that in any future surprise attack, the Air Force itself will constitute a primary target. This aspect also influences the chosen topology, in which the Air Force is the initial target on the relevant axis, as will be presented below.

A Topology for Mapping the Space of Crisis-Inducing Surprise Scenarios for the Air Force

The proposed topology for expanding the October 7th surprise scenario is mapped across a space created by two axes. This framework enables a broader learning process from the October 7th failure, specifically from the perspective of the Air Force: where the surprise attack originates (in terms of dimension, not its source) and where it is directed (the primary target of the attack).

The horizontal axis represents *the target of the attack* (who and what is the primary victim). This axis begins with crisis-inducing surprise scenarios aimed at and damaging the Air Force itself, primarily because the focus of the article, as stated, is on the Air Force, which must specifically address the potential for damage to itself and its ability to fulfill its role in any configuration or scenario. Furthermore, as previously noted, the Air Force's role within the IDF's capabilities—encompassing its rapid mobilization in response to an attack, its contribution to ground combat, and its power and strategic importance as a firepower arm and the leader of deep-strike operations—collectively render it a central target in any attack on Israel. This is especially true in a surprise attack, when its readiness to absorb damage is at its lowest. The axis continues to scenarios involving partial damage to the state—affecting a specific region or sector (with the October 7th failure serving as a representative example of regional damage). Such a scenario could, of course, also include damage to the Air Force itself (which did not occur to a significant degree on October 7th). The axis culminates in a crisis-inducing surprise scenario involving widespread damage to the country or an all-out war.

The vertical axis represents *the domains in which the surprise occurs*. The first is the aerial domain alone, which is under the full responsibility of the Air Force. This is followed by the ground domain, being the primary domain for capturing territory in a war threatening the state's sovereignty and survival. Finally, there is a crisis-inducing surprise scenario unfolding across several domains simultaneously (e.g., land and cyber, air and cyber, sea and land). On October 7th, for all intents and purposes, although there were also minor incursions by air (powered paragliders) and by sea (several rubber boats, some of which successfully landed on the coast), the invasion was overwhelmingly terrestrial in its scope and essence. The use of other domains was intended to facilitate a rapid arrival on the ground, rather than to conduct warfare within those other domains. Accordingly, the following matrix maps the crisis-inducing surprise scenarios along the two aforementioned axes. The table provides examples of a possible scenario for each category.

Table: Mapping of Crisis-Inducing Surprise Scenarios on Two Axes.
Horizontal axis of the target of the attack (where the attack is aimed) and a vertical axis of the medium in which the attack occurs (where the attack comes from). Inside the table are examples of a possible scenario within each of the categories.

		The target of the attack – where the attack is aimed		
		Air Force Operations & Assets	Geographic Region or Specific Sector	Widespread & significant damage to the State
The domain in which the attack occurs	Multiple	A cyberattack on all IAF command and control systems, combined with an attack on facilities and aircraft using UAVs, drones, and commando units	An aerial and naval attack on central Israel, accompanied by a nationwide cyber attack	Full-scale invasion by a foreign army, coordinated with additional attacks on two more fronts, along with internal uprising by terrorist and criminal organizations
	Land	A ground invasion accompanied by incursions into Air Force bases and air defense and control installations	The Hamas invasion of the Western Negev on October 7th	Ground invasion by Hezbollah and militias from Jordan and/or Syria, combined with domestic terrorist elements
	Air	A comprehensive attack on all IAF bases using missiles, UAVs, and drones	A massive-scale attack with UAVs and missiles on all IDF bases in the north and on air defense units	A comprehensive, high-volume attack with missiles, rockets, and UAVs on ~100 critical infrastructure sites and urban centers

This layout allows for a broad perspective on crisis-inducing surprises, with a focus on the Air Force's preparedness. The central box—a ground attack in a specific region of the country—represents the October 7th invasion. The other boxes represent many other potential crisis scenarios. For example, in the top-left box, which represents an attack on the Air Force exclusively across several domains, possible scenarios, or a combination thereof, include the following: disabling the Air Force's command and control systems via cyberattack; a ground invasion by elite forces from Hamas, Hezbollah, or another organization, supported by drones, to damage and paralyze Air Force bases; an infiltration into an Air Force base, disguised as an incited mob approaching and breaching the gate, followed by the paralysis of the base by terror cells or damage to aircraft; and, of course, a large-scale precision missile attack.

Two aids that can be utilized for a realistic layout of this space, though one must be careful not to let them dominate the thinking process, are intelligence on specific plans and intelligence on capabilities (irrespective of any plans). However, it is clear that such intelligence will not necessarily be available for every category. Such was the case, for instance, regarding a comprehensive invasion scenario involving Hamas from Gaza and Hezbollah from the north, possibly assisted by forces from Judea and Samaria and from within Israel itself. It is now known that Hamas and its partners contemplated such a scenario, which was ultimately not realized on October 7th due to Hamas's invasion being carried out without coordination with its partners, but with the expectation that such a scenario would partially materialize on its own. Israel had no intelligence on such a plan, yet it would have been prudent to consider it not merely as a potential scenario but also as one that could occur by surprise and create a catastrophe even greater than the one experienced.

The strength of the proposed topology—that is, mapping the space specifically according to the two proposed axes ("from where and to where": the domain and the target of the attack) rather than others or additional ones—is assessed based on three key questions. The first two draw upon the mathematical concept of spanning a space, as well as the *MECE* (Mutually Exclusive, Collectively Exhaustive) principle, a framework for strategic problem-solving developed at McKinsey in the 1960s.[6] The first question concerns the extent to which the topology is composed of mutually exclusive axes—that is, axes that map the space without any definitional overlap, as such overlap would create inefficiency and distortion in the representation. The second question is the extent to which the topology is collectively exhaustive (complete), meaning it encompasses all possibilities. The third question differs from the first two. While they examine the formal quality and completeness of the topology, the third assesses its relevance to the specific problem domain: namely, the degree to which it allows for generating significant insights regarding the question or problem at hand, as it would otherwise fail to be contributory.

The answers to these questions allow for an analysis of the extent to which the proposed topology is indeed suitable and precise for the learning process from the particular (the October 7th surprise) to the general realm of crisis-inducing surprises. The answer regarding the independence of the axes is straightforward: by virtue of their selection as the dimension and the target of the attack, they are distinct and have no definitional overlap. Regarding the completeness of the mapping, the answer is slightly more complex. From the outset, one must

6 This method is typically employed in decision trees (for example, MBA Crystal Ball https://www.mbacrystalball.com/blog/strategy/mece-framework/ or StrategyU https://strategyu.co/wtf-is-mece-mutually-exclusive-collectively-exhaustive/).

be cautious about confidently mapping all possibilities, as the very essence of a surprise is that it undermines the prevailing paradigm of realistic scenarios that might occur. However, alongside this caution, it should be noted that several additional axes were examined, such as a technological axis—a technological surprise—or an axis for the intensity of the impact, as well as others. The damage axis, for instance, appears to be embodied within the scenarios themselves, and its addition would create a dependency on the existing axes. In contrast, the technological axis is not embodied in the existing ones. It is clearly relevant to some of the Air Force's operational arenas, such as in the use of UAVs during the recent war. The weaponry itself did not constitute a technological surprise; rather, its use and its successes are what challenged the Air Force. Hence, the various scenarios must also incorporate advanced technological weaponry.

Finally, regarding the third question, to what extent is the proposed topology precise and relevant to the problem space, and how does it contribute to learning about a crisis-inducing surprise? The very choice of a "crisis-inducing surprise" as the focal point of the learning process, through the selection of a "from where and to where" topology, is intended to break away from the conventional framework of debriefings, which typically analyze an event or failure within pre-existing parameters. In other words, the proposed approach departs from the debriefing method and aligns with strategic literature that advocates for moving beyond the confines of reality or established practices to explore alternative possibilities (e.g., Lee and Co, 2014). This is achieved through a topology that maps out options within a space of uncertainty and recommends shifting into domains that are similar to, yet different from, reality and familiar possibilities.

To conclude this point, this article does not claim that the proposed topology is the only one possible or that it is entirely complete. It does, however, appear to meet the requirements for a constructive and precise topology, and as such it should be regarded as a foundation for a comprehensive learning process that moves from the specific to the broader realm of crisis-inducing surprise scenarios—a framework worth adopting.

The learning process is advanced by utilizing extreme-case scenarios. Mapping the space of possibilities through categories creates a scenario map composed not of a single reference scenario but of nine distinct ones, each representing a different category. Selecting an extreme-case scenario for each of the nine resulting rubrics and preparing for them will, by an *a fortiori* argument, enable preparedness for other, unstated scenarios as well. That is to say, the specific scenario being prepared for is less important than the very existence of an extreme-case scenario in each of the categories.

Such extreme-case scenarios should be developed by interdisciplinary teams—not one, but at least two or three that operate independently. The outcomes of their planning should then be synthesized into a leading extreme-case scenario for each category. It is certainly appropriate for intelligence on capabilities and plans to serve as the basis for one team's work, but no more than that. All teams should also consider the global technological environment and propose a scenario that remains robust as an extreme case over time. While it is possible and advisable to provide each team with different points of emphasis, the principal directive must be for them to think as if tasked with surprising the State of Israel and the Air Force, and succeeding in this mission. The objective, in other words, is not to find a scenario that is convenient to confront, but rather one against which there is no known course of action.

Discussion

To what extent can a crisis-inducing surprise scenario stemming from a fundamental surprise be overcome? A fundamental surprise is, by definition, one that shatters the surprised party's perception of reality and foundational assumptions. How, then, can the proposed topology assist in confronting such a surprise? If the proposed topology is accepted as one that describes all possible surprise scenarios, or at least the vast majority of what could occur, then it can be cautiously posited that any crisis-inducing surprise scenarios that might transpire are contained within the space mapped by the chosen topology (representing extreme cases of uncertainty beyond the known boundaries of reality). Therefore, the more the Air Force prepares for all the extreme-case scenarios in each category—through relevant force design, plans, training, and the like—it can be assumed that any scenario that might occur will be some combination of what the Air Force has prepared for. The statement by the Air Force Commander, "without intelligence and without appropriate preparation..." (Shapira, N. 2025), will change because appropriate preparation will be in place. Mapping the space of crisis-inducing surprise scenarios and building preparedness according to the various categories makes it possible to significantly mitigate the crisis resulting from a fundamental crisis-inducing surprise, by virtue of being prepared for it even if it remains a surprise on a conceptual level, thereby transforming the surprise into primarily a situational one.

It is important to understand where this approach fits into the methodology of resilience and operational continuity. In principle, organizational resilience can be divided into two parts: one that deals with the organization's fundamental characteristics, such as agility, decentralization, redundancy, human capital, and so on, and one that discusses preparedness (Col. S, 2014). The approach

proposed in this article, which is especially important for the initial hours of a surprise attack, relates to both parts of the organizational resilience doctrine. The essence of the approach is the ability to function based on readiness built through exercises, simulations, and on the basis of appropriate force buildup, one that also builds the components of resilience accordingly, to the extent that the immediate response to a crisis-inducing surprise attack becomes semi-automatic—based on preparedness. That is, it will enhance the ability of the organization and its personnel to adapt quickly in real time to a new perception of reality by allowing them to rely on semi-automatic responses, thanks to their preparation for a collection of scenarios, where the one that ultimately occurs is a combination of them. In other words, in the first hours of a surprise attack, when uncertainty is at its peak and the ability to improvise and adapt to a new situation is challenged to the extreme, partial automation of actions resulting from preparation and readiness is a critical enabling condition. This is very similar to the classic military method of repetitive drilling that reduces the need for improvisation on the battlefield. Thus, the proposed approach contributes to the first part of the organizational resilience doctrine by enhancing human capital and its agility in the most difficult hours of the surprise, precisely by leveraging the second component of resilience—preparedness.

What, then, of a situational surprise that leads to a crisis-inducing surprise scenario? The article defines a crisis-inducing surprise as either a fundamental surprise, for which the Air Force is completely unprepared for the scenario, or a situational surprise, for which the Air Force is not ready for the event despite its preparedness in principle for such a scenario. Even if the Air Force were to develop an operational preparedness that would allow it to significantly reduce the possibility of a fundamental surprise as described, it would still remain vulnerable to a situational surprise: a surprise attack for which there was no early warning, or no warning regarding its full scope.

Today, the Air Force, like other components of the IDF, is heavily reliant on early warning for many aspects of its preparedness, as well as for its self-defense. We will not delve here into the fundamental debate on the extent to which early warning can be relied upon when required, but we will cautiously note that an increasing number of actors now recognize that this reliance is problematic, to say the least. There are also proposals to keep it as an intelligence objective but to remove the element of early warning from the foundational principles of the national security concept—namely, to assume that a situational surprise will occur when the other side seeks to achieve one (Matania, 2024, p. 27).

The Air Force's criticality to the IDF's operational and strategic capabilities, as well as its role as a vital component in responding to a surprise attack—

thanks to the speed with which it can transition from routine to emergency—is now clear even to our adversaries. Therefore, and beyond the broader debate regarding the general reliance of both the IDF and Israel on the prospect of early warning for a surprise attack and the resulting implications for the IDF, it is incumbent upon the Air Force to abandon its complete reliance on early warning regarding its own ability to function and to cope with a surprise attack against itself—that is, for the crisis-inducing surprise scenarios in the left-hand column of the scenario space.

The implications for readiness and resources (both human capital and budget) are clear. Therefore, it is imperative to rely primarily and as much as possible on two classic components of preparedness for a surprise attack, which must become the cornerstones of the Air Force's emergency planning and preparation: survivability and redundancy. The importance of survivability and redundancy has steadily increased over the years. This is due, on the one hand, to modern technology that enables high-damage, precise, long-range strikes and, on the other, to the emergence of simple and inexpensive modern weaponry—such as unmanned aerial vehicles—that allows for the deployment of large quantities of assets in ways previously impossible. The State of Israel, lacking strategic depth, is particularly vulnerable to this threat (Matania, 2024, pp. 19–20; Matania & Berkman, 2024).

Accordingly, investment in survivability and redundancy, alongside a higher threshold of readiness than is customary based on early warning, will enable the Air Force to better contend with any extreme scenario involving significant damage to the force, such that the likelihood of a surprise attack crippling it to the point where it cannot recover and fulfill its range of missions is significantly reduced.

Conclusion

This article aims to expand the October 7th debriefings into a learning process that extends beyond scenarios similar to the Hamas ground surprise attack of that day. It adopts a broader, methodologically structured perspective, moving "from the particular to the general", to map the space of possible crisis-inducing surprise scenarios against Israel, with a specific focus on the Air Force. The article defines a crisis-inducing surprise as either a fundamental surprise, for which the Air Force is entirely unprepared, or a situational surprise, where the Air Force fails to be ready for the event despite its readiness for such a scenario in principle. By employing a topology that maps the space of crisis-inducing surprise possibilities along two axes—a topology that adheres to the principles

of selecting a complete and tailored strategic approach—the article proposes a method for contending with future crisis-inducing surprises.

The axes are the dimension of the surprise attack (air domain, ground domain, or others and their combination) and the target of the attack (the Air Force, a region or sector in Israel, or a comprehensive attack). By laying out these nine categories and selecting characteristic extreme cases within them—and assuming this topology approximates all possible surprise scenarios—it can be posited that force design, plans, and training for these nine extreme scenarios will inherently encompass the possible combinations thereof. Preparedness for such a comprehensive space of scenarios will render the response to a surprise attack in its initial hours—which are the most challenging due to uncertainty and a sudden shift in reality—semi-automatic, thereby minimizing the need for improvisation and reducing recovery time to a minimum. As a result, this approach can reduce the potential for being caught in a fundamental-surprise situation that undermines the Air Force's perception of reality, while also mitigating the scale of the crisis should such a surprise occur.

Finally, the article posits that to successfully contend with a potential situational-surprise, the Air Force must significantly reduce its reliance on early warning, particularly concerning its preparedness to defend itself and its assets in the event of a surprise attack. Instead, it must rely on a force design founded on the principles of survivability and redundancy, which would enable it to preserve a significant portion of its forces even during a surprise attack. This reduced reliance on prior warning is particularly vital for the Air Force, which serves as a strategic arm of Israel. Its role in any campaign is critical, and with the appropriate readiness, it can be fully prepared for a campaign or war within a matter of hours to a day. The ability to be prepared for a surprise attack with minimal reliance on prior warning is especially crucial for Israel, given its lack of strategic depth.

References

Ashkenazi, A. (2024, December 25). Tractor in the air: After October 7th – Israel is changing the rules of the game on the battlefield. *Maariv*. [Hebrew]. https://www.maariv.co.il/news/military/article-1158993

Ashkenazi, A. (2025a, November 20). The conquest of Air Force bases on the agenda – The IDF's immediate preparations have begun. *Maariv*. [Hebrew]. https://www.maariv.co.il/news/military/article-1253745

Ashkenazi, A. (2025b, October 25). The Air Force made a dramatic decision: Israel will also be bombed from the air. *Maariv*. [Hebrew]. https://www.maariv.co.il/news/military/article-1244203

Bohbot, A. (2025, February 27). Where was the Air Force at the beginning of the war? The debriefings show: Not in the right place. *Walla*. [Hebrew]. https://news.walla.co.il/item/3730614

Col. S. (2014). Organizational resilience components as a key to operational continuity in the IDF. *Eshtonot*, *6*. The Research Center – The National Security College. [Hebrew].

Dan, A. (2025a). A conceptual shift in the Air Force: The lessons of October 7th. *Aerospace & Defense*, *2*(1), 7-26.

Dan, A. (2025b). Ambidextrous leadership in military aviation: A comparative analysis of Israeli Air Force crisis response during the 1973 Yom Kippur War and the 2023 October 7th attack. *Aerospace & Defense*, *2*(2), 41-68. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

Ganor, R. (2025). *Change during wartime: The participation and borders group*. IAF. [Hebrew]. https://www.iaf.org.il/9781-62303-he/IAF.aspx

Heller, A. (2025). Air support in ground combat: Meeting requirements or needs? Lessons from the Israeli Air Force's confrontation with two surprise ground offensives. *Aerospace & Defense*, *2*(2), 23-39. https://socsci4.tau.ac.il/mu2/elrom

Lanir, Z. (1983). *The fundamental surprise – Intelligence in crisis*. Hakibbutz Hameuchad Publishing House. [Hebrew].

Lee, L., Horth, D. M., & Ernst, C. (2014). *Boundary spanning in action*. Center for Creative Leadership. https://cclinnovation.org/wp-content/uploads/2014/06/boundaryspanningaction.pdf

Lupovici, A. (2024). Israeli deterrence and the October 7th attack. *Strategic Assessment*, *27*(1).

Maniv, O. (2025, November 29). 'Grounded and not attacking': This is what the Air Force's failure on October 7th looked like. *N12*. [Hebrew]. https://www.mako.co.il/news-military/be11d799e08b8910/Article-657723bb3c0da91027.htm

Matania, E. (2024). *A new security concept for Israel*. Misgav – The Institute for National Security and Zionist Strategy. [Hebrew]. https://www.misgavins.org/wp-content/uploads/2024/12/matania.pdf

Matania, E., & Barkman, A. (2024). Digital weapons: How global digital platforms may potentially disrupt the modern battlefield. *Aerospace & Defense*, *1*(1), 85-98.

Nisani, B. (2024, December 24). The debriefing revealed: Why the Air Force's response on October 7th was delayed. *Kikar HaShabbat*. [Hebrew]. https://www.kikar.co.il/security-news/idf-air-force-october-7-investigation

Razi, E., & Yehezkeally, P. (2013). *The responsible organization: To cope with the phenomenon of unanticipated consequences*. The National Security College – The Research Center. [Hebrew].

Sadan, N. (2025, March 7). The October 7th debriefings: So where was the Air Force on the morning of the Black Sabbath? *Calcalist*. [Hebrew]. https://www.calcalist.co.il/calcalistech/article/bkr93wdike

Shapira, I. (2025). *Early warning revisited: A tool for identifying relevancy gaps in the IDF concepts*. Dado Center for Interdisciplinary Military Studies, Israel Defense Forces. [Hebrew]

Shapira, N. (2025, February 27). Where was the Air Force during the Hamas surprise attack? – The October 7th debriefings. *N12*. [Hebrew]. https://www.mako.co.il/news-military/2025_q1/Article-7d2464667884591026.htm

Shoval, L. (2024, December 22). Revealed: Key findings from the debriefing on the Air Force's failures of October 7th. *Israel Hayom*. [Hebrew]. https://www.israelhayom.co.il/news/defense/article/17025612

Strategeos – Business strategy blog. (2025, July 11). *Strategic option generation – expanding strategic possibility space*. https://strategeos.com/blog/f/strategic-option-generation%E2%80%94expanding-strategic-possibility-space

Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. Random House.

Zitun, Y. (2025, February 27). The surprise from the paragliders, and the dramatic decision at 09:30 – The Air Force's October 7th debriefing. *Ynet*. [Hebrew]. https://www.ynet.co.il/news/article/bkg73zt51

Aerospace & Defense
Journal of the Elrom Center for Air and Space Studies at Tel Aviv University
No. 2(2) | December 2025

Air Support in Ground Combat: Meeting Requirements or Needs? Lessons from the Israeli Air Force's Confrontation with Two Surprise Ground Offensives

Assaf Heller[1]

Abstract

In both surprise attacks on Israel – the Egyptian-Syrian offensive of October 6, 1973, and the Hamas offensive of October 7, 2023 – the Israeli Air Force's contribution to halting the enemy ground forces was limited. The two cases differ in many respects, yet they share a common denominator regarding air support. The IDF's defensive concept relied on the ground forces conducting the main defense battle, with a certain level of air support, while the Air Force's mission was to attack targets according to requirements of the supported headquarters at the regional commands and divisional level. In both surprise offensives, the ground forces failed to stop the enemy forces. The Air Force was therefore required to assume a significant role in the defense battle, but the supported headquarters, fully engaged in the fighting, were unable to provide the Air Force with targets and intelligence in an effective manner.

Both surprise offensives constituted extreme cases of the need for air support in terms of its decisive importance for the ground combat. Yet in these two unique cases in IDF history, the ground forces did not receive adequate air support precisely when it was most needed. The article argues that a primary reason for this is the failure of the IDF's air support concept, which considered air support mainly as providing an optimal, rapid, and precise fulfillment of ad hoc requirements from the ground forces. When appropriate

1 **Dr. Assaf Heller** serves as the Director of Research at the Elrom Center for Air and Space Studies at Tel Aviv University. He holds a Ph.D in philosophy from Tel Aviv University.

To cite this article: Heller, A. (2025). Air Support in Ground Combat: Meeting Requirements or Needs? Lessons from the Israeli Air Force's Confrontation with Two Surprise Ground Offensives. *Aerospace & Defense,* 2(2), 23-39. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

requests for support did not reach the Air Force, effective support was impossible.

An alternative approach to air support is one that is oriented not only to optimal fulfillment of requirements during combat but also, and primarily, to force design that is optimized to the needs of the ground forces. The force buildup process should be based on a deep, shared understanding by the Air Force, the ground forces, and the regional commands of the needs in ground combat and of the strengths and limitations of air power. This approach has prevailed in relatively short periods during the history of the IAF, such as from the mid-1980s to the mid-1990s, and it has the potential to guide the future force buildup for air support. The establishment of the Air Support and Border Defense Division in the Israeli Air Force represents an opportunity to renew this approach.

Keywords: Israeli Air Force, ground forces, air support, surprise attack, Yom Kippur War, Iron Swords War

Introduction

Two of Israel's most difficult wars began with enemy surprise attacks and left lasting imprints on the state, on the IDF, and on Israeli society: the surprise offensive by Egypt and Syria on October 6, 1973, and Hamas's surprise offensive on October 7, 2023. Both have been extensively discussed, primarily with regard to the surprise and its sources. In both cases Israel was surprised at the strategic level: Israeli intelligence missed the enemy's protracted preparations for war and interpreted them in a downplaying manner, while the political and military establishment continued to adhere to its erroneous conceptual paradigm concerning the enemy. In both cases the IDF was also surprised at the operational level by the scope of the force employed by the enemy, by its modes of employment, and by some of the weapon systems the enemy used, which had a significant impact on the battlefield. In both cases, the defense collapsed, yet within several days the IDF recovered and transitioned to a broad offensive.

In both of these surprise offensives, the Israeli Air Force did not manage to play a significant role in halting the invading forces, and the main burden of the defensive effort fell on the ground forces, which suffered heavy casualties. In both cases, the Air Force discovered that it lacked suitable tools to cope with the enemy's modes of action. In 1973, it found that it lacks effective tools for air support as long as it was unsuccessfully striving to gain air superiority over the fronts in the face of surface-to-air missile (SAM) arrays. In 2023, it discovered that it lacked suitable tools to halt a large-scale incursion of low-signature mobile

forces operating inside Israeli territory, in and around IDF bases and Israeli communities. Halting a surprise ground offensive when the ground forces are unable to stand up to superior enemy forces is an extreme case of the need for air support in ground warfare. In this article, the term "support" refers to the full range of actions by airpower that assist a non-air headquarters (division, corps, regional command) in accomplishing its missions, and not to the narrower sense of air support to ground forces in battle (Close Air Support). The first question the article examines is why the Air Force failed to play a significant role in halting the surprise offensives; the second is how airpower should be built so that it can provide a better response to surprise attacks.

There is a lively debate on the lessons of these surprise offensives and on how best to build the military force to cope with surprises. Among other things, it addresses the phenomenon of strategic surprise; the robustness required of the defense in light of the inherent uncertainty of intelligence warning; the need for operational-level planning processes that take into account a wide range of possible scenarios, beyond those explicitly raised in intelligence assessments; and the imperative of critical dialogue within the military system (see, for example, Bar-Joseph, 2025; Heller, 2025; Lukash, 2025). This broader discussion is also relevant to the Air Force and to its readiness for its mission. For example, in light of its failure to cope effectively with SAM arrays in 1973 and, to a lesser extent, its failure against the penetration of powered paragliders and explosive drones in 2023 (which had limited impact on the course of the campaign).

However, within this broad and important discussion of how the Air Force prepares to deal with surprises, it is appropriate to devote special attention to air support in the defensive effort against a surprise ground offensive, which is the focus of this article. Beyond the general issue of preparedness for surprises, the discussion of air support is bound up with the relationship between the Air Force's role in a given mission and its ability to build an effective force. One argument of the article is that under the concept prevailing in Israel in both surprise offensives, the General Staff, the Air Force, and the ground forces conceived the Air Force's role in the ground combat as providing optimal support in accordance with the ground forces' requirements. Yet in both cases, the ground forces failed to convey prioritized requirements to the Air Force. Unfortunately, in the very surprise offensives in which the ground forces struggled to construct a situational picture and to require support, the need for effective air support to halt the offensive was greatest. The fundamental difficulty inherent in a "strike on demand" concept could have impaired the Air Force's effectiveness in the defensive battle even if the IDF had had a plan for dealing with a surprise offensive. This difficulty is hard to overcome even through procurement of

suitable weapons, organizational changes, and training. A second argument is that in force design for air support to ground forces, it is important to emphasize the Air Force's deep involvement in formulating operational concepts for the effective employment of airpower in ground combat, rather than employing the Air Force merely as an on-call fire support resource for ground needs.

The article examines the evolution of concepts of air support to ground forces, focusing on the concepts in force during the two surprise offensives and on their impact on the Air Force's inability to make a sufficient contribution to halting the enemy forces. It identifies a possible solution in the Air Force's concept of air support formulated in the 1980s, which, due to historical circumstances, was never tested in combat and was subsequently replaced by another concept. The sources for the period up to roughly 2020 are primarily in-depth research literature, whereas historical research on October 7th, and on the Air Force's role in particular, is still in its infancy. Accordingly, the discussion of the second surprise offensive relies heavily on journalistic sources that quote excerpts from military after-action reviews.

Air Support in Grounf Warfare

Since David Ben-Gurion first formulated Israel's security doctrine in 1953, the Israeli Air Force has had a central role in the doctrine: defending the state, degrading the enemy's air attack capabilities, protecting the ground forces against air threats, and attacking the enemy's ground forces. From its earliest days, Israel's ground forces have been based on reservists as a solution to the tension between the need for a large army in the face of an existential threat and the state's inability in peacetime to maintain a large standing army. The Air Force has a key role in enabling Israel to rely on a reserve army. The power, mobility, and flexibility of airpower earned it a place among the "strike forces, headed by the Air Force," and the responsibility to confront the enemy "from the outset of the conflict," particularly in the event of a surprise attack (Ben-Gurion, 1981).

The Israeli Air Force is the IDF's only military aviation service. In ground warfare, all aircraft, helicopters, and medium and heavy remotely piloted aircraft (RPAs) are operated by the Air Force; the ground forces operate only small aerial platforms (categories 1 and 2 in US JCS, 2019). The Air Force supports a wide spectrum of ground-force needs: close offensive air support and medical evacuation for the brigade echelon and below; and, for divisions, corps, and regional commands, attacks on enemy ground forces in the enemy rear, interdiction, aerial intelligence collection, airlift of forces, and more. Even in militaries that have organic army aviation, such as the US Army, this branch

does not provide the full spectrum of aerial support to the ground forces. The air force still conducts support missions under other headquarters. Under the joint force commander (JFC) operates a joint force air component commander (JFACC), who plans and employs airpower in accordance with the plans and intent of the JFC (US JCS, 2019, xiv–xviii).

The history of air support to ground forces in Israel reveals extensive effort that, over many years, has yielded limited results. Shortcomings in air support were exposed in the Yom Kippur War (1973), the First Lebanon War (1982), and the Second Lebanon War (2006) (Shelah & Heller, 2023). Over the last decade, a change has become apparent, and in the course of the war in Gaza (2023 to 2025), the Air Force has made a very substantial contribution to support in the ground combat, primarily in close air support and medical evacuation (Finkel, 2024).

Over the years, two main approaches to air support have emerged, each grounded in a different assumption about what constitutes "adequate air support." The first assumes that good support is that which provides an optimal fulfillment of the ground forces' requirements, akin to the "customer satisfaction" approach in the business world. From this perspective, the exceptional success of air support to the ground forces in the fighting in the Gaza Strip is evident, as described by the Air Force Commander, Tomer Bar: "Never before has the connection between a pilot and a tank commander been so direct and tight…. Every one of our ground forces encountering an enemy on the ground is enveloped in air support…" (Ciechanover, 2023). The second approach assumes that good support is that in which airpower is employed in the most effective way relative to the ground forces' needs, akin to the "customer needs" approach in the business world. This approach has been less dominant over the years, but in the mid-1980s it led the Air Force to develop new operational concepts for air support that would realize the full potential of airpower (Finkel, 2022, pp. 184-185).

The Air Force in the 1973 Surprise Offensive

In 1973 the IDF was deployed opposite Egypt along the Suez Canal and opposite Syria on the Golan Heights. The forces holding the front lines were relatively small and were not intended to withstand a broad military offensive. The defensive concept against a large-scale offensive assumed that there would be early warning of war, after which the forces along the front lines would be reinforced. The "Sella" defense plan stipulated that within roughly 30 hours from the issuance of an order following such a warning, the front lines would be reinforced by regular forces together with several reserve units, with the aim of halting a ground offensive. In parallel with the defensive halt, the bulk of the

IDF order of battle, its reserve units, was to reach the front in preparation for launching a counteroffensive. The Air Force was required to assist the ground forces, but first to achieve sufficient air superiority for its freedom of operation in the face of Syria's and Egypt's air defense arrays: fighter interceptors and SAM batteries. Statements by the Chief of Staff David Elazar (Dado) prior to the war demonstrate that the IDF understood that the defensive halt would begin without air support (Gordon, 2008, p. 143). Only after gaining air superiority was the Air Force to participate in the defensive halt and subsequently support the counteroffensive by attacking enemy forces (primarily tank units), positions, artillery batteries, and interdiction missions. The employment method for offensive air support relied on the transmission of targets and intelligence from the regional commands and ground forces to the Air Force via liaison officers (Peled, 2004, pp. 332–333).

The defense plan did not address a "catastrophe" scenario – in Dado's terminology – in which there would be no advance warning of an offensive, which would begin before regular reinforcements could reach the front. At the conclusion of an IDF exercise in the summer of 1972, Dado stated that in the event of a "catastrophe" the regular forces at the front were expected to be worn down, and the Air Force would be required to participate immediately in halting the enemy forces without the time needed to destroy the SAM arrays and to gain freedom of action in the air. Yet this possibility was not subsequently discussed and was not incorporated into the defensive plans (Bar-Joseph, 2021, pp. 40–41).

In the 1973 surprise offensive, the "catastrophe" scenario materialized, and the IDF was forced to defend the borders with forces that were far too small on both fronts. The Air Force did not provide adequate air support in the defensive phase, nor did it do so in the counteroffensive of October 8th (two days after in enemy's offense). Only after several days did air support become more effective (Bar-Joseph, 2021, pp. 196-200). Benny Peled, then the Air Force Commander, summarized the operational gap in the support mission: "The discrepancy between our own expectations, not to mention those of the ground forces, and what we would actually be capable of doing for the ground forces under the conditions we knew would prevail was very great. That is to say, the lack of effectiveness was much greater than expected, and the resulting frustration was very great indeed." (Peled, 2004, p. 332)

One could attribute the failures in air support to the situation at the outset of the fighting: the surprise that created an urgent need for intensive air support in the defensive halt; the failure to gain air superiority over the front due to the unsuccessful suppression of the SAM arrays; and, as a consequence, the loss of aircrafts in the support mission, the reduction in the number of support sorties,

and the adoption of the less-effective loft-toss strike technique out of concern for aircraft losses (Bar-Joseph, 2021, pp. 174-180). Yet this is only a partial answer, which does not address the gaps in preparation for the support mission.

The IDF's method for air support held that the Air Force was to attack targets in accordance with requirements from the ground forces and the regional commands that would arrive during the fighting. However, when support was needed, targets and relevant intelligence often did not arrive – especially not regarding the enemy's breach points, where air strikes were most required (Brun, 2022, p. 73). The difficulty of receiving targets and intelligence from the ground forces was particularly acute in the context of a surprise offensive, in which small ground forces were engaged in continuous, intensive combat, and their headquarters struggled to construct a situational picture and to convey prioritized requirements to the Air Force. The IDF did not prepare for a "catastrophe" case of a surprise offensive, even though the possibility of such an offensive was well known. The chief of staff, who referred to it explicitly before the war, determined that in such a case the Air Force would have to bear the burden of halting the enemy before gaining freedom of action in the air over the front. Like the rest of the IDF, the Air Force did not prepare for this scenario. It did not prepare to provide air support before gaining air superiority, and in the support mission it remained dependent on targets and intelligence that arrived too little and too late from the ground forces and the regional commands. In Peled's words, "If the Air Force had understood that it would not receive significant intelligence through the joint system [with the ground forces], it would have prepared to collect it on its own, despite the limited air superiority, and it would have been far more successful in destroying ground forces in the early stages of the war." (Peled, 2004, p. 279). Of course, it is impossible to know whether the Air Force would have succeeded to the extent Peled suggests – but it did not prepare.

Force Buildup for Air Support in the 1970s and 1980s

The difficulties in the air support mission in the Yom Kippur War led after the war to two major organizational changes. The first was the establishment of a ground-target intelligence branch in the Air Force, following Peled's conclusion that "responsibility and authority cannot be divided," and that in order to perform the air support mission, the Air Force had to be less dependent on the ground forces for constructing the ground combat picture (Peled, 2004, pp. 355–357). The second was the establishment of coordination mechanisms between the Air Force and the ground forces and regional commands – primarily Forward C2 Posts (MASHLAK) of the Air Force at the regional commands and an Air

Support Center (MARSA) at the Air Force Headquarters. In addition, the Air Force began to procure attack helicopters for close support of the ground forces.

These changes led to limited success in providing air support through fighter aircraft in the First Lebanon War (1982), and therefore new solutions were required for the mission. Some of these solutions sought to refine coordination mechanisms, such as the establishment of the IAF Cooperation Unit and the institutionalization of training and exercises. The most significant change, however, was the Air Force's decision to assume broader responsibility for force buildup for air support. Following lessons learned from the war, the Air Force set itself an objective – not only to improve its capability to fulfill the requirements of the ground forces, but also to develop operational and technological solutions for nighttime air support, for air support prior to the suppression of threatening SAM arrays, for targeting enemy's ground forces by the Air Force, for improving air-to-ground IFF (Identification Friend and Foe), and more (Finkel, 2022, pp. 163–178).

The decision by the Air Force to become involved in operational solutions, and not merely to provide an optimal fulfillment of requirements, led it to work together with the regional commands on developing knowledge for the effective employment of the Air Force in war. This tightening of the dialogue produced in the mid-1980s, a set of operational concepts for exploiting airpower in the ground combat based on an understanding of its strengths and limitations, consolidated under a "Master Air Support Plan." Within this framework, plans were formulated for the systematic attack of frontline headquarters, lines of communication, artillery, and concentrations of reserve forces in the enemy's rear, missions in which airpower can be more efficient and effective than in close support, which had constituted the bulk of the Air Force's activity in the First Lebanon War (Finkel, 2022, pp. 184-185).

Force Buildup for Air Support in the 21st Century

The turn of the century brought major changes in the strategic environment that profoundly affected the IDF and, within it, the Air Force. The threat of invasion by state armies receded in light of the peace treaty with Egypt (1979), the collapse of the Soviet Union – which had supported Syria and its military power (1990), the weakening of Iraq in the First Gulf War (1991), and its eventual conquest (2003). Consequently, air support against state armies became less relevant in the IDF, and with that the need for and interest in the concepts and plans of the Master Air Support Plan waned. The state threat was replaced by an asymmetric threat from semi-military non-state organizations such as Hezbollah and Hamas, and to some extent ISIS. The air support required by the ground

forces' against these actors demanded a different operational answer, adapted to the characteristics of the enemy: no longer an emphasis on attacking reserve formations, artillery batteries, and lines of communication but primarily on detecting and striking small, highly mobile, low-signature forces often embedded in dense urban environments. In other words, there existed a reduced need for systematic attack of enemy arrays and a heightened need for rapid "collection-to-strike" loop on numerous small targets that are exposed only briefly.

In these same years, technologies emerged that affected air support: extensive procurement of precision-guided air munitions that enable strikes with meter-level accuracy at high sortie rates; extensive procurement of reconnaissance and strike RPAs that can loiter over a terrain cell for long periods and can be operated, to some extent, by the ground forces; high-throughput aerial sensors; information-processing technologies that allow the conversion of large-scale collection into near-real-time target detection; and computerized, networked command and control systems in the Air Force and ground forces that enable large volumes of information to flow in very short timeframes.

These changes in operational needs on the one hand and technological opportunities on the other drove the formulation of a new approach to air support in the IDF – *Jointness*. The main component of this approach was improving the operational ability to provide rapid and precise air support to fulfill ad hoc ground-force requirements. The digital revolution and improved strike capabilities enabled, according to former Chief of Staff Aviv Kochavi, the "industrialization of precision": vast quantities of information from multiple sensors are fed into a rear intelligence cell in every brigade combat team in order to expose the enemy, and precision fire destroys the exposed enemy and paves the way for the maneuvering force. Jointness was a central building block in the "Operational Concept for Victory" formulated under Kochavi as the answer to the "terror armies" of Hezbollah and Hamas (Shelah & Heller, 2023). The effort to shorten as much as possible the time from demand to strike led to the adoption of techniques such as the "Flash" technique (urgent target attack) involving direct communication between the brigade headquarters and Air Force Headquarters, and "JDAM to the Commander," involving direct control of the strike by the battalion commander and the fighter aircraft. In recent years, increased emphasis has been placed on in-depth training and exercises in air-ground cooperation, to the point that by 2023 every IDF battalion exercise included close air support for the battalion by a dedicated team at the battalion level (Finkel, 2024).

The IDF entered the 2023 war at a time when organizational attention to air support for the ground forces was focused on continual refinement of technique

– the ability of the ground forces to transmit targets to the Air Force, and the ability of the Air Force to strike those targets rapidly and precisely. What was required of the Air Force in order to provide air support was mainly to make aircraft with suitable munitions available in the right place and at the right time, ready to provide support, and to employ them in real time in accordance with incoming requirements. The IDF's jointness approach provided solutions to the two preconditions for effective air support identified by Peled, without adopting his call for expanding the Air Force's independence in air support: the ground forces can now both construct a situational picture and locate the enemy very rapidly and also transmit targets and associated intelligence to the Air Force very quickly and with a high degree of accuracy.

The Air Force in the 2023 Surprise Offensive

The 2023 defensive concept against Gaza was built around a threat scenario that included rocket fire, unmanned aerial vehicles (drones), and limited raids of up to 70 terrorists entering through 4–8 points of penetration via tunnels, overland routes, and powered paragliders (Zitun, 2025). The defensive concept relied on the provision of early strategic warning of an offensive; detection of the attack by tactical collection assets along the Gaza Strip; an above- and below-ground barrier; ground forces deployed along the Gaza Strip; and air defense against rockets, drones, and powered paragliders. In the air defense mission, the Air Force operated autonomously; in defense against ground incursions, however, its mission was to support Southern Command and the Gaza Division in accordance with their requirements. In line with the IDF's concept, with regard to air support, the preparation required of the Air Force was primarily to position armed aircraft in the relevant place and time, ready to provide support.

Hamas's offensive found the IDF manifestly unprepared. The scenario in fact closely matched Hamas's "Jericho Wall" plan, which the IDF had exposed more than a year earlier, but the Israelis considered that plan unrealistic. The offensive began at 06:30, and by 07:00 some 1,200 terrorists had penetrated Israel along dozens of routes, including by six powered paragliders, under cover of approximately 1,400 rockets and mortar shells and dozens of explosive drones and quadcopters. Arrayed against them were fewer than 700 soldiers in the Gaza Division – most in routine posture – and 14 manned tanks. By 08:00, about 2,000 terrorists were already inside Israel, raiding IDF posts, communities, and a music festival site and perpetrating horrific massacres. The ground defense collapsed, and the Gaza Division's Headquarters, which was

supposed to control the defense, was itself fighting terrorists who had penetrated its base (Zitun, 2025).

The Air Force understood the situation with delay. The Air Force Commander was not included in the General Staff situation assessment held in the early hours of the night before the offensive. About two hours before the attack, the General Staff headquarters instructed the Air Force only to deploy a single RPA over the Gaza Strip immediately and to reposition a pair of attack helicopters from northern Israel to the south by 08:00. Despite the surprise, the Air Force managed to defend against the major rocket salvos until the available Iron Dome interceptors in the launchers were exhausted, but it failed to defend against the penetration of powered paragliders and explosive drones. Still, these air defense gaps were minor compared to the salient gap: the inability to employ airpower effectively to halt the ground offensive. Shortly after the offensive began, the Air Force scrambled its available forces; yet at the peak of the first wave of attacks, there were only three RPAs over the incursion area, the attack helicopters had not yet arrived, and the fighter aircraft were initially scrambled for air defense rather than for ground attack in the absence of a ground combat picture. Nearly an hour after the start of the attack, the first strike was carried out by an RPA, and it was only at 08:00 that fighter and attack helicopters began striking targets. The fighter aircraft were employed according to the pre-planned targets list required by Southern Command, but because the command failed to construct a relevant battle picture, the aircraft were initially directed to strike tunnels adjacent to the border fence, headquarters, and weapons depots – targets whose destruction did not affect Hamas's offensive capability. According to the concept, close air support requires cueing by ground forces, but in many cases there was no one on the ground to direct the aircrafts. The Air Force had not prepared for such a scenario, one that diverged from the IDF's working assumptions, and it took hours to adapt the employment of airpower to the characteristics of the offensive, during which the Air Force essentially "reinvented itself." In order to be effective, it suspended the rules that had constrained the employment of airpower: aircrafts struck in and around Israeli communities and IDF bases and attacked vehicles and individuals in the area of the breached border fence even without positive enemy identification (Ilnai, 2025).

The IDF halted Hamas's offensive within several hours, and as the fighting progressed, the Air Force managed to conduct the air support mission with exceptionally high effectiveness relative to past wars (Finkel, 2024). Yet this success did not prevent the question, asked repeatedly since then: Where was the Air Force while Hamas was invading Israeli territory? In the words of Tomer Bar, "Whatever we might have done, without intelligence and prior

preparations we would not have been able to prevent the disaster, only to reduce the damage" (Shapira, 2025).

However, the Air Force's preparations were not geared to air support in the event of a large-scale incursion. Under the IDF's concept of air support, as mentioned earlier, the Air Force's role is to strike targets at the requirement of other Headquarters. The emphasis in the process is on the "industrialization of precision" and "closing the collection-strike loop." In other words, what is required of the Air Force is rapid, precise strikes on demand, rather than advance preparations based on the Air Force's own deep understanding of the needs of the ground combat. The IDF's conceptualization of air support spared the Air Force the need to delve into the expected ground combat picture and spared the regional commands and divisions the need to explain it fully to the Air Force. In missions that are not support missions and in which the Air Force is defined – and regards itself – as responsible, such as air defense and strikes against air defense arrays, surface-to-surface missiles, or interdiction, it is required to develop operational knowledge. In the Gaza theater, where the Air Force's role was primarily to provide support and its dialogue with Southern Command and the Gaza Division revolved mainly around striking targets per a predefined plan, the Air Force was required – under both the IDF's concept and its own – to provide excellent on-demand service.

When Hamas's surprise offensive began, the Air Force discovered – much as it had in the 1973 surprise offensive – that Southern Command and the Gaza Division were unable to "fulfill their part of the arrangement" and convey to the Air Force precise and prioritized strike requirements. The Air Force had prepared to provide excellent service, but there was no one at the command level to direct it – the Southern Command was struggling to construct a situational picture, and the Gaza Division was fighting to defend its own headquarters. In this situation, the Air Force was left almost powerless: it possessed a wide range of military capabilities but had no way of knowing how to employ them effectively to halt the offensive.

As after the failure of air support in the defensive phase in 1973, so too after the failed halt in 2023 the Air Force decided to adapt itself. Just as the Forward C2 Posts (MASHLAK) were established after 1973 to improve cooperation with the regional commands and ground forces, after 2023 the Air Support and Border Defense Division was established to improve the Air Force's ability to provide close support in defensive halts (Blumenthal, 2025). And just as attack helicopters were procured after 1973 as a dedicated platform for air support, after 2023 additional attack helicopters are being procured, as well as Air Tractor aircraft as a dedicated support platform (Lapidot, 2025).

Discussion

The IDF's ground forces are based primarily on reserve units that require time to mobilize and organize for combat; the IDF thus faces a particular challenge in coping with surprise ground offensives. Since the IDF's inception, there have been two principal solutions: intelligence warning that enables early reserve mobilization, and an air force that can provide an operational response within hours in the event of surprise, thanks to its mobility, flexibility, and versatility. In the two cases in which these solutions were tested against a surprise offensive, both proved insufficient. Warning of an impending offensive was not provided in time, and the Air Force did not succeed in employing its immense power effectively to halt the offensives.

Every surprise offensive is surprising in its own way, and the conditions under which air support was required differed greatly in the two cases. In 1973 the Air Force faced a severe threat to its operational capabilities due to enemy's Air Defense, which was absent in 2023. In 1973 the coordination mechanisms between the ground forces and the Air Force were cumbersome and inappropriate, whereas in 2023 streamlined coordination mechanisms existed that had been refined and exercised over several years. Yet the two cases share a common denominator: in both, the IDF's air support concept held that the Air Force would strike targets in accordance with requirements from the ground forces and the regional commands, and in both, targets and intelligence did not reach the Air Force from these echelons in the volume and timeliness required to allow the Air Force to realize its potential in halting the offensives.

One may reach Peled's conclusion: that the Air Force requires independence in generating its own ground combat picture, enabling it to plan air support without close dependence on the ground forces and regional commands. This conclusion offers a conceptual answer to the particular challenge of surprise ground offensives, in which the ground forces lack the resources and bandwidth to construct a full situational picture and to orchestrate the effective employment of the Air Force. However, it ignores the fact that the Air Force will also face limitations in constructing a situational picture in an environment less familiar to it, whereas the ground forces and regional commands are the ones that develop the operational knowledge regarding that environment.

A different conclusion may be drawn from examining the two cases. In 1973, the Air Force might have been better prepared to halt the offensive had the General Staff headquarters and regional commands decided that it was necessary to develop an operational plan to the scenario of an attack without warning described by the Chief of Staff, and had the Air Force planned such a plan together with the regional commands in a way that realized the potential

of airpower. In 2023, the Air Force might have been better prepared to halt the offensive had the General Staff and Southern Command decided that it was necessary to develop an operational plan to a possible Hamas surprise offensive such as that described, inter alia, by the Prime Minister in 2017 (Hilaie, 2023), and had the Air Force planned such a plan together with Southern Command and the Gaza Division so as to realize the potential of airpower. Joint planning for a hypothetical operational challenge of a surprise offensive would have made it possible, before the Yom Kippur War, to recognize the need for the Air Force to be able to locate crossing bridges over the Suez Canal on its own and to provide air support under the threat of SAMs. Joint planning for a hypothetical operational challenge of a Hamas surprise offensive would have made it possible, before 2023, to recognize the need for the Air Force to locate numerous breaching points from the air rapidly, to provide air support within Israeli territory, and to cope with the difficulty of constructing a friendly-force picture in an environment that includes local residents, military forces, police, medical assistance personnel, and armed civilian volunteers.

The fundamental failure in both cases does not lie in the lack of success of air support in halting the invasion but in the erroneous strategic assessment by Israel's leadership and the IDF high command that the enemy lacked motivation at that time to go to war against Israel. As a result, the IDF had no operational readiness at those times for the possibility of a large-scale ground invasion into Israeli territory. However, the operational difficulties in air support stemmed not only from the surprise itself but also from the failure to develop suitable tools for effective air support in a hypothetical case of surprise, regardless of the strategic estimate of its likelihood. In missions for which the Air Force is designated, and perceives itself, as responsible, it knows how to initiate and develop operational tools even for scenarios assessed as low probability.

A basic premise for a dialogue aimed at developing shared knowledge between the Air Force and the ground forces is that the Air Force's role in air support is not only to provide an optimal fulfillment of requirements – a fundamentally reactive approach, but also to help steer the development of support capabilities that will be required in the future – a fundamentally proactive approach. The Air Force has demonstrated over the years that when it adopts a proactive approach it can develop operational answers to a wide range of operational challenges. A prominent example is the development of a solution to the SAM threat. After its failure against the Syrian and Egyptian SAM arrays in the Yom Kippur War, the Air Force developed a unique and comprehensive solution that in the First Lebanon War enabled a phenomenal success: the destruction of a similar Syrian SAM array in Lebanon within a few hours without any aircraft

losses. The dramatic improvement in the ability to cope with SAMs between the two wars stands in contrast to the limited progress in air support capability during the same period.

The Air Force has shown that matters can be otherwise even in the air support mission. As noted, in the wake of the Air Force's lessons from the First Lebanon War, it developed – together with the regional commands – operational knowledge that led to a comprehensive redesign of air support: instead of concentrating most of airpower on on-demand close support, the bulk of the force was focused on preplanned missions in which the efficient exploitation of airpower could make the greatest contribution to the ground combat (Finkel, 2022, pp. 184-185). The same occurred after Operation Protective Edge (2014), when the severity of the tunnel threat in the Gaza Strip and the risks involved in dealing with it through ground forces became widely recognized, and the Air Force developed techniques and means for the effective aerial attack of tunnels (Zitun, 2021). In both these cases, operations research (OR) officers in the Air Force played an active role, bringing with them an approach of in-depth learning, challenging received assumptions, and "out-of-the-box" thinking.

Experience therefore indicates that a proactive approach is not alien to the Air Force even in the mission of air support and that its application enables the Air Force to engage the General Staff and the ground forces in a process of developing shared knowledge and operational capabilities for potential scenarios.

Conclusions

The question "Where was the Air Force?" in the two surprise offensives against Israel can be answered in a formally correct way: the Air Force operated precisely in accordance with the missions assigned to it in the IDF's plans, and in both 1973 and 2023 it did much more as well. The border defense concept and the plans derived from it excluded the Air Force from broader responsibility and left it responsible mainly for executing the precise support missions that would be assigned to it in real time. But a different answer is also possible: that the intrinsic attributes of the Air Force – power, flexibility, versatility, readiness, mobility – and the unique techno-operational expertise it possesses in how to exploit these attributes effectively impose on it a broader responsibility to understand in advance what may be required of it in future scenarios and to initiate preparations accordingly. The Air Force has shown that it knows how to do this both in missions it leads and in missions in which it plays a supporting role. In a mission with partners, responsibility naturally rests on both sides, and the question "Who is more responsible?" – the Air Force, the ground forces, or the General Staff – does not advance a solution.

At present, the Air Force's decision to establish the Air Support and Border Defense Division has considerable potential to improve air support. The foregoing analysis suggests that, alongside organizational arrangements, it is crucial that the Air Force develop operational knowledge together with the regional commands and ground forces in order to gain a deep understanding of the needs and constraints of the supported headquarters in potential scenarios and in order to initiate operational concepts that will realize the full potential of its airpower (Dan, 2025).

References

Bar-Joseph, A. (2025). *Between Two Failures: The 1973 Yom Kippur Surprise and the Surprise of October 7, 2023*. Maarachot. [Hebrew] https://www.intelligence-research.org.il/post/Intelligence-in-october-seventh-uri-bar-joseph

Bar-Joseph, A. (2021). *A War of Its Own*. Kinneret, Zmora-Bitan, Hevel Modi'in. [Hebrew]

Blumenthal, A. (13 February 2025). Able to Operate Independently: The Lesson Implemented in the Israeli Air Force after October 7. *Kan 11*. [Hebrew]

Brun, A. (2022). *From Air Superiority to Multi-Domain Blow*. INSS, Tel Aviv. [Hebrew] https://www.inss.org.il/he/publication/air-force/

Ben-Gurion, D. (1981). Army and State. *Maarachot*, 279–280, 2–11. [Hebrew] https://fliphtml5.com/gcjnv/rfih/%D7%92%D7%99%D7%9C%D7%99%D7%95%D7%9F_280-279/

Ciechanover, Y. (16 November 2023). Air Force Commander: We Have Hit Thousands of Terrorists. *Ynet*. [Hebrew] https://www.ynet.co.il/news/article/sytt00cx46 https://www.kan.org.il/content/kan-news/defense/859506/

Dan, A. (2025). A Conceptual Shift in the Air Force: Lessons from October 7, 2023. Aerospace & Defense, 2(1), 5-25. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

Finkel, M. (2024). Not a "War of Its Own": Offensive Air Support for the Maneuvering Forces in the Iron Swords War in Gaza. *Aerospace & Defense*, 1(1). https://bit.ly/3KRp0tF

Finkel, M. (2022). *Air Force Headquarters*. Modan, Ben Shemen. [Hebrew]

Finkel, M., and Co-authors (2022). *Development of Combined Arms Combat in the IDF*. Modan, Ben Shemen. [Hebrew]

Gordon, S. (2008). *Thirty Hours in October*. Maariv, Tel Aviv. [Hebrew]

Heller, A. (2025). The road to the intelligence failure. In D. Bar-Siman-Tov & O. Guterman (Eds.), *Intelligence and October 7* (pp. 63-78). Maarachot. [Hebrew] https://www.intelligence-research.org.il/userfiles/image/cat11/063-078.pdf

Hilaie, S. (23 December 2023). Netanyahu Warned of Exact Hamas Terror Attack in 2017. *Ynet*. https://www.ynetnews.com/article/skz1zz4va

Ilnai, I. (31 January 2025). How the Israeli Air Force Was Caught Completely Off Guard by Hamas. *Israel Hayom*. https://www.israelhayom.com/2025/01/31/how-the-israeli-air-force-caught-completely-off-guard-by-hamas/

Lapidot A. (19 October 2025). Israel's new plane: Hovers like a butterfly and stings like a bee. *Israel Hayom. https://www.israelhayom.com/2025/10/19/israels-new-plane-hovers-like-a-butterfly-and-stings-like-a-bee/*

Lukash, A. (11 February 2025). Steinitz on 7/10: The Army Did Not Prepare for This Scenario and Did Not Think It Was Even Possible. *Ynet*. [Hebrew] https://tinyurl.com/33fp8npw

Peled, Y. (2004). *Days of Reckoning*. Modan, Ben Shemen. [Hebrew]

Shapira, N. (27 February 2025). Where Was the Air Force in Hamas's Surprise Offensive? *N12*. [Hebrew] https://www.mako.co.il/news-military/2025_q1/Article-7d2464667884591026.htm

Shelah, O., & Heller, A. (2023). Army Aviation: Optimal Integration of Aerial Assets in Ground Combat. Strategic Assessment. *Strategic Assessment*. https://www.inss.org.il/wp-content/uploads/2023/08/Heller_Shelah.pdf

US JCS (2019). *Joint Air Operations JP 3-30*. https://irp.fas.org/doddir/dod/jp3_30.pdf

Zitun, Y. (28 February 2025). Minute by Minute, IDF Orders Issued in Response to First Wave of October 7 Hamas Invasion. *Ynet*. https://www.ynetnews.com/article/bkehxlcqyx

Zitun, Y. (16 April 2021). The Smart Bombs of the Israeli Air Force that Have Already Destroyed a Tunnel with Terrorists Inside. Ynet. [Hebrew] https://www.ynet.co.il/news/article/SJVTbFVU00

Aerospace & Defense
Journal of the Elrom Center for Air and Space Studies at Tel Aviv University
No. 2(2) | December 2025

Ambidextrous Leadership in Military Aviation: A Comparative Analysis of Israeli Air Force Crisis Response During the 1973 Yom Kippur War and the 2023 October 7th Attack

Alex Dan[1]

Abstract

This study explores how ambidextrous leadership theory explains differences in the Israeli Air Force (IAF) crisis response effectiveness during the 1973 Yom Kippur War and the 2023 October 7th attack by Hamas. Using a comparative case study approach, the research shows that commanders' inability to balance exploitative and explorative behaviors led to failures in the initial response. Traditional military leadership methods proved inadequate when facing situations that require maintaining operational continuity while also pursuing tactical innovation.

Key findings indicate that cognitive flexibility, quick learning, and adaptive resource management are essential for effective crisis response. The study highlights ongoing organizational biases toward exploitation rather than exploration, despite fifty years of technological progress. This research is the first systematic application of ambidextrous leadership theory to military aviation crisis response, adapting civilian organizational ideas to suit military command needs. Practical implications include recommendations for personnel selection, simulation-based training, and organizational changes to improve crisis preparedness.

[1] **Dr. Alex Dan** is a senior researcher at the Elrom Center for Air snd Space Studies at Tel Aviv University.

To cite this article: Dan, A. (2025). Ambidextrous Leadership in Military Aviation: A Comparative Analysis of Israeli Air Force Crisis Response During the 1973 Yom Kippur War and the 2023 October 7th Attack. *Aerospace & Defense*, 2(2), 41-68. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

Keywords: ambidextrous leadership, military aviation, crisis management, Israeli Air Force, organizational adaptation, surprise attacks

Introduction

The Israeli Air Force (IAF) faced unprecedented challenges during two pivotal occasions: the 1973 Yom Kippur War, a conflict between Israel and a coalition of Arab nations led by Egypt and Syria, and the October 7, 2023, Hamas attack, which involved a coordinated surprise assault with ground infiltration, rocket barrages, and asymmetric warfare tactics. Despite fifty years of technological advancements and doctrinal evolution between these events, both crises revealed similar leadership shortcomings in responding to strategic surprises.

These experiences highlight key challenges in how military aviation leaders maintain operational efficiency while adapting to unexpected threats. The concept of *organizational ambidexterity*, introduced by James March (1991), distinguishes between exploitation—improving current capabilities—and exploration—pursuing new options. During military crises, ambidextrous leadership reflects commanders' ability to sustain operational efficiency while quickly developing innovative responses to unforeseen threats within the rigid hierarchical structures and high-stakes environment typical of military organizations (Raisch & Birkinshaw, 2008; Soeters, 2006).

Military crisis leadership differs fundamentally from civilian crisis management because of the unique structural, cultural, and operational traits of armed forces (Boin et al., 2016; Kolditz, 2007). The combination of hierarchical authority, standardized procedures, and high-stakes missions creates distinct challenges for leaders trying to balance exploitative and exploratory behaviors during crisis response (Soeters, 2006; Weick & Sutcliffe, 2007). Air forces especially face these challenges as they operate in dynamic threat environments where leaders must execute standard procedures while also adapting to unexpected threats under extreme organizational constraints. The IAF's initial responses to both attacks followed similar patterns: strict adherence to established protocols followed by costly delays before adopting new strategies. Existing research often emphasizes transformational and adaptive leadership in military contexts (Bass & Riggio, 2006; Heifetz, Linsky, & Grashow, 2009) but overlooks the organizational ambidexterity theory, which explains how leaders exploit existing capabilities while developing new approaches during crises (Yammarino et al., 2010).

The IAF serves as a prime case study due to Israel's unique strategic context, where the air force is crucial to a small nation in which operational mistakes

can have immediate strategic consequences, and its distinctive organizational characteristics: a formal military hierarchy combined with operational flexibility, extensive combat experience across various threat environments, and a reputation for both technological excellence and tactical innovation (Ben-Israel, 2011). This strategic criticality amplifies the importance of effectively managing surprise situations, as leadership failures in such contexts can quickly escalate beyond tactical setbacks to threaten national security. However, both surprise attacks revealed significant gaps in decision-making, especially when established paradigms proved insufficient for rapidly changing battlefield conditions.

This article examines the ambidextrous leadership behaviors that enable effective or ineffective crisis adaptation in military aviation and how these insights can inform the selection, training, and organizational structure of contemporary air forces. The underlying assumption is that by identifying these specific leadership capabilities, military organizations can systematically select, train, and adapt their structures to develop such competencies. The article employs comparative case study analysis of responses by high-ranking IAF officers during both conflicts and follows four stages: (1) synthesizing a military-crisis-leadership framework through the organizational ambidexterity theory, (2) analyzing ambidextrous leadership dimensions in each conflict, (3) identifying common leadership patterns beyond technological factors, and (4) translating insights into practical recommendations to improve military aviation crisis leadership capabilities across air forces globally, using the IAF as a representative case study.

Literature Review

Military Leadership in Crisis Situations

Compared to their civilian counterparts, military organizations face fundamentally different leadership challenges during crises. Unique constraints distinguish military crisis leadership from civilian organizational crisis management, primarily regarding the intersection of hierarchical military structures with crisis dynamics (Soeters, 2006; Boin et al., 2016). The structural features of military organizations—rigid hierarchies, standardized operating procedures, and centralized command authority—create natural tensions with the flexibility needed during crises. These command hierarchy constraints can slow decision-making and hinder local adaptation, while standardized doctrines and procedures, designed for predictable situations, often fall short during new, unforeseen crises (Weick & Sutcliffe, 2007; Soeters, 2006). Additionally, these structural limitations are exacerbated by risk-averse organizational cultures that prioritize avoiding failure over fostering innovation, as well as compressed decision-

making timeframes, where the consequences of leadership failures extend beyond organizational performance to encompass strategic and human costs (Kolditz, 2007; Hannah et al., 2009).

Military crises intensify existing challenges, such as time pressure, high-stakes decision-making, and radical uncertainty, through additional factors including life-or-death stakes, the "fog of war" that significantly distorts information, and organizational cultures that prioritize discipline and adherence to doctrine (Kolditz, 2007; Hannah et al., 2009). Traditional military leadership theories focus mainly on transformational leadership's ability to build vision (Bass & Riggio, 2006) and adaptive leadership's flexibility in changing circumstances (Heifetz et al., 2009). However, these frameworks fall short in addressing the conflicting demands of maintaining operational continuity and promoting tactical innovation during surprise attacks within military structures. Research on military organizations reveals that leaders must uphold discipline while fostering creative problem-solving within hierarchical systems in response to dangerous situations. Recent studies have highlighted the difficulty of managing competing organizational demands simultaneously, especially with respect to balancing the need to leverage proven military capabilities with exploring innovative responses under extreme time constraints (Yammarino et al., 2010; Hannah et al., 2009; Campbell, 2012; Soeters et al., 2006).

Organizational Ambidexterity Theory

March's (1991) distinction between exploitation and exploration provides the theoretical foundation for understanding challenges in organizational adaptation. Exploitation centers on refinement, efficiency, selection, and execution, whereas exploration emphasizes search, variation, experimentation, and innovation.

Organizations prefer exploitation because of its immediate benefits and lower uncertainty, which can lead to competency traps when environments change rapidly. O'Reilly and Tushman (2013) expanded this idea by emphasizing organizational ambidexterity as the ability to pursue both exploitative and exploratory strategies simultaneously. Their research revealed that successful organizations cultivate structural and contextual systems that foster both efficiency and innovation. However, military organizations face distinct challenges when implementing ambidextrous structures due to the hierarchical nature of command and the need for standardization.

Gibson and Birkinshaw (2004) introduced the concept of contextual ambidexterity, in which individual leaders shift between exploitative and exploratory approaches depending on the situation. This concept is especially relevant for military commanders who must make quick decisions that require

switching modes during combat. Their framework highlights four behavioral traits that support contextual ambidexterity: discipline, stretch, support, and trust.

Rosing et al. (2011) described ambidextrous leadership as switching between opening behaviors (encouraging experimentation) and closing behaviors (establishing routines). Raisch and Birkinshaw (2008) argued that ambidexterity becomes essential in uncertain environments, such as when confronting surprise attacks. Their framework, however, needs adjustment for military settings where decision reversibility is limited and the consequences of errors are severe.

Ambidextrous Leadership in Military Crisis Contexts

Applying civilian ambidexterity theory to military contexts highlights key differences that change leadership priorities during crises, with Air Force environments facing unique challenges due to the speed, complexity, and high-stakes nature of aerial operations (see Appendix 1: Military vs. Civilian Ambidexterity Context Differences, p. 65).

While civilian organizations manage exploitation-exploration tensions over extended periods, military crises condense these decisions into minutes or seconds, placing extraordinary cognitive demands on senior officers (Kassotaki, 2017; Shields & Travis, 2017). The literature indicates that ambidextrous leadership in military settings necessitates the simultaneous mastery of opening behaviors (exploration) and closing behaviors (exploitation), with middle management serving as essential links for vertical ambidexterity across hierarchical levels (Akinci et al., 2022; Baskarada et al., 2016).

Military organizations present particular structural paradoxes that require ambidextrous leadership, especially in Air Force environments, where these tensions are most evident (see Appendix 2- Facilitating vs. Impeding Factors for Military Ambidextrous Leadership, p. 66). Facilitating factors include a strong organizational identity rooted in mission-critical excellence, precise performance metrics, and rapid feedback from combat operations. Impeding factors include hierarchical rigidity, standardization necessary for safety, and risk aversion driven by life-or-death stakes (Shields & Travis, 2021; Kassotaki, 2017).

Research indicates that military environments exhibit primarily vertical rather than horizontal ambidexterity, as rigid structures hinder the lateral sharing of exploratory activities across units (Kassotaki, 2017). Air Force operational settings require highly developed ambidextrous leadership skills owing to their technological complexity, fast pace, and the multi-domain nature of modern aerial combat. Leaders must balance exploiting proven tactics with exploring new solutions while ensuring split-second decision accuracy (Rashid et al., 2024; Lawrence et al., 2021).

This need for careful balance creates what Shields and Travis (2017) refer to as "pragmatic versatility," where leaders must demonstrate flexible adaptation without compromising operational safety. Building on this theoretical foundation and empirical evidence from Air Force operational contexts, the current research synthesizes various aspects of crisis leadership into a comprehensive framework. Based on this review and Air Force operational needs, it proposes a military ambidextrous leadership framework with five key dimensions that interact dynamically during crisis response, a synthesis that consolidates previously separate leadership elements into an integrated model designed explicitly for military aviation crises. The selection and integration of these particular dimensions are detailed in the methodology section, which explains the rationale for this specific combination and their dynamic interactions (see Appendix 3 – Ambidextrous Leadership Dimensions in Military Crisis Contexts, p. 67). The five key dimensions for the proposed military ambidextrous leadership framework are as follows:

Dimension (1) – Cognitive Flexibility involves quickly switching between different mental modes and tactical frameworks, including overcoming cognitive biases while remaining open to disconfirming information (Šimanauskienė et al., 2021; Kousina & Voudouris, 2023). Being cognitively flexible means shifting from pre-planned missions to real-time adjustments based on unexpected threats, requiring "mindful organizing" under intense pressure of time.

Dimension (2) – Resource Reallocation Agility involves swiftly shifting personnel, equipment, and focus between routine tasks and innovative strategies, reallocating assets quickly from standard missions to counter-surprise operations without disrupting existing commitments (Stei et al., 2024; Riyanto, 2024).

Dimension (3) – Learning Integration Speed involves applying real-time feedback to adjust strategies during ongoing operations, requiring both single-loop learning (fixing errors within existing frameworks) and double-loop learning (challenging the frameworks themselves), especially when established doctrines prove inadequate (Sarika et al., 2024; Lawrence et al., 2021).

Dimension (4) – Command Authority Balance involves toggling between centralized control for coordination and decentralized decision-making for tactical innovation, thereby addressing the tension between hierarchy and local adaptive authority (Guo et al., 2020; Al-Eida, 2020).

Dimension (5) – Operational Innovation Integration involves seamlessly incorporating new tactical methods during ongoing operations while maintaining mission effectiveness and safety standards, ensuring that exploratory actions support rather than undermine mission success (Rashid et al., 2024; Akinci et al., 2022).

These five dimensions lead to three key propositions: (1) military leaders with higher ambidextrous leadership skills respond more effectively to surprise attacks; (2) organizations that support ambidextrous leadership structures recover more quickly; (3) the rapid pace of crises highlights the importance of individual ambidextrous skills over organizational structures.

This framework offers the theoretical basis for understanding how senior Air Force officers manage complex crisis leadership challenges while maintaining operational effectiveness and engaging in innovative adaptation (Shields & Travis, 2017; Rashid et al., 2024).

Methodology

Research Design

This comparative case study methodology (Yin, 2018) examines the 1973 Yom Kippur War and the October 7, 2023, attack within the Israeli Air Force. A fifty-year span between the events allows for analyzing ongoing leadership challenges versus those specific to contexts. Data is triangulated from declassified archives, commission reports (1973), journalistic sources, and early academic articles (2023). Hebrew sources are reviewed in their original language, with validity confirmed through pattern matching and peer review.

Theoretical Framework

This study systematically adapts March's (1991) exploitation-exploration framework for military crisis leadership by selecting five dimensions that directly address the structural constraints identified by Soeters et al. (2006)—hierarchical command systems, standardized procedures, and high-stakes consequences—which Gibson & Birkinshaw's (2004) civilian ambidexterity models do not account for. The dimension selection process builds on March's original dichotomy and incorporates Rosing et al.'s (2011) behavioral switching model to capture how exploitation-exploration tensions manifest within military hierarchical structures during crises.

The five dimensions were specifically chosen based on their theoretical foundation in military organizational behavior: Cognitive Flexibility stems from March's (1991) core cognitive tensions under time pressure; Resource Reallocation Agility translates O'Reilly and Tushman's (2013) structural ambidexterity into military resource constraints; Learning Integration Speed operationalizes Argyris and Schön's (1996) organizational learning within compressed military decision cycles; Command Authority Balance addresses Yammarino et al.'s (2010) identified leadership paradoxes specific to military hierarchical settings; and Operational Innovation Integration incorporates Hannah et al.'s (2009) authentic

leadership principles related to safety and reliability in military operations. These dimensions collectively represent the essential ambidexterity behaviors that emerge when military leaders simultaneously exploit proven capabilities while exploring innovative responses under crisis conditions.

Limitations

Disparities between extensive 1973 declassified materials and limited 2023 documentation may affect comparative accuracy. The focus on a single organization and the Israeli military context restricts generalizability.

Case Study Analysis

The 1973 Yom Kippur War: Exploitation Orientation Under Fire

Organizational Context

The Israeli Air Force entered October 1973 with unwavering confidence. This confidence was directly derived from its decisive victory in the 1967 Six-Day War. The success had solidified into what Bar-Joseph (2008) called "the conception," a fixed strategic mindset that believed Israeli air superiority would deter any major Arab military initiatives.

Air Force Commander Benjamin Peled developed a doctrine emphasizing preemptive strikes and technological superiority (Bar-Joseph, 2013, 2021; Eyeland, 2023). This approach fostered an organizational culture that is deeply committed to utilizing proven capabilities (Gordon, 2008). However, this confidence was severely tested as the war progressed, revealing the limitations of such an exploitation strategy when faced with unexpected challenges. The command structure reflected this exploitation approach through several key features.

First, decision-making remained highly centralized. Second, operational planning relied on detailed, predetermined protocols. Third, tactical flexibility at the squadron level was heavily restricted (Bar-Joseph, 2008; Gordon, 1998). Training programs focused on refining established procedures rather than developing adaptable skills (Gordon, 1998, 2008; Steigman, 2023). Intelligence processes reinforced existing assumptions, forming echo chambers that excluded disconfirming information about the changing capabilities of the Arab world (Gordon, 1998; Tamari, 2011). This filtering ultimately led to a strategic misjudgment with serious consequences for the IAF and broader Israeli military efforts during the conflict.

Initial Response Analysis

When Egyptian and Syrian forces launched their coordinated attack on October 6, 1973, the IAF's initial response revealed apparent limitations of a purely

exploitation-focused approach. Despite tactical warning signs, commanders attempted to carry out standard air superiority operations based on the success of 1967 (Bar-Joseph, 2008). Gordon (2008) documented how the first 48 hours saw repeated attempts to execute pre-planned strike packages against Egyptian bridgeheads. These efforts continued even as increasing aircraft losses indicated fundamental flaws in tactical assumptions. The exploitation bias manifested in three critical dimensions, proving costly.

Tactical Rigidity

Squadron commanders were given detailed mission orders that left little room for flexibility. When pilots encountered unexpected SA-6 surface-to-air missile systems, they had no authority to abort or change their attack plans (Bar-Joseph, 2021; Ben-Israel, 2011). This inflexibility reflected what Perrow (1984) described as "tight coupling" in complex systems. The result was disastrous: 14 aircraft were lost on the first day alone, a shocking toll for a force accustomed to air supremacy (Bar-Joseph, 2021; Gordon, 2008; Haber et al., 2013).

Cognitive Anchoring

Senior leadership faced a similarly significant challenge. Despite mounting battlefield evidence, commanders clung to their existing beliefs about Arab military strength and Israeli technological superiority (Bar-Joseph, 2008). The idea that low-altitude attacks could overcome Arab air defenses persisted despite numerous failed missions. Internal command discussions revealed ongoing efforts to interpret losses as failures of execution rather than as outcomes of external factors (Gordon, 2008; Marcheli, 2023). Leaders refused to recognize the fundamental tactical obsolescence, illustrating what Kahneman (2011) referred to as "theory-induced blindness."

Learning Paralysis

The rapid operational pace hampered systematic adaptation through traditional IAF methods. Individual pilots' real-time innovative efforts went unrecorded in the centralized command system. The organization's learning infrastructure, designed for peacetime refinement of proven tactics, could not support the radical experimentation necessary for responding to new threats (Finkel, 2022; Gordon, 2008; Tamari, 2011).

Ambidextrous Leadership Deficits

Analysis through the ambidextrous leadership framework reveals systematic deficiencies across all five dimensions. This analysis demonstrates how organizational excellence in exploitation can become a liability during a crisis.

Dimension (1) – Cognitive Flexibility Limitations

IAF commanders demonstrated a limited ability to adjust their mental models despite accumulating contradictory evidence. The persistence of "the conception" led to theory-induced blindness, preventing recognition of the fundamentally changed battlefield dynamics. Confirmation bias led to the selective interpretation of intelligence. Commanders emphasized reports that confirmed Arab weakness while ignoring evidence of their adversary's improved capabilities and strategic adjustments. This cognitive rigidity ultimately weakened the IAF's operational effectiveness, highlighting the urgent need for adaptive leadership in high-stakes environments.

Dimension (2) – Resource Reallocation Challenges

Resource reallocation agility was nearly nonexistent during the critical initial phase. Aircraft continued executing pre-war mission profiles aimed at anticipated threats rather than actual battlefield needs. The organizational system for tasking and resource allocation, optimized for deliberate planning cycles, failed to support quick reorientation. Ground support equipment and munitions remained set up for expected scenarios instead of emerging defensive needs (Ben-Israel, 2011; Gordon, 2008). This misallocation of resources worsened the IAF's operational challenges.

Dimension (3) – Learning Integration Failures

Learning integration speed was far below battlefield needs. The centralized command system slowed the quick spread of tactical lessons. Innovations by frontline units took days rather than hours to disseminate across the organization. Squadron-level discoveries about surface-to-air missile engagement zones, effective countermeasures, and modified attack profiles stayed localized (Bar-Joseph, 2021; Gordon, 1998, 2008). Critical tactical knowledge did not reach other units that urgently needed it (Bar-Joseph, 2008).

Dimension (4) – Command Authority Imbalance

The balance of command authority revealed the most fundamental failure of commanders' attempts at ambidextrous leadership. The crisis exposed an inability to balance centralized coordination with distributed innovation in a dynamic

manner. A rigid hierarchy prevented squadron commanders from exercising tactical initiative, even when local conditions clearly demanded deviation from central directives. Simultaneously, senior leadership lacked the granular situational awareness necessary for providing detailed tactical direction. This confluence of factors resulted in paralysis at multiple organizational levels.

Dimension (5) – Operational Innovation Integration

Only after absorbing significant losses did the IAF begin demonstrating exploratory behaviors. By Day 4, commanders authorized the use of experimental tactics. These included the employment of standoff weapons and integrated Suppression of Enemy Air Defenses (SEAD) operations (Ben-Israel, 2011; Gordon, 2008). However, this adaptation emerged through costly trial and error rather than systematic ambidextrous leadership. The eventual tactical innovations, including low-level night attacks and decoy operations, emerged from bottom-up experimentation rather than leadership-directed exploration (Ben-Israel, 2011; Gordon, 2008).

The Aftermath

The IAF's experience during the Yom Kippur War highlights the crucial need for organizations to develop adaptive leadership capabilities. Such capabilities prove essential for navigating complex and unpredictable environments effectively. The delay in adaptation came at a tremendous cost, both in terms of aircraft and pilot lives.

The 2023 October 7th Attack: Technology and Tradition Collide

Evolved Context, Persistent Culture

By 2023, the IAF had significantly improved its technological capabilities, including network-centric warfare systems, precision-guided munitions, real-time intelligence fusion, and the integration of unmanned systems (Ben-Israel, 2011, 2013). However, behind this technological sophistication, the organizational culture remained intensely focused on exploitation. Recent operations against asymmetric threats have reinforced the IAF's reliance on technological superiority and precise, pre-planned operations (Ben-Israel, 2011; Finkel, 2022, 2024a, 2024c; Heller, 2024; Selján, 2024). The command structure had adapted to include more decentralized decision-making, with squadron commanders having greater tactical autonomy than they did in 1973 (Gordon, 1998; Steigman, 2023). Still, this decentralization occurred within a framework designed to carry out variations of established procedures rather than to develop new approaches. Intelligence systems had grown exponentially in complexity, yet their design

was based on assumptions about threat characteristics that proved disastrously wrong on October 7th (Bochbot, 2025; HaCohen, 2024; Lt. Col. Y., 2024).

Surprise and System Failure

The Hamas attack's unprecedented scale and sophistication created conditions that overwhelmed the IAF's exploitation-focused systems. Initial responses showed striking parallels to 1973, indicating deep organizational continuities that went beyond technological changes, despite the vastly different contexts. Procedural paralysis took hold as commanders struggled to adapt to unprecedented scenarios by using existing response templates. IAF units initially tried to implement standard counter-terrorism protocols despite facing a complex, multi-domain assault that included ground infiltration, massive rocket barrages, drone swarms, and cyber-attacks (Ophir, 2023; Ortal, 2025; Preisler-Swiri, 2024; Selján, 2024).

The assumption that technological systems would enable effective responses through established procedures proved disastrously inadequate when facing an enemy that had studied and deliberately exploited these procedural patterns. In the technology-rich environment of 2023, information overload paradoxically became a barrier to adaptation. While 1973 suffered from a lack of information, 2023 experienced information paralysis. The vast amount of incoming data from satellites, drones, ground sensors, intelligence networks, and social media overwhelmed decision-making processes designed for more limited information flows (Selján, 2024; Wyss, 2024). Commanders faced thousands of data points and struggled to synthesize conflicting reports and identify the most urgent responses.

Coordination breakdown across domains exposed critical gaps in the IAF's integration capabilities. The multi-domain nature of the attack, which targeted air, land, sea, and information spheres simultaneously, revealed that organizational structures were still optimized for single-domain excellence rather than an integrated response (Heller, 2024; Blumental & Menashe, 2025; Wyss, 2024; Zeitoun, 2025). IAF liaison officers with ground forces lacked procedures for handling the unprecedented scenario of simultaneous mass casualty events, infrastructure attacks, and conventional military assaults.

Ambidextrous Leadership Analysis

The 2023 crisis revealed both evolution and persistence of ambidextrous leadership challenges, demonstrating how technological advancements without corresponding organizational adaptations may actually reduce crisis response capabilities.

Dimension (1) – Cognitive Flexibility Limitations

Cognitive flexibility has remained limited despite five decades of organizational learning. Modern commanders displayed similar cognitive rigidity as their counterparts did in 1973, though through different mechanisms. The availability bias caused them to interpret the attack using familiar terrorism frameworks instead of recognizing its hybrid warfare features. Command discussions disclosed ongoing attempts to apply counter-terrorism models, focusing on precision and discrimination, despite a situation that required conventional war responses prioritizing speed and mass (Dostri, 2023; Finkel, 2024a; Heller, 2024).

Dimension (2) – Resource Reallocation Challenges

Resource reallocation agility, while showing potential for improvement, still faces practical limitations. Modern command systems offer better capability for quick asset redeployment through networked communications and real-time tracking. However, organizational practices and system interdependencies currently restrain practical agility below its theoretical maximum. There is hope for improvement in this area, as the lessons learned from the 2023 crisis can guide future reforms. Aircraft configured for precision strikes against individual targets proved ineffective against massed infantry assaults that require area effects (Ashkenazi, 2025; Bochbot, 2025; Heller, 2024).

Dimension (3) – Learning Integration Speed

Learning speed demonstrated the double-edged nature of technological advancement. Real-time data systems offer unprecedented potential for rapid learning dissemination; however, organizational structures have not fully or effectively capitalized on this potential. Tactical innovations by individual units, such as using attack helicopters for urban close air support or adapting agricultural drones for reconnaissance, took hours to disseminate despite instantaneous communication capabilities. A bright future lies ahead for the integration of real-time data systems in military operations (Bochbot, 2025; Ganor, 2025; Heller, 2024; Ophir, 2023).

Dimension (4) – Command Authority Balance

The command authority balance reveals ongoing struggles with dynamic adaptation, despite apparent improvements in this area. While squadron commanders have greater formal autonomy than they did in 1973, crisis conditions have exhibited a recentralization of informal authority, as senior leadership has intervened directly in tactical decisions. Modern communications enable, but also promote, micromanagement, with senior commanders able to monitor and

override tactical decisions in real time. This issue urgently needs to be addressed to ensure effective crisis response (Heller, 2024; Ortal, 2025; Shapira, 2025).

Dimension (5) – Operational Innovation Integration

The October 7th attack exposed critical failures in operational innovation integration. The IAF's existing doctrine maintained rigid separation between conventional military response and routine security operations, with no framework for mass infiltrations that exceeded security parameters yet fell short of conventional attack criteria (Dan, 2024; Heller, 2024). Procedures optimized for precision strikes proved incompatible with "swarm" infiltrations requiring immediate area-effect responses (Dostri, 2023). The absence of pre-approved engagement zones for infiltrators within Israeli territory, despite decades of border operations, reflected the deeper limitation of viewing air power as "supporting" rather than "leading" in border defense (Shmueli, 2025; Shimoni, 2025; Finkel, 2024).

Technological Dependence as an Exploration Barrier

A unique aspect of the 2023 case was the role of technology in constraining exploration. Sophisticated systems designed for optimizing known procedures created new barriers to innovation. Automated planning systems channeled thinking toward standard solutions. User interfaces optimized for routine operations proved cumbersome for novel approaches (Shapira, 2025). System interdependence meant that innovations required complex reconfigurations. Training focused on system operation rather than creative problem-solving. These factors suggest that technological advancement without corresponding organizational adaptation may reduce ambidextrous capability by introducing exploitation bias into system design.

Comparative Analysis: Persistent Patterns Across Eras

Enduring Exploitation Bias

Both examples highlight a strong tendency towards exploitation despite functioning in different settings. The emphasis on air dominance in 1973 mirrors the dependence on technological precision, along with similar organizational preferences for proven methods rather than experimentation, in 2023 (Finkel, 2024b; HaCohen, 2024; Heller, 2024). This consistent pattern indicates that exploitation bias stems from deeply ingrained cultural foundations that extend beyond specific technologies or doctrines. The persistence of this bias underscores key aspects of military organizational culture: a professional identity centered on mastery and expertise in validated capabilities, which fosters psychological commitment to current skills; institutional memory that upholds successful past

strategies, especially for organizations like the IAF that built their reputation through particular operational methods; risk-averse cultures driven by the high-stakes nature of military failures, making deviation from proven techniques psychologically risky; and socialization processes that systematically train officers to value discipline, standardization, and adherence to procedures over experimentation (Soeters et al., 2006; Weick & Sutcliffe, 2007).

These cultural patterns reinforce themselves through organizational reward systems, promotion criteria, and professional recognition that favor those leaders who are skilled in exploitation. They punish those whose exploratory efforts fail, regardless of their learning value. The organizational benefits of operational efficiency, predictable results, and easier training create strong institutional incentives to uphold current methods. Meanwhile, the cultural focus on avoiding failure often outweighs incentives for innovation (Finkel, 2022; Gordon, 1998). Both examples show how a focus on exploitation during peacetime can lead to systemic vulnerabilities when crises require innovation. The IAF's reputation for operational excellence—based on mastery of exploitation—can become a liability in situations that demand fundamental innovation (Dostri, 2023; Preisler-Swiri, 2024; Tamari, 2011).

Evolution in Mechanisms, Persistence in Challenges

While specific mechanisms have changed significantly over time, core leadership challenges have remained essentially unchanged (see Appendix 4 – Comparative Analysis of IAF Crisis Response Patterns by Leadership Dimension, p. 68). In 1973, mechanical limitations such as manual information processing, hierarchical communication, limited simulation ability, and slow post-action learning cycles constrained capabilities and hampered crisis response: manual information processing hampered situational awareness, hierarchical communication delayed the flow of information, limited simulation ability hindered pre-crisis planning, and post-action learning cycles were too slow for the fast pace of crises (Gordon, 2008; Haber et al., 2013). By 2023, technological innovations had removed most mechanical barriers. Digital systems enabled full situational awareness. Network communications allowed instant information sharing. Advanced simulations offered thorough scenario planning (Ashkenazi, 2025; Ben-Israel, 2011; Finkel, 2022, 2024a). Real-time data systems supported ongoing learning and adaptation.

Despite these improvements, both cases reveal similar leadership failures in cognitive flexibility, resource reallocation, learning integration, and authority balance. This pattern suggests that leadership challenges originate from human cognitive limitations and organizational factors, rather than technological

constraints. The bounded rationality that limited commanders in 1973 persists in 2023, merely shifting from information scarcity to information overload as the constraining factor (Dostri, 2023; Finkel, 2024b; Ganor, 2025).

Individual Versus Organizational Ambidexterity

Both cases reinforce the critical role of individual-level ambidextrous capabilities in crisis response. Organizational structures and systems, whether primitive (1973) or sophisticated (2023), proved too slow for the rapid adaptation required. Effective responses emerged from individual commanders who demonstrated personal ambidextrous capabilities despite organizational constraints (Ganor, 2025; HaCohen, 2024; Heller, 2024). These findings challenge the literature that emphasizes organizational-level ambidexterity mechanisms.

While such mechanisms remain important for longer-term adaptation, crisis response depends critically on individual leaders' ability to recognize when exploitation fails and rapidly shift to exploration. The temporal compression of military crises underscores the significance of individual capabilities over organizational structures.

Cultural Continuity

Most significantly, both cases reveal profound cultural continuity in the IAF's approach to operations. The emphasis on technical excellence, procedural standardization, and operational precision, while contributing to peacetime effectiveness, created cognitive and behavioral barriers to crisis adaptation (Heller, 2024; Lt. Col. Y., 2024). This cultural orientation toward exploitation reflects broader Israeli military traditions that emphasize quality over quantity, technology over maneuver, and precision over mass (Ben-Israel, 2011, 2013; Gordon, 1998; Zeitoun, 2025). Changing such deeply ingrained cultural patterns requires more than technological advancements or structural reforms. It demands fundamental shifts in how military aviation organizations conceptualize effectiveness, reward innovation, and prepare for uncertainty. The persistence of exploitation bias across fifty years suggests that developing ambidextrous capabilities requires deliberate, sustained intervention rather than an expectation that it will emerge naturally from operational experience.

Discussion

The comparative analysis of IAF responses during the 1973 Yom Kippur War and the attack of October 7, 2023, highlights enduring challenges in balancing exploitation and exploration within military aviation organizations. Despite half a century of technological advancements and doctrinal evolution, the IAF

consistently struggled with this balance during the onset of these crises (Finkel, 2024c; Heller, 2024).

This persistence amplifies the fact that technological advancement alone cannot substitute for fundamental organizational and individual adaptation. Sophisticated command-and-control systems, real-time intelligence networks, and advanced munitions enhanced exploitation capabilities while coincidentally creating new barriers to exploration. The 2023 Israeli case illustrates how technological systems designed to optimize known procedures can nevertheless embed exploitation bias in organizational routines, thereby reducing the flexibility they were intended to enable.

At the heart of these failures lies the tension between operational efficiency and adaptive innovation. Peacetime optimization for exploitation yields clear benefits: reduced training complexity, predictable outcomes, and high reliability under routine conditions. These benefits come at the cost of adaptability under radical uncertainty. Both cases demonstrate how organizations optimized for known threats struggle when confronting novel scenarios that invalidate existing assumptions.

Individual-level ambidextrous capabilities are crucial for effective responses, as some commanders possess exceptional traits that enable them to shift between exploitation and exploration rapidly. Early research shows these effective leaders possess specific cognitive and behavioral features: greater tolerance for ambiguity, which enables operation with limited information; metacognitive awareness to recognize when strategies fail; psychological flexibility to abandon prior successful approaches without cognitive dissonance; and social confidence to challenge hierarchy and pursue new solutions despite organizational pressures (Gibson & Birkinshaw, 2004; Kolditz, 2007; Hannah et al., 2009). Research also indicates that switching between opening and closing activities is especially important in high-stakes military settings, where organizational structures often struggle to adapt quickly for smooth mode changes (Rosing et al., 2011; Kassotaki, 2017). However, limited documentation, especially regarding the events in 2023, hampers a complete understanding of these traits. Future research should systematically analyze the psychological profiles, career backgrounds, and decision-making styles of leaders with strong ambidextrous skills through structured interviews, psychological assessments, and long-term leadership development studies to improve selection and training (Yammarino et al., 2010; Hannah et al., 2009). Even those individuals with apparent ambidextrous abilities faced organizational barriers that hindered the dissemination of innovation. Cultural norms emphasizing centralized control, standardization, and precision created systemic friction, even during crises that required exploration. This tension

suggests future research should explore how organizational structures interact with individual ambidextrous abilities (Gibson & Birkinshaw, 2004; Soeters et al., 2006). The 2023 case emphasizes that modern communication systems which could support distributed innovation instead enabled micromanagement, with senior leaders using real-time monitoring to override local initiatives. This highlights the need to study how technological systems can be designed to support rather than hinder individual ambidextrous behaviors within military hierarchies (Kassotaki, 2017; Weick & Sutcliffe, 2007).

These observations indicate that military aviation organizations must deliberately cultivate ambidextrous capabilities at both individual and organizational levels. Structural solutions—including formalizing decentralized command, creating simulation environments for exploration, and embedding rapid feedback mechanisms—must accompany cultural shifts that reward innovation, tolerate calculated risk-taking, and recognize the value of deviating from standard procedures when conditions demand it.

The study offers critical implications for leadership development. Selection processes must identify candidates with demonstrated cognitive flexibility and adaptive problem-solving skills. Training curricula should shift from focusing on procedural mastery to developing the ability to switch between exploitative and exploratory modes based on situational requirements. Evaluation systems must reward not only precision and efficiency but also creativity and responsiveness in the face of uncertainty.

At a broader level, these findings underscore the need for military organizations to acknowledge surprise as an inherent aspect of warfare, not an anomaly. Preparing for surprise requires more than planning for specific contingencies; it demands building institutional and individual capabilities for rapid adaptation to the unknown.

Practical Recommendations

This study provides concrete recommendations for military aviation organizations seeking to enhance their crisis response capabilities through ambidextrous leadership development.

Selection and Training: Recruitment processes should identify candidates who demonstrate cognitive flexibility, openness to disconfirming information, and creative problem-solving abilities under pressure. Training programs must incorporate scenario-based exercises emphasizing rapid transitions between exploitative and exploratory modes, including surprise injects that deliberately violate standard operating procedures to force innovation.

Organizational Structure: Organizations must strike a balance between centralized planning and decentralized execution through formal mechanisms that clearly define authority delegation during crises. Communication systems should support the rapid dissemination of bottom-up innovation while maintaining necessary coordination.

Cultural Transformation: Cultural change initiatives should promote organizational cultures that value experimentation, tolerate calculated risk-taking, and recognize the strategic imperative of adapting to uncertainty. Reward systems must acknowledge commanders who demonstrate successful mode-switching rather than only those who excel at exploitation.

Technological Design: Command-and-control systems must enable rather than constrain adaptive behavior, supporting transparent information flows while avoiding over-optimization for routine procedures.

Theoretical Contributions

This research extends organizational ambidexterity theory into the military aviation domain by demonstrating how exploitation-exploration tensions manifest during crisis response under extreme temporal compression and life-or-death stakes. The study's unique contribution lies in its systematic application of ambidextrous leadership theory to military aviation crisis response, addressing a significant gap in existing literature that has largely overlooked the intersection of organizational ambidexterity and military command structures.

By analyzing two temporally distant yet thematically similar crises, this research demonstrates the persistence of organizational tendencies that undermine adaptability despite technological advancement. The findings reveal how technological progress can paradoxically constrain ambidextrous behavior when systems embed exploitation bias in their design, therefore extending ambidexterity theory by highlighting technology's role as a mediating factor that can either enhance or impede organizational flexibility.

Limitations and Future Research

Future research directions include cross-national comparative studies examining crisis responses of other military aviation organizations, longitudinal research tracking the development of ambidextrous capabilities in individual commanders, and experimental validation using military simulations to test specific interventions designed to enhance the exploitative-exploratory balance under time pressure.

Conclusion

The persistence of ambidextrous leadership challenges in military aviation over fifty years amplifies the understanding that technological progress alone cannot substitute for developing adaptive leadership capabilities. As surprise remains an inherent feature of warfare, military organizations must invest deliberately in cultivating leaders and structures capable of balancing exploitation and exploration under extreme time pressure.

This study provides an empirically grounded, theoretically informed framework for understanding and improving crisis leadership in military aviation. The findings suggest that military organizations must fundamentally reconceptualize their approach to leadership development and organizational design, building capacity for rapid adaptation to unknown challenges rather than optimizing for known threats.

References

Akinci, G., Alpkan, L., Yildiz, B., & Karacay, G. (2022). The link between ambidextrous leadership and innovative work behavior in a military organization: The mediating role of climate for innovation. *Sustainability*, *14*(22), 1-19. https://doi.org/10.3390/su142215315

Al-Eida, S. N. S. M. (2020). The impact of ambidextrous leadership on organizational excellence: An applied study in small and medium enterprises in Qatar. *International Journal of Business and Management*, *15*(9), 163–175. https://doi.org/10.5539/IJBM.V15N9P163

Argyris, C., & Schön, D. A. (1996). *Organizational learning II: Theory, method, and practice*. Addison-Wesley Publishing Company.

Ashkenazi, A. (2024, December 15). Tractor in the air: After October 7th, Israel changes the rules of the game on the battlefield. *Maariv Online*. [Hebrew] https://www.maariv.co.il/news/military/article-1158993

Ashkenazi, A. (2025, February 27). October 7th investigation reveals: The Air Force prevented the capture of a strategic base in central Israel. *Maariv Online*. [Hebrew] https://www.maariv.co.il/news/military/article-1176302

Bar-Joseph, U. (2008). Strategic surprise or fundamental flaws? The sources of Israel's military defeat at the beginning of the 1973 war. *The Journal of Military History*, *72*(2), 509–530. https://doi.org/10.1353/JMH.2008.0127

Bar-Joseph, U. (2013). *The watchman fell asleep: The Yom Kippur surprise and its sources*. Tel Aviv: Zmora Bitan Publishers. [Hebrew]

Bar-Joseph, U. (2021). *The Angel: The Egyptian spy who saved Israel*. Cambridge, MA: Harvard University Press.

Baskarada, S., Watson, J., & Cromarty, J. (2016). Leadership and organizational ambidexterity. *Journal of Management Development*, *35*(6), 735–757. https://doi.org/10.1108/JMD-01-2016-0004

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Ben-Israel, I. (2011). *Raising birds: The Air Force challenges and missions*. Ra'anana: The Open University of Israel Press. [Hebrew]

Ben-Israel, I. (2013). *Israeli defense conception*. Tel Aviv: Modan Publishers. [Hebrew]

Bigman, E. (2024, January 30). The IDF invented a new defense doctrine, and the settlements are getting hit. *Mida*. [Hebrew] The IDF invented a new defense doctrine, and the settlements are getting hit

Blumental, I., & Menashe, K. (2025, February 16). The IDF will present the October 7th investigation starting next week. *Kan News*. [Hebrew] https://www.kan.org.il/content/kan-news/defense/860697/

Bochbot, A. (2025, February 27). Where was the Air Force at the beginning of the war? The investigations show: Not in the right place. *Walla News*. [Hebrew] https://news.walla.co.il/item/3730614

Boin, A., 't Hart, P., Stern, E., & Sundelius, B. (2016). *The politics of crisis management: Public leadership under pressure* (2nd ed.). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511490880

Bronfeld, S. (217). From the electronic summer of 1970 to winter 1973: The story of losing air superiority. *Between the Poles*, 12, 143–174. [Hebrew]From the electronic summer of 1970 to winter 1973

Campbell, D. J. (2012). Leadership in dangerous contexts: A team-focused, replenishment-of-resources approach. In J. H. Laurence & M. D. Matthews (Eds.), *The Oxford handbook of military psychology* (pp. 158–175) Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195399325.013.0062

Dan, A. (2024). The need for attack helicopters: Characteristics and challenges in the modern era. *Aerospace & Defense,* 1(1).

Dostri, O. (2023). Hamas's October 2023 attack on Israel: The end of the deterrence Strategy in Gaza. *Military Review*, *103*(1), 1–13. https://www.armyupress.army.mil/Portals/7/military-review/Archives/English/Online-Exclusive/2023/Dostri/Hamas's-October-2023-Attack-on-Israel-UA.pdf

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.5465/amr.1989.4308385

Eyeland, G. (2023). The Chief of Staff and senior ranks in the Yom Kippur War. *Between the Poles*, *40*, 139–167.

Finkel, M. (2022). *Air Force headquarters: Force building processes and development of operational plans*. Modan Publishing, Ministry of Defense Publications. [Hebrew]

Finkel, M. (2024a). The military dimension of Israel's national security concept in light of the Iron Swords War. *Between the Poles*, *41*, 117–128. [Hebrew] https://www.idf.il/media/grdckq4f/09-%D7%94%D7%A8%D7%95%D7%91%D7%93-%D7%94%D7%A6%D7%91%D7%90%D7%99.pdf

Finkel, M. (2024b). The sense of control in reality as a saboteur in the IDF's organizational culture. *Between the Poles*, *41*, 61–76. [Hebrew] https://www.idf.il/media/nggavlav/06-%D7%AA%D7%97%D7%95%D7%A9%D7%AA-%D7%94%D7%A9%D7%9C%D7%99%D7%98%D7%94.pdf

Finkel, M. (2024c). Not a "War of Its Own": Offensive Air Support for the Maneuvering Forces in the Iron Swords War in Gaza: Factors of Success and Looking Ahead. *Aerospace & Defense*, 1(1), 25–44. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/wp-content/uploads/sites/14/2025/03/Meir-Finkel-Not-a-War-of-its-Own.pdf?lang=ena

Ganor, R. (2025). Change during war: Participation and Border Protection Group. [Hebrew] https://www.iaf.org.il/9781-62303-he/IAF.aspx

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47(2), 209–226. https://doi.org/10.5465/20159573

Goldstein, Y. (2008). *Leadership in times of war*. Tel Aviv: Ma'arachot Publishers. [Hebrew]

Gordon, A. (2008). *The Yom Kippur War: Israel and the struggle for survival*. Cambridge: Cambridge University Press.

Gordon, S. (1998). *The last order of knights: Modern air strategy*. Tel Aviv: Tel Aviv University Press. [Hebrew]

Gordon, S. (2008). 30 hours in October – Fateful decisions on Air Force deployment at the beginning of the Yom Kippur War. Tel Aviv: Maariv Books. [Hebrew]

Guo, Z., Yan, J., Wang, X., & Zhen, J. (2020). Ambidextrous leadership and employee work outcomes: A paradox theory perspective. *Frontiers in Psychology*, 11, 1661. https://doi.org/10.3389/FPSYG.2020.01661

Haber, A., Schiff, Z., Rothstein, R., & Tamari, D. (2013). *The war: The Yom Kippur War, 1973 (Revised and updated ed.)*. Tel Aviv: Kinneret, Zmora-Bitan, Dvir Publishers. [Hebrew]

HaCohen, G. (2024). The last war in comparative perspective to the Yom Kippur War. *Between the Poles*, 43, 1–9. [Hebrew] https://www.idf.il/media/jjhdoaeu/03-%D7%94%D7%9E%D7%9C%D7%97%D7%9E%D7%94-%D7%94%D7%90%D7%97%D7%A8%D7%95%D7%A0%D7%94.pdf

Hannah, S. T., Uhl-Bien, M., Avolio, B. J., & Cavarretta, F. L. (2009). A framework for examining leadership in extreme contexts. *The Leadership Quarterly*, 20(6), 897–919. https://doi.org/10.1016/j.leaqua.2009.09.006

Heifetz, R., Grashow, A., & Linsky, M. (2009). *The practice of adaptive leadership: Tools and tactics for changing your organization and the world*. Boston, MA: Harvard Business Press.

Heller, A. (2024). The role of air power in combat: Initial insights from the fighting in Gaza in Iron Swords. *Aerospace & Defense*, 1, 9–23. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/wp-content/uploads/sites/14/2025/03/Assaf-Heller-The-Role-of-Airpower.pdf?lang=ena

Kahneman, D. (2011). *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.

Kassotaki, O. (2017). *Ambidexterity and leadership: A multilevel analysis of the aerospace and defense organizations* [Doctoral dissertation]. University of Warwick. https://wrap.warwick.ac.uk/id/eprint/95904/1/WRAP_Theses_Gianzina-Kassotaki_2017.pdf

Klein, G. (1998). *Sources of power: How people make decisions*. Cambridge, MA: MIT Press.

Kolditz, T. A. (2007). In extremis leadership: Leading as if your life depended on it. San Francisco, CA: Jossey-Bass.

Kousina, E., & Voudouris, I. (2023). The ambidextrous leadership – innovative work behaviour relationship in the public sector: The mediating role of psychological ownership. *Public Administration Review*, 83(4), 891–907. https://doi.org/10.1111/puar.13650

Lawrence, E., Tworoger, L., Ruppel, C. P., & Yurova, Y. V. (2021). TMT leadership ambidexterity: Balancing exploration and exploitation behaviors for innovation. *European Journal of Innovation Management*, 24(3), 781–800. https://doi.org/10.1108/EJIM-07-2020-0275

Lt. Col. Y. (2024). Card game or checkers? Irrationality in military decision-making processes and ways to reduce it. *Ma'arachot*, 502, 56–61. [Hebrew] https://online.fliphtml5.com/gcjnv/nerl/#p=56

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87. https://doi.org/10.1287/orsc.2.1.71

Marcheli, A. (2023). Special: Yom Kippur War documents unveiled – *IAF website*. https://www.iaf.org.il/9701-61365-HE/IAF.aspx

Marcus, R. D. (2014). Military Innovation and Tactical Adaptation in the Israel–Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF. *Journal of Strategic Studies*, 38(4), 500–528. https://doi.org/10.1080/01402390.2014.923767

Mintzberg, H. (1979). *The structuring of organizations*. Englewood Cliffs, NJ: Prentice Hall.

O'Reilly, C. A., & Tushman, M. L. (2013). Organizational ambidexterity: Past, present, and future. *Academy of Management Perspectives*, 27(4), 324–338. https://doi.org/10.5465/amp.2013.0025

Ortal, E. (2025). Not a border, a front. *Begin-Sadat Center for Strategic Studies*. https://besacenter.org/he/%D7%9C%D7%90-%D7%92%D7%91%D7%95%D7%9C-%D7%97%D7%96%D7%99%D7%AA/

Perrow, C. (1984). Normal accidents: Living with high-risk technologies. New York: Basic Books.

Preisler-Swiri, D. (2024). The transition from the MAV to the Iron Swords War. *Between the Poles*, 41, 13–27. [Hebrew] https://www.idf.il/media/22apkc32/03-%D7%94%D7%9E%D7%A2%D7%91%D7%A8-%D7%9E%D7%94%D7%9E%D7%91%D7%9D.pdf

Raisch, S., & Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management*, 34(3), 375–409. https://doi.org/10.1177/0149206308316058

Riyanto, S. (2024). Achieving organizational agility and cultivating entrepreneurial orientation of business leaders through an ambidextrous leadership approach: A new perspective. In A. Ahmad & S. Riyanto (Eds.), *Leadership: Advancing great leadership practices and good leaders* (pp. 1–20). IntechOpen. https://doi.org/10.5772/intechopen.114923

Rosing, K., Frese, M., & Bausch, A. (2011). Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership. *The Leadership Quarterly*, 22(5), 956–974. https://doi.org/10.1016/j.leaqua.2011.07.014

Sarika J., Shailja B., Sarita V. (2024). Assessing ambidextrous leadership in organizations: review and future scope for research. *International Journal of Organizational Analysis.* https://doi.org/10.1108/IJOA-03-2024-4373

Selján, P. (2024). The October 7 Hamas attack: A preliminary assessment of the Israeli intelligence, military and policy failures. *AARMS-Academic and Applied Research in Military and Public Management Science*, 23(1), 81-98. https://folyoirat.ludovika.hu/index.php/aarms/article/view/7168

Shapira, N. (2025). Where was the Air Force in Hamas's surprise attack? October 7th investigations. *N12*. https://www.mako.co.il/news-military/2025_q1/Article-7d2464667884591026.htm

Shields, P. M., & Travis, D. S. (2017). Achieving organizational flexibility through ambidexterity. *Parameters*, 47(2), 15–28. https://press.armywarcollege.edu/parameters/vol47/iss2/8/

Shields, P. M., & Travis, D. S. (2021). Resolving contradictions in military operations via ambidexterity. In P. M. Shields & D. S. Travis (Eds.), *Resolving the paradox of our age* (pp. 1–25). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-52433-3_1

Soeters, J., (2006). Organizational Cultures in the Military. In G. Caforio (Ed.), *Handbook of the sociology of the military* (pp. 237-254). New York: Springer International. https://link.springer.com/chapter/10.1007/978-3-319-71602-2_13

Stei, G., Rossmann, A., & Szász, L. (2024). Leveraging organizational knowledge to develop agility and improve performance: The role of ambidexterity. *International Journal of Operations & Production Management*, 44(4), 721-750. https://doi.org/10.1108/ijopm-04-2023-0274

Steigman, Y. (2023). Must continue to play: The Israeli Air Force in the Yom Kippur War. Tel Aviv: Modan Publishers. [Hebrew]

Tamari, D. (2011). Where is air power heading?. *Ma'arachot*, *437*, 4–13. [Hebrew]

Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the unexpected: Resilient performance in an age of uncertainty* (2nd ed.). San Francisco: Jossey-Bass. https://doi.org/10.1002/9781119175834

Wyss, M. (2024). The October 7 attack: An assessment of the intelligence failings. *International Journal of Intelligence and Counterintelligence*, 37(4), 1245-1268. https://ctc.westpoint.edu/wp-content/uploads/2024/10/CTC-SENTINEL-092024_cover-article-1.pdf

Yammarino, F. J., Mumford, M. D., Connelly, M. S., & Day, E. A. (2010). Leadership and team dynamics for dangerous military contexts. *Military Psychology*, 22(1), 15–41. https://doi.org/10.1080/08995601003644221

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Thousand Oaks, CA: Sage Publications.

Zeitoun, Y. (2025). The surprise from the paratroopers, and the dramatic decision at 9:30, October 7th Air Force investigation. *Ynet*. https://www.ynet.co.il/news/article/bkg73zt511

Appendices

Appendix 1: Military vs. Civilian Ambidexterity Context Differences

This comparative analysis highlights the unique demands that military aviation contexts place on ambidextrous leadership, distinguishing them from civilian organizational applications of ambidexterity theory.

Context Dimension	Civilian Organizations	Military Organizations	Air Force Specific Implications	References
Decision Timeframe	Extended periods (months/years)	Compressed (minutes/ seconds)	Split-second tactical decisions at operational speed	Kassotaki, 2017; Shields & Travis, 2017
Stakes	Financial/ competitive	Life-or-death consequences	Mission failure = catastrophic losses	Shields & Travis, 2021; Akinci et al., 2022
Feedback Mechanisms	Market responses, performance indicators	Combat operations, mission outcomes	Real-time intelligence and tactical updates	Lawrence et al., 2021; Sarika et al., 2024
Organizational Structure	Flexible hierarchies	Rigid command structures	Multi-level command with distributed execution	Kassotaki, 2017; Baskarada et al., 2016
Innovation Climate	Encouraged experimentation	Controlled innovation within doctrine	Technology integration with safety constraints	Rashid et al., 2024; Stei et al., 2024

Appendix 2: Facilitating vs. Impeding Factors for Military Ambidextrous Leadership

The organizational characteristics identified in this analysis demonstrate how structural and cultural elements either enable or constrain ambidextrous leadership capabilities in military aviation contexts.

Organizational Characteristics	Facilitating Factors	Impeding Factors	Literature Support
Structural	Strong organizational identity, clear performance metrics	Hierarchical rigidity, standardization requirements	Kassotaki, 2017; Shields & Travis, 2021
Cultural	Rapid feedback cycles, mission focus	Risk aversion, warrior ethos constraints	Shields & Travis, 2017; Rashid et al., 2024
Temporal	Crisis urgency enables rapid decisions	Compressed timeframes limit reflection	Akinci et al., 2022
Leadership	Middle management as ambidexterity conduits	Vertical vs. horizontal penetration limitations	Kassotaki, 2017; Baskarada et al., 2016

Appendix 3: Ambidextrous Leadership Dimensions in Military Crisis Contexts

This theoretical derivation provides a thorough explanation of March's core exploitation-exploration dynamics as they appear within military crisis leadership constraints.

Leadership Dimension	Exploitation Focus	Exploration Focus	Crisis Integration Mechanism	References
Cognitive Flexibility	Pattern recognition from experience	Novel scenario interpretation	Rapid switching between mental models	Šimanauskienė et al., 2021; Akinci et al., 2022; Kousina & Voudouris, 2023
Resource Reallocation Agility	Efficient deployment of proven assets	Experimental allocation to untested solutions	Dynamic portfolio balancing	Stei et al., 2024; Riyanto, 2024; Lawrence et al., 2021
Learning Integration Speed	Application of established doctrine	Incorporation of real-time intelligence	Accelerated synthesis cycles	Sarika et al , 2024; Lawrence et al., 2021; Kassotaki, 2017
Command Authority Balance	Directive control for routine operations	Empowering initiative for novel situations	Calibrated delegation under pressure	Guo et al., 2020; Al-Eida, 2020; Baskarada et al., 2016
Operational Innovation Integration	Maintaining proven tactical procedures	Incorporating novel approaches into operations	Seamless integration of innovation with reliability	Rashid et al., 2024; Akinci et al., 2022; Shields & Travis, 2017

Appendix 4: Comparative Analysis of IAF Crisis Response Patterns by Leadership Dimension

This comparative analysis demonstrates the persistence of ambidextrous leadership challenges across five decades, revealing how similar patterns manifested despite dramatically different technological and operational contexts.

Dimension	1973 Yom Kippur War	2023 October 7th Attack
Cognitive Flexibility	Minimal; persistent reliance on outdated models	Limited; bias toward terrorism frameworks
Resource Reallocation	Slow; assets remained committed to prewar plans	Partial; reallocation delayed by systemic dependencies
Learning Integration	Delayed; innovations localized	Faster but fragmented; technological overload
Command Authority Balance	Centralized, minimal squadron autonomy	Nominal decentralization but frequent micromanagement
Operational Innovation	Integration Rigid; air superiority doctrine incompatible with SAM threat adaptation	Absent; no framework for mass infiltrations requiring area-effect response

Aerospace & Defense
Journal of the Elrom Center for Air and Space Studies at Tel Aviv University
No. 2(2) | December 2025

Integrating Active, Passive, and Offensive Defense: A Comparative Study of Ukraine and Israel (2022-2025)

Sarah Fainberg, Yuval Peleg, and Tomer Fadlon[1]

Abstract

The wars in Ukraine and Israel have been shaped by persistent missile, rocket, and drone attacks on civilian and military targets, illustrating the return of total warfare. This article investigates why and how different states withstand aerial coercion and develops a three-tier analytical framework of active defense (interception), passive defense (early warning, shelters, functional continuity), and offensive defense (degrading enemy strike capacity at its source). We argue that the degree of integration across these layers shapes home-front endurance, and we demonstrate this through a comparison of Ukraine, marked by wartime adaptation under material scarcity, and Israel, where prewar institutionalization enabled rapid but at times uneven adaptation after October 7. Drawing on open-source data, policy and media materials, and interviews with officials, practitioners, and civil society actors in Ukraine and Israel, we show that variations in defense integration affect each case's defense trajectory and performance. The findings contribute to scholarly debates on coercion, resilience, and adaptation in air warfare and offer an empirical basis for shaping defense integration in other high-threat environments.

[1] **Dr. Sarah Fainberg** is a Senior Researcher and Head of the Great Powers Research Program at Tel Aviv University's Elrom Center for Air and Space Studies.
Yuval Peleg is a Researcher at Tel Aviv University's Elrom Center for Air and Space Studies and a Ph.D. candidate in International Relations at the Hebrew University of Jerusalem.
Dr. Tomer Fadlon is Academic Director and Senior Researcher at Tel Aviv University's Elrom Center for Air and Space Studies and a lecturer at Tel Aviv University.

To cite this article: Fainberg, S., Peleg, Y., & Fadlon, T. (2025). Integrating active, passive and offensive defense: a comparative study of Ukraine and Israel. *Aerospace & Defense*, 2(2), 69-102. https://socsci4.tau.ac.il/mu2/elrommagazine-eng/

Keywords: Airpower, Active Defense, Offensive Defense, Passive Defense, Total Defense, Ukraine, Israel

Introduction

Over the past three-and-a-half years, both Ukraine and Israel have found themselves engaged in prolonged warfare characterized by persistent and intense aerial threats. The comprehensive nature of these threats has compelled both states to adopt whole-of-government and whole-of-society approaches, mobilizing military and civilian resources during wartime to confront the challenges posed by sustained aerial attacks. Whether these cases are context-specific or indicative of broader trends in contemporary warfare, a central question emerges: How do states shape their defense architectures to withstand continuous aerial threats and maintain functional continuity under wartime conditions?

This question resonates with ongoing scholarly and policy debates on the concept of total defense in the post-Cold War era. Existing literature on total defense has primarily emphasized comprehensive responses to hybrid threats, particularly cyber operations, information warfare, and limited land incursions. However, the Russo-Ukrainian war and Israel's multi-front war since October 7 underscore the centrality of the air domain across all phases of contemporary high-intensity conflict. This highlights a notable discrepancy between existing approaches to total defense and the operational realities of the two largest wars of the early twenty-first century. This article addresses this gap by analyzing how Ukraine and Israel developed comprehensive defensive responses to unprecedented aerial threats during wartime by integrating three levels of defense: *active*, *passive*, and *offensive*.

Empirically, the analysis draws on open-source datasets on aerial assault patterns, interception rates, and air-alert activity in Ukraine and Israel. Given the inherent uncertainty and contestation surrounding wartime figures, emphasis is placed on identifying trends and shifts rather than precise numerical counts. These data are supplemented by academic and policy research and media analyses. To deepen the evidence base and validate findings, a dozen semi-structured interviews were conducted between 2023 and 2025 with current and former defense officials, public emergency administrators, air-defense practitioners, and civil society actors in both countries (Appendix 1, p. 100). Most interviews were conducted under wartime conditions and are anonymized for security reasons. Interviews took place in Kyiv in August 2023, in Israel in 2025, and via video communication platforms in the summer of 2025 with respondents occupying mid- and senior-level positions in government and military institutions of both countries.

Our findings show that the evolving nature of aerial threats compels states to adopt multi-layered and adaptive defense architectures that integrate active, passive, and offensive components. The absence or weak integration of any single layer diminishes the resilience and effectiveness of the system as a whole. Both Ukraine and Israel built defense architectures combining active interception, passive protection, and offensive disruption of enemy fire, yet they represent distinct models of wartime adaptation. Ukraine illustrates a predominantly *in bello* model characterized by decentralized improvisation, civilian-military innovation networks, and rapid adaptation under severe material constraints. Israel reflects a primarily *ante bellum* model shaped by extensive prewar institutionalization, layered missile defense, and centralized command structures, yet one that also underwent accelerated adaptation following the systemic shock of October 7.

This article contributes to scholarly literature in three main ways. First, it examines how evolving airpower platforms and their operational use reshape the nature and perception of aerial threat and defense. Second, it analyzes how Ukraine and Israel mobilized, adapted, and integrated active, passive, and offensive defense layers under conditions of sustained aerial attacks. Third, it provides an empirically grounded basis for ongoing scholarly and policy debates on the relationship between total defense and integrated air and missile defense: an issue of increasing relevance not only for Central and Eastern Europe and the Middle East but also for Southeast Asia.

Conceptually, the three-tier framework (active, passive, and offensive defense) does more than describe known dimensions of air and civilian defense. It seeks to explain variation in home-front endurance under sustained air attacks by specifying how different degrees of integration among offensive, active, and passive defense shape three observable outcomes: (1) the effective volume and tempo of incoming strikes; (2) interception rate; and (3) state and societal functional continuity under fire. By comparing Ukraine's predominantly reactive construction of its defense architecture under fire and Israel's primarily proactive and prewar model, the study suggests an explanation of why some states can absorb massed missile and drone campaigns with limited systemic disruption while others face prolonged strain despite impressive tactical adaptation.

The article is structured as follows. The next section outlines the literature on total defense and presents the analytical framework. The subsequent section traces the structural and technological shifts in contemporary airpower and their systemic implications for the defender's state and society. The article then applies the three-layered framework to a comparative assessment of Ukraine's

and Israel's defense organization and wartime adaptation before concluding with implications for home-front defense in contemporary conflicts.

Literature Review and Analytical Framework

Russia's annexation of Crimea in 2014 reactivated debates surrounding total defense across Europe and in other regions facing heightened security threats, including Taiwan. While the notion of total defense is today undergoing renewed conceptual elaboration, it draws on Cold War-era foundations, particularly among non-aligned states bordering the Soviet Union, where the principle of the Nation-in-Arms sought to ensure national survival through the continuous integration of military institutions, state administration, civilian industry, and the general population (Bērziņa, 2020; Shaishmelashvili, 2023).

Although attention to total defense receded after the 1990s, Russia's aggressive posture since 2014 has reopened debates across Europe on how societies prepare for severe, multi-domain wartime disruption (Government of the Republic of Estonia, 2023; Government Offices of Sweden, 2024). Notably, these discussions have not evolved uniformly. States adopting total defense models vary significantly in how they conceptualize civilian participation, digital civil engagement, critical infrastructure continuity, reserve-force readiness, and the distribution of responsibilities across municipal, regional, and national levels (Bērziņš, 2023; Jordan, 2024; Ljungkvist, 2025). Even among the Nordic states most closely associated with the model, differences remain in institutional design, societal expectations, and civil-military synergies (Rakov & Fainberg, 2025). Fundamentally, states define total defense according to different strategic logics depending on their threat representation (Ångström & Ljungkvist, 2024).

The renewed relevance of total defense has been empirically tested in two contemporary conflicts that imposed unprecedented pressure on both state capacity and societal endurance: the full-scale Russo-Ukrainian war and Israel's multi-front war following the October 7 attacks. Despite markedly different geopolitical contexts and asymmetries of military power, both Ukraine and Israel experienced strategic shock that temporarily strained command institutions, emergency management systems, and civilian populations, leading scholars to describe them as cases illustrating the return of "total war"—i.e., comprehensive conflicts necessitating whole-of-society and whole-of-government responses (Karlin, 2024). Both governments mobilized not only the armed forces but also municipal authorities, volunteer organizations, private-sector actors, and civilian networks on a rapid and extensive scale (Rakov & Fainberg, 2025), thereby embodying the central logic of total defense: the integration of state and societal resources in response to an overwhelming threat.

Crucially, both wars reveal that the defense of the state and society has been centrally shaped by the need to withstand persistent, multidirectional, and high-intensity aerial attacks. Whereas earlier discussions of total defense focused heavily on hybrid interference, information operations, cyber disruption, and limited territorial incursions (Bērziņa, 2020, p. 5), the wars in Ukraine and Israel illustrate a shift in the center of gravity of coercion. Both conflicts have been defined primarily by sustained missile and drone campaigns targeting national infrastructure, military command nodes, and densely populated civilian areas.

This shift reflects broader structural transformations in airpower. While the integration of civilian technologies into military operations, the proliferation of dual-use objects, and the expansion of warfare into cyberspace and space have already eroded the boundary between the front line and the home front, the transformation of airpower constitutes an additional cumulative layer that exposes entire societies to continuous, large-scale aerial attack. Together, these dynamics reshape the spatial and temporal experience of warfare and place civilians at the center of the battlefield (Stewart, 2025).

Despite its centrality, the air dimension of warfare remains relatively under-conceptualized in total defense scholarship. Much of the post-2014 literature has concentrated on disinformation, cyber operations, and territorial defense forces, reflecting the security priorities of the Nordic-Baltic environment prior to 2022. By contrast, sustained aerial disruption and saturation attacks have only recently been incorporated into national resilience planning, as indicated for example in Sweden's Civil Defense Modernization Program (2026-2028).

The present study, therefore, seeks to advance understanding of the nexus between total defense and aerial threats by focusing specifically on the defense dynamics of Ukraine and Israel, with particular attention to the air domain. Analytically, the study identifies three key physical dimensions of defense critical to a state's ability to mitigate the impact of aerial attacks: active, passive, and offensive defense. This three-layered analytical framework is the basis of the present study.

Active defense refers to detecting, intercepting, or neutralizing incoming aerial threats through kinetic and electromagnetic means. In contemporary conflicts, the decisive variable of defense is the combination of platform sophistication and multi-layered integration: sensors, interceptors, and command-and-control fused into a coherent, multi-layered network across altitudes and domains.

Passive defense comprises non-kinetic mechanisms that preserve life and functional continuity: geo-targeted early warning, shelter policy, continuity of government and services, critical infrastructure protection, and grassroots civilian initiatives. In air campaigns marked by mass production and employment

of projectiles, improved precision, extended ranges, and multi-directionality, passive defense re-emerges as constitutive of national resilience (Karlin, 2024).

Offensive defense (*in bello*) refers to calibrated air (and supporting ground) operations based on high-quality intelligence, drawing on early warning and real-time threat detection, aimed at reducing the adversary's capacity to generate and sustain aerial attacks. It targets launch systems, command-and-control nodes, production chains, and logistical networks during wartime. Conceptually, it complements active interception by degrading strike potential at its source, thereby restoring the defender's initiative and alleviating pressure on active and passive defense layers.

Taken together, these three layers of defense (active, passive, and offensive) are analytically distinct but operationally interdependent (Figure 1). Offensive defense reduces the frequency and volume of incoming salvos; active defense intercepts or neutralizes those that are launched; passive defense mitigates harm and preserves societal and governmental continuity. A failure or shortfall in any single dimension imposes a disproportionate burden on the others, creating observable patterns of overstretch (air defense saturation, shelter network discrepancies and insufficiency, exhaustion of offensive resources). By contrast, higher levels of integration and synergy across the three tiers reduce cumulative vulnerability and enhance home-front endurance, as measured by damage levels and functional continuity under fire.

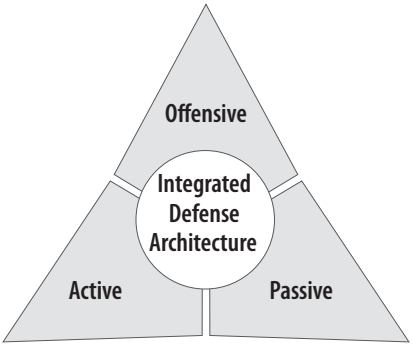

Figure 1: The Three Layers of Integrated Defense Architecture
Source: Elrom Center for Air & Space Studies, 2025.

While acknowledging that additional layers of wartime defense, such as urgent diplomatic mobilization to secure transfers of air-defense assets, play critical roles in shaping outcomes, this article focuses specifically on the capabilities and adaptive behavior of the defender state and society, rather than on arms acquisition or the development of wartime partnerships. Likewise, although

network-centric warfare and cognitive warfare, including information operations and psychological warfare, are increasingly intertwined with aerial coercion campaigns (Healey, 2024; Khoroshko et al., 2024), these dimensions fall outside the scope of this study. Future research could reconnect these layers by examining how network-centric warfare alongside cyber and information operations amplifies the coercive effects of missile and drone campaigns.

In addition, our framework also engages with scholarly debates on aerial coercion. Pape's (1996) typology of coercive air strategies and Horowitz and Reiter's (2001) quantitative study both demonstrate that the effectiveness of air campaigns is conditional rather than automatic, depending not only on strike characteristics but also on the vulnerability and resilience of the defender's military capacity.

Recent airpower scholarship further substantiates this dynamic. Saunders and Souva (2020) demonstrate that airpower correlates with strategic and operational success predominantly when the defender lacks the capability to contest the air domain. Their findings indicate that the coercive effect of air strikes is conditional rather than intrinsic, emerging only when defensive counter-air capacity is weak or absent. Similarly, Kreuzer (2024), and Vogt and Haider (2024), argue that contested skies, dense and adaptive air-defense networks, and extensive drone employment increasingly characterize contemporary air warfare. These structural conditions elevate the importance of robust, multi-layered defensive architectures.

Taken together, this body of literature indicates that modern coercive airpower does not succeed by virtue of strike capacity alone. Instead, its effectiveness is mediated by the defender's ability to integrate and synchronize multiple defensive layers in real time, transforming air defense into a core determinant of wartime endurance.

This article contributes to these debates by examining how Ukraine and Israel integrate active, passive, and offensive defense as mutually reinforcing components of national resilience under sustained aerial attacks. By empirically tracing how these layers interact under stress, we demonstrate how home-front endurance emerges not from any single system but from the synergy between interception, protection, and offensive disruption: a triad that reduces cumulative vulnerability and enables states to function under continuous aerial threats.

Shifts In Air Threats and Their Impact on the Home Front

This section examines the nature of contemporary air threats as illustrated by the wars in Ukraine and in Israel and highlights their systemic impact on the defender (state and society). We highlight five main characteristics of contemporary air

threats: accessibility/affordability, mass employment-quantity, precision, range, and versatility (Figure 2).

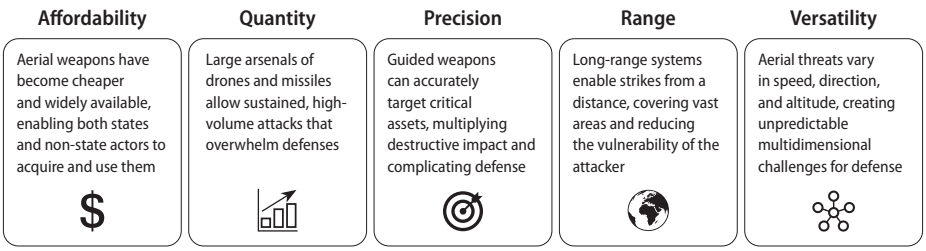

Figure 2: Main Characteristics of Air Threats in the 21st Century
Source: Elrom Center for Air & Space Studies, 2025.

Affordability: What had once been the preserve of advanced militaries is now widely accessible: even poorly resourced actors can acquire drones, loitering munitions, and improvised airborne weapons to sustain disruption and impose psychological pressure on adversaries' home fronts (Hammes, 2016, p. 35; Cronin, 2019, p. 52; Yan, 2025). Miniaturization, commercial components, and dual-use innovation have lowered production thresholds, creating a global market for low-cost and destructive aerial weapons (ADF, 2025). Many of these systems require minimal technological and operational knowledge to use and maintain, leading to their diffusion across actors and war theaters.

Illustrative is the extensive use of relatively inexpensive long-range OWA drones, loitering munitions, and First-Person View (FPV) drones, as well as cheaper short- and medium-range surface-to-surface missiles (SSMs) and cruise missiles (Hammes, 2016; Molloy, 2024; Kunertova, 2025). Russia's One Way Attack (OWA) drone campaign since mid-2022, along with Iran's and its proxies' widespread use of similar systems in the Middle East shows how low-cost standoff drones can overwhelm advanced air defenses and impose strategic costs on defenders (Hollenbeck et al., 2025; Plichta, 2025). Drones are far less expensive than other types of munitions such as surface-to-surface missiles, making them operationally cost-effective, as a single drone can inflict critical damage on an opponent's infrastructure or strategic assets (Hollenbeck et al., 2025). At the time of writing, the Iranian Shahed 136/131, a common type used both by Russia and in the Middle East, is estimated to cost around 25,000-35,000 USD per unit. The cost-effective transformation of rockets into precision-guided missiles, illustrated by Hezbollah's 'Precision Project,' also

shows how low-cost innovation can help non-state actors acquire consequential systems.[2]

Quantity: The principle of mass has long been central to warfare; technological change enables greater destructive power to be achieved through fewer resources (Alman & Venable, 2020; Podestà, 2024). At the same time, it reduces production and maintenance costs, enabling state and non-state actors to acquire, sustain, and employ air capabilities on a massive scale.

Iran and its proxies have exploited this "massification" of aerial weapons, while Russia, after early air force failures in Ukraine, turned to mass missile and drone strikes (Shiferman, 2023). Both have built arsenals that can be produced rapidly and launched in sustained waves, whether as concentrated salvos or as cumulative barrages over time (Elran et al., 2024). These arsenals serve not only to overwhelm air defense and inflict destruction but also to prolong wars.

Since October 7, 2023, Iran and its proxies have fired more than 37,000 projectiles towards Israel (Fabian, 2024) with around 10,000 projectiles launched during the first month, one-third of them in the initial hours of the October 7 attack (Zitun, 2023). Hezbollah, for its part, planned to unleash thousands of rockets and drones, supplemented by smaller numbers of SSMs and cruise missiles, in a single salvo (Zitun et al., 2024).[3]

By 2025, Russia's capacity had expanded to the point where hundreds of projectiles could be launched weekly (Harding, 2025; Jensen & Atalan, 2025; Sabbagh, 2025). Between 2024 and 2025, Russia's monthly use of kamikaze drones surged from roughly 1,900 to 5,300, driven primarily by expanding domestic production capacity. In the same period, long-range ballistic missile launches increased fourfold, collectively enabling Russia to push closer to saturation of Ukraine's air-defense system (Atalan et al., 2025; Adams, 2025; Hollenbeck et al., 2025; Jensen et al., 2025; Kullab & Novikov, 2025).

Precision: The precision revolution initiated by the development of precision-guided munitions (PGMs) in the late 1970s and operationalized by the US military during the first Gulf War in 1991 significantly improved weapons' effectiveness by enabling targeted strikes on command centers, sensors, logistics

2 Throughout the 2010s and 2020s, Hezbollah converted unguided long-range rockets into precision-guided missiles, thereby enhancing its technological capability to hit targets within Israel. According to different estimations, this resulted in a cost a fraction of what an SSM would cost, estimated at $5,000-$10,000 per missile (BICOM, 2019).

3 While failing to do so for different reasons, mostly because of Israeli action, Hezbollah was still able to launch extensive salvos of tens of rockets and other projectiles throughout the entire conflict, in some cases even reaching a few hundred in a single salvo (McKernan, 2024).

hubs, and air defenses (Singer, 2016; Hubbard et al., 2019).[4] New precision strike technologies can be used deliberately for precise and persistent attacks on civilians and civilian infrastructure, a technological development that serves a new "autocratic way of war" used for "civilian victimization" (Bales & Mutschler 2025; Euronews, 2025; Santora, 2025).

The combination of precision and mass, or "precise mass in action" (Plichta, 2025, p. 42), enables states to conduct numerous low-cost, high-precision strikes. Once the exclusive preserve of advanced militaries, these are now accessible to a wide spectrum of actors, from global powers to non-state groups and terrorist organizations. Precision warfare thus magnifies destructive potential: fewer weapons can achieve disproportionate effects while reducing risk to the attacker, whereas mass, low-cost weapons with increased precision broaden the threat landscape (Slusher, 2025).

In Israel's case, militant groups and Iran managed to incorporate precision technologies and weapons (in full capacity since October 7), allowing both massed salvos and highly targeted strikes with growing accuracy (Klein, 2008; Michael, 2022; Antebi & Yanko-Avikasis, 2023; Antebi & Adar, 2024; Zitun, 2024; Jensen et al., 2025). Russia similarly relied heavily on precision weaponry. In the opening phase of its invasion of Ukraine, Moscow sought to establish air superiority and degrade strategic targets through precision strikes, rapidly depleting much of its stock of cruise missiles and precision bombs. It has since ramped up production and procured additional systems from Iran and North Korea, employing them against both military and civilian targets (Hecht & Shabtai, 2023; Hinz, 2025; McCurry, 2025).[5]

Crucially, PGMs are often employed alongside unguided weapons in mixed salvos. Mass barrages of rockets or missiles are launched simultaneously with smaller numbers of guided projectiles, aiming to overwhelm air defense systems, saturate radars and early warning networks, and ensure at least partial penetration of defenses (Goldberg, 2024; Zitun, 2024; Jensen et al., 2025).

Range: Technological advancements have increased the operational range of many air weapons, enabling the attacker to cover vast areas within the defender's territory while maintaining the survivability of air platforms and operators. In Ukraine, Russia launches projectiles of varying ranges, many from within its own territory. For example, long-range cruise missiles like the Kh-101, Kh-47,

4 One often considers navigation and guidance systems such as GPS or other GNSS systems, such as Russia's GLONASS. However, when considering precision weapons, we also refer to optical, infrared, and TV-guided technologies that enable strikes against mobile or concealed targets (Mahnken, 2011; Lifshitz & Meents, 2020; Maurer, 2023; Hoehn & Courtney, 2024).

5 Some examples include the family of Shahed drones used extensively all over Ukraine and short-range missiles such as the Iranian Fatah-360s and North Korean Hwasong-11A/B, which are used for both short-range and front-line attacks.

and Kalibr (1,500–2,500 km) and Shahed 136/131 drones (1,300–1,500 km) can hit targets across Ukraine (Dmytriieva, 2024). Shorter-range systems such as Hwasong-11A/B, Fatah-360, Iskander, and Tochka (120–700 km) strike both frontline and deep-strike targets, including civilian sites (Atalan & Jensen, 2025; Daly, 2025; Hinz, 2025). Israel faces similar threats on a smaller scale, from Yemen, Lebanon, Syria, Iraq, and Iran, with some Iranian and Houthi systems reaching ranges of 1,300–1,750 km that can strike Israel from well beyond its neighborhood.

Versatility: Contemporary aerial threats are increasingly defined by their shifting and at times unpredictable trajectories, velocities, and altitudes (Schütz et al., 2019). Unlike ground operations constrained by borders and terrain, aerial systems exploit the openness of airspace, maneuvering unpredictably and complicating detection, interception, and early warning (Schütz et al., 2019). Drones and missiles are launched from land, sea, and air platforms across multiple regions and countries, arriving at different times and intensities (Kubovich, 2024).

Some threats are extremely fast: Russian weapons such as the Kinzhal air-launched ballistic missile reportedly reach Mach 12, or nearly 14,700 km/h, while the Iskander SSM variant reaches Mach 6.3, about 7,560 km/h. Others are comparatively slow, such as propeller-driven Shahed 136/131 drones, which cruise at around 200 km/h (Epstein, 2025; Kramarenko & Vialko, 2024; Norsk Luftvern, 2025). Altitude adds another layer of complexity. Some drones fly at very low altitudes to evade radar, while others operate at medium altitudes. Ballistic and certain cruise missiles ascend to high altitudes before descending on their targets. This range of flight profiles demands multilayered defenses capable of addressing threats across the spectrum.

A small radar cross-section (RCS) deepens this challenge. Many of these systems exploit gaps in radar coverage and defensive envelopes, reducing warning time and complicating interception even when defenders field a robust air defense architecture (Foreign Policy Council "Ukrainian Prism," 2025; Kalisky, 2025; Kubovich, 2024).

The evolution of airpower described above has redefined both the nature and the perception of threat for both the state and society. Based on comparative insights from Ukraine and Israel supported by expert consultations with Ukrainian and Israeli officials and practitioners (Appendix 1, p. 100), this transformation manifests along several interrelated shifts in threat exposure and perception.

First, the shift from episodic bombardments to constant salvos (enabled by the availability, affordability, and massification of projectiles) has created a perception of permanent danger, transforming the air threat into a continuous

condition. This has fostered a "routine emergency" mindset, in which daily civilian life coexists with the pervasive anticipation of attack. Citizens become accustomed to prolonged stays in shelters, maintaining functionality amid recurring alerts and bombardments. The routinization of alerts and sirens has paradoxically both enhanced and weakened resilience: normalization of danger enables continuous functioning under fire, yet it breeds complacency and delayed responses, occasionally resulting in preventable casualties (personal communication, senior-level Israeli official, October 2025).

Similarly, the increased range and versatility of projectiles have erased the notion of "safe zones." Entire national territories, including peripheral or border areas previously considered as exceptional danger zones, now fall within the range of enemy fire. In addition, the precision strikes interwoven with indiscriminate barrages magnify fear and disruption, spreading terror among civilian populations. The precise, mass targeting of critical national infrastructure and urban nodes has heightened the psychological impact of every strike. Public pressure mounts on governments to ensure high interception rates. In response, civilians organize spontaneously to maintain continuous functionality under fire, securing essential supplies during prolonged periods of disruption or blackout, and engaging in grassroots solidarity and reconstruction efforts.

Increased projectile speed shortens early warning and reaction time, compelling defenders to automate key functions of active and passive defense. Digitalized early-warning systems, rapid command decision loops, and the public's ability to discern between different levels of threat (depending on the projectiles used or their origin) can create a sense of "control" and generate a modicum of wartime routine.

At the same time, uneven exposure to threat and differential access to shelters have revealed and reinforced socio-spatial inequalities. Peripheral communities, often with weaker infrastructure, are at times less covered by air defense systems. These disparities, documented by Ukrainian and Israeli civil-defense officials, generate internal population displacement (whether forced or spontaneous), reverberating across entire areas, particularly border regions, which become economically disaffected and impose a burden on the host communities.

Three-Tiered Defense: Comparing Ukraine and Israel

This section analyzes how Ukraine and Israel have adapted to the evolving aerial threats through active, offensive, and passive defense, which, together, illustrate distinct yet comparable models of state and societal adaptation.

Active Defense

Ukraine

At the start of Russia's full-scale invasion in February 2022, Ukraine's aging but layered Soviet-era air defense network proved qualitatively strong yet quantitatively inadequate for the scale of attack. Its mix of short-, medium-, and long-range systems, aided by early-warning radars and U.S. intelligence-guided dispersal, initially denied Russia quick air superiority (Kofman, 2025; Simmill, 2025). However, the system's static design, logistical fragility, and reliance on Soviet interceptors made it unsustainable against a prolonged, multi-domain assault (Bronk et al., 2022).

Ukraine's air defense evolution unfolded through three main phases, each reflecting distinct adaptations to Russia's shifting aerial campaign and Ukraine's technological and organizational learning curve (Appendix 2, pp.101-102). The first phase (Failed Opening Strike, February 2022) saw Russia attempt to replicate a Crimea-style blitz through concentrated strikes on radar sites, command nodes, and airbases, seeking rapid air superiority. Ukraine's Soviet-legacy Ground-Based Air Defense (GBAD) system (built around S-300, Buk-M1, Osa-AKM, and MANPADS) denied that objective, creating a contested airspace that limited Russian fixed-wing and rotary operations (Kofman, 2025; Shiferman, 2023, p. 52). Yet the system's rigidity, radar dependence, and limited interceptor stocks rendered it unfit for sustained, multi-domain warfare. As Russia introduced Iranian Shahed-131/136 drones from mid-2022, targeting Ukraine's energy grid and cities, the defenders decentralized GBAD deployments, enhanced mobility, and relied increasingly on civilian innovation to maintain operational continuity amid attrition.

The second phase (Russia's transition to "bombing to win" logics, summer to fall 2022) marked the progressive integration of Western technologies and the adaptation of Ukraine's air defense to massed drone and missile warfare. The arrival of Patriot, NASAMS, IRIS-T, and mobile systems such as Gepard improved defense of Kyiv and other critical sites but remained insufficient for nationwide coverage. These high-end capabilities were gradually layered with surviving Soviet assets to form a hybrid structure, while Ukraine's defense industry and volunteer foundations began upgrading older systems.

The third phase (Attritional Punishment, 2023 through August 2025) reflects consolidation and learning under sustained pressure: with monthly attacks exceeding 2,000 projectiles since 2025, Ukraine further institutionalized its hybrid model combining Western high-end interceptors, refurbished legacy systems, and localized production. Appendix 2 summarizes these phases in

greater technical detail; hereafter, we focus on the mechanisms of adaptation rather than on an exhaustive system description.

As Russian strikes intensified, Western assistance proved insufficient to ensure comprehensive national coverage, underscoring a persistent asymmetry between Ukraine's defensive needs and its partners' industrial and political capacity to sustain replenishment. In response, Ukraine implemented three imperatives: decentralization, low-cost response, and synergetic government-civilian effort.

Consider first decentralization: beginning in late 2022, Ukraine shifted from fixed high-value air defense batteries to mobile formations capable of rapid repositioning. These mobile air defenses were deployed to intercept drones at low cost, conserve high-value interceptors, and ensure air defense sustainability through dispersion. Operating primarily in high-risk northern and northeastern regions, these units relied on continuous mobility to evade Russian targeting.

Second, Ukraine resorted, when possible, to low-cost, quick, available, and rapidly diffusible solutions to be able to scale its defenses and keep up with the tempo of Russian attacks. This necessitated the development of early detection mechanisms differentiating between cruise and ballistic missiles and UAVs (Simmill, 2025). This reliance on low-cost solutions was enabled by the development of grassroots innovation and production. Ukraine's defense and security innovation ecosystem has become a cornerstone of its adaptive air-defense strategy, fusing government, industry, academic, and civilian innovation to compensate for Ukraine's limited traditional air-defense capacity. Beginning in 2023, this ecosystem accelerated the development of drones as air defense instruments, notably interceptor drones designed to neutralize enemy ISR UAVs and rocket-drones such as Palianytsia and Peklo, which combine missile-like range and speed with drone agility (Miroshnichenko, 2025). Civilian innovation, supported by crowdfunding and open-source collaboration, played an essential role in bridging capability gaps and fostering continuous adaptation (Matlack, et al.,2025).

Beyond drone platforms, Ukrainian engineers have advanced electronic warfare (EW) and counter-EW technologies, including FPV drones capable of changing frequencies mid-flight and employing machine vision for autonomous target acquisition (Miroshnichenko, 2025). Parallel efforts in swarm automation sought to create coordinated defensive formations capable of intercepting enemy drones or missiles. Institutional initiatives such as the Unmanned Systems Force within the Armed Forces and the Brave1 platform formalized this synergy, providing grants and testing infrastructure as well as doctrinal integration for unmanned systems (Matlack et al., 2025). Academic actors, notably the Institute of Artificial Intelligence Problems (IAIP), have contributed algorithms

for predicting missile trajectories and optimizing radar and sensor fusion (Miroshnichenko, 2025). Collectively, this state-civilian synergetic transformation has embedded innovation into Ukraine's air defense fabric, positioning Ukraine as a global testbed for distributed air-defense architectures (Matlack et al., 2025; Miroshnichenko, 2025).

Israel

In contrast to Ukraine's adaptive wartime evolution, Israel's experience reflects a long-standing, institutionalized model of prewar preparedness. Rooted in its early statehood, Israel's air defense doctrine aimed to offset limited strategic depth through deterrence and early warning, protecting population centers and infrastructure from regional air threats (Brun, 2022). Over time, the threat of ballistic missiles, long-range rockets, and UAVs reshaped this threat environment. Operationally, as a response to the rise of different aerial threats from the 1980s, Israel developed a multilayered air defense architecture capable of engaging diverse aerial threats at different altitudes and ranges.

Despite decades of development, Israel's air defense faced unprecedented challenges after October 7, 2023, requiring full mobilization of national and international resources. For the first time, its entire multilayered system was tested simultaneously against diverse, overlapping threats.

First, Israel implemented its policy of selective interception to reconcile the dilemma between the high cost of interceptors and the potentially catastrophic consequences of a successful strike (Chang & Granados, 2025). This approach helped preserve interceptor stocks and optimized resource allocation, which proved critical during protracted conflict, such as the 2023-2025 war.

Israel also leveraged the operational complementarity of its multilayered system. The Iron Dome, initially conceived for short-range rockets and UAVs launched from Gaza, Lebanon, and Syria, demonstrated flexibility by intercepting residual fragments of longer-range ballistic missiles fired from Iran and Yemen. When advanced enemy missiles fragmented into submunitions mid-flight, thereby challenging the Arrow system's design parameters, Iron Dome compensated by neutralizing residual threats (Gilead, 2025).

Third, Israel bolstered its active defense through external assistance. Despite its strong indigenous innovation ecosystem, Israel's air defense remains structurally dependent on U.S. financial and technological support.[6] During the 2023-2025 war, this strategic dependence deepened. U.S. deployments of THAAD

6 Since 2009, Washington has allocated approximately $3.4 billion to Israel's missile defense programs (Bureau of Political-Military Affairs, 2025), with roughly one-third dedicated to Iron Dome. Israel's multilayered system, comprising Iron Dome, David's Sling, and Arrow 2/3, was co-developed through U.S.-Israeli partnerships: Rafael and Raytheon for David's

interceptors and coordination with allied forces provided critical reinforcement to Israel's defensive posture. The major Iranian missile and UAV assault of April 14, 2024, further underscored the regional dimension of Israel's defense network, with varying degrees of operational assistance from the US, UK, France, Jordan, Saudi Arabia, and the United Arab Emirates (UK Parliament, House of Commons Library, 2024).

Last, the IAF adapted to the evolving challenge of drone warfare defined by low-altitude, small radar signatures, and variable speeds (Fisher, 2024). It employed a spectrum of interception methods: air-to-air missiles launched from fighter aircraft and the use of guided anti-tank missiles and firing cannon rounds from helicopters, naval interceptors, and Iron Dome batteries (The Jerusalem Post, 2025). The prohibitive cost of repeated kinetic interceptions prompted an increasing reliance on EW systems. These proved particularly effective during the Twelve-Day War of 2025, when Iranian long-range UAVs presented extended flight durations that enabled detection and neutralization at distance. Beyond their economic advantage, EW measures provided a psychological benefit: by neutralizing threats before they entered Israeli airspace, they prevented the recurrence of nationwide sirens. Continuous tactical adaptation throughout the conflict improved interception rates and expanded the operational repertoire of Israel's defensive network.

Offensive Defense

Both Ukraine and Israel have resorted to offensive capabilities in wartime as a form of tactical prevention, seeking to degrade the adversary's strike potential and/or to impose logistical, economic, or reputational costs that would postpone or disrupt its ability to conduct sustained and effective attacks.

Ukraine

In Ukraine's case, this evolution marked a deliberate shift from reactive air defense to a proactive, offensive defense posture, designed to reduce Russia's capacity and willingness to wage aerial aggression by striking at the sources of its military and economic power (personal communication, senior Ukrainian military official, August 2023; Simmill, 2025). Ukraine's transition to offensive defense was made possible by two developments: the US (provisionally) authorizing Kyiv in November 2024 to strike with the Army Tactical Missile System (ATACMS) deep inside Russian territory, and the capacity to conduct

Sling, and Israel Aerospace Industries with American funding and technology for the Arrow series (IAI, n.d.).

massive FPV and OWA drone strikes due to the rapid expansion of its military-civilian defense production base.

By mid-2023, Kyiv had launched a sustained long-range drone campaign against enemy oil refineries, fuel depots, and energy infrastructure, expanding both the scale and geographical depth of its operations. A culminating moment in this campaign was Operation Spider Web, launched in June 2025 with over 100 FPV drones reportedly smuggled into Russia and launched in a coordinated strike on multiple strategic airbases. Ukrainian sources claimed that tens of strategic bombers were hit, with many destroyed. These bombers were imperative in Russia's plans of war against NATO, but for Ukraine, more important was the fact that these bombers were used to launch long-range cruise missiles against Ukraine. By attacking them, Ukraine was able, for the first time, to bring about a specific direct attack that would reduce Russian strike capability against it (Collett-White et al., 2025; Reuters, 2025).

The campaign has had some success in protecting the home front, and it successfully exposed Russia's vulnerability to "precise mass in action": the cumulative impact of numerous low-cost, high-precision strikes (Plichta, 2025, p. 42). Long-range drone strikes have constrained Russia's ability to launch and sustain air and missile operations (Reuters, 2025). The Spider Web operation destroyed key bombers (Tu-95, Tu-22, Tu-160, and Su-57), reducing the Russian air threat and forcing Moscow to divert air-defense assets to domestic protection, limiting its offensive flexibility (Collett-White et al., 2025). These strikes also had a psychological impact, bringing the war to Russian territory and demonstrating Ukraine's capacity to impose costs within Russia's home front (Plichta, 2025). However, Ukraine's offensive capabilities remain limited, relying mainly on drones with modest operational effect (landmark operations like Spider Web remain exceptions), with their ultimate effects primarily economic rather than military.[7]

Israel

The proximity of hostile neighboring countries and the lack of strategic depth in Israel shaped its defense doctrine. A central pillar in Israel's defense is its offensive capabilities, encapsulated in the national security concept of offensive defense. The core principle also entails striking threats at their source through preemptive and preventive attacks, both before and during conflict, to diminish enemy launch capacity, reduce projectile volumes, and minimize damage to military and civilian targets. For instance, over several days in August and

7 Ukrainian deep strikes disrupted an estimated 17 percent of Russia's refining capacity, equivalent to 1.1 million barrels per day (Sauer, 2025).

September 2024, the IAF preemptively destroyed thousands of rockets, UAVs, and launchers, effectively dismantling Hezbollah's planned missile offensive (FDD, 2024). In June 2025, Israel's preventive opening strikes on Iranian air defense assets, leadership nodes, weapons depots, and mobile launchers provided a decisive early advantage: the Iranian plan to fire 1,000 ballistic missiles on the first day was reduced to roughly 100 missiles, launched nearly twenty-four hours later, a delay that provided the Israeli home front with critical preparation time and substantially weakened Iran's initial offensive momentum.

Another aspect is direct strikes and fly-by operations that exploit aerial superiority to loiter over hostile territory, detect and neutralize launch sites before they fire, and deny the enemy's launch capability. Though geographically constrained in Gaza, Lebanon, and Iran, these missions relied on real-time intelligence fusion and not only eliminated imminent threats but also generated new targeting data that enhanced situational awareness and the overall targeting architecture (Zitun, 2025).

Passive Defense

Ukraine and Israel have developed parallel yet distinct passive defense models, each reflecting their institutional capacities, technological ecosystems, and levels of synergy among governmental, military, and civilian efforts.

Ukraine

In late February 2022, Ukraine relied on a Soviet-era early-warning network issuing undifferentiated alerts. In response, the newly established and technologically savvy Ministry of Digital Transformation took a leadership role, launching in partnership with private firms an Air Alarm application to deliver geolocated, device-based alerts. By 2023–2025, with satellite communications sustaining essential services during power cuts, the early warning network evolved into a layered, AI-assisted system capable of maintaining functionality during cyberattacks or blackouts (Arkin, 2025). The introduction of district-level alerts in Kyiv in 2025, provided by Israel, further improved functional continuity under fire.

This rapid government-initiated digitalization was accompanied by a broader grassroots mobilization for passive defense: volunteer-run Telegram channels and community-based observers extended coverage to remote regions, forming a hybrid civilian-state warning ecosystem (personal communication, O. Rubina, August 2025). At the local level, civilian authorities and volunteers repaired shelters, restored utilities, and coordinated relief for internally displaced persons (Simmill, 2025). Among the most emblematic initiatives is Dobrobat, a nationwide

volunteer network that rebuilds damaged civilian infrastructure in heavily bombarded regions, enabling the rapid restoration of functional continuity (personal communication, D. Ivanov & M. Brizhko, August 2023).

Sheltering policy also improved *in bello*. Initially dependent on Cold War-era bunkers and Soviet underground metro networks, Ukraine's protection capacity was uneven (ABC News, 2022). From mid-2022 onward, the government elevated shelter construction to a national priority, with President Zelensky repeatedly pressing regional officials on shelter readiness (personal communication, senior Ukrainian official, July 2025). The Iron Shelter Project, launched in 2023 by the Ministry of Strategic Industries, institutionalized this effort through public-private partnerships, prioritizing schools and kindergartens, and mapping real-time shelter availability (Rubryka, 2023).

Israel

By contrast, Israel's approach to passive defense is built on systematic, institutionalized foresight rather than on ad hoc improvisation during wartime. As early as the 1948 War of Independence, Israel had to endure repeated airstrikes by the Egyptian Air Force on Tel Aviv (Nicolle & Gabr, 2024). This experience accelerated the institutionalization of civilian protection, culminating in the 1951 Civil Defense Law, which mandated the construction of shelters. The long-range missile threat demonstrated during the First Gulf War, when 39 ballistic missiles were launched from Iraq, created new challenges for Israel's home front. In response, Israel established the Home Front Command[8] and introduced new regulations requiring that every new apartment include a safe room (Brun, 2022; Israeli Ministry of Defense, 1951). Throughout the 1990s, passive defense was further shaped by intensifying short-range rocket fire from southern Lebanon, followed by similar threats from Gaza. These developments, combined with Israel's lack of strategic depth, reinforced the need for codified civilian protection measures. Given the lack of strategic depth, the use of advanced technologies appeared to be the best way to respond to increasing threats.

Beyond shelters, Israel strengthened its early warning mechanisms. Its digital infrastructure was developed to integrate real-time radar data with public alert mechanisms, transmitting geo-targeted warnings through smartphone applications, SMS, and radio broadcasts. The national *Tzeva Adom* system translates radar detections into locality-specific countdowns calibrated to missile flight times (Ringel, 2024). This precision proved lifesaving in a geographically small country where projectile flight durations can be measured in seconds for border

8 The Home Front Command's mission is to safeguard civilian lives by preparing the civilian environment ahead of conflicts and supporting it during emergencies.

communities. During the 2025 war with Iran, longer ranges initially provided up to thirty-minute warning windows; as hostilities intensified, these narrowed to approximately ten minutes, still sufficient for most civilians to reach safety.

Throughout the war, the Home Front Command sought to maintain societal functionality through graded situational guidelines disseminated via the National Emergency Portal (National Emergency Portal, n.d.). Despite its technological sophistication, Israel's passive defense remains marked by structural disparities and institutional fragmentation. A report by the State Comptroller (2021) indicates that approximately 2.6 million citizens, primarily residents of older housing and peripheral regions, still lack access to adequate shelters. Furthermore, persistent shortages of trained personnel, delays in providing assistance to displaced populations, and fragmented psychological support undermined comprehensive resilience. The Socio-Economic Cabinet, formally responsible for civilian continuity, frequently failed to convene or issue binding directives. As a 2024 audit concluded, "passive defense remains Israel's weakest layer," emphasizing that effective resilience depends as much on institutional communication and coordination as on technological sophistication and sufficient shelter coverage (Ran & Yagana, 2025).

Discussion and Conclusion

Causally, the argument advanced here is that integration across the three tiers functions as a coercion-dampening mechanism. Offensive defense reduces the attacker's capacity to generate and sustain intensive and high-tempo campaigns by degrading launch platforms, command-and-control centers, and production chains. Active defense further reduces the volume of incoming air threats by intercepting a share of projectiles and distributing damage spatially (if any). Passive defense determines how much of the residual harm translates into systemic disruption, displacement, and loss of functionality. Where these tiers are weakly connected, because offensive defense capabilities are limited, interception capability is insufficient, and passive protection is uneven, the same level of aerial attack produces higher levels of cumulative stress on the defender's system. Where integration is tighter, coercive pressure is partly or largely absorbed, preserving the defender system's functionality.

The comparative analysis of Ukraine and Israel under sustained and multidirectional aerial campaigns shows that both states rely on the three-tier defense architecture composed of active, passive, and offensive defense. Their shared reliance on this structure reflects the common character of the threat: high-tempo missile and UAV campaigns combining mass, precision, affordability, and extended range, many of which have been enabled by the

deepening Russia-Iran strategic partnership (Fainberg & Matania, 2025). Yet their respective trajectories reveal two distinct models of adaptation to protracted air warfare: a predominantly *in bello* learning model in Ukraine and a primarily *ante bellum* preparedness model in Israel. Both cases reaffirm the relevance of total defense to contemporary high-intensity war, demonstrating that defense of the home front requires the integration of state and societal resources across these three layers.

Ukraine: Vibrant yet Insufficient in Bello Adaptation

Ukraine's experience demonstrates the challenges and possibilities of constructing a national defense architecture in wartime without preexisting doctrinal or infrastructural foundations. When Russia launched its full-scale invasion in February 2022, Ukraine lacked a conceptual framework for home-front defense, adequate defensive infrastructure, and mechanisms to coordinate military and civilian layers of protection. This absence of prewar preparation at the conceptual, operational, and integrative levels initially limited Ukraine's capacity to protect civilian populations, critical infrastructure, and military installations (Rakov & Fainberg, 2023).

Over the course of the war, however, Ukraine embarked on a continuous process of learning and tit-for-tat adaptation. With limited external assistance and under sustained pressure, it developed new active defense platforms, improvised mobile interception units, and expanded its early-warning systems through rapid digitalization. Simultaneously, it expanded and mapped shelters, especially in major urban centers. These transformations were made possible by a whole-of-society mobilization that fused governmental coordination, civilian innovation, and grassroots entrepreneurship. The emergence of a wartime defense innovation ecosystem, spanning state agencies, start-ups, academic institutions, and grassroots organizations, allowed Ukraine to field cost-effective, decentralized, and scalable defenses.

Technologically, Ukraine's defense has become increasingly adaptive and economically efficient: high-value interceptors were reserved for complex missile salvos, while low-cost drones, mobile machine-gun units, and EW backpacks absorbed the majority of daily UAV attacks. Politically and socially, this distributed model of defense was enabled by Ukraine's highly developed technological culture and has strengthened national resilience and reduced dependence on external supplies. Yet, despite these remarkable wartime innovations, Ukraine's offensive-defense capabilities have remained limited. Deep-strike operations, such as the June 2025 Spider Web campaign, inflicted meaningful but temporary disruptions on Russian logistics and strike platforms. Ukraine has thus achieved

a significant increase in defensive effectiveness but, at the time of writing, continues to operate below the tempo and scale of Russia's escalating airstrikes, constrained by the asymmetry in industrial capacity, range, and stockpiles.

Israel: Ante Bellum Conceptual and Operational Preparedness

Israel represents the inverse case: a state that entered conflict with an institutionalized, technologically sophisticated, and operationally tested defense architecture. Decades of doctrinal development, combined with sustained investment in layered interception systems, provided Israel with a strong capacity to protect its home front, military assets, and critical infrastructure. Conceptually, Israeli defense has long rested on mutually reinforcing pillars in which offensive defense aims to disrupt adversarial fire capabilities before launch, both *ante bellum* and *in bello*, thereby reducing pressure on active and passive defense layers.

Operationally, Israel possesses an advanced and institutionalized infrastructure of active defense assets (sensors, radars, command-and-control, and real-time prioritization mechanisms that integrate ground- and air-based interception systems), as well as a well-developed passive defense system (geo-targeted early warning, a nationwide shelter regime, and codified civilian wartime discipline).

This offensive tier is inseparable from Israel's defense architecture. Systematic efforts to degrade adversary strike capacity through early, preventive, and real-time detection-and-targeting operations are intended to reduce both the scale and simultaneity of incoming salvos. During the 2023-2025 war, preemptive Israeli strikes in Lebanon and preventive and real-time targeting campaigns in Lebanon and Iran against missile stockpiles, launch platforms, and command nodes delayed and diminished subsequent waves of attack. These operations illustrate the decisive value of offensive-defense integration for home-front protection. Active defense then intercepted what remained, while passive defense (anchored in shelters, early-warning systems, and the Home Front Command) absorbed residual impacts.

However, Israel's experience also revealed the limits of this doctrine, particularly the impossibility of preventing all attacks given the scale and technological evolution of missile and UAV threats. Despite high preparedness, the 2023-2025 war exposed persistent inequalities in shelter distribution, coordination gaps among civil-defense agencies, and the practical impossibility of achieving fully hermetic protection under conditions of saturation and multi-domain strike. Nonetheless, Israel's ability to enter the conflict with a high level of conceptual and operational readiness proved decisive in mitigating systemic disruption and enabling rapid adaptation under fire.

Beyond Differences, Converging Trajectories

The juxtaposition of the Ukrainian and Israeli cases underscores the centrality of integration and timing in determining defensive effectiveness. It also shows that integration operates within clear scope conditions: in extended theaters with limited assistance guarantees and industrial constraints, such as Ukraine, reactive wartime innovation can partially compensate for prewar under-preparation but cannot fully offset an adversary's strike capacity. In small, densely populated states with a robust technological base and strong military-defense industry, such as Israel, prewar integration of offensive, active, and passive tiers yields significant advantages but still cannot deliver hermetic protection. In both contexts, the three-tier framework helps explain why comparable patterns of aerial coercion can produce different patterns of damage and population displacement and functional continuity under fire.

Ukraine's *in bello* adaptation shows that a state can learn and innovate under extreme conditions, but at the cost of sustained civilian exposure and infrastructural attrition. Israel's *ante bellum* model demonstrates that prewar integration of offensive, active, and passive tiers yields a structural advantage, allowing the defender to begin from the highest defense level possible. Both cases reveal that a deficit in one tier imposes disproportionate strain on the others: limited offensive-defense capacity, as in Ukraine, increases pressure on interception and civil resilience, while shortcomings in passive defense, as in Israel, erode the benefits of advanced interception and preventive strikes.

The findings of this comparative study therefore indicate that adequate defense against sustained aerial coercion is best achieved through an integrative approach that combines offensive, active, and passive measures within a coherent and mutually reinforcing system. The three tiers function as interdependent layers of a unified defensive architecture: offensive defense seeks to suppress the adversary's strike capacity; active defense filters and neutralizes the projectiles that evade suppression; and passive defense mitigates harm, sustains continuity, and underpins societal endurance. Integration across these tiers reduces cumulative risk, enhances protection, and strengthens functional continuity and endurance on the home front.

Adjusting Total Defense to Shifts in Airpower

Ångström and Ljungkvist (2024) argue that total defense is not a fixed model but is shaped by how states interpret the character of the threats they face. The findings of the present study suggest that the prevailing scholarly emphasis on hybrid warfare, societal resilience to disinformation, territorial defense structures, and reserve mobilization reflects a specific strategic context, namely the Baltic

and Nordic experience before 2022 with sub-threshold coercion and information warfare. While foundational to the development of the contemporary total defense paradigm, these emphases no longer sufficiently capture the primary pressures exerted in high-intensity interstate conflict.

The wars in Ukraine and Israel indicate that sustained aerial coercion has emerged as a central mechanism through which national endurance is contested. Drone and missile campaigns do not merely supplement hybrid or cyber operations; they impose continuous, cumulative strain on state institutions, civil protection systems, and socio-political cohesion. In both cases, the home front became the principal battlespace, and the capacity of the state to maintain functional continuity under persistent aerial attack proved decisive for wartime resilience. Hybrid, cyber, and cognitive operations, therefore, operate as force multipliers to aerial strike pressure rather than as independent domains of coercion.

This may suggest the need to revisit the concept of total defense in a way that places the air domain at its conceptual core. Total defense can no longer be defined primarily as the mobilization of population and armed forces in anticipation of territorial invasion or informational subversion. It must also be understood as an integrated, multi-layered defensive architecture designed to absorb and withstand persistent, high-volume, and geographically distributed aerial attacks. The ongoing expansion of active air and missile defense networks, shelter and early-warning modernization, and continuity-of-government planning in Sweden, Finland, the Baltic states, and Germany reflects the initial institutionalization of this shift, even if the doctrinal implications remain only partially articulated.

However, this argument requires further comparative validation. The centrality of the air domain may represent either a general structural feature of contemporary conflict, driven by the diffusion of precision-strike complexes and inexpensive autonomous aerial systems, or a contingent effect specific to states facing adversaries with substantial strike production capacity. Extending the analysis to strategic contexts such as Taiwan, South Korea, Finland, and Estonia would enable systematic evaluation of whether the reconfiguration of total defense around the air domain constitutes an emergent global paradigm or a regional adaptation to specific threat environments.

Acknowledgments

We would like to thank Dr. and Col. (res.). Assaf Heller, Director of Research at the Elrom Center for Air & Space Studies, for his invaluable guidance and feedback. We also extend our appreciation to our interviewees in Ukraine and Israel, most of whom remain anonymous, for generously sharing their time and insights on wartime defense dynamics. We are grateful to peers and colleagues

for their comments and suggestions, particularly to Mr. Daniel Rakov. Finally, we wish to express our sincere thanks to Or Amini, Research Assistant at Elrom, for his outstanding research support and assistance throughout the preparation and publication of this article, and to Carmel Zisman Peleg for her assistance with design and preparation of the figures.

References

Adams, P. (2025, July 10). Russia's intensifying drone war is spreading fear and eroding Ukrainian morale. *BBC*. https://www.bbc.com/news/articles/c0m8gn7grn2o

Alman, D., & Venable, H. (2020, September 15). Bending the principle of mass: Why that approach no longer works for airpower. *War on the Rocks*. https://warontherocks.com/2020/09/bending-the-principle-of-mass-why-that-approach-no-longer-works-for-airpower/

Ångström, J., & Ljungkvist, K. (2023). Unpacking the varying strategic logics of total defence. *Journal of Strategic Studies, 47*(4), 498–522. https://doi.org/10.1080/01402390.2023.2260958

Antebi, L., & Adar, O. (2024). *FPV drones: From the Ukrainian battlefield to the Middle East* (INSS Insight No. 1825). INSS. https://www.inss.org.il/wp-content/uploads/2024/02/No.-1825-1.pdf

Antebi, L. & Yanko-Avikasis, M. (2023). *Life and Death in the Hands of the Drone: The Small, Cheap Devices Early in the Swords of Iron War* (INSS Insight No. 1772). INSS. https://www.inss.org.il/wp-content/uploads/2023/10/No.-1772.pdf

As drone warfare expands in Africa, Turkey increases share of the market. (2025, February 11). *ADF*. https://adf-magazine.com/2025/02/as-drone-warfare-expands-in-africa-turkey-increases-share-of-the-market/

Arkin, D. (2025, February 24). *Ukraine develops civilian alert system for missiles and drones*. Israel Defense. https://www.israeldefense.co.il/en/node/64454

Atalan, Y., Tiersten-Nyman, E., & Jensen, B. (2025, November 14). *Russia's intense air campaign in October*. Center for Strategic and International Studies. https://www.csis.org/analysis/russias-intense-air-campaign-october

Atalan, Y., & Jensen, B. (2025). *Breaking down Russian missile salvos: What drives neutralization?* CSIS. https://www.csis.org/analysis/breaking-down-russian-missile-salvos-what-drives-neutralization

Bales, M., & Mutschler, M. (2025). A new autocratic way of war? Autocracy, precision strike warfare and civilian victimization. *Defence Studies*, 1–24. https://doi.org/10.1080/14702436.2025.2522052

BICOM. (2019, October). *Hezbollah's precision missile project* [Briefing]. https://www.bicom.org.uk/wp-content/uploads/2024/12/Precision-Project-Paper-Oct-2019-1.pdf

Bērziņa, I. (2020). From 'total' to 'comprehensive' national defence: The development of the concept in Europe. *Journal on Baltic Security, 6*(2), 1-9, https://journalonbalticsecurity.com/journal/JOBS/article/2/text

Bērziņš, J. (2023). Latvia: From total defence to comprehensive defence. *PRISM, 10*(2), 38–53, https://ndupress.ndu.edu/Portals/68/Documents/prism/prism_10-2/prism_10-2.pdf

Bronk, J., Reynolds, N., & Watling, J. (2022). The Russian Air War and Ukrainian Requirements for Air Defence. *Royal United Services Institute*. https://doi.org/10.1515/sirius-2023-1013

Brun, I. (2022). *From aerial superiority to a multi-dimensional blow: The utility of aerial force and its place in Israel's total war* [Hebrew] (INSS Publication No. 219). INSS. https://www.inss.org.il/he/wp-content/uploads/sites/2/2022/01/Memo219_AerialPower_e.pdf

Bureau of Political-Military Affairs. (2025, April 25). *U.S. security cooperation with Israel* [Fact sheet]. U.S. Department of State. https://www.state.gov/u-s-security-cooperation-with-israel

Chang, A., & Granados, S. (2025, June 16). How missile defense works (and why it fails). *The New York Times*. https://www.nytimes.com/interactive/2024/11/02/world/middleeast/missile-defense-israel-iran.html

Collett-White, M., Dutta, P. K., & Zafra, M. (2025, June 4). How Ukraine pulled off an audacious attack deep inside Russia. *Reuters*. https://www.reuters.com/graphics/UKRAINE-CRISIS/DRONES-RUSSIA/mypmjzayyvr/

Cronin, A. K. (2019). *Power to the people: How open technological innovation is arming tomorrow's terrorists*. Oxford University Press.

Daly, J. (2025, April 24). The most lethal missiles Russia uses against Ukraine's civilians. *United24 Media*. https://united24media.com/war-in-ukraine/the-most-lethal-missiles-russia-uses-against-ukraines-civilians-7794

David's Sling vs. SAMP/T air and missile defense systems comparison. (2025, March 18). *Norsk Luftvern*. https://norskluftvern.com/2025/03/18/davids-sling-vs-samp-t-air-and-missile-defense-systems-comparison/

Dmytriieva, D. (2024, November 21). Russia launches intercontinental ballistic missile, Kinzhal and Kh-101 at Ukraine in the morning. *RBC-Ukraine*. https://newsukraine.rbc.ua/news/russia-launches-kinzhal-and-kh-101s-at-ukraine-1732177685.html

Elran, M., Mizrahi, O., Heimann, A., & Shapira, A. (2024, July 7). *How would a full-scale war with Hezbollah affect the resilience of Israel's civilian front?* (INSS Insight No. 1872). INSS. https://www.inss.org.il/wp-content/uploads/2024/07/No.-1872.pdf

Epstein, J. (2025, May 25). Russia's attack drones are flying higher and faster. *Business Insider*. https://www.businessinsider.com/ukrainian-air-defender-guns-arent-enough-kill-russian-drones-anymore-2025-5

Fabian, E. (2024, June 10). Over 19,000 rockets fired into Israel since start of war, IDF says. *The Times of Israel*. https://www.timesofisrael.com/liveblog_entry/over-19000-rockets-fired-into-israel-since-start-of-war-idf-says/

Fainberg, S., & Matania, E. (2025). Ad Hoc or Enduring? A Dynamic Taxonomy of Strategic Partnerships in the Middle East and North Africa. *Aerospace & Defense*, 2(1), 65-94. https://www.researchgate.net/publication/397653129

Fisher, J. (2024, October 14). Drone attack on Israel puts spotlight on Iron Dome's limitations. *BBC*. https://www.bbc.com/news/articles/c4g9wx2q09ko

Foreign Policy Council "Ukrainian Prism." (2025). *Blue and Yellow Annex: To the White Paper on the future of European defence*. https://prismua.org/wp-content/uploads/2025/04/Blue_and_yellow_annex_on_defense.pdf

Foundation for Defense of Democracies (FDD). (2024, August 25). *Israel hits strategic Hezbollah launchers preemptively* [Flash brief]. https://www.fdd.org/analysis/2024/08/25/israel-hits-strategic-hezbollah-launchers-preemptively/

Gilead, A. (2025, June 19). Can Israel handle all of Iran's ballistic missiles? *Globes*. https://en.globes.co.il/en/article-can-israel-handle-all-of-irans-ballistic-missiles-1001513313

Goldberg, D. (2024, October 14). Hezbollah's trick, the contact that worked and the interception that failed | Investigation on the drone disaster. [Hebrew]. *JDN*. https://www.jdn.co.il/news/2284447/

Government Offices of Sweden. (2024, July). *National security strategy*. https://www.government.se/contentassets/dee95d002683482eba019df49db2801f/national-security-strategy_.pdf

Government of the Republic of Estonia. (2023, February 22). *National security concept of Estonia* [Framework document]. https://www.kaitseministeerium.ee/sites/default/files/eesti_julgeolekupoliitika_alused_eng_22.02.2023.pdf

Hammes, T. X. (2016, October 18). The democratization of airpower: The insurgent and the drone. *War on the Rocks*. https://warontherocks.com/2016/10/the-democratization-of-airpower-the-insurgent-and-the-drone/

Harding, L. (2025, August 13). 'It's a robot war': Eastern Ukraine faces onslaught of Russian glide bombs, rockets and kamikaze drones. *The Guardian*. https://www.theguardian.com/world/2025/aug/13/eastern-ukraine-russian-glide-bombs-rockets-kamikaze-drones

Healey, J. (2024). *Cyber effects in warfare: Categorizing the where, what, and why. Texas National Security Review, 7*(4), 37–50. https://doi.org/10.26153/tsw/56029.

Hecht, E., & Shabtai, S. (Eds.). (2023). *The war in Ukraine: 16 perspectives, 9 key insights*. BESA Center. https://besacenter.org/wp-content/uploads/2023/08/201-4.pdf

Hinz, F. (2025). Israel's attack and the limits of Iran's missile strategy. *IISS*. https://www.iiss.org/online-analysis/online-analysis/2025/06/israels-attack-and-the-limits-of-irans-missile-strategy/

Hoehn, J. & Courtney, W. (2024). *How Ukraine Can Defeat Russian Glide Bombs*. RAND Corporation. https://www.rand.org/pubs/commentary/2024/06/how-ukraine-can-defeat-russian-glide-bombs.html

Hollenbeck, N., Altaf, M. H., Avila, F., Ramirez, J., Sharma, A., & Jensen, B. (2025). *Calculating the cost-effectiveness of Russia's drone strikes*. CSIS. https://www.csis.org/analysis/calculating-cost-effectiveness-russias-drone-strikes

Horowitz, M. C., & Reiter, D. (2001). When does aerial bombing work? Quantitative empirical tests, 1917–1999. *Journal of Conflict Resolution, 45*(2), 147–173. https://doi.org/10.1177/0022002701045002001

Hubbard, B., Karasz, P., & Reed, S. (2019, September 14). Two major Saudi oil installations hit by drone strike, and U.S. blames Iran. *The New York Times*. https://www.nytimes.com/2019/09/14/world/middleeast/saudi-arabia-refineries-drone-attack.html

Hundreds of Iranian drones intercepted 'around the clock' by IAF during Op. Rising Lion. (2025, June 25). *The Jerusalem Post*. https://www.jpost.com/israel-news/defense-news/article-859015

IAI. (n.d.). *From ambitious concepts to groundbreaking air and missile defense systems*. Israel Aerospace Industries. https://www.iai.co.il/news-media/iai-action/ambitious-concepts-groundbreaking-air-and-missile-defense-systems

Israeli Ministry of Defense. (1951). Civil Defense Law [Hebrew]. *Nevo*. https://www.oref.org.il/media/3x2huqvl/%D7%97%D7%95%D7%A7-%D7%94%D7%92%D7%90.pdf

Jensen, B., & Atalan, Y. (2025). *Drone saturation: Russia's Shahed campaign*. CSIS. https://www.csis.org/analysis/drone-saturation-russias-shahed-campaign

Jensen, B., Atalan, Y., & Tiersten-Nyman, E. (2025). *The new salvo war: Russia's evolving punishment campaign*. CSIS. https://www.csis.org/analysis/new-salvo-war

Jordan, J. W. (2024). Evolution of the concept of total defence in the Baltic States. Rozprawy Społeczne/Social Dissertations, 18(1), 315–344. https://doi.org/10.29316/rs/188761

Kalisky, Y. (2025). *The Israel–Iran war: Air defense performance*. INSS. https://www.inss.org.il/social_media/the-israel-iran-war-air-defense-performance/

Karlin, M. (2024, October 22). *The return of total war.* Foreign Affairs. https://www.foreignaffairs.com/ukraine/return-total-war-karlin

Khoroshko, V., Artemov, V., Brailovskyi, M., & Kozura, V. (2024). Modern Network Wars. *Scientific and Practical Cyber Security Journal (SPCSJ), 8*(3), 53-64. https://journal.scsa.ge/wp-content/uploads/2024/11/0034_modern-network-wars.pdf

Klein, D. (2008). Defense of the home front in the Gaza periphery: Examining the national investment. *Strategic Assessment, 10*(4), 6–11. https://www.inss.org.il/wp-content/uploads/2022/12/fe-1451416010.pdf

Kofman, M. (2025). Russian airpower in context: The first year of the war. In D. Henriksen & J. Bronk (Eds). *The Air War in Ukraine. First Year of Conflict* (pp. 12-30). Routledge.

Kramarenko, D., & Vialko, D. (2024, December 20). Ballistic and cruise missiles, drones, and other weaponry: What Russia uses to attack Ukraine. *RBC-Ukraine*. https://newsukraine.rbc.ua/analytics/ballistic-missiles-drones-and-cruise-missiles-1734721150.html

Kreuzer, P. (2024). *Beyond air superiority: The Growing Air Littoral and Twenty-First Century Airpower. Æther: A Journal of Strategic Airpower & Spacepower, 3*(3). https://www.airuniversity.af.edu/Portals/10/AEtherJournal/Journals/Volume-3_Number-3/Kreuzer.pdf

Kubovich, Y. (2024, June 20). Hezbollah's drone threat is growing, and the IDF are looking for an effective solution [Hebrew]. *Ha'aretz*. https://www.haaretz.co.il/news/politics/2024-06-20/ty-article/.premium/00000190-369e-d700-a7f0-bffe957d0000

Kullab, S., & Novikov, I. (2025, August 22). Russian attack on western Ukraine hits an American factory during the US-led push for peace. *AP*. https://apnews.com/article/russia-ukraine-war-zelenskyy-putin-trump-security-92ee89feba2224f140429bcb573e61f9

Kunertova, D. (2025). *Embracing drone diversity: Five challenges to Western military adaptation in drone warfare* (Paper No. 29). Freeman Air & Space Institute. https://www.kcl.ac.uk/warstudies/assets/paper-29-dr-dominika-kunertova.pdf

Lifshitz, I., & Meents, A. (2020, November 17). The paradox of precision: Nonstate actors and precision-guided weapons. *War on the Rocks*. https://warontherocks.com/2020/11/the-paradox-of-precision-nonstate-actors-and-precision-guided-weapons/

Ljungkvist, K. (2025, August 13). *Participatory war and its challenges for total defense*. Carnegie Endowment for International Peace. https://carnegieendowment.org/research/2025/08/participatory-war-and-its-challenges-for-total-defense?lang=en

Mahnken, T. G. (2011). Weapons: The growth & spread of the precision-strike regime. *Daedalus, 140*(3), 45-57. https://www.jstor.org/stable/23047347

Maurer, J. D. (2023). The future of precision-strike warfare: Strategic dynamics of mature military revolutions. *Naval War College Review, 76*(2), 13-38. https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=8342&context=nwc-review

Matlack, J. W., Schwartz, S., & Gill, O. (2025, April). *Ukraine's drone ecosystem and the defence of Europe: Lessons lost can't be learned* (Research Report). LSE IDEAS. https://www.lse.ac.uk/ideas/Assets/Documents/Research-Reports/2025-04-05-DRONES-MatlackSchwartzGill-FINAL-WEB.pdf

McCurry, J. (2025, April 25). From ammunition to ballistic missiles: How North Korea arms Russia in the Ukraine war. *The Guardian*. https://www.theguardian.com/world/2025/apr/25/how-north-korea-arms-russia-in-ukraine-war

McKernan, B. (2024, June 12). Hezbollah fires big salvo of rockets at Israel after senior commander killed. *The Guardian*. https://www.theguardian.com/world/article/2024/jun/12/hezbollah-fires-big-salvo-rockets-israel-senior-commander-killed

Michael, K. (2022). *Rocket fire into the heart of the country: Another component of Hamas's new strategy*. INSS. https://www.inss.org.il/social_media/rocket-fire-into-the-heart-of-the-country-another-component-of-hamass-new-strategy/

Miroshnichenko, K. (2025). *Wartime Ukraine Defence Innovation Ecosystem Formation through Drone Technologies* [Master's thesis, University of Gothenburg, Sweden). https://gupea.ub.gu.se/bitstream/handle/2077/89195/IIM%202025-32.pdf?sequence=1

Molloy, O. (2024, August 1). How are drones changing modern warfare? Lessons learnt from the war in Ukraine. *Australian Army Research Centre*. https://researchcentre.army.gov.au/library/land-power-forum/how-are-drones-changing-modern-warfare

National Emergency Portal. (n.d.). *Iron Swords War*. https://www.oref.org.il/eng

Nicolle, D., & Ali Gabr, G. (2024). *Air Power and the Arab World, 1909-1955*. Casemate Group. https://www.torrossa.com/it/resources/an/5870036

Pape, R. A. (1996). *Bombing to win: Air power and coercion in war*. Cornell University Press.

Plichta, M. (2025). Precise mass in action: Assessing Ukraine's one-way attack drone campaign. *The RUSI Journal*, *170*(4), 42-48. https://www.tandfonline.com/doi/full/10.1080/03071847.2025.2527923

Podestà, A. (2024). The concepts of mass and surprise in future air wars. *Æther: A Journal of Strategic Airpower & Spacepower, 3*(4), 41-55. https://www.jstor.org/stable/48809075

Rakov, D., & Fainberg, S. (2023). *The Growing Impact of the Civilian Population on the Modern Battlefield: A Glimpse into the Russia–Ukraine War* (Research Report 0123E). ELROM Center for Air & Space Studies, Tel Aviv University / ELNET, https://elnetwork.eu/policypaper/the-growing-impact-of-the-civilian-population-on-the-modern-battlefield-a-glimpse-into-the-russia-ukraine-war/

Rakov, D., & Fainberg, S.M. (2025). Civilian resistance as a cornerstone of national resilience: Insights from Ukraine and Israel. *Mūsų žinynas: karo mokslo, karinio rengimo ir ugdymo žurnalas*, 40(2), 5–32, https://journals.lka.lt/journal/mz/article/2250/info.

Ran, H., & Yagana, Y. (2025, March 18). Cities in the center are opening shelters: "We experienced volleys before, better to be ready in advance" [Hebrew]. *Walla*. https://news.walla.co.il/item/3735265

Ringel, S. (2024, August 4). Home Front Command's new warnings that will take control of your cell phone screen [Hebrew]. *N12*. https://www.mako.co.il/news-money/tech12/Article-6a6223795ad1191027.htm

Russian drone strike on Odesa injures four and causes power outages. (2025, March 4). *Euronews*. https://www.euronews.com/my-europe/2025/03/04/ukraine-says-four-injured-as-russian-strikes-hit-odesa-overnight

Sabbagh, D. (2025, July 11). The Shahed blitz: Can Russian drone onslaught break Ukraine's resolve? *The Guardian*. https://www.theguardian.com/world/2025/jul/25/russia-record-attacks-ukraine-struggles-defend-itself

Santora, M. (2025, March 7). Russia hits Ukrainian power and gas facilities in widespread attack. *The New York Times*. https://www.nytimes.com/2025/03/07/world/europe/ukraine-russia-attack.html

Sauer, P. (2025, August 27). Frustrated Russians grapple with fuel crisis as Ukraine attacks oil refineries. *The Guardian*. https://www.theguardian.com/world/2025/aug/27/frustrated-russians-grapple-with-fuel-crisis-as-ukraine-attacks-oil-refineries

Saunders, R., & Souva, M. (2020). Air superiority and battlefield victory. *Research & Politics*, *7*(4). https://doi.org/10.1177/2053168020972816

Schütz, T., Mölling, C., & Stanley-Lockman, Z. (2019). *A new dimension of air-based threats: Germany, the EU, and NATO need new political initiatives and military defense systems* [Policy brief]. DGAP. https://dgap.org/en/research/publications/new-dimension-air-based-threats

Shiferman, Y. (2023). The Russian Air Force in the war- Issues for review. In E. Hecht & S. Shabtai (Eds.), *The War in Ukraine: 16 Perspectives, 9 Key Insights* (pp. 39–50). BESA Center. https://besacenter.org/wp-content/uploads/2023/08/201-4.pdf

Simmill, K. (2025). Air defence insights from the Ukraine-Russia conflict. *Contemporary Issues in Air and Space Power, 3*(1). https://doi.org/10.58930/bp51798635

Singer, M. (2016). *The new threat of very accurate missiles* (Perspectives Paper No. 356). BESA Center. https://besacenter.org/new-threat-accurate-missiles/

Shaishmelashvili, G. (2023, August 2). *Total defense: The strategy on how to defeat strong* [Policy Paper]. PMC Research Center. https://pmcg-i.com/publication/total-defense-the-strategy-on-how-to-defeat-strong/

Slusher, M. N. (2025). *Lessons from the Ukraine conflict: Modern warfare in the age of autonomy, information, and resilience*. CSIS. https://csis-website-prod.s3.amazonaws.com/s3fs-public/2025-05/250501_Slusher_Ukraine_Conflict.pdf?VersionId=01UUwSkCxsWGAU5vOtwYQHmtq3F1.XKM

Solutions to win: Iron Shelter website debuts in Ukraine, providing vital information on shelter conditions. (2023, October 21). *Rubryka*. https://rubryka.com/en/2023/10/21/v-ukrayini-zapustyly-portal-zalizne-ukryttya/

State Comptroller. (2021). *Annual report 70C*. Office of the State Comptroller and Ombudsman. https://library.mevaker.gov.il/sites/DigitalLibrary/Documents/2020/70c/2020-70c-TAKTZIRIM-EN.pdf

Stewart, R. (2025, May 22). The shifting battlefield: Technology, tactics, and the risk of blurring lines in warfare. *Humanitarian Law & Policy*. https://blogs.icrc.org/law-and-policy/2025/05/22/the-shifting-battlefield-technology-tactics-and-the-risk-of-blurring-lines-of-warfare

UK Parliament, House of Commons Library. (2024, July 25). *Israel–Iran April 2024: UK and international response (Research Briefing No. 10002)*. https://researchbriefings.files.parliament.uk/documents/CBP-10002/CBP-10002.pdf

Ukraine strikes Russia with missiles and drones in one of largest air attacks. (2025, January 14). *Reuters*. https://www.reuters.com/world/europe/ukraine-strikes-russia-with-massive-drone-atacms-attack-russian-telegram-2025-01-14/

Ukraine residents sheltering in subway stations, basements and purpose-built bunkers as Russia invades. (2022, February 25). *ABC News*. https://www.abc.net.au/news/2022-02-25/ukraine-schools-and-subways-become-bomb-shelters-and-gun-ranges/100860338

Vogt, K., & Haider, A. (2024, August). Challenged air superiority: Adapting to the drone and missile age. Joint Air & Space Power Conference 2024, https://www.japcc.org/essays/challenged-air-superiority/

Yan, O. (2025, March 11). Mexican cartel attacks competitors with drones. *Militarnyi*. https://militarnyi.com/en/news/mexican-cartel-attacks-competitors-with-drones/

Zitun, Y. (2023, November 9). About 10 thousand rockets were launched since the beginning of the war: The attack on October 7th the largest since the founding of the state [Hebrew]. *Ynet*. https://www.ynet.co.il/news/article/b1j9rp9qt

Zitun, Y. (2024, August 30). 10 drones and 35 rockets in a combined volley: This is how Hezbollah tried to overwhelm Iron Dome [Hebrew]. *Ynet*. https://www.ynet.co.il/news/article/yokra14057755

Zitun, Y. (2025, June 16). The Zik's hunting trip in Tehran's skies: This is how elimination drones work [Hebrew]. *Ynet*. https://www.ynet.co.il/news/article/yokra14408610

Zitun, Y., Ben Ari, L., Eichner, I., El-Hai, L., & Kraus, Y. (2024, August 25). The plan: Launching hundreds of rockets, side by side with drones | IDF: Most of the attack was foiled, no base was hit [Hebrew]. *Ynet*. https://www.ynet.co.il/news/article/sjl4hwoo0

Appendix 1: List of Interviews

- Interview with two senior military officials involved in drone warfare, Kyiv, August 2023.
- Interview with a former Staff Officer, Armed Forces of Ukraine, Kyiv, August 2023.
- Interview with the policy think tank ANTS Team (Ukrainian NGO promoting national defense initiatives and post-war reconstruction through advocacy, expert networks, and youth empowerment), Kyiv, August 2023.
- Interview with Joseph Zyssels, Head of the *Vaad* of Ukraine (Jewish organization), Kyiv, August 2023.
- Interview with Leonid Finberg, Director of *Duh i Litera* (academic publishing house), Kyiv, August 2023.
- Interview with Dmytro Ivanov, CEO of *Dobrobat* (main Ukrainian NGO involved in grassroots reconstruction), Kyiv, August 2023.
- Interview with Mikhaelo Bryzhko, Regional Head of Dobrobat, Kyiv, August 2023.
- Interview with Oleksandra Rubina, former Project Manager, Ministry of Digital Transformation of Ukraine, via Zoom, August 5, 2025.
- Interview with a mid-level Home Front Command officer, Tel Aviv, October 15, 2025.
- Interview with a senior Ukrainian diplomat, via Zoom, July 3, 2025.
- Interview with two former senior IAF officials, Israel, July 2025.

Appendix 2: Ukraine's Air Defense Response and Adaptation to Russia's Air Attacks By Phase (February 2022-August 2025)

	Russian Strategy	Ukrainian Air Defense Response	Key Outcomes & Constraints
Phase 1- Failed Opening Strike [Feb 24, 2022]	Russia launched concentrated salvos against command-and-control airbases and communication nodes to create a "shock and awe" effect.	**Soviet-legacy layered Ground-Based Air Defense (GBAD):** **– Short-range:** Man-portable air defense systems (MANPADS), AAA, Osa-AKM (SA-8B). **– Medium-range**[9]: Buk-M1 (SA-11). **– Long-range**: S-300 variants (S-300PS, S-300V1, S-300PT-1). **– Complementary**: Early-warning radar network, MiG-29 and Su-27 interceptors (partially modernized).	Overlapping short-range and long-range ground-based air defense systems denied Russia rapid air dominance, foiling plans for a "Crimea 2.0"-style campaign. MANPADS played a significant role in maintaining the airspace as a mutually denied environment, making the use of helicopters and low-flying fixed-wing aircraft forward of the line of troops prohibitive for the Russians. The Ukrainian air defense architecture remained static, resource-intensive, and not designed for protracted multi-domain strikes.
Phase 2- Bombing to Win [Summer–Fall 2022]	Precision strikes on defense industry, logistics hubs, and government communications. In the summer and fall of 2022, introduction of **Iranian Shahed131/136-drones**, used in swarms from Belarus and Russia-occupied territories, added a low-cost, high-pressure vector to saturate Ukraine's already overstretched defenses and target the energy grid and urban centers.	**Decentralized** mobile GBAD deployments to sustain resilience. Severe depletion of interceptors. No domestic manufacturing capacity for timely replacement. Emergence of **civilian-led innovation,** especially in drone and counter-drone warfare. Establishment of the "Drone Line" initiative and of the "Sky Sentinel" project.	Energy grid heavily degraded, command infrastructure manufacturing targeted. Traditional radar-based defenses struggled against low-flying Shaheds. Ukraine's inventory of interceptors was severely depleted, and there was no domestic capacity to manufacture timely and effective replacements.

9 Ukraine's primary SAM assets, such as the long-range NPO Almaz S-300 (RS-SA-10 Grumble) and medium-range NIIP Tikhomirov 9K37 Buk (RS-SA-11 Gadfly) were deployed to intercept Russian land-attack cruise missiles like the air-launched Kh-101 (RS-AS-23A Kodiak), sea-launched 3M14 Kalibr (RS-SS-N-30A Sagaris), and short-range ballistic missiles such as the Iskander-M (RS-SS-26 Stone) and Tochka-U (RS-SS-21B Scarab).

	Russian Strategy	Ukrainian Air Defense Response	Key Outcomes & Constraints
Phase 3- Attritional Punishment [2023-2025]	As of late 2023 and early 2024: shift to massive drone and missile barrages. As of August 2024: Increased and sustained integration of cruise missiles with Shahed swarms, linked to Ukrainian Kursk counteroffensives and diplomatic milestones. Since mid-2024, an average of over 1,000 missile and drone attacks per month, transitioning to over 2,400 since September 2024. 2025: Increased intensity of strikes, with monthly figures approaching 3,000.	**Influx of Western systems – Short-, mid-, and long-range:** Gepard: German self-propelled anti-aircraft system initially delivered in September 2023. Zu-23-2: Initially delivered to Ukrainian troops starting in January 2024. UK modified MBDA ASRAAM missiles mounted on Supacat HMT 600 vehicles ("Raven"): first deployed in 2022. Gravehawk: Improvises R-73 missiles to be launched from a standard shipping container; 2 prototypes delivered in September 2024, with standard deliveries in 2025. OSA SAM system upgraded with R-73 missiles. Delivery of Poland's S-200 systems in June 2024. Involvement of civilian actor "Come Back Alive Foundation" in the modernization of existing air defense systems in December 2024. **– High-end:** Deployment of U.S.-made **Patriot batteries** (6 by mid-2025: 2 US, 2 Germany, 1 joint DE/NL, 1 Romania; partial system from NL). **– Integration:** Gradual layering of Western platforms with surviving Soviet assets.	Patriots significantly enhanced defense of Kyiv, Odesa, Dnipro, and high-value targets. Yet coverage remained below Ukraine's minimum requirement (10–25 systems). Patriots constrained by cost, limited availability, and logistical demands. Ukraine's reliance on U.S./European supply chains introduced structural vulnerability; political delays in Washington/Brussels slowed replenishment. Demonstrated NATO commitment but underscored asymmetry between Ukraine's needs for nationwide defense and the Alliance's lack of comprehensive and sustainable solutions.

Source: Elrom Center for Air and Space Studies

ELROM CENTER FOR AIR
AND SPACE STUDIES
TEL AVIV UNIVERSITY