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Overview

Jean-Christophe Noël

Dear readers,

The issue you are currently reading stands out in stark contrast from previous ones. Those of you with a printed version will have immediately noticed its lighter weight compared to issues 5 and 6. Readers with the digital version will have observed that the table of contents comfortably fits onto two pages. In fact, after two voluminous issues, this time we are offering a slimmer *Vortex*, bringing together articles on three main themes.

The first topic concerns the use of drones in Ukraine. V. Turret contributes to two articles that trace the integration of drones into the force structures of both Russian and Ukrainian militaries. He illustrates how the same doctrine can evolve differently within two distinct military organisations, depending on the challenges to be met, the organisations they adopt, the resources at their disposal, and the initiative left to civil society. These lessons learned can stimulate our own reflections.

Pierre Grasser, meanwhile, recounts how the Russians have organised themselves in the field of C-UAS (counter-unmanned aircraft systems). It is worth noting that this C-UAS uses the most basic forms of electronic warfare resources to counter lightweight drones and does not encompass the entirety of anti-drone defence measures. The analysis reveals that C-UAS is still highly perfectible, which may partially explain why the flying machines they aim to neutralise are proliferating on the battlefield.

The second theme addressed in the journal is operational art. Professionals and planners might find it surprising that such a topic should continue to be discussed when its fate seems to have been settled long ago. The notion had its moment of glory during the Second World War, with the Germans inventing “blitzkrieg” by combining new machinery with a mobile vision of war, and while the Soviets introduced the “deep battle,” seemingly launching successive waves of soldiers and tanks along the same axis of advance. Today, the notion of “operational art” seems to have receded and been replaced by the concept of the “operational level.” This level corresponds to the level of command where tactical effects from various domains are integrated to achieve the desired final effect.

Yet, according to B. Bihan, certainties in this area could be shaken. Drawing inspiration from the Soviet strategist A. Sviétchine of the 1920s, B. Bihan thinks of “operational art” as a discipline and presents its essential terminology. He questions whether the West may have taken a wrong turn by declining or reinterpreting this unique art in its own way. He extends the discussion to explore the application of operational art to air power, sketching a history of aerial warfare from the 1940s onwards.

Another article looks at the training designed to support planning at the operational level. The author, J. F. Reilly, is one of the developers of Ops Design, a planning method that appeared at the beginning of the 21st century to correct certain limitations of Effect-Based Operations. J. F. Reilly provides an exhaustive description of the process used to train practitioners in this method. The text, introduced by P. Gros, highlights the way in which apprentice planners are taught various intellectual reasoning methods, enabling them to consider the different military options open to them in the best way possible.

The third and final theme addressed is international humanitarian law, with a specific focus on warfare and urban combat. Numerous questions have arisen on this topic in the context of recent conflicts. Notwithstanding the war in Ukraine, the most heated discussions have centred on the conflict between Tsahal and Hamas in Gaza. G. S. Corn had the opportunity to visit Israel and interview Israeli soldiers on how they conducted their fighting from a legal perspective. He was kind enough to answer our questions, touching on some very sensitive issues, particularly including how the principle of proportionality was applied by the Israeli army. Additionally, A. Férey was invited to comment on this interpretation of the law. Clear points of divergence emerge between the two experts. One insists on taking operational aspects into account, while the other stresses the dangers of straying from foundational principles. Their remarks will undoubtedly convince some while frustrating others. The hope is that these discussions will stimulate readers’ reflections and enable them to fully grasp the complex issues surrounding these essential themes of modern warfare.

After having covered these three themes, the issue then transitions to the regular sections of *Vortex* on the history of aeronautics, aviators’ testimonies, and book reviews.

The “History” section opens with an interview with O. Wiewiorka, who published in 2023 *Histoire totale de la Seconde Guerre mondiale*, a single volume World War Two history. The publication of this book provides an opportunity to discuss with the author of this highly acclaimed work, certain more or less controversial aspects on the use of air power between 1939 and 1945.

An article by Pierre Vallée reviews and puts into perspective two books: S. Hersh’s 1991 *The Samson Option: Israel’s Nuclear Arsenal and American Foreign Policy*, and A. Cohen’s 1998 *Israel and the Bomb*. These works are essays that examine Tel Aviv’s alleged nuclear manoeuvres during the Six-Day War in 1967 and the Yom Kippur War in October 1973. It is worth noting that such manoeuvres have never

been confirmed by Israeli authorities. More broadly, Tel Aviv has always refused to acknowledge the existence of any nuclear military programme. Be that as it may, the pleasure of reading Pierre Vallée's text remains, with one very important potential lesson that will come as no surprise to French readers: the shadow of nuclear power quickly invades any conventional battlefield when one belligerent possesses nuclear weapons and perceives its existence to be threatened by the fate of war.

The "Testimonial" section features an excerpt from the farewell speech of Air and Space Force General L. de Rancourt. Breaking away from the often formal and occasionally dull nature of such addresses, L. de Rancourt reflects on his aviation career in a highly original, even poetic manner. Veterans of the *Transall* aircraft will undoubtedly recognise scenes from their own flights. Yet, it is likely that all aircrew members will share in one passage or another the emotions that the author has sought to describe.

Finally, this issue concludes with the reviews of three books, each of a different nature. The first two, published by Harpia, whose book series on the Chinese Air Force was previously featured in issue 5 of *Vortex*. This time, the two books focus on the Taiwanese and South Korean military air forces. The quality of editing and the pleasure of reading will be the same as with the books on the Chinese air force. The third book, written by H. Hude, is entitled *Philosophie de la Guerre*. It is reviewed by J.-B. Manchon, who praised "the original approach to the question, the subject of a long and fruitful reflection". The review perfectly illustrates the philosophical and ethical significance of the work, and strongly encourages the readers to explore it.

If you would like to comment on the content of this issue, or if you have any queries or suggestions, please do not hesitate to contact us at vortexlarevue@gmail.com.

We wish you an excellent reading.

WAR IN UKRAINE

Drones at War: The Russian and Ukrainian Confrontation

Part One: From Ukraine's Independence to February 2022

Vincent Turret

Vincent Turret is currently writing his thesis on “Russian strategic culture” at the Université du Québec à Montréal (UQAM), under the supervision of Justin Massie. A former researcher at the Future Conflicts Observatory of the Foundation for Strategic Research (FRS) from 2018 to 2022, with which he is now associated, his work assesses the impact of doctrinal and capability innovations on force postures.

Introduction

While the war in Ukraine is not the first war to feature drones, it undeniably marks their first massive confrontation. It confirms the ascendancy of this category of devices, which, over the past two decades, has continued to expand, diversify, and above all, democratise amongst belligerents worldwide. From theatre intelligence to observing enemy forward positions, adjusting artillery fire, penetrating air defences, and conducting strategic strikes, drones now influence all operational functions and cover the entire spectrum of conflicts.

Analysing the use of drones, especially in a high-intensity conflict, involves grappling with the dual challenge of ubiquity and multiplicity. It is important to recognize that, unless one relies on forced abstractions or an excessive focus on a single, well-defined type of device, the drone as a homogeneous and unified analytical category no longer exists. Attempting to link a technical characteristic to an established function or a specific depth—whether tactical, operational, or even strategic—proves imperfect. This is because drones act as “great equalisers,” capable of reconfiguring and amalgamating pre-existing weapon systems into precision strike instruments.

The question of a precise definition therefore arises. How, for instance, can one differentiate between a loitering munition and an explosive drone? Considering factors such as endurance or varying degrees of autonomy in selecting a target—that is, the ability to independently and iteratively recognise and neutralise an objective—are increasingly insufficient criteria for distinction. These characteristics only represent differences in degree, not in kind, between increasingly sophisticated devices. The term “dronised munitions” has even emerged, further blurring their definition.

Similarly, while it is generally accepted that drones are remotely operated aerial objects, they are no longer simply “unmanned aircraft” but can be helicopters, primitive cruise missiles or even civilian sports or agricultural surveillance devices that have been militarized. The adoption of a fixed or rotary wing configuration, the payload and the type of motorisation (be it electric, piston or jet engine) naturally affect the operational use of drones. However, this diversity of options underlines their modular and adaptive nature, enabling them to adapt to the specificities of the weapons they replace or support.

These questions should prompt the observer to take into account the characteristics of the weapons to which drones are linked, whether they complement or replace them. Such an approach avoids proposing an unsatisfactory definition that treats drones as a standalone category, requiring absolute proof of their effectiveness or operational niche regardless of the threat or theatre of operations. Symptomatic of this inconclusive approach, the article “Why drones have not revolutionised warfare”, published in the magazine *International Security* in April 2022,¹ sought to assess the decisive impact of drones in armed conflicts using three criteria: (1) Do they alter the balance between offence and defence, particularly through their ability to penetrate air defences? (2) Do they reconfigure the distribution of power between belligerents, in other words, do they offer one actor a form of “equalising power” against a more powerful adversary thanks to an affordable entry cost into the system of modern military operations?² (3) Do they transform the characteristics of force deployment by materialising the promise of “non-contact warfare”?

However, the authors of this article consider only strike-capable drones. They consequently exclude all their ISR (Intelligence, Surveillance, Reconnaissance) and C2 (Command and Control) dimensions. Moreover, their observation of the permanence of close-combat in Haut-Karabakh has led the authors to consider the contribution of Syrian contingents as the decisive element of the conflict. They reduce the contribution of drones accordingly. The article thus concludes that drones are not sufficiently capable of compensating for an actor’s conventional inferiority... Nevertheless, one might well ask what other conventional weapons systems could have had such compensatory power.

1. A. Calcara *et al*, “Why Drones Have Not Revolutionized War,” *International Security*, Vol. 46, No. 4 (Spring 2022).

2. S. Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton: Princeton University, 2004).

This lack of contextualisation and differentiation between the different types of drones and their uses has had the effect of polarising the debates on their subject. They are alternately presented as a miracle weapon—described by the Turks in 2018 as the tool of a “geopolitical breakthrough”³—but also criticised as mere gadgets or as equipment for the “poor man’s” air force, too vulnerable to survive in a high-intensity environment.

In many respects, the way the debate on drones is structured shares the fate of helicopters. Long associated with the counter-insurgency context of their emergence, their doctrinal use has fluctuated between integration into ambitious 3D manoeuvre schemes, and inhibition regarding their anticipated attrition in confrontations against peer adversaries.⁴ Drone usage in the Ukrainian war follows this pattern of contradictory positions. For instance, one must assess the contrast between the iconic status granted to the Turkish *TB-2* drone (whose role during this war must be greatly moderated) and the use of cheap Iranian drones by the Russians. They were initially hardly distinguishable from primitive cruise missiles used for terror purposes but demonstrated gradually real operational effect on the articulation of Ukrainian air defense.

Consequently, the aim of this article is not so much to examine the drone in terms of its performance as to consider its integration into a force structure. The analysis can be constructed by contextualising the employment strategies assigned to drones by various actors. Studying these strategies makes it possible to measure the gap between the theory and practice of the belligerents, between their ambitions and their constraints, between the stated objectives and those achieved. It is by highlighting the discrepancies with pre-established employment models that factors such as surprise, friction, and chance can be reintroduced. It is under these conditions that the opportunities and limitations offered by the drone can be better appreciated.

From this perspective, the drone war in Ukraine stands out as a confrontation not between two fundamentally different military models but between two radically diverging applications of Soviet military thought. The Russian model is shaped by a fear of Western airpower’s superiority in the realms of information and firepower. Ukraine’s model, on the other hand, developed in response to the Russian approach, in order to compensate for its systemic weakness against Moscow. The early causes of Ukraine’s success are already apparent: its forces were designed to counter the strengths of the Russian model, whereas the latter was not specifically prepared for the invasion it ultimately launched.

In order to compare these two models, the first part of this article reviews the salient features of the pre-war doctrinal debates (pp.11-34) before delving into the analysis of drones in the conflict in the second part (pp.35-59).

3. C. Kasapoğlu, “Rising Drone Power: Turkey on the Eve of Its Military Breakthrough,” *EDAM* (01 May 2018).

4. M. Allen, *Military Helicopter doctrines of the major powers 1945-1992* (Westport: Greenwood Press, 1993).

I. Russian Drones: nervous systems of the Reconnaissance and Strike Complexes

The development of drones in Russia was not primarily conceived as an effort to catch up with Western UAVs but as a large-scale process of robotizing the C4ISR⁵ functions of its armed forces.

The Russian drone, as developed from 2010 to the 2022 invasion, is not an autonomous strike asset. Instead, it serves as an adjunct to conventional firepower, acting as its nervous system. Its introduction, which began with the New Look reform of 2010, is part of the new paradigm of so-called “contactless” or “new generation” warfare, the postulates of which date back to the Soviet “military-technical revolution” (MTR) of the 1980s. The central idea is that firepower, now guided by space-based resources and calibrated by computer calculation, becomes an autonomous force on the battlefield, able to crush formations in contact to the point of replacing them as the main element of maneuver in depth.

The emergence of these “manoeuvring fires” upends the foundation of the Soviet model – Mass – by favouring Western-inspired force structures centred on air dominance, which integrate ISR and strike capabilities within a single domain. Once made precise, firepower could enable decisive outcomes from the outset of the initial period of the war, bypassing mobilization and deterrence.⁶ Before continuing this analysis, it is therefore essential to understand the Russian concept of manoeuvre through fires to fully grasp the crucial role that drones are set to play within it.

A. A fire-centric army with soviet complexes

For the Russians, modern warfare unfolds like a massive counter-battery engagement, where victory—or at least survival—is ensured by the ability to neutralise the adversary’s deep precision strike system, either by its disorganization or the annihilation of its effectors. Much like a nested matryoshka doll, the objective is to restore fire superiority at the tactical and operational levels by employing an outward fire echelon capable of striking into strategic and operational depths, thereby inhibiting and degrading Western advantages in airpower and ISR domains.

The doctrine of “active defence” or “strategic deterrence” seeks to re-establish credible conventional strike capabilities against the West. The aim is not to fight “strength against strength” but to degrade, in advance, the airpower and information superiority underpinning Western precision strikes.⁷ The model therefore proposes the development of a kind of air-land “Bastion”. This is not designed as an impenetrable fortress that would passively await an offensive. This Bastion represents a system that shelters and protects the Russian offensive vectors, capable of actively reaching and degrading enemy’s striking forces as well as the infrastructure and

5. Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance.

6. V. N. Tikshaev *et al*, “Le problème de la lutte contre les véhicules aériens sans pilote et les voies possibles de sa solution,” *Pensée militaire*, No. 1 (2021).

7. V. Tourret, “Les approches multidomaines russe et chinoise : un même combat aérospatial,” *Vortex. Études sur la puissance aérienne et spatiale*, No. 1 (2021) : 39-51.

networks that support them. Such a framework was intended to compensate for the individual and technical shortcomings of artillery and anti-missile units approaching obsolescence. Their integration into a networked “single information space” promised to synergistically contribute to the early degradation of enemy capabilities and subsequently, the interception of adversary salvos.⁸

The major concepts used to unify this indirect firepower were developed within the MTR at the tactical level (the ROK: reconnaissance-strike complex) and operational level (the RUK: reconnaissance-fire complex). These incorporate three subsystems dedicated to shock, support, and control.⁹ In practical terms, they integrate artillery pieces, ISR sensors, and an architecture constituted by “automated C2” (ASU) posts situated across the various operational echelons.

Originally, the ROK and RUK were concepts restricted to artillery and ballistic strike units. The Russians adapted these frameworks, transforming them into a matrix for the joint integration of their forces—or, rather their aggregation. Their objective is to enhance firepower to a level capable of saturating the theatre of operations. To emphasize the growing complexity and technical progress of these architectures, Russia now uses terms such as fire/strike-reconnaissance “circuits” or “contours.” These agglomerate and connect the different strike means necessary to neutralize a set of targets linked to the operation plans’ objectives. These plans generally take the form of an “enemy fire engagement plan” (OPP), which prioritises targets for destruction then articulating and distributing strike vectors.

Compared to the Soviet era, the issue of force integration has then imperceptibly shifted under Putin’s era. Initially, the ROK and RUK were technical iterations of a new Soviet conceptual framework for defeating NATO through strategic operations in depth. However, by 2010, the ROK and RUK had evolved from simple architectural models to operational plans, and from “a set of procedures” to a force employment concept. There soon existed as many ROK variations as specific missions: one might refer to a *ROK for counter-battery*, a *ROK to defeat moving armoured targets*, and so on.¹⁰ The ROK became the central ingredient of a kind of magical thinking. The “interaction” between kinetic, anti-aircraft, and electronic fires, or the Russian joint-forces “association,” was no longer articulated and justified in terms of operational objectives to be achieved in a campaign. Instead, these interactions were reduced to purely technical considerations of digital connectivity and interoperability between equipment. Technical feasibility began to outweigh operational relevance, without, for example, defining clear distinctions between applications in local wars and those in high-intensity conflicts.

8. A. V. Ananiev *et al*, “Formation d’un système de reconnaissance interspécifique et de contours de choc,” *Pensée militaire*, No. 8 (2020).

9. Edition 2017 of the Russian military encyclopedia.

10. M. A. Safronov, “Développer la reconnaissance de l’artillerie par le recours au système de contrôle de réseau intelligent,” *Pensée militaire*, No. 12, (2021).



Source: "Variant of the construction of a promising network system for artillery reconnaissance of a joint-arms formation," in M. A. Safronov, "Développer la reconnaissance de l'artillerie par le recours au système de contrôle de réseau intelligent," *Pensée Militaire*, No. 12 (2021). UAV BD: close range; UAV MD: short range. V. Litvinenko *et al.*, "Exiger une autorisation" *Collection Militaire*, No. 9 (2022).

From a doctrinal and material standpoint, this approach allowed the Russians to "make something new out of something old." Networking optimised the old Soviet-style structure of the Russian forces and enhanced firepower without challenging its centralisation. It positioned the drone as the "eye" of various automated C2 (ASU) systems: ASU Yesu-TZ at the tactical level, ASU Akatsia-M at the operational level, and ASU NTsUO at the strategic level. These ASU systems serve as the "spine" that integrates strike elements, which are themselves equipped with automated guidance and fire control systems: ASUNO¹¹ for artillery, SVP-24 Gefest for aviation and KRUS Strelet for infantry. Drones provide robotic reconnaissance for this automated structure. They come to fill the gaps in the existing organization, which, although digitized, has not been reformed, as it no longer has the means to deploy and maintain heavy manned ISR platforms. This logic even goes so far as to justify, in May 2021, the proposed replacement of manned *Su-24MR* reconnaissance aircraft with *Altius* and *Orion* drones – though this has not yet been achieved.¹²

Beneath a veneer of modernity, the integration of drones into Russia's force structure remains governed by Soviet organisational principles. Formations are echeloned

11. Nagovitsin *et al.*, "Statut et tendances de développement des systèmes de communication de l'artillerie dans les perspectives les plus proches," *Nouvelles de l'Académie Russe des Sciences des Fusées et de l'Artillerie*, No. 1, vol. 86 (2015).

12. R. Kretsul *et al.*, "Rejoignez l'essaim : les unités des Forces aérospatiales passent à la reconnaissance sans pilote," *Izvestia* (21 May 2021).

and specialised according to their assigned objectives. In this respect, drones inherit the roles and missions traditionally assigned to helicopters in Soviet doctrine for in-depth operations. They are responsible for aerial reconnaissance, target designation for strike groups, artillery fire adjustment, and post-strike damage assessment. They facilitate the command and control of troops, ensure communications, and participate in the suppression and interdiction of “enemy troops, firearms, and equipment”, as well as the destruction of fortifications, concentrations of military resources, vectors and HQs.¹³

Much like helicopters, whose specific usage justified the creation of dedicated units to master their technical and doctrinal employment, drones are concentrated within specialised units (drone companies and platoons). Inter-service coordination is managed by the senior commander (of the regiment or brigade), who echelons these units within the overall force structure based on their objective (tactical, operational, or strategic). Integration through “single-person command”¹⁴ and the close subordination of sub-units to the overarching plan are intended to ensure a greater concentration of effort. However, the downside of this rigid centralisation is that units lack the training, equipment, or authorisation to interoperate in the event of operational failure or communication breakdowns.

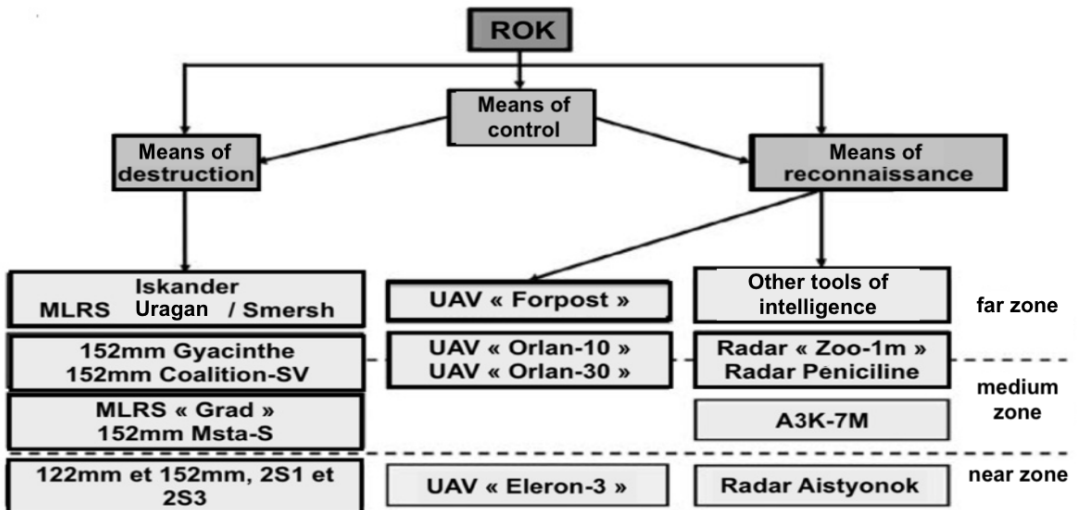
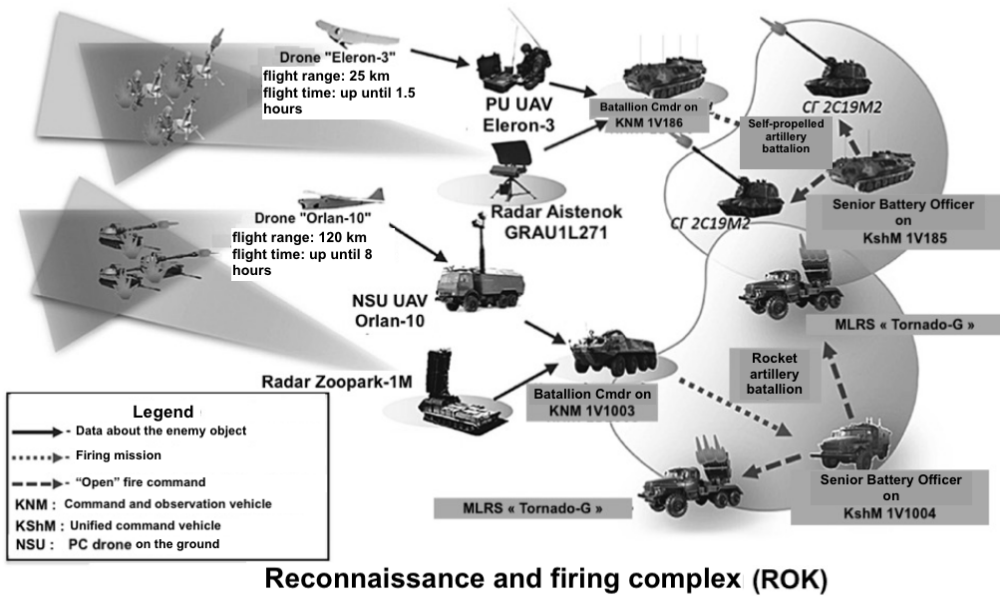


Рис. 13. Распределение огневых средств и средств разведки по зонам поражения

Source: V. Litvinenko *et al*, “Exiger une autorisation,” *Collection Militaire*, No. 9 (2022).

13. A. S. Budnik, “Contrôle de l’aviation et maintien de l’interaction avec les troupes lors des opérations de combat,” *Pensée militaire*, No. 10 (2016).

14. Since the Soviet era, the Russian officer has personified the unity of command and effort. They decide and plan operations, but also direct and supervise their execution. This Russian specialisation of the C2 function is reflected in a staff that “executes” its commander’s decisions, rather than “assists” his decision-making (commander-driven versus staff-driven).



Source: S. V. Boog, "Expérience historique du combat contre-batterie comme facteur de développement des actions de reconnaissance et de frappe dans les opérations modernes," *Bulletin de l'Académie des Sciences Militaires*, No. 2 (2022).

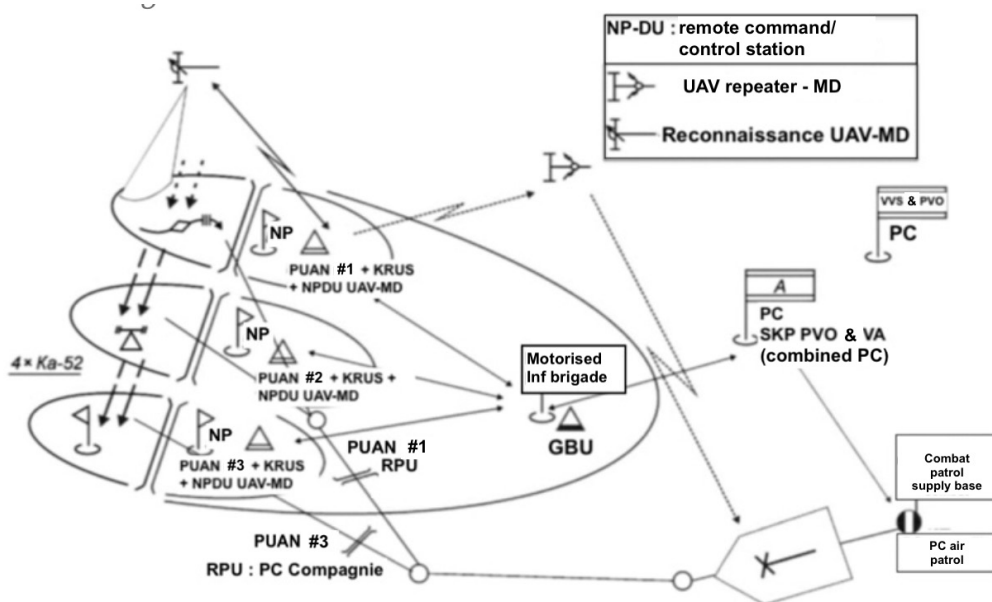
From 2010 to the present, the Russians have placed their MALE drones, *Forpost* and *Orion*, under the authority of the VKS to enhance strikes at the tactical-operational level (200 to 300 km). At the tactical level, meaning under 100 km, ground brigades and divisions operate UAV companies, each composed of two platoons. The first platoon manages "very short range" drones (25 km), including *Granat-1*, -2, -3, and -4, *Tachyon*, and *Eleron*. The second focuses on "short and medium range" (50 to 100 km) using *Orlan-10* drones¹⁵ (three to four units, with four crew members per drone¹⁶). Specific to rocket and artillery brigades of the ground forces, the *Orlan-30* drone guides Krasnopol precision shells and Iskander missile.¹⁷ These missiles complete the range of fires against more hardened or better protected targets that exceed the destruction capabilities of the artillery and tactical aviation.

15. Vladimirovich *et al*, "Justification scientifique et méthodologique des méthodes d'application des véhicules aériens sans pilote pour le renseignement et la destruction de cibles," *Académie militaire Mikhailovskaya, JSC NPO Spets Materialov* (2021).

16. M. V. Silnikov *et al*, "Cours d'artillerie pour l'opérateur du complexe de reconnaissance aérienne (hostile)," *RARAN* (2022).

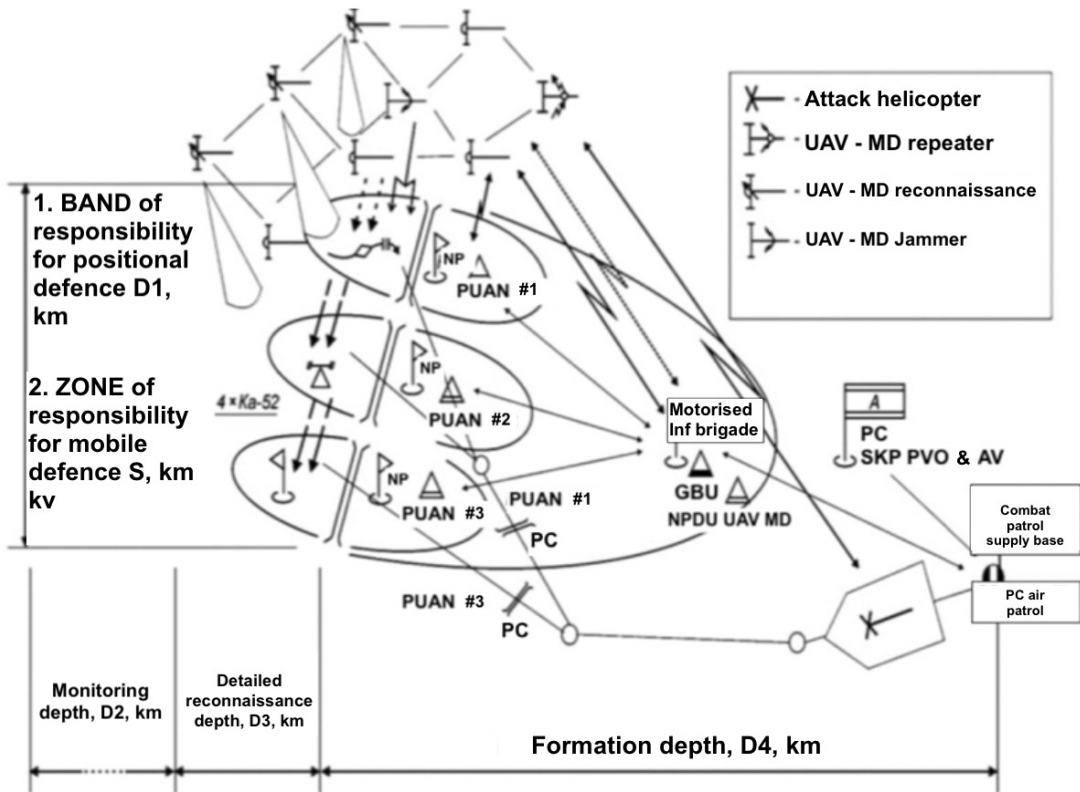
17. A. Ramm, B. Stepovoi, "Drone to the field: "Orlan-30" will find targets for artillery," *Izvestia* (02 October 2019).

However, the situation becomes more complex when integrating the VKS's MALE drones, which must adhere to the procedures governing support from manned aviation. The TsBU deploys, as a first echelon, three combat control groups (GBU) to organise and control aviation in coordination with units. These GBU then establish "air control points," also referred to as advanced aviation artillery observers (PUAN), who maintain direct contact with the command of the combined arms unit they support. The PUAN personnel are responsible for designating targets and directing crews toward them. This system is frequently criticised for its rigidity, lack of responsiveness, and even its potential danger.¹⁸



Option for operation of the air support circuit with UAV MD reconnaissance and communication relay

18. A. S. Budnik, *op. cit.*



The use of a mixed group of MD drones with air formations as part of an air support for troops

Source: A. V. Ananiev, S. V. Filatov, "Système de contrôle d'un groupement interspécifique de troupes (forces) avec intégration d'unités d'aviation sans pilote," *Pensée militaire*, No. 9 (2017).

The two diagrams above illustrate the sequence of Russian air-ground integration. They also point to its future developments, highlighting the need for drones specialised in SIGINT and COMINT. Drones play a crucial role by providing a much faster and more direct retransmission of support requests between PUAN and GBU compared to the traditional model. Combined with the ASU Strelets system for infantry support, drones appear capable of addressing the noted lack of responsiveness, pending improvements in tactical-level ASU connections (such as the YESU-TZ).¹⁹

This framework functioned relatively smoothly until the 2020 Nagorno-Karabakh war. It spurred the growth of the Russian drone fleet, which expanded from 400 units in 2014 to 1,500-1,800 by 2018. The majority of this fleet consists of *Orlan-10* drones, the versatile "workhorse" of the Russian army.²⁰ The conflicts in Ukraine

19. V. I. Okunev, "Nous analysons les actions conjointes de reconnaissance et de frappe d'une force de raid et d'un groupe aérien tactique mixte," *Pensée militaire*, No. 9 (2021).

20. G. A. Kuznetsov *et al*, "Analyse rétrospective, état actuel et tendances de développement des véhicules aériens sans pilote nationaux," *Revue d'ingénierie : science et innovation* (2018).

from 2014 to 2015 and in Syria seemed to demonstrate the effectiveness of the “contactless” model in supporting Battalion Tactical Groups (BTGs). These lighter, more compact modular formations are designed to leverage this enhanced firepower to operate autonomously in the depth of enemy systems.

However, Russia’s main challenge appears to lie in the production and sophistication of its fleet, which has been significantly impacted by sanctions imposed after the 2014 annexation. Issues with motorisation, particularly electric ones, and a lack of advanced components for optronics have severely hampered the industry. The development of heavier or longer-endurance UAVs has been particularly affected.²¹ As a result, platforms such as the *Altius* for maritime reconnaissance and the *S-70 Okhotnik* for air superiority have struggled to progress beyond the prototype stage.²²

B. Russian drones beyond Karabakh: Envisioning “Mixed Reconnaissance and Strike Groups”

In this context, 2020 can be considered an *annus horribilis* for the Russian model. The strike systems employed by the Turks dismantled Russia’s air defence layers and tactical formations on three separate occasions. The Russian model proved to be outmatched during Operation Spring Shield in Idlib in February-March, then the intervention in the Battle of Tripoli in May, and finally, the Nagorno-Karabakh war in September.²³ The centralised integration of drones and artillery was being outpaced and outranged by the first employments of *TB-2* strike drones and the emergence of the first loitering munitions. Russian military analysts acknowledged that relatively unsophisticated but now armed drones were the “ideal tool” to “combine, process, and interpret (information) in real time, while simultaneously applying the necessary means of influence (fire or informational) to target objects.” However, a major problem emerged: the Russians lacked such drones.²⁴

Rather than questioning the foundations of their “contactless” models, the Russians concluded that the Turks had simply outpaced them. They argued that Turkish successes highlighted the “widespread use of ROK and RUK complexes” built on “mixed-composition groups” of unmanned reconnaissance, strike and “vaga-bond ammunition” (ABB) aircraft.²⁵ These UAVs “concentrated the fires of artillery groups while maintaining a safe distance”.²⁶ At the same time, they formed “several

21. M. S. Ivanov *et al*, “L’état actuel et les perspectives de développement des centrales électriques des véhicules aériens sans pilote,” *Pensée militaire*, No. 4, (2019).

22. M. Khodarenok, “Kamikaz russe : les drones lancet deviendront-ils des armes de masse ?,” *Gazeta.ru* (20 April 2021).

23. S. I. Makarenko, “Lutte contre les véhicules aériens sans pilote. Monographie,” *Technologies à forte intensité scientifique* (2020): 204.

24. P. Kutakhov, A. E. Titov, “Systèmes d’aéronefs à grande échelle avec des véhicules aériens sans pilote – Un nouveau paradigme d’opérations militaires,” *Forces aérospatiales : Théorie et pratique*, No. 19, (September 2021)..

25. P. A. Dulnev *et al*, “The Main Trends of Development of Ground Forces Tactics (According to the Experience of the Military Conflict in Nagorny Karabakh),” *Pensée militaire*, No. 11 (2021)

26. *Ibid*.

waves of raids” capable of exhausting then paralysing enemy air defences.²⁷ This significantly increased the vulnerability of armoured vehicles, troop concentrations, and their reserves.²⁸

The Russians thus observed an “increase in the spatial reach of joint combat” thanks to “the depth of the impact on the enemy”, which gives combat operations “a sort of multi-sphere character” (the Russian equivalent of the notion of multi-domain).²⁹ There were therefore an urgent need to “create and use integrated combat systems that can transform the totality of heterogeneous forces and assets into ‘single forces’”.³⁰ It was necessary to address inter-system integration deficiencies to enhance the detection and interception capabilities of air defence forces (PVO) and to support the artillery reconnaissance of the Rocket and Artillery Forces (FRA).

The latter, in fact, proved insufficient to make a ROK capable of achieving the objectives of enemy fire destruction (OPP). Back in 2019, the editor-in-chief of the ground forces journal, V. Litvinenko, highlighted that the poor performance of long-range UAVs, coupled with a lack of parts and artillery range, resulted in 30-40% of OPP targets being uncovered. Moreover, 10-15% of covered targets remained unstruck due to a lack of precision.³¹ While the low effectiveness of artillery reconnaissance was likely linked to an “inadequate and unreasonable definition of its functions” in the OPP, the fact remains that an alternative strike force must be created.³² Thus, by 2021, the idea of developing a range of multipurpose drones to support new “reconnaissance and strike raids” in depth began to take shape. In practical terms, this involved robotising some parts of the Russian tactical-operational aviation missions (*Su-34*, *Su-24MR*, and fighters) to offset their slow response times and make up for the limitations of artillery.³³

Colonel O. V. Ermolin, head of the Air Force Research Centre, and Lieutenant Colonel A. V. Ananiev of the VKS emerged as the most prolific authors on this topic. Through numerous articles, they developed what they termed “strike and reconnaissance groups” (RUGs) to break through the defences and gain air superiority against the West.³⁴ These systems were conceptualised as temporary or permanent recon-

27. I. E. Afonin *et al*, “Analysis Of The Experience Of Combat Use Of Groups Of Unmanned Aerial Vehicles To Destroy Anti-Aircraft Missile Systems Of The Air Defense System In Military Conflicts In Syria, Libya And Nagorno-Karabakh,” *Systems of Control, Communication and Security*, No. 4 (2020); S. I. Makarenko, A. V. Timoshenko, “Analyse des moyens et méthodes de lutte contre les véhicules aériens sans pilote. Partie 2,” *Systèmes de gestion de la communication et de la sécurité*, No. 1 (2020).

28. P. A. Dulnev *et al*, “The Main Trends of Development of Ground Forces Tactics (According to the Experience of the Military Conflict in Nagorno Karabakh),” *Pensée militaire*, No. 11 (2021).

29. P. A. Dulnev, *op. cit.*

30. *Ibid.*

31. V. Litvinenko, “Objectifs pour l’artillerie,” *Collection Armée*, No. 4 (2019).

32. M. A. Safronov, *op. cit.*

33. A. V. Ananiev *et al*, “The justification method of the enemy reserve movement prevented with usage of strike unmanned aerial vehicles at air support of land forces,” *Bulletin of the Academy of Military Sciences (AVN)*, Vol. 66, No. 1 (2019).

34. A. V. Ananiev *et al*, “La méthode d’utilisation conjointe des véhicules aériens sans pilote de petite classe et des bombardiers multifonctionnels lors de la chute des systèmes de défense aérienne sur la route de vol,” *Forces Aérospatiales: Théorie et Pratique*, No. 19 (2021).

naissance-strike circuits.³⁵ Once again, the idea was to modernise Soviet doctrine to establish firepower superiority within tactical-operational depths (200–300 km). The goal remained to preempt adversary sortie generation by targeting their ISR, C2, airport infrastructure, and, most critically, grounded aircraft.

According to Lieutenant Colonel Ananiev, the task of “overcoming air defences” by creating “corridors” within adversary depth would take far too long. The Russian air fleet would then be vulnerable to counter-attacks from the enemy’s superior fighter fleet. While the aerial corridor might be breached, the primary strike force, composed of bombers, would likely be shot down. It was therefore deemed essential to neutralise the adversary’s fleet on its tarmac within five minutes before launching operations. However, intelligence on the enemy’s air arrangements was too limited, artillery was positioned too far away, and manned aviation was too costly and too easily detected to be engaged effectively and in a timely manner.

Faced with this impasse, Ananiev views drones as the solution, both to accompany the main strike groups in order to shore up their corridor, but also to infiltrate in advance and, in a way, discreetly undermine the enemy’s airspace. Colonel Ermolin even argues that it is possible to establish an “air base blockade” using loitering munitions (ABB) coupled with “airmobile stations”. The latter would ensure stable navigation and control of the ABBs in enemy territory by bringing together relay and ISR drones.³⁶ He envisions these ABBs as capable of establishing “territorial control” while conserving, or even sparing, the flight resources of manned aviation. Ermolin’s concepts are heavily influenced by U.S. models, where he imagined a “mother aircraft” capable of disseminating ABBs. He also contemplates “intellectualised” munitions (integrated with artificial intelligence – AI) to accompany manned aviation.³⁷

For the 2020s, the objective is therefore to combine the robotisation of reconnaissance-strike complexes with their “intellectualisation” through AI. The aim is to enhance the “quantitative justification of decisions”³⁸ and to expand the management capabilities of “UAV groups” to enable their large-scale deployment despite the cognitive limitations of human operators. For the Russians, it seems impossible that the widespread use of drones could result in the recruitment of an equivalent number of “operators in the troops”.³⁹

Yet, three years later, the reality proves to be quite the opposite. While the *Orion*, modelled on the *TB-2*, and the *S-70* “stealth” wingman of the *Su-57* were expected

35. A. B. Ananiev *et al*, “Opérations conjointes de reconnaissance et de frappe d’un détachement de raid et d’un groupe d’aviation tactique mixte,” *Pensée militaire*, No. 9 (2021)

36. O. V. Ermolin, N. P. Zubov, “Utilisation d’armes avec des munitions aériennes dans les conflits militaires actuels et futurs,” *Pensée militaire*, No. 3 (2021).

37. O. V. Ermolin, “Special Features Of The Combined Employment Of Manned And Unmanned Combat Aircraft Of The Aerospace Forces In Combat-Related Strike Missions (Tactical Operations),” *AVN*, Vol. 75, No. 2 (2021).

38. O. V. Maslennikov, “L’intellectualisation est une composante importante de la numérisation des forces armées de la Fédération de Russie,” *Pensée militaire*, No. 7 (2020).

39. A. E. Titov *et al*, “Systèmes d’aéronefs à grande échelle avec des véhicules aériens sans pilote – Un nouveau paradigme d’opérations militaires,” *Forces aérospatiales : Théorie et pratique*, No. 19 (2021).

to win the day, it was the old *Orlan-10* that proved its effectiveness on the front line. Taken by surprise, Russia has come up against a Ukrainian adversary who has turned the drone into a veritable weapon of popular resistance.

II. Ukrainian Reconnaissance and Strike Complexes

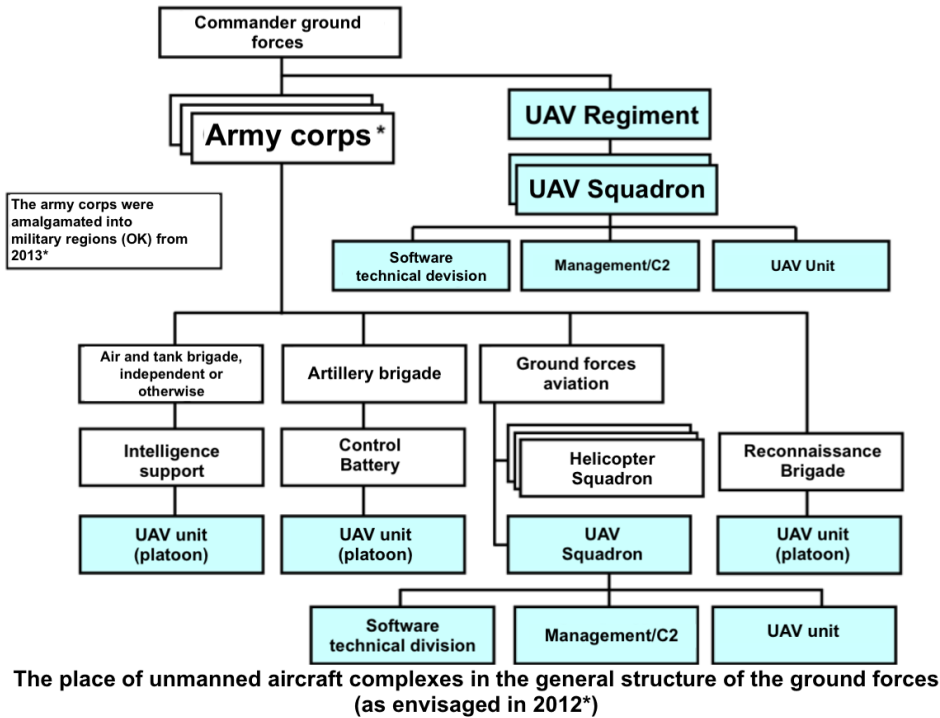
“But Ukrainian warriors and idealists, equipped with their desire, competence, and thirst for victory, strive to transform these Cold War relics into an augmented, networked, and modernised species; a steel cyborg assimilating humans, machinery, and technology.”⁴⁰

At first glance, Ukraine’s interest in drones appears similar to that of Russia. It originates from the same Soviet assumptions about the nature of future conflicts – network-centric warfare and aerospace superiority. It has thus led to an emulation and even a direct import of the processes and schemes of integration by “reconnaissance and strike complexes” that the Russians put forward. The Ukrainians differ, however, in the absence of a strategic dimension to these systems. They do not articulate them within a wider theory of conventional deterrence or active defence. Instead, they reserve them primarily for ISR coverage and tactical and tactical-operational battlefield fire.⁴¹

The first imperative is the financial and technical optimisation of existing strike capabilities by leveraging information technology. This approach aims to compensate for the loss of mass in the ground forces and to find a credible alternative to the programmed obsolescence of the air fleet. In a way, until 2014, Ukrainian writings almost seem to be the “purist”, but “pocket-sized”, version of the Soviet vision of powerful, automated, and echeloned complexes of artillery tubes and ballistic missiles. Drones are considered a new type of ISR tool, regimented for the benefit of corps commanders to operate within ranges of 70 to 300 km, and assigned in platoons to various manoeuvre units.

40. V. K. Medvedev, I. S. Korenivska, Yu. A. Khazhanets, A. O. Salov, “Les véhicules aériens sans pilote et leur influence sur le cours de la guerre russo-ukrainienne,” *Science et Défense*, No. 2, (2023).

41. Yu. Salnyk *et al*, “L’état actuel de l’équipement des forces armées ukrainiennes en systèmes aériens sans pilote,” *Une collection d’ouvrages scientifiques de l’Académie ukrainienne des sciences* (24 January 2013).

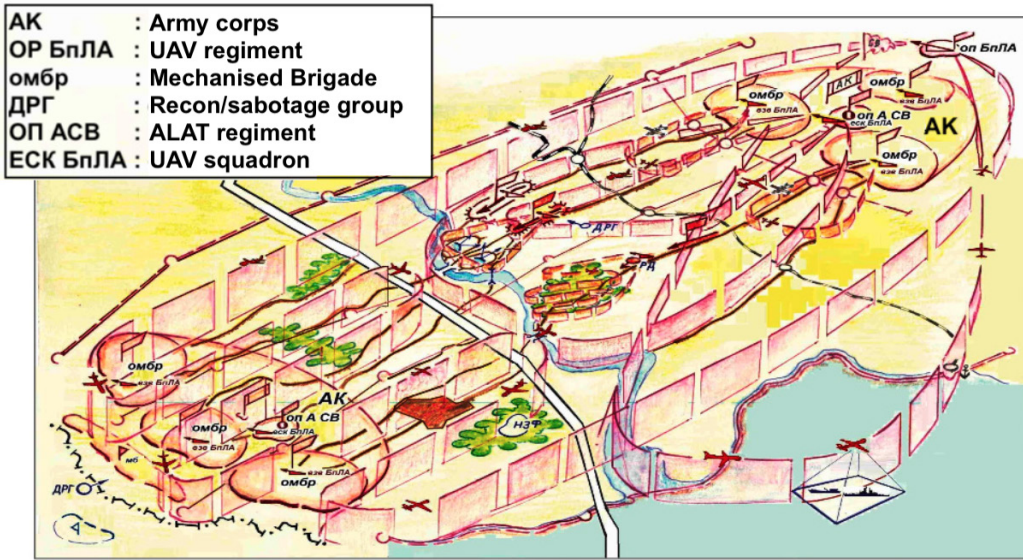


Source: M. Datsenko *et al*, “Définition et justification des tâches drones opérationnels tactiques et tactiques des complexes aéronautiques dans l’intérêt des forces terrestres,” *Systèmes d’armement et équipements militaires*, No. 2, Vol. 30 (2012).

The missions envisaged focus on reconnaissance of targets typical of Soviet “engagement by fire” (OPP): strategic vectors, counter-battery and anti-aircraft assets, HQs and ASUs, second echelon and reserve positions, concentrations, etc. In 2013, requirements were estimated at 52 drones for the army as a whole, including 16 tactical/operational aircraft, and 12 of tactical rank.⁴² However, at a time when the Russians were preparing to annex the Crimean peninsula, Ukraine only had the Soviet *Tu-141* and *Tu-143* drones grouped together in the 383rd separate “armed remote-controlled aircraft” regiment of its air force.⁴³

42. *Ibidem*.

43. M. Bugriy, “The Rise of Drones in Eurasia (Part One: Ukraine),” *The Jamestown Foundation* (23 May 2014).



The task of air reconnaissance of the BpLA (БнЛА) during the regrouping (movement) of troops (option)

Source: I. M. Datsenko *et al*, *op. cit.*

A. Donbass Interregnum: Struggles for Influence Between Neo-Soviet, Cossack, and NATO STANAG Standards

The occupation of Crimea in 2014 and the successive defeats of the anti-terrorist operation in the Donbass until 2015 did not fundamentally challenge this initial Ukrainian vision: “Drones are at the heart of precision fires”.⁴⁴ Rather, these events radicalised Ukrainian thinking towards more asymmetric and opportunistic aspects.

The design of fires and the identification of threats initially mirrored Russian assessments of the period, like a mirror held up to the aggressor. Ukraine viewed itself as existentially threatened by a “strategic air offensive”. This would not take the form of an “avalanche of fire” against its ground forces, but as “surgical operations involving the massive and simultaneous use of high-precision weapons and unmanned aerial vehicles”. These shared Russian and Ukrainian concepts led to similar solutions. Ukrainians believed that in response to Russia’s “contactless” and “informational” warfare, culminating in “hybrid war”,⁴⁵ they must respond by integrating and synchronising all available strike resources in a single information space.⁴⁶

44. V. K. Medvedev, *op. cit.*

45. Yu. A. Sarichev, “L’expérience des forces armées des principaux pays du monde dans le but d’améliorer le support d’information des forces armées ukrainiennes,” *Collection d’études scientifiques au Centre d’études militaro-stratégiques*, No. 2, Vol. 72 (2021).

46. V. V. Tkachev, “Points de vue sur l’organisation de la défense aérienne dans les conditions modernes,” *Science et défense*, No. 4 (2021) and A. Remez, “Recommendations for Evaluating the Battle Efficiency of the Use of Troops Taking Into Account the Creation and Use of Different Options of Reconnaissance-strike Systems in Operations,” *Social Development and Security*, No. 3 (2021).

The tactical and operational emphasis of the early days gradually gave way to an ambition for “total” territorial defence.⁴⁷ The idea was to compensate for technical and material shortcomings by involving civil society and fostering initiatives at the lowest tactical levels. The focus shifted to flexibility rather than centralised automation: “[It is a fundamental error] to believe that the mechanical, technical unification of the management bodies of military formations at all levels will solve the problems of stability and reliability of troop leadership”.⁴⁸ However, although the concept of a total defence was adopted in 2015 and was inspired by Baltic doctrines,⁴⁹ it appears to be less the result of a deliberate concertation by the general staff than an attempt to channel *a posteriori* the vast popular mobilisation movement that emerged in 2014. The result is an eclectic modernisation which, until the years 2020-2021, verges on fragmentation between a neo-Soviet model, the appropriation of Western Standardization Agreements (STANAG), and a distinctly Cossack culture of combatant collectives.

In the years following the 2014 invasion, Kyiv maintained extensive Soviet-style automation programmes for ASUs intended to interoperate: *Oreanda-PS* for air defence, *Dzvin-AS* for strategic-operational management, and *Prostir* for tactical sensor and fire control (battery battalion).⁵⁰ For ISR functions, Kiev preferred fixed-wing tactical drones to equip the reconnaissance units within its artillery brigades and the artillery groups of the manoeuvre brigades.⁵¹

Progress, however, remained limited until 2021. The first drones received in 2016 were 72 *RQ-11 Ravens*, which fell victim to Russian electronic warfare capabilities. The three Polish *FlyeEye* drones, delivered to the 26th Artillery Brigade in December 2014, were not formally accepted until 2017.⁵² Production of the system only began at the end of 2020.⁵³ Worse still, although the *Oreanda-PS* was deployed in 2016,⁵⁴ the land ASUs proved to be too expensive and largely disconnected from the actual operation of the forces. In the meantime, these forces have already become

47. S. S. Sobko, “La défense territoriale dans le modèle de défense prospectif de l’Ukraine,” *Science et Défense*, No. 2 (2023).

48. Yu A. Sarichev, *op. cit.*

49. T. Fouillet, “Guerre en Ukraine : étude opérationnelle d’un conflit de haute intensité (premier volet),” *Recherches & Documents*, Fondation pour la recherche stratégique, No. 2 (28 February 2023).

50. V. Zablotski, “Dimension numérique de l’AFSU. Dans quelles conditions est-ce possible?,” *Courrier Industriel de la Défense* (25 December 2019).

51. Académie nationale des forces terrestres, “Directives temporaires sur le travail de combat des unités de complexes d’aviation sans pilote de troupes de missiles et d’artillerie des forces armées,” *VKDP* 3-(06,07,46)03.01, NASV, (June 2019)

52. M. O. Zhironkhov, “L’utilisation du complexe de reconnaissance sans homme Flyeye pendant la guerre dans le Donbas,” *Deuxième conférence scientifique et pratique pan-ukrainienne, Académie nationale des forces terrestres* (08 October 2021). It should be noted that they were acquired for the benefit of the State by the Roshen confectionery company, the company of the Ukrainian President at the time.

53. P. Tolok, “Développement de la production de systèmes robotiques sans pilote en Ukraine grâce à la coopération militaire et économique internationale,” *Revue d’articles scientifiques “Développement social et sécurité”*, Vol. 11, No. 5 (04 September 2021).

54. This is also a constant with the Russian adversary: the anti-aircraft defence forces, probably because of the technical nature of their tasks, are generally well prepared for networking, relying on Soviet architectures that were already very advanced in terms of automation.

significantly decentralised to counter Russian aggression, both in terms of initiative-taking and their organisation and equipment. Faced with Russian firepower, the regular units improvised to survive, drawing as much as possible on the resources and ingenuity of Ukrainian civil society. By 2016, they had embryonic reconnaissance and strike complexes, which were rudimentary but tactically effective. These complexes have been self-constituted by groups of specialists, mavericks and volunteers who developed their own ISR platforms, information and guidance systems, as well as practices and procedures for their use.

Strictly speaking, at least until 2017, there were no units formed to use drones in the Ukrainian forces. Instead, there were “free crews,” “combat groups,” or “drone batteries” attached to various units. They self-identified within these formations under the label *Aerorazvedka* (“aerial reconnaissance”).⁵⁵ These groups purchased and modified civilian mini-drones, primarily quadcopters or fixed-wing drones from the Chinese firm DJI (*Phantom-3/4*, *Mavic-2*). To sustain their activities, these volunteers in turn set up a vast ecosystem of associations that raised funds, procured drones, and widely disseminated their innovations and lessons learnt as much as possible.

This ecosystem oscillated between patriotic movements, mutual aid networks, clientelism, and military entrepreneurship. Still playing an essential role in 2024, its most important entities are Come Back Alive (logistics and training),⁵⁶ the Air Reconnaissance Support Centre (production and training), Army SOS, and *Aerorozvdika* (which will eventually be integrated into the army). The latter two were particularly decisive, as they understood very early on the need to offer a “system-of-systems” solution linking sensors to effectors. Respectively, they developed the two *Kropiva*⁵⁷ and *Delta* programmes. The first concerns the automation of artillery calculations and links, while the second is a situation-intelligence system, which aggregates various ISR sources.⁵⁸ These two systems, together with GIS ARTA⁵⁹ for artillery and *Virage-Tablet* for aerial imagery,⁶⁰ have since become essential components in the architecture of the Ukrainian forces and their strike complexes. Since 2022, *Kropyva* and *Delta* have even been providing Battle Management System-type functionalities and interfacing with NATO’s C4ISR. However, this success story cannot conceal the profound imbalances and shortcomings that have led to the formation of a multi-speed Ukrainian army.

The Ukrainian state’s attitude toward these initiatives alternated between predation, cooptation, and integration. On the industrial front, from 2018 onwards,

55. V. Yasynska, “L’éclaireuse aérienne Maria Berlinska : ‘Quand j’ai vu les morts entassés, j’ai réalisé que j’étais prête à étrangler à mains nues les meurtriers de mon peuple’,” *Censor.net* (14 December 2017).

56. Although the association did not deliver any lethal weapons or training until the 2022 invasion.

57. T. Cooper, “*Kropyva: Ukrainian Artillery Application*,” *Medium* (10 June 2022).

58. Interview by the author with V. K. Medvedev, *op. cit.*

59. “Innovations pour l’armée. Système SIG “Arta” pour les artilleurs,” *Pravda.ua* (02 June 2015). GIS ARTA fell into disuse at the end of 2022.

60. S. P. Leshchenko *et al.*, “Système de sécurité de l’information pour lutter contre les avions ennemis sans pilote avec l’application complexe de mesures de guerre radioélectronique,” *Collection d’ouvrages scientifiques de l’Université nationale de l’armée de l’air de Kharkiv*, Vol. 73, No. 3 (2022).

Kyiv readily adopted the machines of entrepreneurs to build up its own range of tactical drones. These drones are the *Furya* from Athlon-Avia, the *Leleka-100* from DeViRo and the *PD-1/2* from UKrspecsystems.⁶¹ Functionally similar to the Russian *Granat*, *Eleron*, *Tachyon*, and *Orlan* drones, these new aircraft easily aligned with the post-Soviet state-centric ISR logic focused on artillery. Their ramp-up was swift, with 300 *Furya* and *Leleka-100* drones delivered to Ukrainian forces by 2021.⁶² They are now the standard equipment of the fire coordination centres in each Ukrainian artillery brigade group.

On the other hand, the government has decided to take control of training and information systems development, slowing down progress rather than harmonising it. In June 2017, Kyiv imposed a military status on operators with certification similar to that of a fighter pilot.⁶³ From 2018, doctrinal documents mandated that operators be organised into “UAV platoons” for DiviZions⁶⁴ (battalions) of the brigades and in “UAV batteries” of one or two platoons for artillery brigades.⁶⁵ In 2019, they were required to train at the 190th Training Centre of the Zhytomyr Institute, which also taught electronic warfare. However, only around ten hours were devoted to flight training for cadets.⁶⁶ By comparison, current programmes such as Dronarium require 200 hours.⁶⁷

These decisions largely ignored the needs of infantry units, which continued, often reluctantly, to rely on civilian associations for DJI mini-UAVs and negotiated with their command to continue flying on the front line.⁶⁸ As a result, until today, there is a flagrant lack of standardisation of UAVs, hindering their maintenance and mass deployment. Similarly, the lack of a single organisational structure, staffing levels, and training made it difficult to carry out joint actions.⁶⁹ This point was compounded by the equivalent lack of unified information systems.

61. G. Bondarev *et al*, “Aspects historiques des équipements avec appareils de vol sans pilote des véhicules blindés des forces armées d’Ukraine,” *Deuxième conférence scientifique et pratique pan-ukrainienne*, Académie nationale des forces terrestres (08 October 2021). Oreanda-PS appears to be derived from the Soviet Baikal-1 for controlling ground-to-air system batteries, while Virage-Tablet merges radar sources with those now supplied by NATO.

62. V. Badrak, “La bataille des drones : comment la rivalité entre l’Ukraine et la Fédération de Russie se développe dans la création de l’aviation sans pilote,” *LB.UA* (27 October 2021).

63. Order of the Ministry of Defence of Ukraine, No. 661 of 08/12/2016 “On Approval of Rules for Execution of Flights by Unmanned Aeronautical Complexes of the State Aviation of Ukraine”

64. DiviZion is a term without equivalent in our military lexicon. It is a sub-formation that can consist of a single battery of an artillery battalion, or of several batteries.

65. VKDP-3, *op. cit*; Ukrainian Ministry of Defence, “Combat status of land forces. Artillery of the Ukrainian Armed Forces, Part II (Division, Battery, Platoon, Gun),” *BP 3-07(11)56(57).01*, 2020 and 2021 editions. Readers will note that a “Divizion” is a formation ranging from a battery to a detachment..

66. R. Vus, “Aviation militaire sans pilote : réussites et défis,” *ArmyInform* (16 August 2019).

67. T. Melnik, “Apprendre à voler. Près de deux douzaines d’écoles d’opérateurs de drones sont apparues en Ukraine,” *Forbes* (02 August 2022).

68. I. Semenyaka, “Les exigences sanitaires pour les opérateurs de drones dans les Forces armées sont les mêmes que pour les pilotes de chasse Su-27...,” *Pages Militaires Ukrainiennes* (30 January 2021).

69. S. P. Bouriak, “Caractéristiques de l’utilisation des UAV pendant les opérations de combat,” *Conférence de l’université de défense nationale “L’armée ukrainienne: présent et rétrospectives historiques”* (2023).

The flip side of the bottom-up innovation process is that each service – National Guard, Border Guard, and even certain units – developed its own solutions. Meanwhile, some drone manufacturers (such as Athlon-Avia with the *Furya*) failed to account for existing ASU systems. This resulted in paradoxically under-digitised and heterogeneous forces lacking scalability. By 2021, some authors estimated that barely 10-30% of C2s were automated.⁷⁰ While *Dzvin-AS* fell victim to corruption in 2021 and *Prostir* never saw the light of day,⁷¹ the Delta programme was marginalised until October 2021.⁷² On 24 February 2022, the Ukrainians were without a unitary ASU, while Delta, for all its merits and improvements, continued to suffer from authentication, prioritisation, and interoperability issues across various operational levels.⁷³

B. The Appeal of the Turkish Model and the Promise of an Independent Strike Force

Whether the correlation is fortuitous or a direct cause, the Ukrainian surge coincides with the election of Volodymyr Zelensky in 2019. The strategic C2 has undergone a profound reorganisation, with operational and administrative roles being separated. The Chief of the General Staff was no longer the commander of the armed forces; this role became distinct from that of the joint commander of forces in the Donbass. The westernisation of Ukraine's military apparatus was reaffirmed with the appointment of Valerii Zaluzhnyi, who revived the Delta programme.⁷⁴

Beyond its geopolitical interest, this westernisation seems to provide the organisational solutions needed to manage the de facto decentralisation of the country's forces and war effort, by promoting initiative. Between 2019 and 2021, Ukraine published a new White Paper, a new Strategic Bulletin, a "comprehensive defence" strategy, and an industrial development plan. These documents highlight "the production of unmanned platforms and shock robotics"⁷⁵ alongside the strengthening of the partnership with Turkey. Ukraine acquired six *TB-2* drones and established joint ventures with Aselsan (for communications and munitions) and Bayraktar (for drones). By supplying engines (via Ivchenko-Progress) and missile expertise (through the Luch Design Bureau), Ukraine aimed to advance in Turkey's areas of excellence – SIC, sensors, and avionics – in which they were lagging behind.⁷⁶

70. Yu A. Sarichev, *op. cit.*

71. Y. Gonchar (lieutenant-colonel), "Le système DZVIN ASU incarne une armée soviétique numérisée qu'ils veulent faire passer pour une réforme," *Pages Militaires Ukrainiennes* (04 March 2021).

72. "Delta, which Khomchak was trying to destroy, proved to be compatible with the F-16," *Ukraine Military Pages* (11 July 2023).

73. S. Pettyjohn, "Evolution Not Revolution," *CNAS* (February 2024); T. Melnik, "Burning nettle," *Forbes* (24 July 2022). Interview with author: "Anyone can put an alert on Delta, sure, but there is no notification; no one knows who has put the alert or when. The details can be lost." On Kropyva: "Officers doesn't understand the need to specifically train on those equipment and the notepad needs to be bought by the volunteers."

74. A. Chtoupun, "Valery Zaluzhnyi : 'Le commandement opérationnel Nord a de la chance avec les gens'," *Defense Express* (18 February 2020).

75. P. Tolok, "Développement de la production de systèmes robotiques sans pilote en Ukraine grâce à la coopération militaire et économique internationale," *Revue d'articles scientifiques "Développement social et sécurité"*, Vol. 11, No. 5 (04 September 2021).

76. C. Kasapoglu, "Turkey and Ukraine Boost Mutual Defense Ties," *Eurasia Daily Monitor*, Vol. 17, No. 162, (2020).

An analysis of Ankara's interventions in Syria, Libya and, of course, Nagorno-Karabakh in November 2020, dominated the Ukrainian doctrinal debate.⁷⁷ According to Serhii Korsunov, an instructor at Kharkiv Air University, "the traditional use of drones is a thing of the past".⁷⁸ In addition to its role as a C4ISR catalyst for precision fires, the drone is establishing itself as an "independent strike force".⁷⁹ In the newspapers and at conferences given by Ukrainian officers, it was repeated that the drone seemed capable of achieving "air superiority or dominance".⁸⁰ However, these terms must be understood in their Soviet sense: they refer to obtaining fire superiority in the third dimension, not to the freedom of maneuver of an independent air force.

Indeed, drones simultaneously ensure and threaten the integrity of the "system-of-systems" of land-based reconnaissance and strike complexes. It is both its eyes and its relays, but it is also a scalpel that can cut through the enemy's detection and anti-aircraft, anti-missile protection envelopes. Its low signature and agility enable "rapid, non-standard, almost unpredictable and powerful strikes" to isolate the combat zone and provide direct air support to ground troops with fire and tactical intelligence.⁸¹

Anticipating future battles against entrenched Russian positions in the Donbass, Ukrainians were particularly drawn to the Turkish model and its ability to offer a shock and dislocation capability to light infantry. However, from then on, they understood that drone usage had to be massive and sudden—"You must have enough (hundreds, preferably thousands) of drones"⁸²—in the face of a properly echeloned anti-aircraft defence combined with electronic warfare.⁸³ The authors stressed the importance of camouflage measures and the need for decoy and kamikaze aircraft. They also emphasised the need to combine different types of fire (kinetic, electronic, anti-air) in a common plan (hence the interest in swarm automisation) with, in return, the need to develop "mobile fire groups" dedicated to anti-drone warfare.

The Ukrainian authors rigorously took note of the work of the most renowned Russian authors on the subject (Makarenko, Filatov, Ananiev and Afonin) to envision "mixed heterogeneous aviation groups". These groups would implement "symbiotic

77. V. Riabykh, "Nous avons besoin d'ASU modernes, de drones d'attaque, de défense aérienne et de guerre électronique : les forces terrestres des forces armées ukrainiennes ont tiré les leçons du Karabakh," *Defense Express* (11 December 2020).

78. A. F. Volkov, "Analyse de l'application des UAVs dans le conflit militaire arméno-azerbaïdjanais et des moyens possibles de les combattre," *Systèmes d'armes et équipements militaires*, No. 4, Vol. 64 (2020).

79. S. I. Korsunov, A. F. Volkov, "Transformation des tâches d'aviation sans pilote : de la création à l'application dans les conflits militaires modernes," *Science et technologie des forces de défense des forces de défense ukrainiennes*, No. 3, Vol. 44 (2021).

80. V. Gerasimenko *et al*, "L'expérience d'utilisation de l'aviation sans pilote dans le conflit arméno-azerbaïdjanais à l'automne 2020. Leçons pour l'Ukraine," *Bulletin historique militaire*, Vol. 40, No. 2 (June 2021).

81. S. I. Korsunov, *op. cit*; O. Malkov, "Analysis of the use of unmanned aircraft and military aircraft during a combat operation," *Journal of Scientific Papers "Social Development and Security"*, Vol. 11, No. 4 (2021).

82. S. I. Korsunov, *op. cit*.

83. *Ibidem*; V. Gerasimenko, *op. cit*.

interaction” between manned and unmanned aircraft, organised into specialised echelons based on tasks or missions.⁸⁴ The diagrams below illustrate the emergence of what the Ukrainians called two years later “drone-centric operations” to carry out long-range strikes on the Russian system.⁸⁵ Taken together, they constitute a “dronisation” of the operational schemes for “overcoming anti-aircraft defences” that were organised according to Russian and Soviet manuals.⁸⁶

In a classic way, the formation comprises a main group responsible for strikes with support sub-groups (reconnaissance, electronic warfare, etc.), which protect it and optimise its performance. A similar organisation is proposed for C2, [with a co-location of the aviation PU \(PC\)](#), drones and fires in the same combat centre, *a priori* at the operational command (OK) or strategic command level.⁸⁷ Finally, the use of *Tu-141/143s* as decoys or “barrage munitions”⁸⁸ has already been clearly explored.

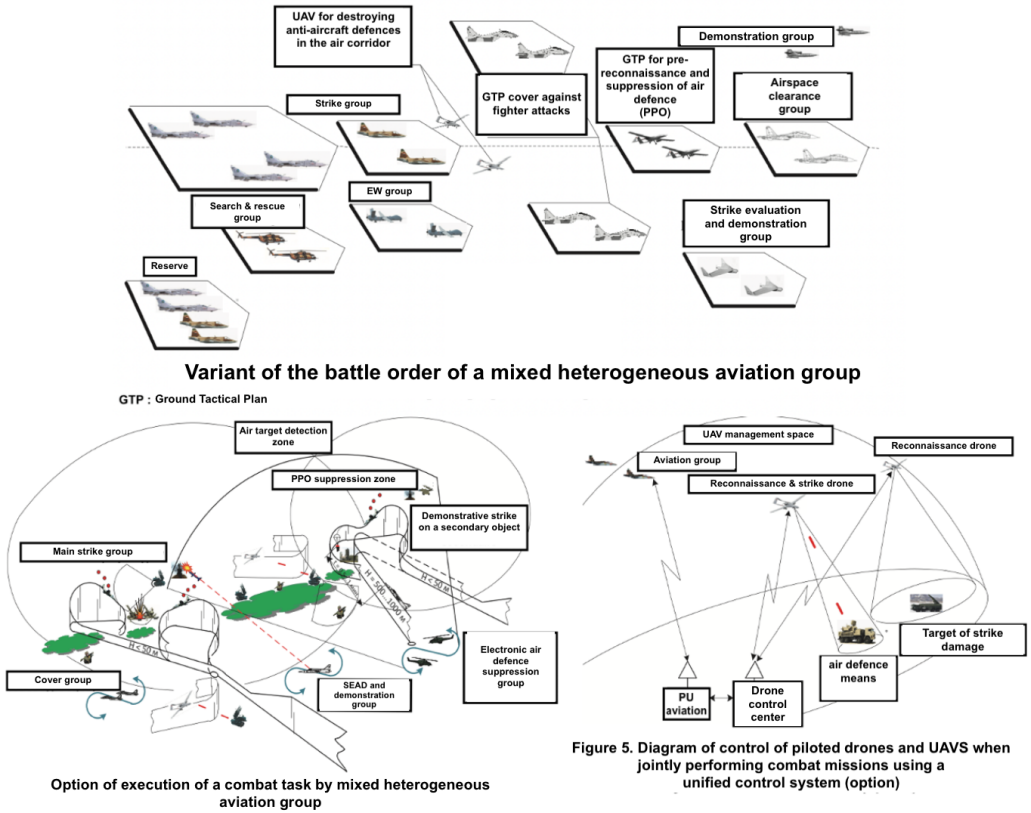
84. A. A. Petrov, “Formes et méthodes d’utilisation conjointe de l’aviation homme et sans homme dans les opérations de combat,” *Systèmes d’armes et équipements militaires*, Vol. 67, No. 3 (2021).

85. G. Stepanov, “Développement d’opérations centrées sur les drones selon l’expérience des conflits armés et de la guerre russo-ukrainienne,” *Puissance aérienne de l’Ukraine*, Vol. 5, No. 2 (2023).

86. Influenced once again by Soviet grammar, the Ukrainians and Russians distinguish between a “task”, which designates an elementary form of action, and a “mission”, which brings together and sets to music several tasks in order to achieve a particular objective. P. Gros, S. Delory, V. Tourret, “La neutralisation des défenses aériennes adverses (SEAD),” *Fondation pour la Recherche Stratégique* (29 April 2021).

87. Since the C2 reform of 2020, the joint commander of the area of operations has control over air resources.

88. Ammunition dedicated to the attrition of the interception resources of the enemy’s integrated air and missile defence.



Source: A. A. Petrov, “Formes et méthodes d’utilisation conjointe de l’aviation homme et sans homme dans les opérations de combat,” *Systèmes d’armes et équipements militaires*, Vol. 67, No. 3, (2021).

Ukraine’s Air Force was at the forefront of these developments. The 383rd Regiment had swapped its *Tu-141/143s* for Turkish *TB-2s*. Ukrainian airmen were indeed contemplating their obsolescence by 2050 and, in return, aspired to establish themselves as the operator service for tactical-operational and strategic drones. However, the war decided otherwise.

Drones at War: The Russian and Ukrainian Confrontation

Part Two: The War in Ukraine, Mutual Surprise, and Constant Catching-up Efforts

Vincent Tourret

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After more than 30 months of confrontation, drone warfare has already undergone several phases and ruptures. These can be grouped into three overlapping periods, each marked by an uninterrupted duel of innovations and countermeasures: massification (1), strikes (2), and manoeuvres (3).

1. 2022: Massifying Infantry Support

The first phase began with the invasion and ended with the conclusion of the Russian winter offensive of 2022–2023. During this period, state-operated drone fleets were transformed through the urgent and improvised addition of civilian mini-drones, primarily for observation and, occasionally, harassment purposes. The periods laid the groundwork for civil-military integration for training and production, with Ukraine launching the Army of Drones programme in July 2022, followed two months later by the consolidation of Russian volunteer associations under the Dronnista initiative.¹

1. S. Bendett, J. A. Edmonds, “Russia’s use of uncrewed systems in Ukraine,” *CNA* (May 2022); A. Timokhin, “The driverless future is being created now. About the Dronnitsa-2023 rally,” *Top War* (23 October 2023).

This period also witnessed the refinement of fire-support procedures and techniques between drones and artillery batteries, as well as between drones and armoured vehicles engaged in indirect fire. The after-action report (Retex) from Ukraine's 72nd Mechanised Brigade regarding the Battle of Brovary (9 March 2022) highlights the remarkable decentralisation of artillery and armoured firepower achieved through these drones. The successful training and integration of "aerial reconnaissance groups" equipped with *Mavic-3* and DJI *Matrice* drones enabled the Ukrainian commander to disperse artillery groups into multiple support batteries at close range while also enabling him to reconfigure his fires on more distant targets (over 5km) through the actions of his *Furia* and *Leleka* platoons.² Russian observers characterised this Ukrainian approach as "roaming artillery groups" and were astonished by the level of initiative and coordination demonstrated by their adversaries.³

This "dronisation" of fires reduced reaction times, eased logistical burdens, and contributed to the fluidity—mobility and agility—of formations, which was all the more critical given the lethal consequences of any concentration of forces.⁴ Rapidly, the first models of "mortar" or "bomber" drones were tested. These were produced from quadcopters (*Mavic* with 30–40 mm grenades), agricultural hexacopters (*E620 Kazhan* carrying *TM-62* mines), or improvised systems (*R-18* from the *Aerorozvidka* unit).⁵ Force structures, which had previously concentrated drones into specialised units, burst under the widespread distribution of these new remotely operated binoculars and grenades. While this phenomenon increased the risk of siloed organisational fragmentation, every squad, company, and battalion began operating its own aerial reconnaissance cycle using *Delta*.⁶

2. H. S. Haydarly, R. M. Lyman, "Guerre terrestre au niveau tactique (y compris le 3e bataillon mécanisé de la 72e brigade mécanisée séparée)," *Science et défense*, No. 3 (2023).

3. V. Litvinenko, D. Tsekhanovitch, "Exiger une autorisation," *Collection Militaire*, No. 9 (2022).

4. "It has become possible to operate in highly disjointed combat formations of primary tactical units (platoons, squads, fireteams, crews). These primary tactical sub-units (tactical units) can quickly receive reconnaissance information from the drone and call in timely artillery fire, within which they have become orders of magnitude more survivable and effective," Trotsenko, *op. cit.*; A. V. Romanchuk, "Perspectives d'augmentation de l'efficacité des opérations défensives de l'armée," *Pensée Militaire*, No. 4 (2023).

5. D. Hambling, "Ukraine is Fielding A 'Heinz 57' Fleet of Heavy Drone Bombers against Russian Forces," *Forbes* (20 December 2022).

6. H. Halem, "Ukraine's Lessons for Future Combat: Unmanned Aerial Systems Ukraine's Lessons for Future Combat: Unmanned Aerial Systems and Deep Strike," *Parameters*, Vol. 53, No. 4 (20 October 2023).

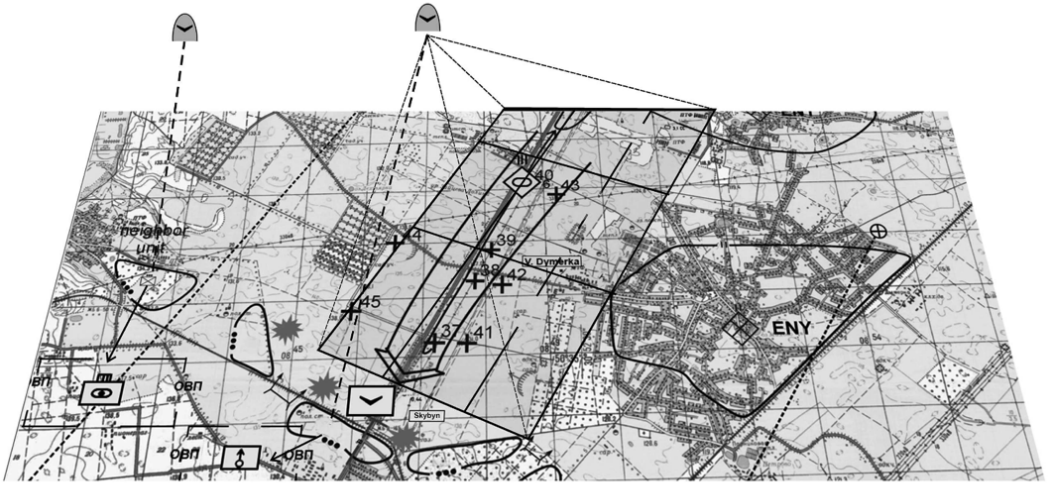


Fig. 4. UAV support

Source: H. S. Haydarly, R. M. Lyman, “Guerre terrestre au niveau tactique (y compris le 3e bataillon mécanisé de la 72e brigade mécanisée séparée),” *Science et défense*, No. 3 (2023)..

The success and demand for small quadcopters thus caught both Russian and Ukrainian states largely off guard. Moscow and Kyiv had anticipated drone combat to resemble tactical aviation operations or, for the Russians, large raids and deep penetration operations.

The major difference between the two armies proved to be the maturity of Ukraine’s associative ecosystem. It was able to quickly innervate infantry units with mini-drones and, crucially, with experienced operators and instructors. While Ukraine’s fleet likely stood at around 800 drones before the launch of the “special operation”. By August 2022, it had grown to approximately 6,000 devices, according to the Ministry of Digital Transformation.⁷ Between June and December 2022, Ukrainian superiority in the commercial drone segment was reportedly a ratio of 9 to 1 (2,624 compared to 284).⁸ The contribution of Starlink terminals (20,000 units as of late October 2022)⁹ was also significant. These terminals enabled the establishment of a consistent tactical communication network across various platforms and applications. This facilitated the harmonisation of different software systems and ensured interoperability between state-operated and civilian drones.

7. T. Melnik, “Apprendre à voler. Près de deux douzaines d’écoles d’opérateurs de drones sont apparues en Ukraine. Comment ils sauvent la vie des militaires et économisent de l’argent pour les Ukrainiens,” *Forbes* (02 August 2022).

8. S. Pettyjohn, “Evolution Not Revolution,” *CNAS* (February 2024). The CNAS study, which is essential, is based on the commercial drone tracker WindtalkerX developed by Edgesource. It is the more robust equivalent of those sold by DJI AeroScope.

9. S. Kharaluzhnyi *et al*, “Le seul jour facile était hier. Hostomel. Oméga,” *Portail National d’Information Tysk* (28 September 2022); V. Dudko, “Le prix de Starlink, les conversations avec Musk, les drones contre les drones et la numérisation du secteur des jeux d’argent. Grand entretien avec Mikhail Fedorov,” (31 October 2022).

Unlike the previous decade, the Ukrainian state involved the associative ecosystem into the war effort. The Army of Drones programme provided further momentum to mobilisation efforts by combining crowdfunding with public-private partnerships. This programme became the central federator of this alternative Ukrainian mobilisation. It effectively managed to channel funding through the United24 donation platform, structure operator training through schools like Dronarium or Boriviter, and franchise production of hundreds of workshops. It is supported by prominent patriotic organisations such as Come Back Alive and ARMY SOS, as well as industrial partners, numerous charities, and private initiatives, notably the fund established by the actor Serhiy Prytula.¹⁰

Regarding training and formation, future operators benefit from online courses, such as MOOCs (for example, on the educational platform *Prometheus*) and manuals compiled by veterans.¹¹ From April 2022, they could also train at around twenty training centres offering 4 to 5-day programmes on quadcopters.¹²

However, the demand and attrition rates were at that time exponential. Eighty percent of drones were shot down within 2 to 7 days.¹³ With the fleet's expansion, only 20% of aerial reconnaissance officers were considered experienced by August 2022.¹⁴ The objective was therefore to train 25,000 operators by 2023 – a target that has since been surpassed. Dronarium alone trained 4,500 operators by February 2023, reaching as many as 7,000 specialists by February 2024.¹⁵ Maria Berlinska's Centre for Aerial Reconnaissance, now operating under the foundations Dignitas and Victory Drones, reported in August 2023 that it had trained 28,000 operators with the support of 150 instructors across 12 training sites.¹⁶

The Russian response to this “soldier’s scourge” or “these swarms of gnats” remained more hesitant, if not at least conservative, regarding the role of mini-drones and volunteers within its force structure.¹⁷ Influenced by its Syrian experience, Russian literature initially viewed these devices as terrorist weapons, particularly suited to non-linear warfare.¹⁸ Furthermore, their use was believed to endanger operators near the front line by drawing enemy fire. Mini-drones, therefore, were not expected to endure.¹⁹

10. T. Mironenko, “Sans blague. Comment l’équipe de Serhiy Prytula a construit l’un des plus grands fonds militaires d’Ukraine en six mois,” *Forbes.ua* (02 September 2022).

11. “Théorie et pratique de l’utilisation de véhicules aériens sans pilote (drones),” *Manual created by UA Dynamics combat veterans* (2022).

12. Y. Yahori, “Trois règles de victoire. Comment les écoles de drones préparent les opérateurs au front,” (29 September 2022)

13. T. Melnik, *op. cit.*

14. *Ibidem.*

15. V. Melkozerova, “Ukraine’s Drone Academy is in session,” *Politico*, (26 February 2023).

16. V. Golovine, A. Ringis, “Mère des drones. Maria Berlinska a créé le plus grand écosystème de formation d’éclaireurs aériens en Ukraine. Quel est le secret de l’efficacité du bénévole?,” (21 August 2023).

17. M. Goldreer, “Comment Abattre Un Drone Léger,” *Arsenal de la Patrie* (16 October 2022).

18. Nonlinearity refers to fluid and patchy areas of operations, typical of counterinsurgency wars. P. Gros *et al.*, “L’espace de bataille futur. Quelle place demain pour la linéarité ? Quelles conséquences pour la manœuvre interarmées?,” *Fondation pour la Recherche Stratégique* (2019).

19. *Ibid* and *Op. cit.*, Trotsenko.

Once the negligence of the invasion's first phase had passed, this scepticism was reinforced by the solid performance of Russia's various tactical UAVs. The *Orlan-10* and *Eleron-3* emerged as the "workhorses" of the Russian army.²⁰ Paradoxically, within Russia's centralised model, these UAVs "saved" its ROK complexes by tactically bypassing various higher-level ASUs (automated C2 posts). Although their intended role was to integrate with artillery batteries, in practice, these C2 systems proved largely inoperable and obsolete.²¹

For the Russian state, the problem did not initially appear to lie in the performance or composition of its fleet, but in the unsustainable attrition of existing drones. Russia thus focused primarily on increasing production of its military models while seeking ways to bypass sanctions to obtain missing components. For Moscow, the priority was to sustain the volume of firepower its artillery could generate on the front – the fate of its infantry remaining of little concern.

On the ground Russian combatants, however, quickly recognised that drones were key to seizing the initiative and ensuring their tactical survival. It was necessary to quickly equip, or even "saturate," platoons and companies with drones, against a backdrop of a general shortage of specialised units or operators.²² "Emergency crews" were established, often "without any understanding of drones or their combat capabilities".²³ Between March and May 2022, a third of the drones sent to the troops by volunteers were reportedly lost due to the lack of skills of their operators.²⁴

Similar to Ukraine's response in 2014, it appears that the most resource-deprived Russian troops were also the most innovative. This was particularly true for units from the Donetsk and Luhansk People's Republics (DNR and LNR). Spontaneously, these units formed independent teams – such as *Suricate* and *Kaskad* – which could rely on a handful of ultra-patriotic organisations. The most significant amongst them was the Centre for the Coordination of Assistance to Novorossiia (KCPN). The model mirrored that of the Ukrainians: the KCPN compensated for gaps in state logistics, raised funds (1.8 million dollars in cryptocurrency by February 2023²⁵),

20. V. Litvinenko, D. Tsekhanovitch, *op. cit.*

21. The YESU-TZ is notoriously hellish: "We do not have a common understanding of what needs to be done and how to carry out automated command and control of troops during battle [...] That is, the situation created in "Acacia" cannot be "thrown" into YESU-TZ? Definitely. They're even on different graphics editors, you know? Unbelievable. But what about the graphic editor used in YESU-TZ? In YESU-TZ, the graphic editor is the shittiest editor available. And implementing the situation online with this editor is simply NOT POSSIBLE;" V. Murakhovskiy, "Entretien avec le chef d'état-major de la 20e armée du District Militaire Ouest, Colonel Mikhail Yuryevich Teplinski," *Arsenal de la Patrie*, Telegram channel (22 May 2023).

22. R. Kirill, "Acquérir de l'expérience : les drones russes dans l'opération spéciale," *Topwar* (18 May 2022).

23. S. A. Egorenkov, M. V Anikanov, "Utilisation au combat de véhicules aéronefs sans pilote lors de l'exécution de tâches de service et de combat par des unités des troupes de la garde nationale au cours d'une opération militaire spéciale," *Lecture de Yakovlev* (2023).

24. S. Bendett, JA Edmonds, *op. cit.*

25. F. Greenwood, "The Drone War in Ukraine Is Cheap, Deadly, and Made in China," *Foreign Policy* (16 February 2023).

and supported or trained drone teams. It published manuals on UAV production, detection, and usage. KCPN firmly established itself in this domain by launching the Dronnitsa forum in September 2022, coinciding with the Russian state's formal authorisation for units to use civilian or improvised drones.²⁶

Since then, Dronnitsa has become an educational platform and technical incubator. It even organises a summer university where Colonel Ananiev – a prominent pre-war author of Russian drone doctrine – delivers lectures.²⁷ The organisation has trained 1,500 quadcopter operators and co-authored, alongside the Mikhailovskaya Artillery Academy, a manual on “the use of UAVs in artillery fire control”.²⁸ In addition to KCPN, the Dronnitsa forum now brings together other initiatives such as the Archangel Project and the Sudoplatov group, which specialise in the FPV segment and are supported by the Russian state.

Gradually, these Russian efforts began to bear fruit. By March 2023, parity with Ukraine had been achieved. According to detections conducted using the *Windtalker* system,²⁹ there were 3,817 Russian DJI drones compared to 3,901 Ukrainian models of the same type.³⁰

2. To strike and Counter-Strike: April 2022–March 2023

To analyse the second phase of the conflict, it is first necessary to examine the intensification of Counter-Unmanned Aerial Systems (CUAV) operations, before considering the tactical and strategic responses of the actors involved.

Countering the Strike

From April to June 2022, the saturation of the front line with civilian drones prompted a reorganisation and densification of Russian anti-aircraft and electronic defences in the occupied territories.

The Russians revised their methodology for echeloning and interfacing batteries³¹ and developed new forms of anti-aircraft operations, such as the “PVO-REB barrier” and “PVO-KVO defence”.³² They also introduced mobile CUAV groups,

26. S. Bendett, J. A. Edmonds, *op. cit.*

27. A. Timokhin, “The driverless future is being created now. About the “Dronnitsa-2023” rally, Top War,” *Top war* (23 October 2023).

28. “Résumés du rapport d’Alexeï Chadayev sur le développement du projet Dronnitsa,” *Dronnitsa* (28 September 2023).

29. A system that allows the detection of drones operating in a given geographical area. It is the more robust equivalent of the Aeroscope drone scanner sold by DJI.

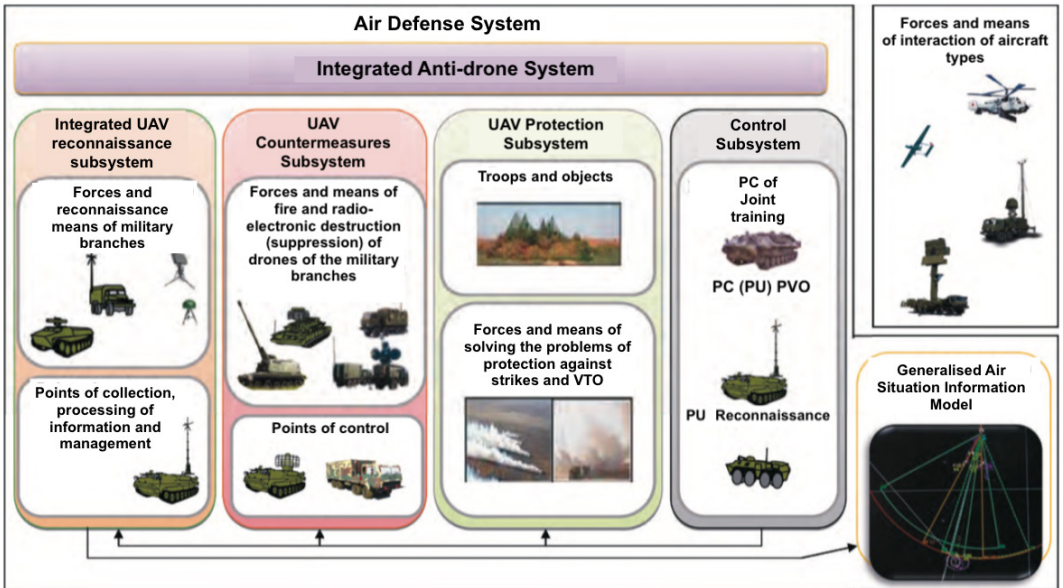
30. S. Pettyjohn, *op. cit.*

31. The Russians are going beyond their nomenclature to form ‘mixed batteries’ of systems of different echelons and services, no longer in a self-defence role (classically Pantsir with S-400) but according to the performance of the organic radar of the most advanced battery in a sector to be defended: S-300V4-Pantsir-Buk-Tor; Tor-Osa or even Tor-Pantsir-MANPADS; A. Leonkov, “‘Adjutant’” of our superiority,” *Arsenal of the fatherland* (14 November 2023); J. Watling, N. Reynolds, “Meatgrinder: Russian Tactics in the Second Year of Its Invasion of Ukraine,” *RUSI* (19 May 2023).

32. PVO-REB barrier: Anti-aircraft (PVO)/electronic warfare (REB) barrier; PVOKVO defence: Anti-aircraft (PVO) defence of critical infrastructures (KVO).

coordinated via *Strelet*,³³ and streamlined their C2 structure from February 2023, by subordinating the PVO-SV (ground air defense forces) to the PVO of the VKS.³⁴

Some authors conceptualise these countermeasures as organised in concentric circles. They would consist of a first line seeking the “active destruction” of Ukrainian drone generation centres (production and training sites, as well as operators). These countermeasures would then be followed by a circle of PVO-REB interference designed to inhibit their effectiveness, and finally by passive defence measures using camouflage, decoys, etc.³⁵ This layered organisation has since been widely replicated by both sides (as of summer 2024) with “separate” echelons of CUAV resources providing force coverage.³⁶



The structure of the integrated combat system against drones by functional section (option)

Source: G. V. Yeremin, S. N. Cherny, “The System of Combating Unmanned Aerial Vehicles as the New Technological Standard and Comprehensive Approach,” *Pensée Militaire*, No. 7 (2022).

Electronic warfare is becoming the key element in the fight against drones. This is primarily to reduce interception costs but also to compensate for the detection limitations of traditional anti-aircraft batteries and radars. As several Russian spe-

33. G. V. Yeremin, S. N. Cherny, “The System of Combating Unmanned Aerial Vehicles as the New Technological Standard and Comprehensive Approach,” *Pensée Militaire*, No. 7 (2022).

34. PVO-SV: anti-air defence forces (PVO) of the ground forces (SV). “Des sources ont signalé la réaffectation de la défense aérienne militaire des forces terrestres aux forces aérospatiales russes,” *TASS* (26 February 2023).

35. I. N. Aleshin *et al*, “Hiérarchie d’un système intégré de lutte contre les véhicules aéronefs sans pilote,” *Raran conference* (2023).

36. Interview with the author, July 2024, Kyiv.

cialists warned at the time of the conflict in Nagorno-Karabakh, these batteries and radars were configured against targets with a radar cross-section (RCS) of 0.1 to 1 m². However, according to their estimates, mini-drones have a radar signature of between 0.01 and 0.1 m²³⁷ (or even 0.001 to 0.1 m² according to Makarenko).³⁸ They therefore estimate that a metric radar will only detect them between 1.5 and 8 km and that decimetric radars will only be able to detect them between 800 m and 9 km.³⁹ However, centimetric radars defend themselves better, achieving this between 1.4 and 12 km.⁴⁰ Detection remains very difficult, nevertheless, when accounting for terrain masking, enemy jamming, the weather, and the UAVs' low speeds.⁴¹ For these reasons, it is much easier to identify radio transmissions and redirect fire onto the receiver device or the operator transmitting them.

According to Russian authors, significant efforts have thus been made to address the tactical "incompleteness" of Russian forces and overcome an "electronic fear," echoing the tank panic during the Great Patriotic War.⁴² The "autonomous" use of electronic warfare (EW) assets by tactical groups has now become standard practice.⁴³ Here again, Russian volunteers quickly addressed the issue, improvising radio scanners and EW suppressors, mirroring Ukrainian ingenuity.⁴⁴ The Suricate group of the 2nd Luhansk Corps, for example, describes in its manual how to detect and jam a *Mavic-3* at a distance of 1,500 metres.⁴⁵ A critical tool in this effort was the DJI *Aeroscope* box, which has an effective range of 10 km and a maximum range of 50 km. This portable unit is capable of identifying DJI drones in operation, indicating their trajectory, altitude and the position of their operator.⁴⁶

Following these initial developments, "electronic trench warfare" began. It aims to detect the frequencies of Ukrainian UAVs (*Silok-1* system) and then block the transmissions emitted by their operators and/or their GPS navigation (*Polye-21*, *Strizh-3*, *GE Harpoon-3* rifle) at ranges of between 2 and 4 km. Typically, redundancy and echeloned deployment of EW assets are intended to tighten defensive coverage. Front-line EW assets are constituted by modular and consumable devices which are, in turn, supplemented by "heavy" EW systems (*R-330Zh Zhitel*, *Shipovnik-aero*,

37. A. V. Ananiev *et al*, *op. cit*.

38. S. I. Makarenko, A. V. Timoshenko, *op. cit*.

39. Metric, decimetric and centimetric refer to the wavelength generated by different radar frequencies. The higher the frequency, the shorter the wavelength. The frequency indicates the accuracy a radar can achieve and the wavelength of its range. In general, different radars are combined to provide early detection and fire control.

40. A. F. Volkov, *op. cit*.

41. A. V. Kogtin, G. Y. Shaidurov, "The development prospects of smaller unmanned aerial vehicles and the problem of their detection," *Military Thought*, No. 1 (2023). In comparison, these problems put a premium on human observation: 200 to 400 metres in front, 500 to 700 metres in profile; A. F. Volkov, *op. cit*.

42. The author draws a parallel with the Soviet infantry's "fear of tanks" during Operation Barbarossa (June 1941).

43. K. Leventov, K. Popov, "Champ de bataille électromagnétique", *Collection Armée*, no. 8 (August 2022)..

44. Electronic Warfare. "Comment se protéger des drones ennemis – Conseils pour l'infanterie," *Forces de Défense Territoriale* (no date, accessed 10/01/2024).

45. "Organisation of the fight against small drones methodological manuals," @Murmansk01, X account (2023).

46. S. A. Egorenkov, *op. cit*.

etc.) positioned every 7 to 10 km along the line of contact. These focused on neutralising the uplinks supporting the use of aircraft, helicopters and GNSS-guided munitions (*Excalibur*, *GMLRS*).⁴⁷ This heavier equipment belonged to the companies of the regiments and the EW brigades of the military districts.⁴⁸

The strengthening of Russian anti-aircraft and electronic defences has been mirrored on the Ukrainian side with the creation of “mobile firing groups” that cover operational theatres and approaches to urban areas. These combine MANPADS,⁴⁹ *ZU-23-2* and *S-60* cannon artillery, or *DShKM* mounted on technicals.⁵⁰ The whole system is connected to *Virage-Tablet* and *Delta*, enabling it to be closely coordinated with the PPOs (PVOs in Ukrainian),⁵¹ the EW units and MLRS units that can strike enemy UAV stations.⁵²

Owing to its Soviet legacy, Ukraine can rely on a substantial pool of EW operators equipped with around 300 *Khortysia-M* and *Plastun-3000RP* systems, with respective ranges of 45 and 15 km.⁵³

This initial anti-drone interception layer preserves the resources of classic surface-to-air missile (SAM) batteries, SHORAD⁵⁴, or long-range systems, which are reserved for air interdiction and anti-missile combat. In this segment, the Ukrainian IADS were expanding at that period with the reception of the first Western surface-to-air systems. It has especially benefited from the electromagnetic intelligence (ELINT) of the ISR assets of the Atlantic Alliance. From November 2022 onwards, if complete and properly supplied, this Ukrainian air defence can achieve an interception rate ranging from 60% to 80% on average against long-range *Shahed* drones.⁵⁵

Counter-strike

The development of Russian and Ukrainian defences has led to an exponential attrition of commercial and military drone fleets. By November 2022, 90% of the drones acquired by Ukraine in the early months of the war were deemed destroyed.⁵⁶ By March 2023, a single Ukrainian brigade was consuming around

47. GNSS: Global Navigation Satellite System, the best-known of which is the American GPS.

48. J. Watling, N. Reynolds, *op. cit.*

49. Man-Portable Air-Defense System.

50. T. Safronov, “Groupes mobiles de défense aérienne dans la lutte contre les drones de la Fédération de Russie,” *Militarnyi* (06 June 2023).

51. PVO/PPO: Anti-air Defence Forces.

52. BП 7-(01).03.01 (October 2022) and BП 3-00(116)120 (March 2023).

53. M. Cazalet, “Silent Struggle: Accounts from the Frontlines of Ukraine’s Electronic War,” *European Security & Defense* (21 September 2023).

54. Short Range Air Defense.

55. BП 3-00(116)120, *op. cit.* But not against the entire Russian salvo. According to kyiv, out of 3,700 *Shaheds* fired, 2,900 were intercepted, an average of 78%. However, out of 7,400 missiles, only 1,600 were intercepted, or 21%; “Russia has fired 7,400 missiles, 3,700 *Shahed* drones in war so far, Kyiv says,” *Reuters* (21 December 2023).

56. M. Zabrodskiy, “Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine: February-July 2022,” *RUSI* (30 November 2022).

one hundred drones per month.⁵⁷ The lifespan of a *Mavic* drone was estimated at just half a day⁵⁸ or roughly three flights.⁵⁹ Fixed-wing drones averaged only six flights.⁶⁰ At the same time, Russian estimates similarly concluded that a civilian quadcopter could perform only three to five flights before becoming inoperable.⁶¹ By July 2023, the British think-tank RUSI assessed Ukrainian monthly losses at 10,000 drones.⁶²

The attrition caused by the two IADS effectively “closes the skies” for both belligerents. It marks the failure of pre-war drone fleets to function as an “*independent strike force*” capable of covering tactical-operational depths. This failure leaves no more options for stand-in manoeuvre and strikes for the Russian and Ukrainian manned aviation, which depended on this unmanned ISR to move in depth. The Ukrainian *TB-2*, Russian *Forpost* and *Orion* MALE UAVs finally disappeared from the battlefield, to be used as ELINT⁶³ platforms or communications relays. Above all, attrition forced tactical UAVs to become consumable equipment requiring large flows to continue to equip the infantry *en masse*.

In response, the dronisation effort during this period focused on strike capabilities to neutralize or overtake each PVO/PPO. This second phase, which overlapped with the first, led to advancements in “kamikaze” or “loitering” munitions. The choice depended on whether the aim was a precise strike for counter-battery or saturation of interception capabilities. Initially used primarily for observation, drones began to take on the characteristics of rudimentary cruise missiles or unitary rockets.

The Russians were particularly active in this segment, compensating for the reduced range and responsiveness of their aerial and missile firepower. They employed *Kub* and *Lancet* drones to replace their helicopters and *Su-25* assault aircraft. To reinforce their actions, at the end of 2022, they developed reconnaissance-strike drone groups by combining the *Lancet 1* (3 and 3M)⁶⁴ drone munitions with Iranian ISR drones of the *Orlan-10/30*, *ZALA* and *Mohajer-4/6* types.⁶⁵ The Russians have thus developed a mini-SEAD⁶⁶ that can reach a depth of 30 to 40 km. The actions of these reconnaissance-strike groups are facilitated by the combined deployment of decoy drones designed to flush out Ukrainian air defense

57. “Yes, that’s the reality. One brigade consumes 100 drones a month,” Constantine’s X account (@Teoyaomiquu).

58. “Interview: Ukrainian colonel Oleh Shevchuk,” *Pravda.com.ua* (01 March 2023).

59. O. A. Korshets *et al*, “Leçons de l’application des UAV dans la guerre russo-ukrainienne,” *Force aérienne d’Ukraine*, no. 1, vol. 4 (2023).

60. *Ibidem*.

61. A. G. Bazaev, Y. O. Bondarenko, “Expérience d’utilisation d’aéronefs sans pilote russes lors d’une opération militaire spéciale sur le territoire de l’Ukraine,” *Lectures de Yakovlev* (21-22 March 2023).

62. J. Watling *et al*, *op. cit*.

63. Electronic Intelligence.

64. 3 kg explosive charge for the *Lancet-3* compared with 1 kg for the *Lancet-1*; 60 km range compared with 40 km respectively. The ergonomics of the *Lancet-3* have also been improved by making it more portable.

65. BII 3-00(116)120, *op. cit*.

66. Suppression of Enemy Air Defences: SEAD

positions (PPO) and other so-called “barrage” UAVs, intended to saturate and exhaust Ukrainian interception capabilities.⁶⁷



Source: Rybar telegram channel (Russian) (November 2022).

The deconcentration of ISR, strike, and relay/repeater functions ensures continuous pressure to be exerted on enemy systems, while improving the assessment of strike outcomes. Above all, it compartmentalises the vulnerabilities of the devices by positioning ISR assets tasked with target acquisition and designation at a safe distance. This then limited the radiation (and therefore the detection) of the *Lancet* munition and its operator.⁶⁸ This last point is essential because the *Lancet* still functions like a first-generation ATGM that exposes its operator. The operator must “be present

67. Kucherenko, A. A. Grizo *et al.*, “Analyse des caractéristiques et évaluation de l’efficacité de l’utilisation de moyens potentiels de dégâts d’incendie sur des éléments du système de défense aérienne dans la guerre russo-ukrainienne,” *Science et technologie de l’armée de l’air des forces armées ukrainiennes*, Vol. 50, No. 1 (2023).

68. O. O. Oleksenko *et al.*, “Utilisation de véhicules aériens sans pilote par les forces armées de la Fédération de Russie dans la guerre contre l’Ukraine,” *Science et technologie de l’armée de l’air des forces armées ukrainiennes*, Vol. 49, No. 4 (2022).

in the drone's control loop until the target is hit".⁶⁹ Consequently, the *Lancet* operates in a "reconnaissance-relay-strike" mode. However, Russian efforts are underway to mitigate this issue by incorporating an Automatic Target Recognition (ATR) mode, which would also enhance the *Lancet*'s resistance to jamming.⁷⁰

Carrying an explosive payload of 3 to 5 kilograms, the *Lancet* has proven highly effective against lightly armoured or lightly hardened targets, though it can be stopped by simple steel mesh.⁷¹ It is well-suited for tactical SEAD (Suppression of Enemy Air Defences) roles but performs less effectively in targeting armoured vehicles. In counter-battery operations, the *Lancet* has a decisive effect but tends to suppress rather than destroy the enemy's assets. Enemy gunners tend to conceal themselves or limit their exposure when they know *Lancet* strikes are a possibility. According to *Lost Armour*—a Russian platform akin to *Oryx*—from July 2022 to October 2023, the *Lancet* was responsible for up to 64% of Ukrainian self-propelled artillery losses (169 out of 222 pieces recorded by *Oryx*).⁷² However, as of March 2024, of the 266 artillery pieces targeted by the *Lancet*, only 30% (80 pieces) were confirmed as destroyed, with 54% (143 pieces) recorded as damaged.⁷³

Finally, as a corollary to the strike and ISR functions at the tactical level, communications repeater/relay drones are undergoing extensive development. The failure of the invasion revealed the fragility and technical obsolescence of the Russian communications network. It tended to fragment due to a lack of range or incompatibility between certain radio sets. Initially, the Russian response was to convert their most advanced radios—*Azart*—into fixed stations for the higher echelons and to redirect their traffic to satellite communications (SATCOM), which were rapidly becoming saturated.⁷⁴ Frontline units, however, were left to their own devices. To remedy this, they began attaching their radios to their drones to increase their range. This method was adapted from Russian peacekeeping forces in Nagorno-Karabakh, where it had been tested on *Orlan-10*, *Forpost-M*, and *Granat* drones.⁷⁵

In practical terms, the Russians now convert *Mavic* or FPV drones into repeaters by attaching batteries or antennas. In more advanced setups, they deploy quadcopter relays launched from off-road vehicles equipped with communication stations. A power cable links the latter to the drone, which can hover at an altitude of around a hundred metres and connect to the surrounding network, particularly GSM.⁷⁶

69. O. E. Agafonov, "Les bases de l'application des complexes avec munitions errantes," *Problèmes actuels de protection et de sécurité*, conférence de l'Académie des Forces de Roquettes et d'Artillerie (RARAN) (2023).

70. *Ibid.* The addition of an ATR mode is also being actively pursued by the Ukrainians.

71. "Comment se protéger des drones ennemis," *op. cit.*

72. Denis, "Lancet. Confessions," *Lost Armour* (October 2023).

73. "L'utilisation de munitions errantes 'Lancet' dans la zone de la Région militaire Nord," *Lost Armour* (March 2023).

74. M. Klimov, "Le problème le plus critique de nos forces armées dans la SVO est la communication," *Topwar* (25 June 2023).

75. D. Kozoriz *et al.*, "Répéteurs de communication aérienne," *Collection Militaire*, No. 3 (2022).

76. O. V. Kolupaev *et al.*, "Analyse théorique de l'utilisation d'avions sans pilote dans la guerre moderne," *Conférence panrusse*, Omsk (2023).



Source: V. V. Tishkov *et al*, “Justification de la conception de complexes et d’équipements de communication prometteurs basée sur l’expérience de l’organisation des communications lors d’une opération militaire spéciale,” *Pensée militaire*, No. 9 (2023).

Initially rudimentary, this relay drone scheme has bolstered Russian ambitions to establish a “communications manoeuvre” through the deployment of mobile transmission groups. These groups operate on a zonal principle rather than adhering to a static positioning system logic based on unit echelons.⁷⁷ The radio engineering troops, thus “freed” from the strict requirement to accompany units, could envisage a much more fluid recomposition of all communication systems. In the longer term, Russian authors envision even greater autonomy, conceiving a “seeding” of the battlefield by repeater drones coordinated by artificial intelligence.

Strategic Strike Campaigns

Alongside this tactical struggle, the Russians were regenerating a strategic strike capability through the acquisition of *Shahed-131/136* drones (rebranded as *Geran-1/2*) from Iran. These drones are part of the high-low mix salvos that the Russians have been launching since the start of the conflict. They complement their most sophisticated, yet relatively scarce, vectors with a mass of obsolete missiles (Toskha) or repurposed ones (S-300 interceptor missiles, Kh-22 naval missiles, etc.) which they possess in large quantities.

The *Shahed* drones act as a screen for the ballistic and cruise missile arsenal. They are not piloted but follow a pre-programmed route. Typically flying between 15 to 30

77. I. G. Vorobyov, V. M. Romanov, “Développement de formulaires et de méthodes pour la construction d’un système de communication pour un niveau de commandement tactique,” *Pensée militaire*, No. 6 (2022).

minutes, they operate at altitudes of 700 to 2,000 metres before initiating an approach on their target at an altitude of 200 m. They are generally launched at night and masked by reflector balloons that act as decoys.⁷⁸ Their construction using *Getinax*—a mixt of paper and resin—makes it complicated to detect them. The drones attack in several groups of 9 to 12 units, the whole constituting a salvo of 30 to 40 units launched either in frontal or cross-pattern formations. These tactics are designed to overwhelm and confuse defences. They thus operate in the manner of the soviet “*reconnaissance in force*” configuration, which seeks to harass, probe, and identify weak points in enemy defences in order to break through and launch more sophisticated vectors into the depths. Used for saturation, Russia reportedly acquired 2,400 *Shahed* drones from Iran. Tehran even franchised part of their production after 9 November 2022.⁷⁹ According to Ukraine, Moscow could manufacture 330 to 350 *Shaheds* per month by 2024,⁸⁰ with ambitions to produce 6,000 drones by the summer of 2025.⁸¹

For deep strikes, Ukraine, less advanced in this domain, has opted for an asymmetric strategy. This approach resembles the “mosquito” tactics used against the Black Sea Fleet.⁸² The aim is to degrade the Russian salvo generation at its source, by hitting strategic platforms, airport, ISR, and energy infrastructures. Unable to rely on a large mass of missiles, Ukrainian operations take the form of incursions or raids into Crimea and Russia. From October to December 2022, they succeeded in exploiting gaps in Russian radar coverage by launching converted *Tu-141s* and Chinese civilian drones (*Mugin-5*).⁸³

In 2023, they are developing much more ambitious operations as part of what the Ukrainian Air Force calls “drone-centric operations” to carry out “pre-emptive” or “retaliatory strikes”.⁸⁴ This concept, presented in the first part of this monograph, seems to be *a posteriori* a rationalisation of the operations carried out in Crimea or against Moscow. However, it seems to be largely a response to the Ukrainian Air Force’s desire to centralise this type of operation under its authority. President Zelensky’s announcement of the creation of an independent drone service or branch in 2024 seems to invalidate this attempt, but not its *modus operandi*. The latter is a sophistication of the “mixed groups” previously discussed, which nevertheless confers a marginal role on manned aviation.

78. S. I. Korsunov *et al*, “L’aviation sans pilote de la République islamique d’Iran et l’expérience de son utilisation dans la guerre russo-ukrainienne,” *Collection d’articles scientifiques de l’Université nationale de Kharkiv Force aérienne*, Vol. 76, No. 2 (2023).

79. *Op. cit*, Kucherenko.

80. O. Bezpalko, “Les Russes sont motivés à se battre pour l’argent, environ 1 000 à 1 100 personnes rejoignent l’armée chaque jour,” *Rbc.ua* (15 January 2024).

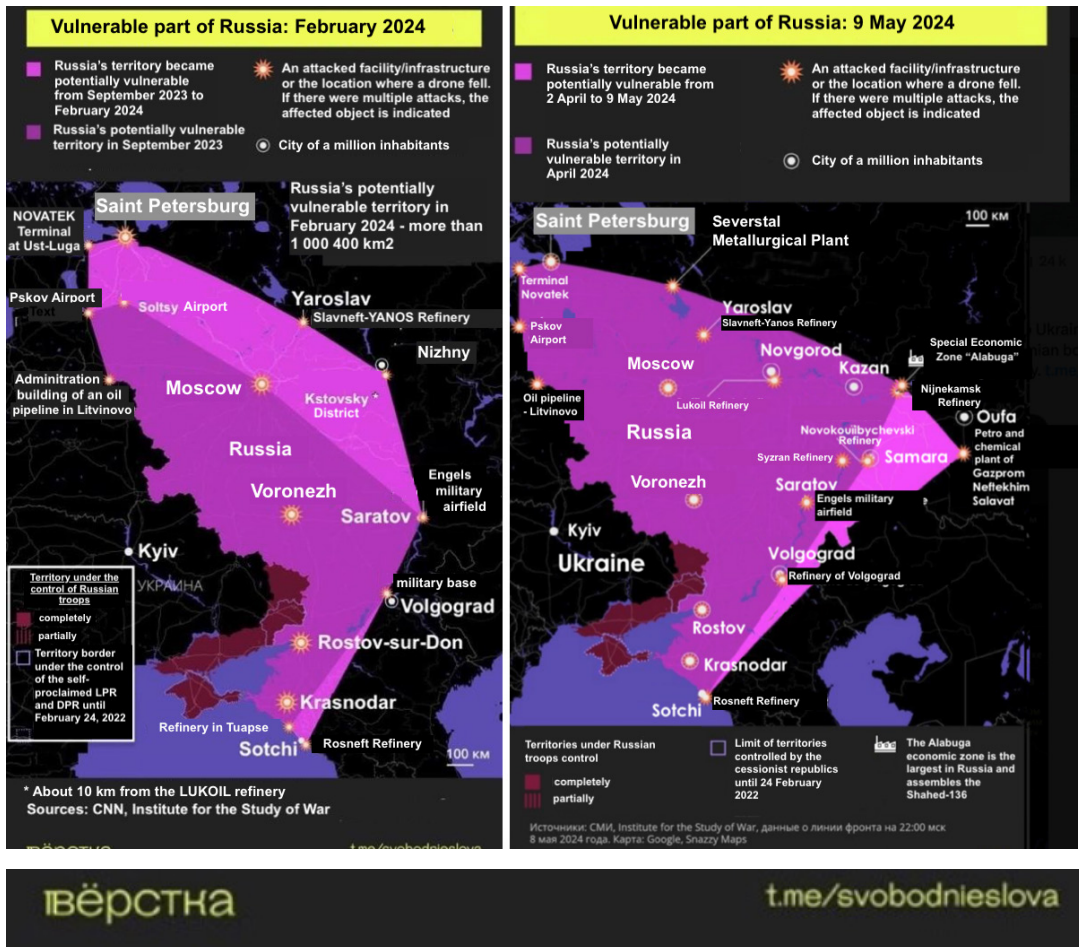
81. D. Bennett, M. Ilyushina, “Inside the Russian effort to build 6,000 attack drones with Iran’s help,” *The Washington Post* (17 August 2023).

82. I. Kabanenko, “The Ukrainian Navy: Conceptual Aspects and Cooperation with the West,” *Eurasia Daily Monitor*, Vol. 14, No. 32 (09 March 2017).

83. H. I. Sutton, “Guide To Ukraine’s Long Range Attack Drones,” *Covert Shores* (19 February 2024).

84. G. Stepanov, *op. cit*.

The operation is structured in the classic way, with several echelons employed sequentially, according to a “single plan”,⁸⁵ against strategic or operational targets. The first echelon, the “detection” or “demonstration” echelon, is designed to identify and disrupt the enemy’s defences, using detachments of decoy drones, a platoon of ISR UAVs, and support from electronic warfare troops. This is followed by a break-through echelon, which must destroy the enemy batteries or aircraft contributing to its anti-aircraft defence. Finally comes the strike echelon, which brings together drones and long-range strike resources to destroy the infrastructure and reserves on which the enemy’s aerospace salvo depends. A “support” or “security” echelon ensures the coherence of the whole system, to ensure stable communications.



85. “A single plan” is not a “similar” plan. The expression, originally Soviet, refers to a concept of operation that “unifies” the interaction and coordination of the different forces involved. It prescribes the kinematics (sequential or simultaneous) of their different tasks and missions according to the objectives.

This second period therefore culminates with the end of the Russian ground and air offensive between February and March 2023, resulting in a mutual disappearance of penetration capability. Firepower and drone fleets remained structurally separated between the “infinitely small” and the “infinitely large”. A gaping gap separating the line of contact and the strategic depths is perpetuated, sanctioned by the disappearance of the drone-based ISR responsible for covering it. It thus deprives both armies of genuine interdiction and disruption capabilities.

3. FPV: The Alliance of Speed and Fire, Organisations Designed for Shock, 2023–2024

The final phase spans the entirety of 2023, marked by the alliance between the technical innovation of FPV drones⁸⁶—more powerful and robust against interference—and improved organisational integration of drone units into joint manoeuvres. This trend continues today.

In early 2023, the Ukrainians began building their assault brigades, with drones becoming integral to their force structure. These UAVs were to provide them with a shock capability akin to that of a remote mortar or a “pocket-sized” light aviation.⁸⁷ Two companies, one for observation and the other for strikes, were added along the UAV platoons already in the brigade artillery groups.⁸⁸ Experiments were conducted during the fighting in Bakhmut in March 2023, with the formation of three shock UAV companies within the 92nd, 54th and 35th brigades. Five others were established the following May in the 47th, 59th, 3rd, 5th and 1st armoured brigades.⁸⁹ Each seems to have been equipped with a Starlink complex,⁹⁰ around forty *R-18s*, *E620 Kazhans* (also known as “*The Bat*”) and *Vampires* for support against enemy fortifications and concentrations, and around 140 FPVs.

In comparison, the Russians began to conceptualise dedicated units for shock mini-drones as early as March 2023 to reduce their dependence on artillery, though these ideas didn’t receive much implementation.⁹¹ During the 2023 edition of *Dronista*, the idea of emulating Soviet anti-tank regiments from the Second World War emerged, aiming to establish fire superiority within a 2 km depth. However, Russian efforts were focused primarily on optimising the artillery and making it more flexible in terms of effects. Consequently, drone unit projects did not come to fruition during this period.

86. First Person Viewer: the drone is controlled through so-called “immersive” or subjective goggles that transmit directly to the pilot what the drone “sees”.

87. Y. Michel, O. Schmitt, E. Tenenbaum, “Les enjeux militaires de la guerre d’Ukraine : une impasse en trompe-l’œil?,” *Politique étrangère*, Vol. 89, No. 1 (Spring 2024).

88. “Des compagnies de frappe de drones se forment dans les forces armées,” *Militarnyi*, (27 January 2023).

89. “8 compagnies de frappe de drones ont été équipées du matériel nécessaire,” *Armyinform* (08 May 2023).

90. V. V. Kisil, “The use of UAVs in the Russian-Ukrainian war as one of the high-tech products of the defence industry for superiority in the air and on the battlefield,” in “The Ukrainian Army: Present and Historical Retrospectives,” *National Defense University* (2024).

91. A. G. Bazaev, Y. O. Bondarenko, *op. cit.*

The Russian approach therefore has remained centralised but is gradually creating a space that could be described as a “bordered” or “managed” initiative. Tactical commanders were permitted direct control over fire support and drones allocated to their operational zones. The principle of “rejecting the value of intuition” was maintained by reinforcing the automation of the existing hierarchy thanks to ASUs, but a certain “collegiality in the management” of forces was tolerated at the lowest levels.⁹²

During the summer/autumn 2023 counter-offensive, the results of the Ukrainian companies were mixed. The cover provided by the Russian EW largely prevented the “heavy mini-UAVs” from being deployed.⁹³ However, the Russians recognised the danger associated with these “bombers”, which can drop 11kg mines on their positions.⁹⁴ Conversely, FPVs proved effective in hitting soldiers or vulnerable parts of vehicles in a counter-mobility role. Carrying approximately 1.5 kg of explosives, FPVs had an effective range of 5 to 8 km and were comparable to anti-material rifles or grapeshots. FPVs were especially appealing because their production was neither complex nor expensive. They cost between \$350 and \$1,000 a unit (depending on their payload, optronics, and ammunition), compared with more than \$2,000 for a DJI or \$35,000 for a *Lancet*.⁹⁵

Their primary bottleneck was the lack of operators and the unavailability of frequencies, drastically limiting their mass deployment. Operator training required three to four weeks, with a success rate of 60–70%,⁹⁶ and, in the end, operators could control only one FPV at a time during 15- to 30-minute flight sequences. This therefore necessitated significant human resources. In addition, the transmission channels were generally analogue, making their control rather unstable. The engagement of FPV drones saturates available radio frequencies, hindering the deployment of new UAVs at the risk of jamming or even doing unintentional spoofing (usurpation of control) of allied FPV drones. Finally, their linkage was highly sensitive to terrain and obstacles, requiring a repeater to double their range.⁹⁷

Despite these constraints, FPV consumption quickly surged. According to the estimate of a volunteer producer, usage increased from around 50 units per company in June 2023⁹⁸ to about 20 per day for the 47th Brigade alone by October 2023 (in addition to the 20 or so it was producing itself).⁹⁹ FPV production is increasing ex-

92. S. M. Dudko *et al*, “On Improving the Efficiency of Management of Tactical Military Formations,” *Military Thought*, No. 7 (2023).

93. J. Watling, N. Reynolds, “Stormbreak: Fighting through Russian Defences in Ukraine’s 2023 Offensive,” *RUSI* (04 September 2023).

94. A. Timokhin, *op. cit*.

95. Interview with the author, March 2024.

96. S. Pettyjohn, “Evolution Not Revolution,” *CNAS* (February 2024); “Pilot Training Issue is Looming to Undermine Ukraine’s Plan for FPV Drone Production,” *Defense Express* (27 December 2023).

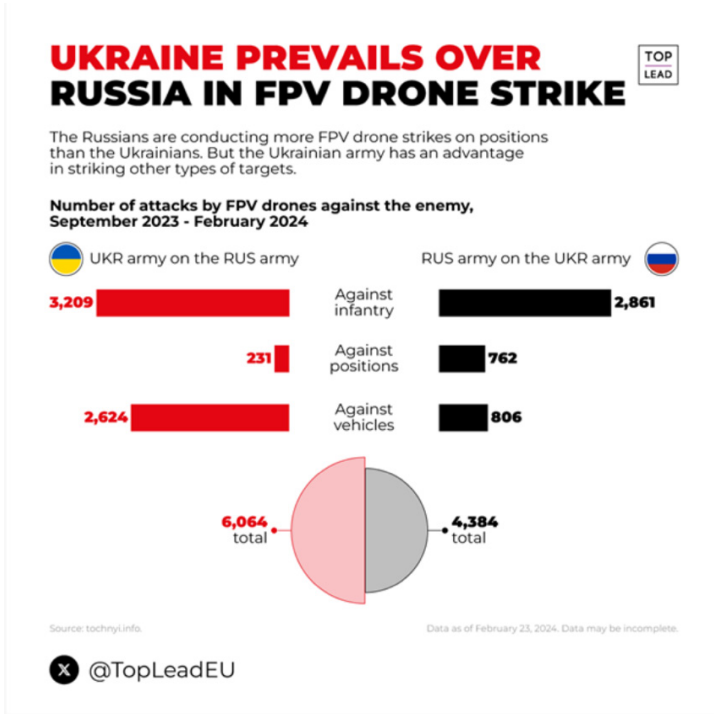
97. “As a reminder, repeater drones are used to extend the useful range of small FPV drones,” X account by @DanielR33187703.

98. T. Kolomychenko, “Ces joueurs long-courriers tricheront, tout comme l’iFlight chinois,” *Censor.net* (21 June 2023).

99. S. Roblin, “Drones on the Front Line for Ukraine’s Counteroffensive,” *Inside Unmanned Systems* (19 October 2023).

ponentially. During the same period, Ukrainian forces were assembling over 6,000 or even 15,000 FPVs according to some sources.¹⁰⁰

Russia was catching up in early September, with between 20,000 and 25,000 FPVs produced, including the *VT-40*, *Ghoul* and *Rusak* models developed by volunteers.¹⁰¹ At the time of writing this article (summer 2024), Ukraine was said to be producing between 50,000 and 100,000 FPVs, while Russia was said to be making around 100,000 or more.¹⁰²



Source: @TopLeadUE infographic, based on work by tochnyi.info and data collected by @AndrewPerpetua (X).

As a result of the counter-offensive, the frontline has become densely covered with UAV posts. The Ukrainians estimate that up to eight tactical UAV launch sites (in addition to those for mini-drones), often positioned 2 km from the contact line, can be established within a brigade's area of responsibility.¹⁰³ According to one account, around 20 teams, each consisting of 2 to 4 personnel, operate within a single brigade, and with each consuming between 10 and 15 FPVs per day.¹⁰⁴

100. "New threat: FPV Drones Adapt for Night-Time Operations," Мілітарний (24 November 2023)

101. S. Roblin, "Drones on the Front Line for Ukraine's Counteroffensive," *art. cit.*

102. D. Hambling, "How Ukraine Is Building A Drone Army at Its Kitchen Tables," *Forbes* (07 March 2024).

103. O. A. Korshets *et al.*, *op. cit.*

104. Interview by the author, March 2024.

The rapport between traditional melee forces (infantry, armoured vehicles, etc.) and drone support has thus begun to equalise, and in some cases, even reverse. U.S. researcher Michael Kofman notes that drone support could have constituted up to 60% of the assets in the composition of a Ukrainian assault during the summer 2023 counter-offensive. ISR and communication requirements, the centrality of firepower in manoeuvre planning, and the need to protect UAVs from enemy electronic interference and interception justify this choice.¹⁰⁵ In September 2023, Maria Berlinska, Director of the Air Reconnaissance Support Centre, estimated for her part that 20,000 to 25,000 *Mavic* quadcopters, thousands of *Leleka* drones, and around 90,000 to 95,000 FPVs would be needed per month to hold a front line.¹⁰⁶

However, the initial advantages of decentralised production now appear to hinder Ukraine's ability to transition to mass production. At the Kyiv National Defence University's annual conference in early 2024, for example, one of the presenters pointed out that Ukrainian companies were only managing to produce 10-15% of the UAVs required, compared with an estimated need of 200,000 FPVs.¹⁰⁷ The primary issue is not a lack of manpower or production facilities, which are relatively easy to establish, but rather a financial shortfall.

Ukraine's response has taken three main directions. The first is the introduction of a public subsidy system to encourage production, whereby entrepreneurs would earn a 25% margin for every drone sold to military units. The second is commercial expansion into Europe by establishing joint ventures to bypass Ukrainian state restrictions on arms exports.¹⁰⁸ Finally, the third approach involves broadening the artisanal production base through new volunteer programmes such as Victory Drone and People's Drone. These initiatives focus on training FPV assemblers to boost domestic production.

105. Michael Kofman, "The Russian contingency," *War on the Rocks* (03 July 2023).

106. "Maria Berlinska, head of Ukraine's "Aerial Intelligence Support Center" and the "Invisible Battalion" projects," *Ukrainews.com* (27 September 2023).

107. S. V. Sidorov, "The Flow of Innovative Technologies for Determining the Development Directions of Unmanned Aircraft for the Battlefield: The Experience of the Defense Forces of Ukraine (2014-2023)," in "The Ukrainian Army: Present and Historical Retrospectives," National Defense University (2024).

108. V. Melkozerova, "Ukraine's weapons industry presses government to allow arms exports," *Politico* (09 October 2024).



**ІНЖЕНЕРНИЙ ОНЛАЙН-КУРС
«НАРОДНИЙ FPV»**

**ЦЕ ВАШ ШАНС СПАЛИТИ
РОСІЙСЬКИЙ ТАНК!**

Ви власними руками зберете FPV дрон,
яким наші військові вдарять по окупантах

Translation: “ONLINE ENGINEERING COURSE ‘VICTORY FPV’: THIS IS YOUR CHANCE TO BURN A RUSSIAN TANK! You will assemble an FPV drone with your own hands, which our soldiers will use to strike the occupiers.”

In spite of these constraints, the Ukrainians prefer to maintain their decentralised production to maximise the speed of their innovation and adaptation cycles. For the time being, the Russians continue to focus on quantity rather than quality. The Ukrainians continue to value and benefit from the inventiveness of their associative ecosystem and its effective exploitation by military units. At a time when forms of combat require drones to be permanently reconfigured *in situ* (on the battlefield) to survive electronic interception or change ammunition, the Ukrainian model manages to gain the upper hand over the Russian mass model. Russian processes are less agile and lag behind in terms of organisation and operating methods.

Consequently, the Ukrainians are deepening their organisational experiments, including the development of a new drone doctrine in December 2023. This was followed by the formation of UAV battalions and the announcement of the creation of an independent service for the use of drones. From now on, it will be mandatory for joint commanders (up to battalion level) to have drone units at their disposal to initiate manoeuvres and conduct strikes. This is an important reminder in an army where the officer culture is heterogeneous. Those who were educated according to

the precepts of the Soviet school are being urged to modernise their practices. The doctrine formalises centralised planning at higher levels for the allocation and definition of missions. Management, on the other hand, was decentralised to the UAV unit commanders themselves. “Preliminary” planning can evolve and become “unforeseen” so that the commander can seize tactical opportunities. In practice, this doctrine institutionalises the “disciplined improvisation” demonstrated by Ukrainian frontline units, aiming to reconcile their autonomy with the need to increase the complexity of their combined-arms coordination.

In this context, the establishment of the new independent service does not appear to call into question the configuration of operational control of drones by the Ukrainian forces. It rather seems to affect their support and generation. Several hypotheses can be considered. The first, minimal hypothesis is that the service will assume administrative responsibilities similar to those of the Ukrainian Air Force, whose operational control lies with the theatre commander. The service would be responsible for generating and maintaining resources.

The second, intermediate hypothesis is that the service could specialise in informational or “high-tech” support, akin to the Chinese model of forces dedicated to “strategic support”. In this case, the service would rationalise the interaction between Ukrainian information systems and their space and drone-based sensors.¹⁰⁹ It would become the main point of contact for technical intelligence from the West.

Lastly, and not exclusively, the service could assume control of strategic drone strike missions, taking over some of the responsibilities of military intelligence (GUR).

A Summary for Conclusion

The general trend has been towards the specialisation and mass deployment of drones rather than their sophistication or hardening. This evolution was initially driven by the shortcomings and inadequacies of reconnaissance and strike complexes, which failed to provide reactive fire support across all offensive and defensive directions. As a result, it became necessary to saturate frontline units with mini-drones to meet their ISR needs and, more critically, to ensure an alternative or backup precision strike capability in the absence of adequately integrated artillery, helicopters, or tactical aviation.

This exponential growth in demand coincided with advancements in air defence systems, which effectively combined kinetic interception means with electronic warfare resources, while echeloning them much more effectively and closely. The attrition of this “closed sky”¹¹⁰ has confirmed the failure of MALE combat drones, which have been unable in their current configurations to constitute an independent strike force. It has also turned drones into consumable objects. To cope with attri-

109. Interview conducted by the author in October 2024.

110. K. Leventov, K. Popov, “Champs de bataille électromagnétique,” *Collection Armée*, No. 8 (2022).

tion and rising demands, drones have then been functionally disaggregated within increasingly diverse fleets. The increasing skills of crews and the growing complexity of their operational schemes thus compensate for and take advantage of the technical simplification of these devices. Unmanned aerial vehicles (UAVs) are less versatile, but together they participate in a veritable aerial micro-manoeuve, combining the functions of detection, communication relay, combat, “munition-barrage” (barazhuyuchi boyeprypasy), and decoys.¹¹¹

The majority of fleets are first tasked with obtaining fire superiority in the tactical depths—as distinguished by the Russians—in close combat (very short range) up to 25 km, and then in tactical combat (short range) at 50 km.¹¹² They are used for counter-mobility, then counter-battery (ground-to-ground and ground-to-air) and finally attrition against vehicles and personnel. In this way, drones have not revolutionised aerial combat as pre-war doctrines envisioned but have instead transformed infantry combat, as foreshadowed by the clashes in Nagorno-Karabakh. Infantry units now have access to inexpensive precision firepower to break enemy defences and secure their own advances. Friendly drones, in this regard, function like reactive armor for front-line units. Enemy drones, on the other hand, function as a form of permanent grapeshot, hampering their movement. In order to survive or to evolve on the modern battlefield, melee formations can no longer rely on extra armour or mobility. Every time they move, they have to ensure that their drones cover their approaches and mask their positions from those of their adversary.

Consequently, on a front of several thousand kilometres, in a situation of parity and without air superiority, the range and success of operations depend largely on the ability to generate ground strikes. Offensives have therefore become fragmented into hyper-localised battles depending on the availability of “dronised” fire (from integrated artillery or from the drones themselves). The very short range of these operations has thus only led to surface attrition, line after line, incapable of significantly disrupting the organisation of the rear. Today’s drones create a belt or envelope of fire that encircles infantry and immobilises the contact line. By late 2024, this “screen” or drone-layered echelon has become increasingly difficult to neutralise or contest. The reason being that it forms a highly adaptive “multi-fire, multi-dimensions”¹¹³ coverage with its own regenerative capabilities, which is capable of combining the “heavy” firepower from tanks, artillery, and tactical or light aviation with that of drone-based munitions. The resulting configuration of the battlefield is reminiscent of that envisaged by the U.S. Active Defence doctrine of the 1970s. The

111. O. Taran *et al.*, “Recommandations méthodologiques aux ‘unités militaires générales concernant la lutte contre les aéronefs de fabrication iranienne shahed-136’ (‘Geran-2’) et de l’association russe ‘Lancet-2’ (basées sur l’expérience de la guerre russo-ukrainienne de 2022-2023),” BPI 3-00(116)120, Ministère de la défense ukrainienne (March 2023).

112. I. V. Matviychuk, “Control and Correction of Artillery Units Fire by Close-Range Air Reconnaissance Systems,” *Pensée Militaire*, No. 7 (2023).

113. Multidomain operation in France has been translated into the M2MC doctrine: *Multimilieux, multichamps*. It could be translated as multi *physical* domains, multi *electronical*, *informational* dimensions.

latter, marked by the “new lethality” of the first precision fires, rejected the possibility of large-scale manoeuvres in favour of attritional and positional warfare.¹¹⁴

In Ukraine, this configuration imprints every movement with an extremely methodical character, reminiscent of the “conducted battle” doctrine of the French school in the inter-war period. The two systems evolve as their fires are deployed and constantly refined, with their forward points advancing or anchoring themselves within the enemy glaxis. The echelonment of robotic, drone-based, and automated fires and sensors replaces the echelonment of forces. The neutralisation or preservation of their architectures now represents the new lines of operation. The two adversaries are thus engaged in a new kind of counter-battery combat, which blends the destruction or suppression of traditional batteries with a micro-SEAD effort against the drone-based layer of the opposing ‘system-of-systems’ fire structure.

The conception of tactical manoeuvre has been fundamentally disrupted. It must succeed in dynamically synchronising its actions with extremely diverse effects. It must integrate the *in situ* development of its close-in fire in an organic way. Drones indeed require constant adaptation of their payloads, adjustments to frequencies, potential structural modifications, or more complex transmission systems. In this regard, RUSI refers to a capability for “Accelerated Capability Refresh Cycles”.¹¹⁵ This is no longer mere improvisation but a continuous, short-cycle research and development process carried out within units to counteract the opponent’s electronic and kinetic countermeasures. This kind of effort, combined with the imperative of having the most controlled environment possible, further reduces the volume of forces that can be deployed and the complexity of their operations.

Both belligerents’ strategic strike campaigns aim to loosen “upstream” this air-land belt or envelope. However, they lack the needed dynamic targeting capabilities and thus cannot effectively support their operations. These campaigns are thus reduced to targeting the entire aerospace and military potential of the opposing state. The “droning” of long-range vectors “democratises” the use of cruise missiles, increasing their volume (thus applying continuous pressure) and complicating the composition of salvos, which become more difficult to intercept.

Nevertheless, this new mass, though extensive, still lacks the agility needed to produce direct operational effects. For now, these effects remain predominantly indirect and fall into two categories. The first is a classic one: a “cost-rising” air campaign that seeks to undermine the enemy’s will by targeting its critical military, economic, or societal infrastructures. From this perspective, the Russian strike campaign could cause the Ukrainian war effort to run out of steam across the board, or even lead to a demographic haemorrhage in the event of a severe energy crisis. Yet, historical examples offer no certainty about the time and additional effort required

114. P. H. Herbert (Major), “Deciding what has to be Done: William E. DePuy and the 1976 Edition of FM 100-5, Operations,” *Leavenworth Papers*, No. 16 (July 1988): 83.

115. J. Watling, O. V. Danylyuk, N. Reynolds, “Preliminary Lessons from Ukraine’s Offensive Operations, 2022-23,” *Special report, RUSI* (2024).

to achieve such outcomes. Moreover, while Russia currently holds the advantage in strategic salvo duels, Ukraine is progressively developing a “high-low mix” of inexpensive drones and Western long-range vectors. Its performance is ensured by the contribution of Western ISR and increasingly sophisticated sensor fusion.

The second effect is the splitting of Ukrainian anti-aircraft defences between protection of the front and security of the rear. This is by far the most worrying problem today. This split is leading to the gradual and now critical anaemia of Ukrainian SHORAD assets. They are no longer able to prevent the action of the Russian air force and tactical drones, due to a lack of platforms and interceptors. This weakening provides the Russians with an opportunity to reintroduce drone ISR over ranges of up to 50 kilometres. They can reorganise reconnaissance-strike complexes to target Ukrainian force concentrations, logistics, and fortifications. The addition of “gliding bombs” (bombs with flatter paths, equipped with a *Glonass*/laser guidance kit) to the VKS arsenal fully exploits this in-depth drone reconnaissance. Only major Western assistance, or even more direct intervention, could mitigate this threat.

Limits and Challenges of the “Drone Revolution”: Kinematics of Operations and Army Models

Ultimately, what are the conclusions that can be drawn regarding pre-war ambitions? Paradoxically, drones have both amplified and disrupted firepower on the battlefield. As a technical solution for building and integrating increasingly robotic reconnaissance and strike complexes, drones have subordinated these systems to their performance, overturning the organisational frameworks originally designed for their use. Rather than intangible proof of the new superiority of defence over the offensive, drones have deepened the divide between firepower and manoeuvre, a gap that existed even before their mass introduction into Russian and Ukrainian forces.

In fact, drones are often reduced to their capacity to “fire”, either to direct artillery or as munitions, but they are above all expedients, “short circuits” to compensate for deeply flawed targeting and command chains. This particular situation does not call into question the real gains that drones bring to the functions and weapons they serve, nor the revolution in precision fire that they intensify. However, they simply cannot replace the framework and concepts of operations that must ultimately align ends and means in a coherent and relevant manner. This is one of the most urgent issues to consider for the future of our military force model.

The issue of integrating drones into our own forces must indeed account for the specific nature of their “participatory” mode of production and generation, at the risk of being overtaken by their use. The drone is not just an object of “dual” consumption. It represents a new mode of production that leverages agile development methods,¹¹⁶ additive production technologies, 3D printing, AI, and advances in electric propulsion. In this respect, the drone appears to be a reflection of digital societies

116. T. Dingsøy, S. Nerur, V. Baliyepally *et al*, “A decade of agile methodologies: Towards explaining agile software development,” *Journal of Systems and Software*, Vol. 85, No. 6 (2012): 1213-1221.

at war, the product of the digital and globalised economies of what some consider to be the “third industrial revolution”.¹¹⁷ This revolution integrates consumers and clients more directly into its value chains, transforming them into self-production or maintenance units. By combining mass with precision, and introducing the first AI techniques into information gathering, processing, and even decision-making, “droning” has the potential to rewrite operations in the same way as motorisation or mechanisation in past centuries.

We thus face a choice in this revolution, between the specialization or the generalization of drones within our force structure. On one hand, drones could be relegated to the sole purpose of optimizing our traditional firepower. On the other, we could seek to emulate and adopt the close-range drone echelon observed in Ukraine. The first approach is that of the pre-war era, in which drones are used as adjuncts to artillery or aviation. It is the most prudent in terms of human resources and industrial capabilities, but risks being outdated in terms of technologies and operating methods.

The second approach is more radical, as it entails recreating aspects of the participatory production models seen in the Russian and Ukrainian civil-military ecosystems. This would require broader socialisation and acculturation of the forces, encouraging them to appropriate and reconfigure these objects. It would also involve fostering the creation of civil-military start-ups or incubators. The role of operational reserves seems particularly important in establishing this type of micro-ecosystem, where civilian solutions and military needs interact and mutually reinforce one another.

Some will argue that embarking on such a transformation would amount to an “Ukrainisation” of our forces. On the contrary, we believe that it is a necessary adaptation in order to keep pace with a broader technological and societal acceleration already embraced by allies and adversaries alike. Failure to act therefore risks marginalisation and a significant loss of capabilities.

117. J. Rifkin, *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy, and the World* (New York: Palgrave Macmillan, 2011).

Still on the way: Ten years of Russian C-UAS (counter- unmanned aircraft systems)

Pierre Grasser

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“There are more drones in the sky than birds now. We need protection systems of all kinds, using electronic warfare, interceptor drones [drones that intercept other drones], or the old-fashioned way: 6 bullets per cubic meter and there won’t be any more drones.”¹

Dmitri Rogozin, vice-president of the Russian government, in charge of defense and the space industry from 2011 to 2018 before joining the Ukrainian front at the end of 2022, spoke these words on September 21, 2023. He was present with his group of private combatants, deployed near Vuhledar, an industrial city then in the hands of Ukrainian forces, not far from Mariupol. Apart from an assault by Russian Naval Infantry in February-March 2023, the area remains calm, though there were daily overflights by drone swarms launched by both sides. Despite the former politician’s wishes, Russian electronic warfare (EW) capabilities have yet to be expanded and unified. No army is yet capable of deploying interceptor drones over wide areas, while the lightest aerial vehicles are as difficult as ever to destroy with individual soldiers’ weapons.

Although they can appear on every battlefield, Unmanned Aircraft Systems (UAS) do not by any means constitute a homogeneous threat that would overwhelm defense systems. Medium and heavy systems, like the American *Predator* or the Turkish *Bayraktar TB-2*, are effective weapons for observation missions or for harassing dispersed, poorly-equipped adversaries. Although their flight profiles and silhouettes have been familiar since the late 1990s, these vehicles are now vulnerable to

1. “[Dmitry Rogozin: there are more drones in the skies over the Zaporizhzhia front than birds](#)”, Украина.ру (21 September 2023)

modern ground-to-air systems. Light drones, which have been on the rise since the mid-2010s, represent a different level of challenge. These include remotely-operated models, usually multicopters, or families of mini-drones (between 2 and 20kg) and micro-drones (from 200g to 2kg). They can carry out reconnaissance missions by day or at night, assist with artillery spotting, or neutralize targets using explosives. These multi-rotor craft powered by electric motors are difficult to detect.

C-UAS (stands for Counter-UAS) uses the most basic EW methods to defeat light drones. It differs from offensive jamming, which uses relatively powerful effectors, usually transported by vehicle and designed to operate over a wide area. C-UAS is mostly characterized by the absence of kinetic interception systems, unlike surface-to-air defense, which uses cannons and missiles, or individual weapons such as assault rifles and machine guns.

C-UAS is based on lightweight devices specifically designed to detect, identify and intercept mini- and micro-drones. The vehicle is neutralized mainly by jamming, which limits the risk of collateral damage compared with kinetic AA fire. The anti-drone gun is the preferred effector for interception. It emits a directional jamming signal towards the intruder, with a range of 600 to 1,500m, to disrupt the remote control signal. The drone falls to the ground² or returns to its operator if programmed to do so. In addition to visual alerts, the warning system relies on the detection of control signals to anticipate the arrival of the flying object. More rarely, optical systems or radar are used to detect such discreet targets, or to gain time or range.

Among the countries that have invested in C-UAS are France, the UK and the U.S., as well as China and Russia. Although the initial intention was to provide protection for certain installations in the rear or exceptional events from civilian drones, C-UAS has greatly expanded its field of action. It is now being used on the front line in Ukraine, which has generated significant operational feedback. From airfields to the quagmire of Pokrovsk, the Russian soldier talks about his experiences and questions: how can C-UAS, designed in peacetime, is suitable to cover a theater of operations saturated with drones whose characteristics are constantly evolving?

I. Blocking light drones before the war: not a priority, but on the agenda

Russian forces observed by light drones in 2014, attacked by them since 2017

It was in Ukraine in 2014 that light drones were first used as a weapon on the battlefield. Faced with pro-Russian separatists in the Donbass region, the Ukrainian forces took advantage of crowdfunding to procure various civilian drones. These models were used for artillery spotting but other offensive uses were soon being studied. At the end of April 2015, the Ukrainian company Aerorozvidka converted 16 commercial drones to carry grenades³. Little is known about the results, but the

2. Jamming is effective inside a cone with an angle of around 20°. The drone can be affected without having to aim precisely at it.

3. G. Champeau, "[Crowdfunding to kill drones](#)", *Numerama* (24 April 2015).

process was extended to larger models. An *R-18* drone, with 8 propellers, developed by the company in 2016, could drop up to 5kg of explosive charges. It was reportedly engaged in combat in 2018.

At the same time, Russian forces came under attack from drones during their operations in Syria. Some of these were medium-sized systems, capable of flying up to 100 km, and targeting fighter jets stationed at the Latakia base using GPS coordinates. Air defense systems and heavy jamming equipment were rapidly strengthened and successfully blocked the attacks. On the other hand, attacks carried out by *Daesh* using light commercial drones were also observed, without any effective countermeasures. *Phantom-III* drones carrying grenades, for example, were used to attack the Deir ez-Zor stadium on October 24, 2017. Captured a few days earlier by Russian and Syrian pro-regime fighters, the compound was being used as a military depot. The detonation of the ammunition dropped by the drone triggered a chain of explosions that destroyed a battery of *BM21* rocket launchers, stocks of personal effects and a regional cash reserve⁴. These quadcopters were also used by opposition forces fighting against Bashar al-Assad's regime. Several models took off from insurgent strongholds in the center of the country, but detailed information is lacking. On August 3, 2017, Russia announced a *Verba* very short-range surface-to-air missile strike against a drone in Eastern Ghouta, near Damascus, without giving further details.

It was also in the Syrian theater that Russian forces had their first experience with C-UAS systems. *Pichal* and *Arbalet-1* anti-drone guns were photographed there in 2016. A *IL122* short-range radar, used to detect small targets, was also observed near Palmyra in March 2018. In the same year, the soccer World Cup in Russia provided an opportunity to benefit from this experience on Russian territory. On July 3, 2018, media reports highlighted two locally-built *Stupor* anti-drone guns assigned to internal security forces to ensure protection during the event. In the end, two drones belonging to Chinese and Australian tourists were neutralized and confiscated. The manufacturer of the *Stupor* jammer gun took this opportunity to state that it should be possible to neutralize a drone in “20 to 40 seconds”⁵. In the absence of any serious incident, Russian forces had no reason to question this assertion.

Russia, late 2021: working to improve self-defense.

From 2015 to 2021, the performance of lightweight drones continued to improve. The market was dominated by civilian products from China's DJI — consumer-friendly and ergonomic — and Autel — featuring high-resolution optics. In six years, the endurance of their flagship products improved by 50%, maximum speed by 30% and payload capacity by 20%. In military terms, this equipment could keep watch over an area for longer periods, intervene more rapidly and carry larger — if need be, expendable — payloads. They could also be controlled over wider frequency bands, improving their probability of survival in the event of interference.

4. “[A \\$500 drone caused \\$100,000,000 in damage](#)”, *BMPD-CAST* (01 June 2020).

5. “[Russian Anti-Drone guns Tested in Syria Protect FIFA 2018 World Cup](#)”, *Mil.Today* (03 September 2018)

DJI drone improvements over six years

	<i>Phantom-III</i>	<i>Mavic Air 2</i>	<i>Mavic 3</i>
Arrival on the market	2015	2020	2021
Endurance	25 minutes	34 minutes	46 minutes
Maximum speed	58km/h	68km/h	76km/h
Payload capacity	500-700g	830g	~ 900g

The ability of Russian forces to detect these drones varied. Remote control signals, which indicated the drone's arrival, could be detected by spectrum analyzers. The Russian company Arinst, established in 2020 in Voronezh, specialized in the manufacture of this type of product. It supplied the Russian market as well as exporting to Japan and China. These receivers cost around 200 euros each, an affordable price for the fighter seeking to improve his equipment. Range was no more than 1,500m. Beyond that, optical warning systems (optronic turret, panoramic camera) were non-existent. However, Russian officials highlighted the use of *IL122* and *IL277* short-range radars for drone detection. The first was a low-frequency (L-band) system which could detect objects in more or less static flight, but which was not very suitable in terms of accuracy. The second radar operated in the Ku-band, a high frequency optimized for detecting small objects at close range. However, this radar was primarily designed for observing targets on the ground. It could only monitor 20 tracks simultaneously, and elevation was limited to 18° — a handicap for drone surveillance.

Interception capabilities also needed to be strengthened. Control frequencies for light drones ranged from 2,000 to 6,000MHz, frequencies that only three jamming vehicles could cover. The *Svet-KU* entered service in 2012⁶ and could jam up to 6,000MHz⁷. However, it was reserved for intelligence-gathering missions⁸, while EW units were too small to disperse these resources to other missions. Two other systems specially designed to counter light drones entered service in 2016: the *Chipovnik* and the *Repellent*. The former ensured jamming up to 2,485MHz, the latter up to 6,000MHz. Deliveries of these systems were sporadic: as of October 2017, the Russian army had only one battalion equipped with such systems, within its five EW brigades⁹.

6. "Sviet-KU," *MilitaryRussia* (03 May 2014)

7. "Russian Electronic Warfare Systems. Analytic Insight Report," *3Gimbals*, (06 July 2023): 49. The Cdma2000 signal, which the Svet-KU must be able to jam, ranges from 300kHz to 6.4GHz

8. "Sviet-KU", *art. cit.*

9. "First permanent C-UAS unit formed in Western Military Region," *official website of the Russian Ministry of Defense* (28 October 2017). Russian EW brigades typically comprise three to four battalions each. The 16th Brigade was the first to see one of its battalions equipped with C-UAS systems, in October 2017..

Convoy self-protection, therefore, relied on vehicle-mounted *RP-377* jammers¹⁰. Originally designed to counter improvised explosive devices on the ground, they could generate interference at ranges up to 30m¹¹, which was not enough for C-UAS. The Russian soldier could still rely on a few Russian-made anti-drone guns, such as the *Stupor* or the *Garpun-2* and *-3*. The latter was presented on the sidelines of Exercise “*Slavic Brotherhood*” in November 2021¹², as an example of up-to-date equipment. At the same time, trains crisscrossed Russia on their way to Ukraine’s borders, loaded with thousands of combat vehicles, rarely optimized to counter the lightest drones.



Syria 2016: *Pichal* and *Arbalet 1* anti-drone guns at Latakia air base.



Russian *Garpun-3* anti-drone gun presented to the media in November 2021.

II. Starting in summer 2022, support from the rear to re-equip the front.

Another threat, the drone’s omnipresent eyes and grenades.

As they cross the Ukrainian border, Russian columns have ample coverage from anti-aerial defenses. The short-range *Strela-10*, *Osa* and *Tor* systems are deployed by ground forces, while the air force provides a few modern *Pantsirs*. All these systems have been designed to counter low-flying aircraft, helicopters and even cruise missiles, against which an air defense missile remains cost-effective. However, heavy losses in surface-to-air weaponry were endured during the first weeks of the conflict, while anti-aerial launches emptied ammunition stocks. After the reorganization of Russian lines in eastern Ukraine in April-May 2022, the losses in modern Russian surface to air systems were compensated by the delivery of old hardware from depots. The ageing systems distributed were even less suitable to deal with discreet targets such as light drones.

However, the Ukrainians engaged micro drones from the very first day of the war. In March 2022, Russia emphasized the C-UAS protection measures implemented in-theater. Near Kiev and Kharkiv, *IL122* radar operators, combined with *Strela-10*

10. The *RP-377* variant-2 has a jamming range of 20 to 2,000MHz. The *-3* variant offers jamming up to 3,000MHz.

11. <https://vseprezentacii.com/armiya/osnovy-radioelektronnoy-borby-inzhenernogo-obespecheniya-i>

12. “The *Garpun-3* portable C-UAS system,” *Top War* (10 November 2021)

surface-to-air systems, were highlighted in propaganda¹³. However, all this equipment was inadequate, or outdated, given the large number of drones already flying over the battlefield. According to the head of the Kiev-based drone import company DroneUA, 6,000 drones were employed on the Ukrainian side as of June 7, 2022¹⁴. Their impact on the dynamics of operations was significant, as illustrated by the failed attempt by Russian forces to cross the Siverskyi Donets river in northeastern Ukraine. On May 8, a Russian mechanical bridge was deployed to catch the Ukrainian forces in the rear. The structure was spotted, but not from the ground, as it was shielded from view by smoke bombs. It was located by a quadcopter of the 17th Ukrainian Armored Brigade¹⁵. The Russian position was destroyed by artillery fire. Seventy-seven vehicles were burned out or abandoned. Drones were not just observing. Out of 57 images broadcast by Ukrainian channels between May 25 and June 15, four show grenades being dropped, and the upward trend was increasing¹⁶.

Faced with the inexorable increase in the use of drones by the Ukrainians, Russian troops were looking for new protection. Until something better, *Orsis* sniper rifles were used to shoot down small flying objects, at the end of May 2022, near Severodonetsk. Mounted on tripods, their sights were modified to reduce shooter fatigue during prolonged AA lookout periods.

Eventually, specific C-UAS systems made their appearance. On April 25, 2022, the Russian military presented on Telegram a DJI *Matrice 200* drone used by the Ukrainians, which they had reportedly neutralized by jamming. In mid-May, the 100th Motor Rifle Brigade in Donetsk showed off a homemade anti-drone gun¹⁷. The first appearance of a regulation system came in May 22, when a Russian soldier posed with a powerful *Garpun-2M*¹⁸. A small *Zala Aero-Rex-2* anti-drone gun was also seen on the southern front on May 25, followed by a medium-sized *LPD-801* on July 7¹⁹. The upturn was illusory: the *Garpun* and *Zala* were not seen again that year, while other models remained extremely rare. Yet the need was real. Two captured ex-Ukrainian *EDM4S* anti-drone gun were immediately reused by pro-Russian units in Donetsk and by the Wagner private military company (PMC)²⁰. The slow pace in buying new equipment for Russian forces, which could be explained by the comprehensive reorganization under way at the time, prompted civilian support groups to bypass institutional channels in order to send better equipment to the front.

13. "Engagement of a Strela-10NM by VDV forces in Kiev," *MilinfoLive*, Telegram channel (28 March 2023).

14. T. Kadam, "A Drone 'Live Streams' Its Own Destruction By A Russian Defense System," *The Eurasian Times* (07 June 2022).

15. G. Carbonaro, "Ukrainian Soldier Reveals How He Secretly Blew Up Russian Bridge," *Newsweek*, (12 May 2022).

16. The statistics are provided by the Telegram channel "Ukraine War Report" as well as the X accounts "Igor Girkin" and "Osint technical".

17. E. Helfrich, "Russian-Backed Separatist Shows Off Questionable Homemade Counter-Drone Jammer Gun," *The War Zone* (18 May 2022).

18. "Group O soldier with Garpun-2M anti-drone gun," *MilinfoLive*, Telegram channel (22 May 2022).

19. "LPD-801 anti-drone gun," *Ugolok Sitha*, Telegram channel (07 June 2022).

20. "Donetsk combatant with EDM4S anti-drone gun," *Anne News*, Telegram channel (02 November 2022); "Wagner soldier with EDM4S anti-drone gun," *Vestnikpvo*, Telegram channel (24 January 2023).



Russian soldier from the Eastern Military Region, with a *Zala Aero Rex* anti-drone gun, May 2022.



Garpun-2M anti-drone gun in Ukraine around May 22, 2022.



December 8, 2022, a soldier from the 200th Motor Rifle Brigade, north of Bakhmut with an LPD-801 anti-drone gun.

Private donations to replace the State and protect the soldier

On the Russian side, the first crowdfunding operations were observed at the end of March 2022, for the supply of firearms sights²¹. The process was extended to other domain where Russian soldiers were asking for assistance. It was organized from Russian Telegram channels dedicated to military news, aviation stories or electronic warfare. Crowdfunding initiatives for C-UAS gears started at the end of 2022, as Russian forces prepared for upcoming Ukrainian counter-offensives.

Distributing anti-drone guns

Hosted by a former *Su-34* bomber pilot, the Telegram channel *Fighter-bomber* started the movement with a crowdfunding operation to finance an anti-drone gun. Delivered in mid-January 2023²², it was adopted by aerospace forces to protect their air bases against Ukrainian commando drone attacks. The jammer used was a Chinese-made *UAV-80P*, priced between 1,200 and 1,700 euros. This model became rapidly popular due to its affordability. As an illustration of its success, it is also the only anti-drone gun in Russia to have been given a nickname – “*Harpy*”²³. As of April 17, 2023, the *Troika* Telegram channel, close to Wagner and the paratroopers, had already delivered some 90 anti-drone guns to the front, mainly of this model²⁴. The Marines stood out from the rest by requesting mainly Russian *Garpun* models, which were the most powerful but also the most expensive in Russia.

Provide warning sensors

To try and jam a drone, Russian soldiers needed to anticipate its approach and, if possible, its trajectory. The Russian company 3MKh produced portable spectrum analyzers for this purpose. At the end of April 2023, it presented the *Bulat*, a model

21. “Acquisition of monocular mounts,” *MilinfoLive*, Telegram channel (March 2022).

22. “Equipment handed over to VKS,” *Fighterbomber*, Telegram channel (January 2023).

23. “Drone anti-drone guns in a nutshell: pros and cons, comparison chart,” *Bigcamping* (11 March 2023).

24. “The weapons we buy,” *Rustrouka*, Telegram channel (17 April 2023).

designed to detect drones in difficult front-line conditions. However, this equipment was far from being part of standard army gear. The *Sudoplatov* Telegram channel set to work and, by July 18, 2023, had paid for and sent 77 units to the front²⁵. A new radar, the *Repeinik*, designed to detect drones, was developed using Wagner funds. Capable of tracking 256 targets and operating on an X-band frequency²⁶, it was optimized for small, agile aerial objects. This sensor was tested near Bakhmut at the end of December 2022.



Batch of six UAV-80P anti-drone guns donated by the Troika Telegram channel to the 106th Airborne Division.



Bulat drone spectrometer, presented in early May 2023.

C-UAS lessons, close to the front

Equipment purchased in Russia was preferably handed over to combatants – often enlisted – with experience in electronics²⁷. Drone operators also received these devices, since their control signals attracted Ukrainian attacks²⁸. However, many soldiers received anti-drone guns without prior training. A compromise was sought between the risk of revealing certain procedures or weaknesses and the need to train as many soldiers as possible. Telegram channels, which were followed on the front line, filled this intermediary role, providing instructions on how to operate the equipment.

They described the frequency bands to be jammed when the enemy adopted a new model. They also explained how the equipment worked. The Telegram channel of an *Orlan-10* drone pilot even proposed an exercise to understand the combined use of the gun and the spectrum analyzer²⁹. His message was posted on June 7, 2023, the day before the launch of the Ukrainian counter-offensive, during which very high pace of Ukrainian drone activity were expected.

25. “The ‘Last Judgment’ program has purchased 77 drone detectors,” *Sudoplatov*, Telegram channel (18 July 2023).

26. S. Ptitchkin, “The new ‘Repeinik’ C-UAS radar,” *RGRU* (16 December 2022)

27. I. Gomolskii, “For just 45,000 rubles, you can protect a tank against FPV drones,” *Украина.ру* (28 November 2023).

28. “Report on the Livadia UAS unit,” *XronikaBPLA*, Telegram channel (03 July 2023).

29. “Text for the lucky ones, who were given an anti-drone gun by volunteers,” *Xronika-BPLA*, Telegram channel (07 June 2023).

Learning to jam: recommendations relayed on his Telegram channel by an Orlan-10 drone pilot, to recipients of anti-drone guns (June 7, 2023)³⁰.

“1 - Find an electric charger! Study its parameters, look at the equipment you can plug it into. Store the charger like the apple of your eye [...].

2 - Find an Arinst spectrum analyzer [...]. To check the suppression process: [go to] a field far from the front. The drone operator uses each frequency, so that the anti-drone operator [with the spectrum analyzer] can observe how the signal changes.

3 - Look for as many drones [typical] of the combat zone as possible. Mavic reconnaissance drones, FPV anti-tank drones. The more diverse the “soul-less” aviation, the better. Each time, the signal suppression ranges are recorded in a notebook [...].”

Who to recruit for the Russian C-UAS? Opinion of an EW officer, 200th Motor Rifle Brigade (excerpt from *Ria Novosti* interview, broadcast on October 1, 2023).³¹

“There really aren’t enough specialists. But the army is full of smart people who don’t make themselves known. [...] We have a lot of work to do. There are a lot of educated people, especially among mobilized troops. Our task is to find them and get them to contribute.

We can protect [armor; with electronic warfare], but not forever. Sooner or later, the enemy will start using other drones flying on different frequencies. Our work won’t stop here.

In war, it’s the intellect that works first, not the muscles. The winner will be the one whose brain works the fastest, who has the best personnel, who performs the tasks with the most skill.”

III. Miniature threats and massive challenges: building trust in C-UAS

Operational feedback in 2023: assessing C-UAS credibility

The effectiveness of C-UAS systems can be measured in terms of quantitative and tactical effects, as well as in terms of sustainability: in other words, in terms of the number of drones intercepted, the freedom of maneuver retained and the ability to adapt to evolving Ukrainian equipment.

The number of drones destroyed is hard to tally. Until the end of September 2023, Russian troops in the Zaporizhzhia and Bakhmut regions bore the brunt of the Ukrainian counter-offensive. While the lines generally held, many fighters were iso-

³⁰. *Ibid.*

³¹. I. Gomolskii, *art. cit.*

lated and their actions are largely unknown. In addition, the process for confirming drone destruction remains opaque. Some C-UAS detachments count the wrecked intercepted drones.³², but there is nothing to suggest that this is a general practice. What's more, this process does not take into account aircraft that have fallen into no man's land, or those that have not been found. Despite these uncertainties, on September 22, 2023, the Russian Ministry of Defense declared that its forces had destroyed 7,000 Ukrainian drones since the start of the conflict³³, by all systems, including jamming. The figure was 5,000 two months earlier³⁴. The reality could be quite different: the number put forward by Moscow (less than 1,000 per month) already seems overestimated in relation to the claims of individual units.³⁵

Regardless the neutralization amount, Ukrainian drones did not disappear – on the contrary. Despite capturing dozens of trenches during their 2023 counter-offensive, Ukrainian forces found only one anti-drone gun³⁶. C-UAS equipment appeared to be rare. A Russian anti-drone group was filmed near Vuhledar in a report broadcast on May 31, 2023. The action takes place behind the front lines, on a corridor used by Ukrainian drones. Observing the scene, it becomes clear that the operator of the jammer has been delegated to neutralize his target as soon as it comes within range. Nevertheless, the operator makes radio contact with an official in charge of Russian light drone activity in the area, to avoid any risk of friendly fire³⁷. A minimalist chain of engagement is thus set up in an attempt to ensure that only enemy items are intercepted. However, Russian drone jammer guns are no more than a nuisance to the Ukrainian light drones, which have maintained constant pressure on Russian forces.

Finally, as far as sustainability is concerned, the situation changed in the summer of 2023, when FPV drones³⁸ became more widely used and proved their effectiveness. Similar in size to commercial quadcopters, these models crash into the target with their explosive payload. FPVs target equipment or soldiers with precision, following low-altitude trajectories that make them difficult to shoot down with anti-drone guns. They first appeared in February 2023 and became more frequent thereafter: 75 videos of Ukrainian FPV strikes were released in May, 130 in June and 152 in July³⁹.

32. "Drones intercepted by jamming," *Rustroyka*, Telegram channel (09 July 2023).

33. "Total Ukrainian drones destroyed: 7,000 units," *Pvo VKS*, Telegram channel (22 September 2023).

34. "The official score is 5,000 drones destroyed," *Pvo VKS*, Telegram channel (14 July 2023).

35. A detachment of the Central Military Region, in charge of C-UAS operations in the Zaporizhzhia region, armed with 11 guns, claimed 20 drones in two weeks, at the end of April 2023. As of December 19, Russian claims in the Avdiivka sector, one of the epicenters of Ukrainian drone activity, were 10 quadcopter drones per day; N. Nartiakova, "Destroyed quadcopters were thrown in the garbage," *Samara* (02 March 2023); "Russian forces break through Ukrainian defense in Avdiivka," *Pvo VKS*, Telegram channel (19 December 2023).

36. The capture took place on July 10 in the Zaporizhzhia region. The model concerned is a UAV-80P made in China, whose markings show that it was supplied by the Telegram Troika chain; "Russian anti-drone gun captured by Ukrainian soldiers in Zaporizhzhia direction," *X, Clashreport* (10 July 2023).

37. "With Russian DPR Special Forces Recon & EW Team on Ukraine Frontline Mission," *YouTube* (31 May 2023).

38. FPV for *First Person View*: type of quadcopter drone, flown using virtual reality goggles, originally designed for racing in sports competitions.

39. "Ukrainian FPV Drones Massively Outnumber Russian Ones on the Frontline, What Can Russia Do About it?," *Defense Express* (04 August 2023).

As Ukrainian ground assaults weakened, Russian troop movements near the front become more dangerous. Nevertheless, even though their equipment was delicate to operate, C-UAS operators did not desert the battlefield. A video from October 18, 2023 shows a Russian soldier equipped with a *Stupor*⁴⁰ anti-drone gun being attacked by a Ukrainian drone carrying a grenade. The soldier tries to aim his jammer at the drone, but is unable to raise it high enough. The equipment weighs 5.5kg, and its front-end center of gravity, unlike traditional long-barreled firearms, makes it difficult to handle for soldiers who are dehydrated, malnourished and aching after weeks in the trenches. The weight rises to 10.5 and 8.5kg for the *Garpun-2M* and *-3*, which, on the other hand, are the only models not to suffer from rapid overheating.⁴¹



A Russian C-UAS operator, armed with a *Stupor*, June 12, 2023.



Stuck in Ice: a *Mavic-3* drone found by Russian soldiers, circa March 2023.

Russian operators have also been apprehensive about the side effects of anti-drone guns. A drone pilot, specialized in electronic warfare, offered the following advice on the matter in early March 2023:

“If you work with a [anti-drone] gun once or twice a day, you have nothing to worry about. If you work every day for dozens of minutes, it’s a bad thing.

*You won’t get cancer, you won’t be irradiated, you won’t become impotent. [...] How this will evolve decades from now, nobody knows [...] in any case VOGs [grenades dropped by Ukrainian drones] are clearly more harmful.”*⁴²

What’s more, this recognizable anti-drone equipment made C-UAS operators prime targets. Some were spotted by Ukrainian drone controllers and hit by their FPVs⁴³. In spite of these issues, and despite the fact that they were not causing overwhelming losses to Ukrainian drones, Russian anti-drone guns were retained. To provide some reassurance, for want of anything better, they were deployed

40. “A drone from the 30th Mechanized Brigade attacks an enemy near Bakhmut,” *YouTube* (18 October 2023).

41. “Anti-drone guns in a nutshell: pros and cons,” *Big Camping* (11 March 2023).

42. “How does an anti-drone gun affect a person?,” *XronikaBPLA*, Telegram channel (09 March 2023).

43. “Russian soldier with an anti-drone gun is hit by a Ukrainian FPV drone,” *Reddit* (July 2023); “Rus-soriz drone attack by 47th Brigade,” *Tsaplienka*, Telegram channel (January 2024).

during the Battle of Avdiivka in winter 2023 to cover casualty evacuations⁴⁴ and infantry foxholes⁴⁵. In order to take this city near Donetsk, Russia lined up entire columns of BTR wheeled armored personnel carriers to transport soldiers. These formations suffered heavily against combined attacks from FPV drones and Ukrainian artillery, assisted by light observation drones. New layers of protection are therefore needed.

C-UAS or self-protection jamming: hesitations about future choices

Few changes have been observed in Russian C-UAS operating methods in 2024. Nonetheless, anti-drone guns are increasingly observed among Russian soldier, worldwide, like in Syria⁴⁶. C-UAS efforts are generally appreciated, so much so that in February 2024, the Afrikanskii Korpus PMC (a resurgence of Wagner) went so far as to approach student operators in EW training centers in order to support its operations in the Sahel⁴⁷. Russian State is now more active to provide large amount of anti-drone guns. A batch of 90 of them (all Chinese made), for example, was handed over by the Russian Ministry of Defense to a unit of “Bars” volunteers on December 22, 2023⁴⁸.

This does not prevent Ukrainian light drones from continuing their harassment activity, even at night, when darkness makes them more difficult to detect. In this domain, increasing radar detection capabilities should be one of the main focuses to reinforce Russian C-UAS efforts – in line with Ukrainian practice⁴⁹. The *Repeinik* radar, supported by the Wagner Group in spring 2023, has disappeared. It could be replaced by a new Russian-made model, the *Antidron M-4-01*, which seems to have the backing of the State. Fitted with 4 fixed radiating antennae, it is produced by *Sintezor* and is said to have been engaged on the front line at the end of 2023⁵⁰. Given the moderate pace of production, coupled with saturated order books, these detection systems are likely to remain sparse on the ground in the theater of operations for a long time to come.

44. “Russian troops with anti-drone gun,” *Serhii Flash*, Telegram channel (22 January 2024).

45. “Avdiivka march,” *X, Girkin Girkin* (09 December 2023).

46. “Rusich group combatant with Zala Aero Rex-2 gun in Syria,” *XronikaBPLA*, Telegram channel (01 October 2024)..

47. “Contact for volunteers from V/Tch 61460 center to join Afrikanskii Korpus,” *VK* (26 February 2024).

48. “New equipment for BARS,” *Imperialherald*, Telegram channel (22 December 2023).

49. The British company Blighter announced a “significant” number of its anti-drone radars sold to Ukraine in 2022 and 2023. Similar announcements for this type of product have been made by Polish manufacturer APS.

50. “The new radar that will warn of drone attacks,” *Izvestia* (06 December 2023).



Photo released on October 2, 2024 of a Russian-speaking fighter from the Rusich group in Syria. He is equipped with a small *Zala Aero Rex-2* anti-drone gun.



The *Repeinik* radar was briefly used in spring 2023.

While the quantity of equipment counts, quality remains essential to ensure that it is effective in the hands of the operator. Given the difficulties of forces facing the threat, anti-drone guns are mainly purchased from online platforms specializing in security equipment, with no qualification for military equipment. These sites arouse suspicion, as they are accused of misrepresenting the characteristics of the equipment sold⁵¹. Chinese *UAV-80P* models in particular have been criticized for poor assembly and overheating. In order to rectify this, a wealthy donor – singer Vika Tsiganova – created the specialized workshop 3MKh. She explains:

*“We organize the production of these weapons near St. Petersburg. [...] The construction is Russian, we only buy parts in China. Then we test and evaluate everything.”*⁵²

This Russian variant of the Chinese gun arrived on the front line at the end of April 2023⁵³ under the name “*Airat*”. However, it has made only anecdotal appearances. In addition to quality, the effectiveness of the equipment also determines user confidence. However, drone control frequencies change – particularly for FPV drones⁵⁴ – forcing defenders to jam new bands. Some Russian anti-drone guns, such as the *PARS-S*, have been modified for this purpose. Other models remain unchanged, such as the *LPD-801* or the *Zala Aero-Rex*, but are becoming less and less useful. These

51. For example, online platforms mention power consumption, in watts, instead of radiation power, also in watts, which is the power that can be used against drones. This covers up the under-performance of certain products, misleading the buyer; “Anti-drone guns in a nutshell: pros and cons, comparison chart,” *art. cit.*

52. “Famous singer tells how she takes part in the assembly of anti-drone guns”, *Mosreg Today* (07 April 2023).

53. N. Artiakova, *art. cit.*

54. A. Radchenko, “Barrajiruouchie boepripassi,” *Armeiskii Sbornik* (September 2023): 37. The 2.4GHz frequency was first used for FPV control on both the Ukrainian and Russian sides, before being switched to the 820-960MHz band in summer 2023 (which has remained the standard band ever since). The 1,200 and 1,500MHz frequencies were explored in autumn-winter 2023-2024, followed by the 430 to 520MHz band in summer 2024.

uncertainties have left support groups unsure of what to do in the C-UAS domain, especially as alternatives are emerging.

Other types of protection are needed ahead of the front line. C-UAS is better suited to static defense, with an organized warning and interception chain, than in support of counter-attack movements. However, since the end of summer 2023, Russian soldiers have often gone on the attack carrying a 12-gauge shotgun or portable omnidirectional anti-drone jammers. These practices are not part of C-UAS. In the first case, it's more a case of a degraded all-weapons-type self-defense, with no sensors and no engagement chain. In the second case, jammers prevent any short-range approach from the air. These are often Chinese models, or homemade examples based on Chinese components.

Crowdfunding plays a key role here. The first equipment of this type was delivered to tank crews in August 2023⁵⁵. Models manufactured by Russian industry appeared at Armia-2023. These are the *Volnoretz*, *Sania* and *Triton*. Available for sale online, they were on the front line by Autumn^{56,57}. In a review of deliveries between July and December 2023, the *Dambiev* Telegram group noted that it had stopped supplying anti-drone guns, to deliver 15 *Volnoretz* jammers instead⁵⁸. However, this equipment remains spread, with perfectible characteristics (inadequate power supply, difficulty in omnidirectional jamming) to guarantee absolute security. For the foreseeable future, the light C-UAS should continue to play a role in the Russian forces, complementing other EW systems and kinetic effectors.

To conclude, investing in new technologies to protect against unfamiliar threats is challenging. C-UAS is no exception: the effectiveness of anti-drone guns depends, for instance, on the distance between the light drone and its operator. The further away the operator, the weaker the signal received by the drone and the better the performance of the jammer. Cold temperatures can also reduce battery charge, resulting in degraded performance. Unexpected changes in drone control frequencies also accelerate the obsolescence of these costly jammers. Despite these concerns, Russian C-UAS has continued to expand its systems in Ukraine. Conceptually adapted to fight light commercial drones, it is showing its limitations with the emergence of ultralight FPV-class suicide drones. Other types of protection are therefore needed to enhance the safety of soldiers and their equipment. These may include vehicle-mounted omnidirectional jammers, different types of shotgun or passive measures such as protecting equipment with grid and nets. Although maybe too unsightly to be displayed on parade, equipment protected in this way should have better chance of surviving on the modern battlefield.

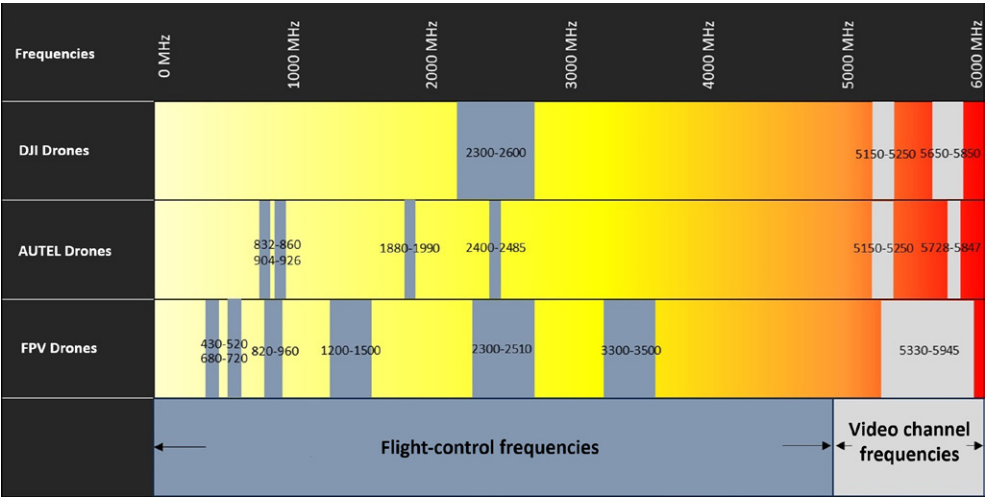
55. "[Homemade jammer for tank operator](#)", *MilinfoLive*, Telegram channel (05 August 2023).

56. "[Testing the Triton jammer](#)", *Zmaps*, Telegram channel (25 November 2023).

57. The *Volnoretz* jammers, effective at very close range, were first seen on the T-80BVM in September 2023, then on the T-90M, T-72B3, BTR-80, an ammunition transport robot, and on Toyota Hilux and UAZ Bukhanka vehicles. The *Triton* jammer was seen on a GAZ Tigr armored vehicle on November 25. Financing was organized in early December to supply one for a group of nurses. The *Sania* was seen on a T-80BVM tank in the Bakhmut sector, around January 16, 2024; "Collection to provide our doctors with a *Triton* jammer," *Aviahub34*, Telegram channel (20 January 2024).

58. "[Procurement overview for Russia's 36th Army](#)", *ChDambiev*, Telegram channel (30 December 2023).

Appendix 1: Ukrainian drone control frequencies, according to Russian EW units⁵⁹



59. “[Ukrainian drone frequency range](#)”, *Rustroyka*, Telegram channel (06 July 2023).

Appendix 2: Drone anti-drone guns for Russian C-UAS: which models, for whom, at what price?

Model	First known appearance in Ukraine	Identified user units	Weight with batteries + Price as of January 2024
<i>Garpun-2M</i> 	May 22, 2022	336th Naval Infantry Brigade⁶⁰ 155th Naval Infantry Brigade 177th Naval Infantry Regiment 31st VDV Brigade	10.5kg €22,000
<i>Stupor PARS-S</i> 	June 7, 2022	- Private volunteers, Vatan group (Bashkiria) - Donetsk drone unit - Private volunteers, Rusich group 5th Tank Brigade (Bulgaria)	5.5kg €4,800
<i>LPD-801</i> 	July 7, 2022	<i>Orlan-10</i> drone operators - Donetsk drone unit 11th VDV Brigade⁶¹ 31st VDV Brigade	4.1kg Between €5,600 and €9,500
<i>UAV80P (Chinese)</i> 	January 18, 2023	- VKS airfield protection squadron⁶² - Wagner 33rd Motor Rifle Regiment⁶³ 106th VDV Division 200th Motor Rifle Brigade 155th Naval Infantry Brigade - Kaskad private military group⁶⁴	5kg €1,200
<i>Airat-100</i> 	June 3, 2023	132nd Motor Rifle Brigade⁶⁵ 31st VDV Brigade⁶⁶	5kg Between €1,650 and €2,000

60. “Anti-drone guns for the 36th Marine Infantry Brigade”, *Rustroyka*, Telegram channel (29 March 2023).

61. “With the ‘Last Judgment’ project, we were able to supply equipment to the 11th Guard Brigade,” *Sudoplatov*, Telegram channel (05 November 2023).

62. “Equipment handed over to VKS,” *op. cit.*

63. “Counter-UAS group of the 33rd Motor Rifle Regiment”, *Mobiki33*, Telegram channel (20 April 2023).

64. “With Russian DPR Special Forces Recon & EW Team On Ukraine Frontline Mission”, *YouTube* (31 May 2023).

65. “Brothers of the 132nd, it is we who thank you,” *Rustroyka*, Telegram channel (03 June 2023).

66. “Gifts for the legendary 31st VDV Brigade”, *Rustroyka*, Telegram channel (04 April 2023).

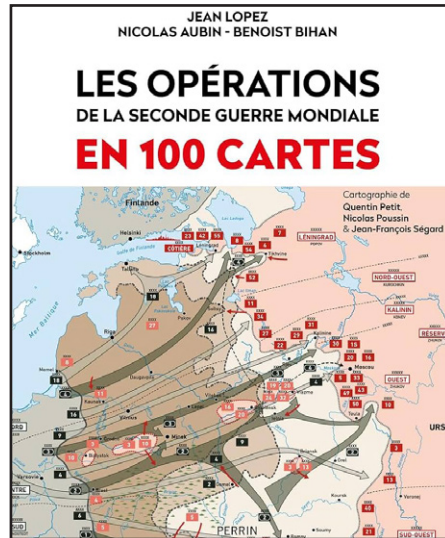
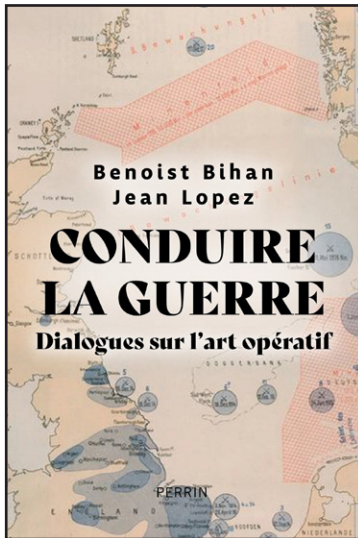
OPERATIONAL ART

A conversation with Benoist Bihan

By Jean-Christophe Noël



Benoist Bihan is a strategist, historian and the director of the Centre d'Analyse et de Prévision des Risques internationaux (CAPRI). He wrote "Conduire la guerre. Entretiens sur l'art opératif" [Conducting War: Conversations on Operational Art] (with Jean Lopez, Paris, Perrin 2023), a topic which he has been working on for the past fifteen years, and "Les opérations de la Seconde Guerre mondiale en 100 cartes" [The Second World War Operations in 100 maps] (with Jean Lopez and Nicolas Aubin, Paris, Perrin, 2024). He is also the editor-in-chief of SPACE International magazine.



In early 2023, you published a 400-page book titled “*Conduire la guerre. Entre-tiens sur l’art opératif*” [Conducting War: Conversations on Operational Art]. This book is built around your conversations with Jean Lopez, who is the editor-in-chief of *Guerres & Histoire* magazine and has written a number of highly acclaimed books about military operations on Europe’s Eastern Front between 1941 and 1945¹. Together, you discussed operational art. In France and in the West at large, we tend to speak of the “operational level of war”. Our approach to operational art revolves around means of integrating tactical effects, which are produced by a variety of factors. Yet, it appears that you view this way of reasoning and proceeding as falling short of the main point.

Indeed, in my book, I examine the nature of the operational art and the different forms it has taken on. I’m not particularly convinced by French or Western practices in this field. In a nutshell, I’d say that operational art shouldn’t look down the chain of command towards tactics, but up towards strategy. What’s more, operational art should not be considered as a headquarters level: what is known in the West as the “operational level of war” actually has very little to do with operational art as a whole.

Your answer, as well as the contents of your book, suggests a number of departures from current practices. In order to delve into the matter, perhaps we could begin with the importance of tactics in the West’s practice of operational art. How would you explain the current state of affairs, one that you seem to view as an anomaly, or even an error?

First, we will need to think back to the early 1980s, when the American military discovered operational art. The concept was originally devised in the 1920s by the Soviet Union’s Aleksandr Svechin – a former officer under the Tsar who joined the Red Army. The U.S. embraced the concept, but soon went on to distort it. What, then, was America’s stumbling point? The core mission of the U.S. Army and its allies was to deter and – if all else failed – to thwart the invasion of Western Europe by the forces of the Warsaw Pact. To this end, the U.S. developed an active defense² concept for the border separating the two Blocs, yet feared it would not be able to hold the front line. The American military believed that the Soviets would launch successive echelons of armored and motorized forces against their positions. This would allow them to penetrate the Alliance’s front line, overrun it and permanently break NATO’s defense system by capitalizing on depth. Broadly speaking, this mas-

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1. Among others: J. Lopez, L. Otkhmezuri (dir.), *Joukov. L’homme qui a vaincu Hitler* [Zhukov: The man who defeated Hitler] (Paris: Perrin, 2013); J. Lopez, L. Otkhmezuri (dir.), *Barbarossa. 1941. La guerre absolue* [Barbarossa – 1941: Total War] (Paris: Passés composés, 2019); J. Lopez, L. Otkhmezuri (dir.), *Les maréchaux de Staline* [Stalin’s Marshals], (Paris: Perrin, 2021).
 2. Published in 1976, the so-called Active Defense doctrine was essentially the U.S. Army’s updated version of German combat methods from the end of the Second World War. Its aim was to defeat a potential Soviet offensive in Europe by gaining tactical superiority during the “first battle of the next war”. The intention here was to foil the opposition’s plan by establishing superiority in combat. Beyond its debatable premise, Active Defense mainly aimed to put “high-intensity” conventional combat back at the heart of America’s doctrine. This shift followed two decades of nuclear strategizing and waging wars against irregular forces – particularly in Vietnam.

sive maneuver, stretching over one hundred kilometers, would be articulated around the Operational Maneuver Group (OMG) – the direct heir to the USSR’s Second World War tank armies and corps. In fact, the latter had become an obsession for American military planners.

Thus, the concept of AirLand Battle was developed as a response. The aim here was to generate joint operations on a tactical level. The Army’s artillery and helicopters would be sent to devastate the rear of the enemy’s first echelon and neutralize its tactical reserves. Meanwhile, the Air Force would be tasked with bombing the following echelons, neutralizing theater reserves and the infamous OMGs – far from the front line, before they could even engage – to break the momentum of the Warsaw Pact’s forces.



General Donn A. Starry, then head of the U.S. Readiness Command (circa 1981). He and General William E. DePuy are considered to be the founding fathers of the AirLand Battle concept.

Source: “[GEN Donn A. Starry](#)”, *Wikimedia Commons*.

This national doctrine was mirrored by NATO’s Follow-On Forces Attack doctrine, which it embraced in 1984. Its aim was to coordinate the actions of NATO air forces on the one hand and land forces on the other, by means of adapted battlefield coordination and planning processes.

Yet, the whole construct that Americans apathetically named “operational art”, or the “operational level of war”, was in fact underpinned by a tactical issue: “what procedures should be implemented to avoid being overwhelmed by the Soviet tidal wave?”

Was France – in its unique position towards NATO’s Command Structure – not affected by these discussions?

Though exchanges had indeed taken place between France and the Alliance since the 1967 Ailleret-Lemnitzer agreements, France remained rather distant. In the event of a “hot” war with the USSR, France’s doctrine was based on nuclear deterrence.

At the time, we wanted our tactical resources to buttress a “last warning” nuclear strategy. We had to show our resolve in the event of an imminent invasion. Our theoretical debates were therefore much more focused on how to deter and – if that failed – how to stop the war as soon as possible, rather than on how to win it. Indeed, the latter would have made little sense had we utilized the nuclear option. Therefore, the proliferation of American doctrinal ideas only affected us indirectly.

Thus, we discovered this debate as late as the 90s, a delay that posed two main challenges. We only had access to the finished version of the documents, but had no understanding of their initial assumptions or biases. More importantly, we were consulting an amended version, built upon the lessons that the Americans had drawn from the 1991 Gulf War.

From the Pentagon’s point of view, the aim was to tactically replicate its achievements in the sands of Arabia and Iraq against any new disrupter that might emerge. Operational art became a technical and technological exercise; a process that aimed to strike one’s adversary dead by optimizing all sources of firepower. Whether it was the infantry, bombers, offshore vessels, artillery or – soon after – drones taking the shots was irrelevant: the objective was to optimize lethal power as much as possible, thereby achieving a sort of joint operation geared towards total annihilation. This was reflected in the slogans and buzzwords that dominated America’s rhetoric at the time: *Rapid Decisive Operations*, *Shock and Awe*, and so on. In France, this approach took on the form of a keen interest in promoting joint operations.

Aren’t joint operations and the ability to optimize firepower both important assets in achieving true superiority on the battlefield?

Of course, I’m not saying otherwise. Yet it seems to me that in this situation, the core issue laid elsewhere. Once again, operational art is not an offshoot of tactics. On the contrary, it must remain relevant to the political and strategic problems at hand. The most important question facing the practitioner of operational art is: “how do I define the goal of my operation so that it brings me closer to the political goal of the war?”

If we set aside politics, the enemy’s nature, their personality and their military goals, our adversary become vacuous. They are reduced to a set of inert, shapeless targets with no will of their own, capable only of being progressively obliterated. War became a technical feat. It was no longer a test of strategic intelligence and, more importantly, it was no longer a dialectical process. At that point, we began to have a real problem on our hands.

After a lengthy introduction, our readers must now be eager to learn your definition of operational art. Are there any particular authors or schools of thought that led you to your current standpoint?

To define operational art, we must first agree on what strategy and tactics are. The art of war is essentially a function of the former, while being largely influenced by the latter. The whole is situated within a bipolar system composed of politics – which

decide whether war is waged and set out its goals – and combat – an act of organized armed violence.

Tactics are the theory of combat. They teach us how to best use each weapon, as well as how to deploy and move units according to their organic make-up – men, weaponry and internal structure – in relation to the adversary and the terrain. In short, it dictates how to combine all of these factors towards achieving a sole objective: winning the battle.

Strategy, on the other hand, is the military conduct of war as a whole. Its underlying question is: “how does one use combat or – more accurately – its results in order to achieve the goals of the war?” In virtue of this core preoccupation, strategy is more turned towards politics.

Svechin summed up this logical divergence in the clearest of ways: “while strategy pursues goals, tactics solve problems.” Operational art emerged due to the dissonance caused by this rift, which affects the proper conduct of war. Combat, in fact, boasts its own form of logic: it aims only for the adversary’s immediate defeat, while paying little attention to the political dimension of war in the moment (quite understandably, since its underlying principle is survival). This difference can even lead to unexpected or unintended results! It is indeed extraordinarily difficult for strategy to – in a sense – steer combat towards achieving political goals. Once the battle has been won, what does one do upon realizing that not a single inch of progress has been made towards resolving the war on a political level?

And this definition would be?

I’m getting there. This is precisely where operational art comes into play. The definition I put forward is the following: operational art is a discipline or branch of the art of war, the purpose of which is to bolster strategy by providing means to serve political goals through combat. This is done by “combining operations for achieving the ultimate goal of the war”. This phrase is the title of a chapter in *Strategy*, in which Svechin lays out his vision of operational art.

To this end, operational art provides a set of tools to enable the Strategist – a theoretical personification of command – to devise and carry out one or more (usually more) “operations”. Each of these operations is a sequence of military actions: combat and maneuvers combined with logistical endeavors. By achieving intermediate objectives, these operations work together to drive the Strategist along a path, the “strategic line of conduct”, which leads them to fulfill goals set out by their Sovereign – i.e. a political authority.

This succinct definition of operational art summarizes the one provided by the concept’s inventor, Soviet theorist Aleksandr Svechin (1878-1938), in his major book *Strategy* (originally titled *Strategiia*) published in 1926. I’d like to draw your attention to the title of the book, which clearly underlines the main branch of the art of war that operational art is intended to serve – i.e. strategy – by resolving the divergence between the logics of strategy and tactics.



Aleksandr Andreevich Svechin in 1923.

Source: W. C. Wilson, C. Blythe, "[A History of Operational Art](#)", *Military Review* (12 November 2018).

Svechin holds two notions as key: the goal and the strategic line of conduct. Could you expand on these concepts for our readers?

For Svechin, the "*strategic line of conduct*" is the logical path that the strategist maps out and pursues in order to achieve the political goals of warfare. Broadly speaking, it is the critical path via which they will attain victory. It is the strategic

equivalent of a navigator's route: not only does it define the goals of various operations; it also establishes the landmarks that will govern their design. Thus, the strategic line of conduct is, quite simply put, the way in which strategy sets out the goals that operational art must achieve. What's more, it can alter these goals in an iterative fashion, not only according to changes in the general context of warfare, but also by factoring in consequences of successive operations.

Though it may be easy to define, the strategic line of conduct is much more difficult to map out! This feat requires a tight-knit combination of political intelligence and military skill. It is the *sine qua non* for operational art to even hope to be effective when relevant goals are not already set out.

Speaking of goals: an operation only comes into being once its objectives are defined. Exceptional circumstances set aside, these objectives always have a limited scope. In essence, if strategy is to pursue the ultimate goal – i.e. the political goal of the war – the strategist must then break it down into limited goals, each of which is achieved through one or more operations. The aim of an operation is generally expressed in terms of its effects on the enemy, or in terms of geography: e.g. defeating a major enemy group – e.g. German Army Group “Centre”, was the aim of Operation Bagration in June 1944 – or capturing a town or region – the industrial basin of Silesia during the Vistula-Oder offensive in January 1945; or the bridgehead in Normandy during Operation Overlord.

In terms of strategy, the goal of an operation can be defined as a given point in the dialectic of warfare, one that enables us to gain an advantage over our adversary. Yet such goals can also sport a more covert political purpose. For example, in 1945, Stalin wanted Silesia to be taken unscathed in order to “donate” it to future Communist Poland. Down the line, however, he was looking to ensure that the Polish working class would be more receptive to Moscow's interests after the war. Another example is the offensives against the Kwantung Army in Manchuria in August 1945. These moves had a military goal (to break Japan's power in mainland Asia) but also a more distant, two-part political objective: to eliminate the army's commanders, who would constitute an undesirable political faction in post-war Japan; and to turn Manchuria into a springboard for Soviet influence in Asia. Thus, each goal was, in and of itself, merely a step in the direction of strategic advancement.

In your view, what processes need to be implemented in order to practice operational art effectively?

More than a process, I would advocate for a state of mind. While military concerns definitely remain essential, they must no longer be confined to combat, doctrine and resources. The key factor here is the way that strategic aspects – i.e. the combination or “nexus” of political intelligence and military talent – are taken into account by headquarters, right down to lower ranks (sometimes even lower than one might expect). As a matter of fact, action itself is driven by the goals and strategic lines of conduct that we have just defined.

The framework of one's overall political intention must take precedence. This intention must be broken down in such a way as to identify not a desired end state (DES) – which bothers me as a concept, as one's so-called ends always include other underlying intentions – but rather increasingly precise, comprehensive, attainable and comprehensible objectives.

Could you give us an example?

If the aim of a given operation is to establish democracy and the rule of law, that's all well and good, but for planning purposes, it is of no practical use whatsoever, as it is not a concrete goal. It remains too vague, subjective and often proves impossible to achieve within a restricted time frame.

Conversely, in the example above, Stalin ordered Silesia to be seized because he anticipated that after the war, Poland would need an industrial basin to develop a working class that could support a strong Communist Party. Of course, we can legitimately question the validity of this rationale: would Polish workers necessarily turn out to be communist pro-Russians? Nevertheless, Stalin's political, strategic and operational objectives were certainly aligned.

That explains why you reject the idea of an operational level of war. Where do you think this idea originated?

It was the American military that developed this idea, according to which there is a special level of warfare, dubbed the operational level, where political considerations have no place and military genius alone can rule.

Once again, it's worth recalling the context in which this concept originated. During the Vietnam War, the American military suffered greatly from the intrusion of politics into its operations, right down to the lowest echelons. Many will recall the need to count the number of Vietnamese casualties, for example, in order to build indicators that would serve the higher-ups. Following the United State's defeat, the military attributed a great deal of the responsibility to this kind of interference. The post-Vietnam military had already been excluded from nuclear-related political decisions. Thus, the military establishment wished to carve out a domain over which it had exclusivity, one in which it could act according to its own principles, without interference. The military was absolutely convinced that it could win the war, since it would finally be free to "do its job" as it saw fit.

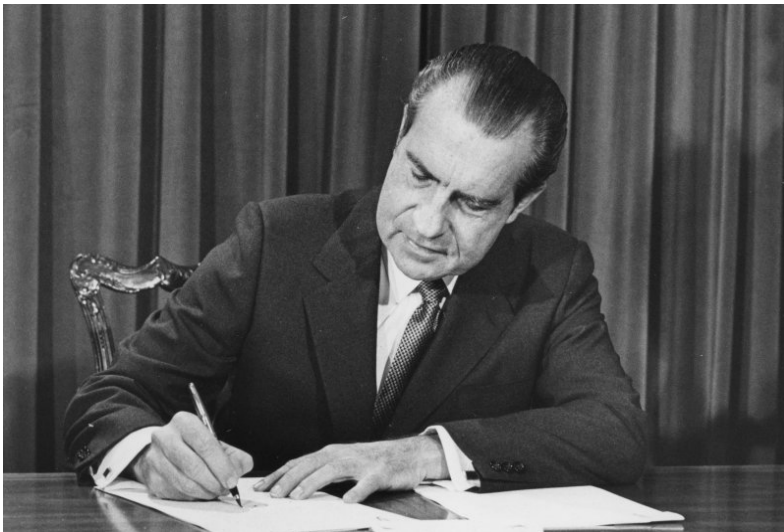
Unfortunately, the military had grossly misread the Vietnam War. It hadn't lost because it was prevented from bombing Hanoi, Haiphong or the North at will, but rather because it was set on protecting a truly unviable State. Setting up teams perfectly versed in operational art wouldn't have changed a thing: the true issue was an unrealistic political goal, one that gave rise to an impossible strategy. In a deeper sense, the "operational level" tries to turn strategy into a "problem to be solved" – in other words, to apply tactical logic to it³ – and that is a dangerous dead-end.

3. Author's note: In *Strategy*, Svechin explains: "While strategy pursues goals, tactics solve problems" (68). Operational art must therefore be geared towards strategic goals, not solving issues generally reserved for a tactician.

Could we say that practicing Svechin-style operational art doesn't necessarily guarantee victory in war? What pitfalls might you pinpoint in this concept?

Operational art offers no real protection against the ideological biases of a State. In any case, this is not its function. However, once a political intention has been formulated, the Strategist can take a more proactive approach, hand-in-hand with their political leader. The former, who works on breaking down goals into concrete military objectives, can regularly ask the latter for clarifications when an obstacle presents itself. The politician is thereby included in an operation's design, i.e. in the sequence of actions required to achieve the goal at hand. The process starts out by going top-down. Only then can it go bottom-up, to ensure that the pieces of the puzzle all fit together.

What's more, military personnel are generally men of action looking to solve the problem at hand. However, it is essential to recognize that some problems cannot be solved, at least not militarily. You can't "solve" a society! The viability of the South Vietnamese state or – in an example that is closer to home – the Afghan state was completely outside the realm of military considerations. It took a form of lucidity or courage to recognize this state of affairs, which Nixon was able to muster regarding Vietnam. Leaving Afghanistan, however, posed other problems, particularly in terms of the political inconsistency of withdrawing, which turned into a debacle in real time, as well as the lack of clarity surrounding the political decision that led to this precipitous withdrawal.



President Nixon on December 30, 1972 announcing the end of the bombing campaign in North Vietnam and the resumption of peace negotiations in January 1973.

Source: "[On This Day: Nixon halts bombing in North Vietnam](#)", *UPI* (30 December 2020).

Our conversation leads me to wonder whether we might be facing a major lexical issue. These days, the word “operation” is a loaded term. Anyone can understand it as they see fit, based on what they’ve read or experienced. This slows down the overall comprehension of the concepts associated with it. Worse still, it may even add to the confusion. In terms of vocabulary, would we need to wipe our current slate clean to better grasp your ideas? Could we perhaps use the word “operatic”?

You’re right; the Soviets went to great lengths to give meaning to their concepts and words – much like philosophers. When operational art was defined, the term came with a cascade of related definitions. From then on, the notion of operations was crystal-clear for Soviet Army officers. We’re a long way from this kind of lexical rectitude in the West, where a company can carry out an operation, but so can an army group.

In fact, in our armies, carrying out an operation means “to act according to a plan”, which is highly reductive. We’re just piling up tactical actions. Operational art is a school of rigor, one that is far removed from the profusion of buzzwords churned out by the Americans. That which is well conceived is clearly articulated, one might say.

You’re also right in that using a different term would have the added benefit of “de-Sovietizing” the concept. There is a strong tendency to associate operational art with Soviet military doctrine. However, Soviet doctrine does not encompass operational art as a whole. It is merely an application – at a given time and in a particular context – of the general principles that Svechin spelled out.

To change the term, we’d have to find one that refers to clear notions and complement it with a full lexicon. It would be a Herculean task! I think it’s more important to start by ridding the concept of the myriad of innuendos and lexical dross attached to it. That’s why I prefer to keep using the term “operational art”.

Your interpretation of Svechin boasts similarities with the famed “Mission Command” principle. According to this principle, which is exclusively applicable at the tactical level, the leader on the front line is tasked with devising the plan to fulfill their assigned goal. Their assessment of the situation is deemed to be indubitably superior, as their position on the ground allows them to seize brief opportunities that distant headquarters would have missed. It is essential, however, that they remain aware of the battle’s overall framework and of their command’s intentions – for the sake of coherence in their actions.

That is a fair comparison, and yes, there are a number of similarities. The notion of *Auftragstaktik* – the original Prussian term, which the Americans turned into their notion of Mission Command a century later – does apply to tactical command, as you pointed out.

The issue that Prussia and others faced in the 1860s was that information and orders were no longer flowing smoothly across ever-expanding battlefields. Thus, von Moltke and his peers decided to cut lower-echelon officers some slack when

engaged in battle. Their reasoning was that commanders on the front-line are the most qualified to understand the situation at any given time, as they are face-to-face with the reality of combat. This allows them to take pertinent initiatives, provided of course – and this is essential – that they remain aware of the commander-in-chief’s intentions and of the overall direction the latter wishes to pursue.

Thus, *Auftragstaktik* embraces the principle of subsidiarity in combat. This principle is effective when applied by officers from educated middle or upper classes, as was the case in Germany. It’s even more effective when combined with the art of tactics, which Germany also mastered. It’s worth noting that, in most cases, when officers begin to follow the manual too closely – due to them not knowing how to use other means – their tactics become predictable, even rudimentary when said officers lack experience. From that point on, failure is assured, whether or not subsidiarity is used in command.

The keystone of operational art, however, lies in dialectics, rather than in the principle of subsidiarity. Why so? As I pointed out earlier, a political leader must interact with his generals. Let us return to the example of the Soviet Union: the *Stavka*, the General Staff of the Red Army, received its orders from Stalin. The representatives of the army’s various fronts – figures such as Konev, Zhukov, Vasilevsky or Rokossovsky – based their plans on his directives in a fairly autonomous manner. Obviously, we’re not talking about tactics here, as the time constraints involved were much less severe and military planners could discuss and exchange ideas. Their plans were then submitted to the *Stavka* and, consequently, to Stalin. This “internal” dialectic was combined with an “external” one; i.e. with the enemy, but also with diplomatic allies, factoring in the constraints the latter involved. This is precisely where the “landmarks” for an operation – to which I referred earlier – come into play. In short, operational art is more closely related to strategy than to tactics, as the latter involves different constraints.

This dialectic doesn’t merely apply to the enemy then. It lies at the heart of the relationship between politics and the military, is that correct?

Exactly. The goals of warfare must be defined in relation to an adversary. Otherwise, we might as well give up right away. Yet this must be followed up by a dialogue between the Sovereign and the Strategist – and I do mean a dialogue, not injunctions. If a politician issues orders that are disconnected from reality, their general could win every conceivable battle, yet wouldn’t be able to prevent a fatal political outcome: we’ve circled back to the essential issue I mentioned regarding the Vietnam War.

Between you and me, operational art presupposes intellectual and moral courage on behalf of military leaders, perhaps even physical courage: when Zhukov dared to stand up to Stalin, he knew that if the situation got out of hand, or greatly irritated his leader, he may well have left the room surrounded by guards to be stood in front of a firing squad within the following minutes, without a second thought from the Soviet dictator.



Joseph Stalin and Marshal Zhukov.

Source: O. Yegorov, "[How Georgy Zhukov, the Soviet Union's greatest military leader, confronted Stalin after WWII](#)", *Russia Beyond* (13 June 2019).

German generals, on the other hand, all bowed to Hitler – despite the image some tried to reflect in their memoirs. They discussed methods, not the aims of operations. Adolf Galland from the *Luftwaffe* is a fine example. Erich von Manstein – who devised the plan to invade France, conquered Crimea and emerged victorious at Kharkov – was no exception, despite what his written work would have us believe. Guderian was the only one to oppose Hitler in any way. The solutions he proposed, however, were no better, as Guderian lacked even the basics of political thought. He believed that the 1943/1944 Red Army had remained unchanged since 1941. Inevitably, it had evolved, far more than the *Wehrmacht* ever could. His strategic proposals became increasingly unrealistic, making him no better than Hitler in this respect.

War has many facets. These include economic, diplomatic and cultural dimensions. Do you view these as being part of operational art?

Your question points to the broader “comprehensive approach” – which is yet another catchphrase. If I may, let me go back to the fundamentals of operational art: it is a military art form, used against an adversary to produce strategic effects. Thus, war is waged through combat, which constitutes the essential means to one’s end. Other players, other areas may contribute. Nonetheless, it is the strategist’s role to handle and interact with these economic and diplomatic factors – among other

things. The role of the politician is to exert influence – on the experts, the various factions present within a government and the different groups seeking to influence the decision – in order to create alignment or embark on a given course of action.

With this framework in mind; it is the military's job to design actual operations. Diplomats, economists and politicians, however brilliant, do not possess this ability. They can, however, intervene as advisors to explain dynamics, to pinpoint the economic, industrial or even moral weaknesses of the adversary. During the Second World War, the Allies made extensive use of such specialists to refine their bombing plans. That being said, their results remain difficult to measure, since analyzing and dissecting a human society is complicated. At any rate, the “scientific” conduct of war is a dangerous illusion.

Operational practices allow the aims of an operation to be materialized into objectives that can be achieved by force. Let's take the example of Silesia: Stalin's goal was political, diplomatic and economic. Konev, as the person in command, then pursued a more geographical objective. Thus, every part of the chain of command – from the Marshal of the Soviet Union down to 2nd Class officers – could spontaneously understand what Silesia meant. They could see it; it was a concrete point on a map.

In my other example of Manchuria in 1945, the underlying goal was once again political, economic and diplomatic. Yet, on the surface, the target was an armed force: the Kwantung Army. Vasilevsky's operation was designed to annihilate this group, in a way that was immediately intelligible to all his subordinates. As you can see, the aim wasn't to bomb perceptions into shape through some psycho-social principle, one that would try to bypass the discontinuity between politics and combat.

On that topic, let's discuss the use of military aviation in operational art. In your opinion, is there a specific aerial strategy upon which we could base a form of aerial operational art?

As a Clausewitzian, my postulate is that the nature of strategy is exclusively singular, or unitary, since it doesn't stem from an environment, but from politics. In my view, there is no such thing as an exclusively aerial strategy, any more than there is a purely naval or land-based strategy. However, while strategy is defined by politics, it can be applied in a number of ways. Some operations may pursue goals that are specifically airborne, while others may be primarily naval. Nevertheless, these are all variations of one strategy. Basically, environment-based logic is technical and tactical, not strategic.

The only “autonomous” air operations I can think of within the framework of an overall strategy are those involving the control of the air. Controlling the air has been essential to all military operations since the First World War. It's no coincidence that Douhet called his book *Il dominio dell'aria* (*The Command of the Air*). Many people tend to forget the importance of air superiority, jumping to the conclusion that it has now been acquired once and for all. Nothing could be further from the truth: the

norm is to dispute airspace and is likely to remain so as we move forward – along the lines of what we’re seeing in Ukraine.

Moreover, acquiring and retaining control of the air involves one or more operations: it’s not an initial state of things, unless there’s no opposition. History is teaming with successes and failures. The Germans failed during the Battle of Britain. Operation Barbarossa – the Soviet Union’s attempted invasion in June 1941 – proved a success for the *Luftwaffe* in the air. Yet its victory was short-lived, as its efforts needed to be sustained after the battle. The same applies to the annihilation of Nazi air forces in the skies over Western Europe in early 1944. The operation was a success, yet required considerable efforts over time in order to be sustained. This is one of the major structural differences between predominantly land-based and predominantly air-based operations. The former exploit space and focus on geography: one penetrates enemy lines to seize and occupy terrain. The latter, however, are more of a long game, as air superiority is a state of mastery that, once achieved, must be maintained over time.

As you pointed out, acquiring air superiority is a difficult task that requires considerable resources. Couldn’t we settle for local air superiority, which might be less satisfying, but easier to achieve from time to time?

This means that the air branch becomes a supporting arm. Plus, its control of the air would be limited in time and space: it would no longer be an “air operation”. But after all, why not? In this field, I’d personally follow the recommendations that Warden provided early on in *The Air Campaign*. I think the air force has an essential role to play in air control and deep interdiction missions. In fact, I believe it is more effective for this type of mission than for fire support.

Are you less enthusiastic about Warden’s advocacy for the strategic use of air power?

Indeed. I don’t believe in his approach regarding targeting in particular. In my opinion, it’s far too broad. The key problem I detect is that one doesn’t win the war when one has decided so. It’s actually the enemy who proclaims our victory, once they decide or admit that they have lost. The issue is that Warden became prisoner of his own five-circle model, which sparked his rise to fame. Once criticism began to mount, he made no attempt to adapt and stiffened his intellectual stance instead.

He’s not the first person to dig their heels in to defend a model they created.

Of course, but he also seemed to present a flaw common to many aviators – especially in the English-speaking world. They have this obsidional complex, according to which other parts of the military are ready to do away with them. Therefore, to survive or defend their independence, they have to prove that the air force can win the war on its own. Plus, if they can also appeal to politicians by claiming that they can win the war while limiting the number of casualties, they’ll have hit the jackpot.

Nevertheless, that is but a pipe dream: war always results in casualties. In 1991, the low number of Coalition casualties during Desert Storm mainly boiled down to

the war's very limited goals. Had it been necessary to go all the way to Baghdad, the cost would, unfortunately, have been much higher.

Well, in the words of Woody Allen: “just because you’re paranoid, doesn’t mean they’re out to get you”! Nuclear power set aside, does air power have any conceivable strategic uses?

I don't believe so. In fact, I think this debate is polluting the field of thought surrounding operational art, as well as the indispensable use of aviation for air control and interdiction missions – which I mentioned earlier. The United States and Great Britain – two liberal powers – are responsible for developing doctrines of conventional strategic bombing in Douhet's wake. Their military approach is infused with rationales based on the development of economic power, as well as maritime power, which spearheaded the economy prior to the 20th century. The ultimate goal here was the abrogation of combat. By superseding the front lines, by striking industry (United States) or the population's morale (Great Britain), they would bring about their adversary's collapse and defeat.

How idealistic! To begin in theoretical terms, relying on morale to win is an overly simplistic interpretation of social sciences. To cut a long story short, Douhet was applying Gustave Le Bon's theses from *The Crowd: A Study of the Popular Mind* (1895) to the military. Le Bon believed that the crowd possesses a “soul”, one that is irrational and can probably be manipulated by force. This hypothesis was simplistic, to say the least.

It's also unrealistic from an operational standpoint. A country's economic potential may collapse, but one would have to strike with deadly accuracy and – once again – maintain and exploit one's advantage over time. What's more, a country like 1943 Germany could adapt and develop its industry underground, beyond the reach of bombs.

Allow me one last try; what about Kosovo in 1999?

Sorry to disappoint you once again, but I don't share the view that the air force was responsible for Milošević's surrender. I believe that the deployment of NATO air-land forces on Serbia's borders, the Belgrade regime's internal political fragility and the fact that Russia diplomatically abandoned Milošević all played a key role. I'd go as far as to say that the decisive factor laid in Moscow. The crisis was settled in a context of diplomacy between superpowers – the United States and the USSR – and during America's “unipolar moment”. At the time, Washington held nearly all of the cards in its hand, even before the first bomb was dropped on Serbia. Now, don't get me wrong: of course the bombings played their role. They were a necessary escalation towards de-escalation.



General Clark (SACEUR) during a presentation on the Kosovo air campaign (1999).

Source: “[1998-1999: NATO Enlarges and Faces Another Balkans Crisis](#)”, *SHAPE official website*.

What kind of aircraft would you say are required for an air force to meet all the criteria of operational art?

In a perfect world, one only selects a tool once a global vision and a clear-cut strategy have been defined, as it helps align one’s interests with one’s vision. Without a clear strategy, all forms of capability-building would prove useless.

That being said, I would tend to favor versatility, so that the air force could respond to as many different situations as possible: I believe this to be the most consistent with France’s ongoing foreign policy, one worthy of a nation with a global role to play – and whose military apparatus must therefore be able to adapt to as many different situations as possible. In the field of aviation, this approach hasn’t always worked out in the past, particularly in the 1930s with the birth of the BCR (Bombardment-Combat-Reconnaissance) program and the soon-to-be outdated multi-purpose multi-seater: the concept was not aligned with the technological means of the time. Things are very different today though. I feel that the Rafale embodies this idea of versatility – if we’re setting aside the fact that only few are actually in service.

Nevertheless, versatility is a quality that should be applied to an armed force as a whole, rather than to each individual device *per se*: sometimes, having two or three different, more specialized models operating in unison really pays off.

Do you have any historical examples of such a force?

The *Luftwaffe* was designed to be a versatile force. Admittedly, they steered clear of heavy bombers, which were too expensive. Yet, a decision had to be made

and they stood by it. From an economic, industrial and doctrinal point of view, *Luftwaffe* leaders preferred to manufacture and operate two twin-engine bombers, rather than a single four-engine bomber. The decision was consistent with their strategic circumstances: prior to 1939, Germany's potential adversaries were France and Poland. The German army planned to fight across a square of 500x500km – 500 km being roughly the distance between Danzig and Krakow, or between Lille and Strasbourg. Flying a four-engine plane across the Atlantic was of no use to them. Flying bombers capable of making the round trip between Frankfurt and Paris (480 km apart), however, made a lot more sense.

What, then, would the perfect doctrine be for an air force practicing operational art?

As I see it, the air force's primary objective is – you guessed it – air control, in order to exploit the airspace in support of operations on the ground or at sea. As soon as its mission strays away from air control, the air force must work towards a goal that is no longer aerial in nature.

Now, we must remain cautious: this does not mean that its operations can no longer feature predominantly airborne components. Two recent examples illustrate this point quite well. The first is Afghanistan, during the 2001 invasion. The bulk of America's military effort was based on air power. The *Taliban* were swept, as American Special Forces provided an interface between the air and their local Afghan allies, allowing for the use of colossal firepower. While some *Taliban* leaders, who were not on the battlefield, had suffered Soviet bombings, new recruits had no such experience. As a result, the *Taleb* regime fell very quickly, its militias having been completely dislocated by this formidable asymmetry in terms of firepower. However, the core aim of this operation was not airborne per se; it was political – yet ill-defined, which explains the West's many setbacks in Afghanistan.

The second example is the invasion of Iraq in 2003. We are all aware of the outcome, which constituted a geopolitical catastrophe. Yet the origins of this tragedy were political, not military. During Operation Iraqi Freedom, air force and ground forces were on equal footing. The former's primary task was to neutralize the enemy. The U.S. Army and the Marines were then tasked with exploiting their adversaries' impairment, by maneuvering around targets locked in by the eye in the sky. The air force proved rather effective, as Iraqi forces retreated into cities to shelter from the bombs. As a result, the heaviest hostilities unfolded in an urban environment.

These examples go to show that, from a tactical point of view, the air force can do most of the fighting and generate the bulk of military effects – albeit in absence of opposition, a fact that shouldn't be overlooked. Nonetheless, these missions weren't air operations in my opinion; they were operations, period. On the flip side, air control can also be achieved with the participation of cruise missiles fired from warships or ground-to-ground artillery. These ships and ground-based weapons would, in that sense, be carrying out air operations, as their main goal would be aerial.

While we're on the subject of air operations, could we perhaps broach some of those that took place during the Second World War through your prism of understanding? I'd be curious to hear how you read them. Let's start with the Battle of Britain.

On the Germans' side, the operation they had designed seemed sound on the whole, at least in its early stages. It was relatively consistent with their pre-war doctrine: the *Luftwaffe* would strive to gain control of the air so as to have sufficient freedom of action for a landing, followed by a ground offensive headed towards London. That being said, the Germans were acting on the fly: while they had long prepared for war against Poland and France, they had not anticipated a conflict with Great Britain. As a result, they were sorely lacking in intelligence regarding their adversary. This led to several critical miscalculations. First, they grossly underestimated the potential of the British aeronautics industry, thereby misjudging the RAF Fighter Command's ability to regenerate its fleet in the midst of a confrontation. Why so? Because the Germans themselves produced relatively few aircraft in 1940, which led them to assume that their adversaries boasted similar capabilities overall.

The second issue related to targeting: the Germans didn't really know what they were bombing. They didn't go after targets that would have proven critical in this "battle" – specifically British aircraft factories. They simply didn't know where most of them were! Instead, they bombed the airfields, hoping to push the RAF away from the beaches selected for Germany's impending landing. Yet, airfields proved to be vastly less significant than factories. What's more, due to this lack of knowledge regarding their enemy, the Germans sometimes focused on secondary airfields and forward bases, instead of targeting the most important airfields: the air bases where Fighter Command HQs and maintenance infrastructures were located.

The third issue involved command. The *Luftwaffe*'s staff was incapable of taking charge of an entire air operation. At its helm, Göring still envisioned air warfare as he did in 1918, when he commanded the *Jagdgeschwader 1*: he thought that neutralizing the enemy's air force was mainly a matter of aerial combat. On the contrary, an air force should be seen as a system, one against which destroying a factory is more effective than waging a hundred dogfights.

From the end of August onwards, this entirely outdated vision became an issue. It ultimately gave rise to the faulty reasoning behind the onslaught against London, which led the Germans towards defeat. These miscalculations were compounded by the fact that the two *Luftflotten* leading the assault on Britain each devised their own offensives and bombing plans independently. This brings us back to the need for an undivided strategy and, by extension, command. Too much subsidiarity can cause serious problems, by letting operators stray too far from the goal of their operation. In summary, the Germans lacked two things: effective intelligence and commanders with a global vision that could be shared with their military planners.

Let's move on to the war in the Pacific. The Japanese used their air force towards building their short-lived empire.

Indeed, the operations leading up to the Japanese advance of 1941-1942 are exemplary in many respects. The Japanese planned effectively and the West completely lacked the resources to counter them effectively. In any event, the Westerners are totally contemptuous of their adversaries, leading them to dangerously underestimate the Japanese. The latter's offensive consisted in a series of landings at various locations in the Pacific. The aim here was to develop a network of air bases. They hoped to use these bases to gain air control over large areas above the land and ocean, allowing them to ward off any threats to their "Co-Prosperity Sphere". Malaysia's defenses collapsed after the landing at Kota Bharu, in the north-east of the peninsula, where the Japanese seized an RAF base. Japan's army air corps moved in, providing cover for the 25th Army as it descended towards Singapore. In Borneo and the Philippines, the Japanese took over or built more airfields, giving them complete freedom of action and preventing Allied counter-offensives. The conquest and occupation that followed proved quite economical in terms of land resources, as Japan's supremacy in the air also allowed its navy to maneuver freely, transporting reinforcements and supplies at will.

Thus, the Japanese relied on broad maneuvers, in which complementary air and naval resources played an essential role. What's more, these resources were superior to those wielded by the Allies, particularly in terms of range – an essential factor in the vast expanses of the Asia-Pacific. Last but not least, aircraft carriers were used to create a true AirSea "operational maneuver group": the *Kidō Butai*'s whirlwind of a journey – from Pearl Harbor to Ceylon, via Darwin and the Indian Ocean – neutralized the American and British fleets long enough to guarantee the offensive's success.

How did the U.S. proceed in order to repel the Japanese?

To emerge victorious in the Pacific, the Americans needed to control the sea and move up towards Japan. To do so, they had to retain control of the air. This led them to draw the same conclusion as the Japanese: in this region, they had to have aircraft carriers (but even the U.S. Navy didn't have enough at the start of the war) and seize air bases (and thus retake at least some of the positions that had fallen into Japanese hands). The use of air power was key for America's plans. The goal was to impose a strategic blockade on Japan, by sea and by air, in order to suffocate and defeat the nation – though initially, the end-of-war strategy wasn't so clear-cut.

To save resources – once they had caught on to the fact that they could in turn deny their adversary freedom of movement by regaining air control – the Americans decided to practice what they called "leap frogging": exclusively seizing positions that were necessary to establish air bases, which would then neutralize isolated Japanese garrisons without needing to storm them. These strategic bases were repeatedly bombed, literally starved, denied supplies and overrun by land and sea. The amphibious blockade and neutralization of the large Rabaul base – between the summer of 1943 and early 1944 – constitutes the finest example of this strategy.

The air forces played a leading role, backed by submarines that cut off all connections to the sea. Nevertheless, the air force's actions were very much part of an overall operation. America's main offensive in the central Pacific was based on – and greatly sped up by – the same rationale: hit strategic points, isolate the others. The Japanese system proved to be more fragile than expected, particularly due to different bases not being able to support each other, by sheer lack of air power.

We can now return to our current issues. What does the future hold for operational art?

Today, we often mix up operational art and Multi-Domain Operations (MDOs). I believe we're making the same mistake we did after the First Gulf War. In this context, operational art is reduced to the level of integration, one that has become "multi-domain" rather than "joint". It merely boils down to setting up the best possible C2 (Command & Control) to create synergies between submarines, satellites, cyber-attacks, bombers, etc. If it's feasible, that's all well and good. Yet, the same question remains, one to which MDO provides no answer: "what for?" To me, multi-domain logic sounds like another case of "problems to be solved": it is a tactical and technical pursuit, not an operational one.

Will artificial intelligence bring about added value in the field?

Operational art must be distinguished from the technical and technological context in which it is implemented. In my opinion, the true added value of operational art lies in mastering the conception of operations, under and in service of strategy and, ultimately, of the political goal of the war – it is not a mere technique to be used by military staff.

If AI partially replaces military staff by proposing a plan or options, will we see any progress? I don't think so, because – besides the fact that we are often mistaken about what AI is and what it can do, it seems to me – the truly crucial factor here is that the strategist must have a clear vision, be able to identify their strategic course of action and break it down. Generally speaking, war is fought between humans and, in the end, what really counts is convincing your opponent that they have lost. I don't think a machine can do that. Thus, humans still have a huge role to play in the practice of operational art and strategy, as we are able to answer truly fundamental questions: "who are we?" and "what do we want to achieve?"

Foreword: Operational Design

Philippe Gros

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In this foreword to Jeffrey M. Reilly's article, it is worth recalling the origin and nature of Operational Design (OD). In a nutshell, it is a planning method for "distilling clarity from complexity for decisive action¹."

Originally dubbed Systemic Operational Design (SOD), this method was developed by General Shimon Naveh in 1995 at the Israeli Defence Forces' Operational Theory Research Institute (OTRI). The US Army's Training and Doctrine Command (TRADOC) adopted the concept as an alternative to Effects-Based Operations (EBOs). EBOs consist in planning and conducting operations in order to achieve set military objectives, by precisely defining the effects to be wrought upon one's adversaries – who are thereby viewed as a "system of systems" – before determining the actions and tasks required to achieve said effects. The concept was later renamed "Effects-Based Approach to Operations". The latter was devised and promoted by the US Air Force and was soon incorporated into targeting cycles. At joint level, it was also used – in a different manner – by the US Joint Forces Command (USJFCOM), which handled the transformation of US forces and the joint level until 2011. However, the Army and Marines found this method "too prescriptive", that it "assumes a level of unachievable predictability", that it

1. J. M. Reilly (PhD) *Operational Design: Distilling Clarity from Complexity for Decisive Action*, (Maxwell AFB: Air University Press, August 2012)

“cannot correctly anticipate reactions of complex systems”, that it “leads to micro-management”, etc. – as summarized by General Mattis, who ordered USJFCOM to renounce the concept’s usage in 2008².

Thus, TRADOC adapted the SOD method and its terminology – which was initially rather abstruse – to the Future Force’s conceptual corpus (Pamphlet series 525), as part of the Commander’s Appreciation and Campaign Design (CACD)³. A large portion of this work’s intellectual added value is owed to the Center for Application of Design, hosted by Booz Allen Hamilton. The center namely employed Shimon Naveh, retired General Van Riper and retired General Huba Wass de Czege – the main creator of the Air-Land Battle doctrine adopted by the US Army in 1982 and TRADOC’s School of Advanced Military Studies (SAMS)⁴. The concept of Operational Design was finally adopted on a joint basis in 2011⁵, before being incorporated to the US’s Joint Publications and army doctrines⁶. It would soon be added to NATO’s *Comprehensive Operations Planning Directive* (COPD) and AJP-5. In the United States, Operational Design was rapidly implemented by combatant commands⁷ with varying degrees of success.

In the context of these doctrines, Operational Design is presented as the methodological crucible of “operational art.” In concrete terms, it is a method of reasoning that is complimentary to the operational planning process – one that ensures “the conception and construction of the framework that underpins planning⁸.” The precise definition of OD may vary from one document to another. For example, the US Army uses a four-part framework, while Joint-Pub 5-0 uses a nine-step method. For the sake of simplicity, we shall stick to the Army’s four-part framework, which consists in:

- Understanding the strategic direction set forth at the political level, as well as the relationship between “ends, ways and means” from which one derives a military Desired End State (DES),
- Understanding the strategic and operational environment from a systemic standpoint (i.e. taking into account both the observed and the desired system), with support from Intelligence Preparation of the Operational Environment (IPOE),

2. J. N. Mattis, “USJFCOM Commander’s Guidance for Effects-based Operations,” *Parameters* Vol. 38, No. 3 (2008).

3. Pamphlet p. 525-5-500, “Commander’s Appreciation and Campaign Design,” *Capabilities Integration Center* (28 January 2008).

4. For example: K. C. Davison, “Systemic Operational Design (SOD): Gaining and Maintaining the Cognitive Initiative,” *School of Advanced Military Studies, United States Army Command and General Staff College*, Fort Leavenworth, Kansas (May 2006); V. J. Delacruz (Major), “Systemic Operational Design, Enhancing the Joint Operation Planning Process,” *School of Advanced Military Studies, United States Army Command and General Staff College*, Fort Leavenworth, Kansas (20 May 2007).

5. *Planner’s Handbook for Operational Design Version 1.0*, Joint Staff, J-7 Joint and Coalition Warfighting, Suffolk, Virginia (07 October 2011).

6. For example: C. E. Lemay Center for Doctrine Development & Education, “Operational Design Fundamentals,” *Air Force Doctrine Publication (AFDP) 3-0, Operations And Planning* (4 November 2016).

7. *Design and Planning Insights and Best Practices Focus Paper*, Deployable Training Division (DTD), Joint Staff, J7 (July 2013).

8. *US Joint Staff, Joint Publication 5-0*, Joint Planning (1 December 2020): GL-11.

- Defining the strategic and/or operational problem to be solved, by identifying the disparities and tensions among the different players' objectives, the obstacles for achieving one's desired military end state, as well as the opportunities to be exploited. This also involves establishing certain assumptions,
- And finally, determining the required operational approach. This provides a basis upon which to build a course of action.

OD constitutes a break with the past in several ways, by emphasizing the need for "creative and critical thinking." It proposes a genuine heuristic approach, capable of addressing the complex and "ill-structured" issue that underpins all forms of strategy. In decision-making theory, OD embodies a perfect example of the "constructive approach", according to which the decision-maker devises their own rational model, by engaging in a learning process that is consistent with decision-making procedures. This approach is already widely used in the corporate world⁹.

Nevertheless, OD is nothing more than an evolution of previous planning methods, insofar as its conceptual toolbox (i.e. the "elements" of OD) remains largely unchanged. It includes all of the following notions: objectives, military end state, centers of gravity, effects, culminating point, lines of effort and lines of operation, decisive points, direct and indirect approaches, force employment mechanisms (i.e. defeat and support mechanisms), operational reach, arranging operations (including phases, branches and sequels), and so on. In light of its operational nature, OD's evolutionary origins become self-evident: the many examples proposed in the literature constitute no more and no less than a course for action, extending right down to decisive effects and conditions, while tasks and actions themselves fall by the wayside. In fact, one analyst rightly pointed to a contradiction between the method for understanding the environment and framing the problem to be tackled, on the one hand, and the method for developing an operational approach – which remains causal and mechanistic¹⁰ – on the other. As a matter of fact, proponents of these methodological approaches still engage in heated debates¹¹.

Finally, when it comes to implementation, this approach boasts several variations. In US doctrines, the OD process is separate from the operational planning process (the Joint Planning Process, and the Military Decision-Making Process in the Army), though both remain symbiotic. Within NATO, OD is an integral part of the operational planning process.

Thus, OD will undoubtedly continue to evolve, particularly in view of the newfound prominence of high-intensity warfare and strategic competition between great powers.

9. Confer A. Tsoukiàs, "De la théorie de la décision à l'aide à la décision," [From decision theory to decision support] in D. Bouyssou, D. Dubois, M. Piriot, H. Prade, *Concepts et Méthodes pour l'Aide à la Décision* [Concepts and Methods for Decision Support] (Paris: Hermès, 2006), available at <https://www.lamsade.dauphine.fr/~tsoukias/papers/chat01v02.pdf>.

10. R. Erdeniz, *Military Operations Planning and Methodology: Thoughts on military problem-solving*, Licentiate thesis in Philosophy and Military studies, KTH Royal Institute of Technology, Swedish Defence University, Stockholm (2017).

11. C. Mercalf (Colonel) (ed.), *Campaign Planning Handbook* (Academic Year 25, US Army War College, 14 August 2024).

OODA Point: Professional Military Education's Crisis in Producing Strategic Thinkers

Jeffrey M. Reilly

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“Our military officers, including our junior officers, are conducting not just joint military operations, but inter-agency and international operations, as well. Are our officers prepared for these real challenges of today? Not only at the tactical and operational level, but are we developing a cadre of grand strategists able to navigate the uncertain waters for tomorrow's geopolitical struggles?”¹

Professional Military Education (PME) in the United States is at a critical inflexion point. Over the past two decades, a rapidly changing digital ecosystem has created a security environment where the sophistication of quantum, directed energy, nanotechnology, and hypersonics are eclipsing the normal capacity to predict their effects on strategy and maneuver warfare. Today, military forces must contend with dynamic targeting, bistatic and multi-static passive detection, space based hyperspectral imagery, and a host of other evolving challenges. Although the world has undergone dramatic technological changes in the past, we are still only in the nascent stages of understanding the full impact of evolving advanced technology on future military operations.

Additionally, advances in technology are dynamically changing all previous notions of domain synchronization, battlespace, and maneuver. The impact of this manifestation is fostering a compression of planning, decision, and execution (PDE) cycles that is metaphorically known as OODA point.²

1. United States House of Representatives, Subcommittee of the Committee on Armed Services, “[Another Crossroads? Professional Military Education Twenty Years After the Goldwater-Nichols Act and the Skelton Panel](#)”, HASC publication, No. 111-67 (20 May 2009).

2. C. Down, M. Ryder, “[Rethinking reflective practice: John Boyd's OODA loop as an alternative to Kolb](#)”, *The International Journal of Management Education*, Vol. 20 (3). OODA refers to Col John Boyd's observe, orient, decide, act loop decision cycle.

Unfortunately, these changes in advanced technology have coincided with a large number of harsh critiques in the United States about PME's capacity to produce strategic thinkers. These critiques have been levied not only by senior general and flag officers, but also by the civilian leadership within the Senate Armed Services and House Armed Services Committees. One of the strongest voices criticizing PME was former Secretary of Defense, General (ret) James Mattis who personally identified PME as "stagnated" in the United States 2018 National Defense Strategy.³³ The significance of this characterization is the perception that the military is not being adequately educated to meet the ever-changing characteristics of war.

Almost eighteen years ago, however, the United States Air Force's Air Command and Staff College began a grass roots experiment to reinvent PME and examine future maneuver concepts. The experiment has been far from perfect, but the lessons learned from this experiment are beginning to shape the future of PME. This article charts the successes, failures, and lessons learned of what is today known as the Joint All Domain Strategist program.

The Ops Design Genesis

In 2006, six students and one faculty member began a once a week, three-month research elective focused on the future of warfighting. The theory the students and faculty explored was cross domain operations. However, instead of a three-month elective, the students and faculty member decided to stay together all year and develop a theoretical six domain construct that they believed would form the foundation for future maneuver. The construct envisioned six interrelated domains (electromagnetic spectrum, space, air, land, maritime, and human) designed to exploit complexity, speed, and precision. The focus of the construct was maneuvering in deliberate combinations of domains to destroy an adversary's interdependencies between the domains and cause the collapse of the adversary's system.

The next academic year (AY), the elective doubled the number of students and concentrated on design, senior level decision making, and risk analysis. During this AY the students and faculty devised ways to leverage different forms of operational design to create vision for planning. Operational design is the intellectual framework that underpins the joint planning process (JPP) and the execution of campaigns and operations. It provides a logical structure to analyze the operational environment, identify problem sets, and create a cognitive map for understanding the entirety of an operation. Although the concept of design has existed for many decades in the United States, the structural elements of operational design did not begin to crystallize until the 2005-2006 timeframe. The reason for this is the wars in Afghanistan and Iraq had exposed a crucial vulnerability in the traditional planning process. This vulnerability involved a commander's ability to create comprehensive vision and identify critical planning insights in a plan that would otherwise go unnoticed. Much

3. US Government Accountability " [Office Professional Military Education, Programs are Accredited, but Additional Information is Needed to Assess Effectiveness](#) ", (February 2020).

of the original work on operational design emanated from Israeli Brigadier General (ret) Shimon Naveh's concept of systemic operational design (SOD).

As Naveh's work was being studied, another emerging concept was introduced to the United States military. This concept was effects-based operations (EBO). After faculty and students investigated SOD, EBO, and systems theory, they discovered systems theory provided operational design with an advanced means to not only create vision, but also project the effects of actions on the entirety of a system. Additionally, it provided a methodology beyond EBO's capacity for deliberately changing the structures in an operational environment to manipulate an adversary's decision-making. This innovation led to an operational design concept that bifurcated the environment into observed and desired systems to gain greater fidelity in forecasting second and third order effects and in identifying short, intermediate, and long-term problem sets. The resultant process also established a cognitive map methodology that used problem sets to graphically depict lines of operation and decisive points in a manner that made branches, sequels, and key decisions visible.

In conjunction with this, the faculty developed decision support matrices that provided commanders explicit operational decision criteria, analyzed the adversary's reaction to decisions, and examined the risk of decisions in terms of how to mitigate risk, and the residual risk after mitigation. In the ensuing years, the elective continued to flourish and in 2012 produced a monograph *Operational Design – Distilling Clarity from Complexity for Decisive Action*. This monograph is the single most published Air University book by and has been used as a framework for guiding combat operations by leaders in the US Joint Special Operations Command.

In spite of this series of successes, however, the elective completely collapsed in 2013. The cause revolved around several key issues. The elective expanded from 24 students and three faculty to 82 students and 10 faculty whose primary teaching responsibilities were in other teaching departments. This rapid expansion of students and faculty created an environment that made coordination between teaching departments, faculty preparation, and curriculum development untenable. The student and faculty surveys on the elective were the absolute worst in the entire college. A board was officially convened to determine why such a popular and effective elective had utterly failed. The senior faculty member for the elective offered his resignation to the Dean and Commandant of the college. The Commandant, Brigadier General Thomas Deale, refused the resignation and instead directed the faculty to regroup and accept more risk.

What ensued after the 2013 failure was a complete reexamination of PME. The student population was reduced to 24 and the number of faculty was two. The faculty initiated a thorough examination of andragogical approaches to professional military education. The pathway selected was outcome-based education. During the next three years the faculty conducted a number of interviews with a wide variety of senior leaders. These leaders included: General Denis Mercier, Supreme Allied Commander Transformation NATO; Lt Gen Michael Short, Combined Force Air

Component Commander for Operation Allied Force; General Helge Hansen, former Commander of NATO's Allied Forces Central Europe; Lt Gen Timothy Evans, Commander Allied Rapid Reaction Corps; and 68 other senior military leaders from around the world. The intent of the interviews was to determine the outcomes senior leaders expected of intermediate and senior level PME graduates. The results fell roughly into four categories in which graduates are able to:

- Develop and recommend solutions to ill-defined problems at the operational level of war
- Formulate strategic and operational approaches and lead the Joint Planning Process (JPP) at the working group level
- Plan and execute joint all domain operations to counter future threats in contested and degraded environments
- Anticipate, adapt, and respond to surprise and uncertainty in complex environments

In addition to these outcomes, JADS graduates must meet the Chairman's Joint Chiefs of Staff (CJCS) Desired Leader Attributes, National Defense Authorization Act requirements, and special areas of emphasis directed by the Military Education Coordination Council and the CJCS Officer Professional Military Education Policy (OPMEP).⁴

JADS 2.0: Theoretical Aspects

Based on the four outcomes and CJCS directives JADS designed an entirely new approach to PME. The theory selected to guide JADS approach was Framework Theory. This theory exposes students to several core theories and places them in different real world operational environments to solve wicked problems.⁵ The foundation of this style of education emanates from Jean Piaget's theories of assimilation and accommodation.⁶

The students are first introduced to assimilation where they use pre-existing schema to understand new knowledge. Once the students have a solid comprehension of this process, the focus becomes accommodation. In contrast to assimilation, accommodation is the process of using new information from the environment and altering or creating new schema in order to understand the new information. The transition to accommodation assists students in combining different parts of theories and concepts and developing creative processes to provide solutions to complex problems.

4. Officer Professional Military Education Policy (OPMEP) defines CJCS objectives and policies regarding the educational institutions that comprise the officer professional military education (PME) and JPME systems. The OPMEP also identifies the fundamental responsibilities of the major military educational participants in achieving those objectives. The current OPMEP is CJCSI 1800.01F (15 May 2020), available at https://www.jcs.mil/Portals/36/Documents/Doctrine/education/cjcsi_1800_01f.pdf?ver=2020-05-15-102430-580

5. H. W. J. Rittel, M. M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, No. 2 (1973): 155-169.

6. J. Piaget, *The Origin of Intelligence in the Child* (New York: Routledge & Kegan Paul, 1953).

In accordance with the Cynefin framework, problems exist in four basic categories. Those categories are simple, complicated, complex, and chaos.⁷ The students are introduced to each of these categories as they progress through the curriculum and are exposed to different operational problem sets. Additionally, they are taught how and when to use the theories of reductionism and systems theory. René Descartes's theory of reductionism is present in some form of every academic discipline. One form is methodological reductionism that attempts to reduce explanations to the smallest possible entities to understand a problem. By the time most students reach intermediate level education they have a very good comprehension of reductionism.

However, most students have not been exposed to the deeper explanations of systems theory that exist in works such as Karl Ludwig von Bertalanffy's *General System Theory*.⁸ Systems theory teaches students the interrelationship of actions. When the military takes an operational action, that action affects a series of micro, macro, and exo-systems and military planners and operators must assess the possibilities of those effects on the systems. The intent is to understand the possible effects and change the structures in the operational environment to proactively shape the adversary's reaction in the form of reflexive control.⁹

The ability to convey these concepts requires a deliberate analysis of instructional methodology. As a result of this, one of the core revisions of the 2013 failure was instructional methodology. In graduate level liberal arts education, the Socratic teaching methodology is almost always preferred. It is an excellent process to dissect readings and enhance facilitated discussions.

However, when this methodology is used in professional education learning is primarily limited to the lower levels of learning Bloom's Taxonomy. In 1956, Benjamin Bloom and his colleagues published a set of hierarchical models used to classify educational learning objectives into levels of complexity.¹⁰ As a result of this analysis, JADS changed instructional approach to focus on application, analysis, and higher levels of learning. Only 10% of JADS's instructional methodology is dedicated plenary sessions and Socratic style seminars. Students are given an overview of a theory, placed in a scenario setting, and directed to apply the theory. Instructors are present during the application, however, they only intervene when absolutely necessary. As can be expected, students are highly resistant to this style of instruction, but the confidence and problem solving skills students gain through this repetitive process is markedly different from the Socratic style.

7. D. J. Snowden, M.E. Boone, "[A Leader's Framework for Decision Making](#)", *Harvard Business Review*, No. 11 (2007): 68-76.

8. K. L. von Bertalanffy, *General System Theory* (New York: George Braziller, 1969).

9. T. Thomas, "Russia's Reflexive Control Theory and the Military," *The Journal of Slavic Military Studies*, No. 2, (2004): 237-256.

10. B. S. Bloom, "Taxonomy of educational objectives: The classification of educational goals. Vol. Handbook I: Cognitive domain," in M. D. Engelhart, E. J. Furst, W. H. Hill, D. R. Krathwohl (eds.), *Taxonomy of Educational Objectives: The Classification of Educational Goals; Handbook I: Cognitive Domain* (New York: David McKay Company, 1956).

The revisions JADS has initiated since 2013 have transformed the educational model and the quality of its graduates. Today, JADS is a selective, year-long advanced program specializing in developing leaders who understand the employment of joint all domain maneuver to counter future threats in highly contested and degraded environments.

The curriculum focuses on improving critical thinking and problem solving skills at the operational level of war. It prepares selected students for future operational and command assignments requiring advanced knowledge of the capabilities, methods, and challenges associated with operations within and across six domains (electromagnetic spectrum, space, air, land, maritime, and human). Additionally, students study and apply strategic and operational design, reflexive control theory, aggregation theory, decision making theory, and risk analysis.

JADS 2.0: How does it work?

Students must volunteer for the program by submitting their Single Unit Retrieval Format (SURF) or Officer Record Brief (ORB) which provide an overview of their assignments, education, awards, and demographic data. In addition to this each student must submit a one- page summary of what they are going to contribute to the program and possess a Top Secret-Sensitive Compartmented Information (TS/SCI) security clearance. In a typical year, 100-150+ students will apply for the program and a board of officers selects 60 students comprised of all Services and civilians from the Department of the Air Force and inter-agencies. In accordance with the 1986 Goldwater-Nichols Act and its provisions on joint professional military education (JPME), each seminar must have a minimum of one soldier and either a Navy or Marine Corps officer. The student body is divided into four equal seminars each with a wide diversity military and civilian expertise.

The JADS curriculum encompasses 30 Credit hours of graduate level courses consisting of seven core courses plus leadership and research. The program is accredited to award a Master's of Operational Art and Science and JPME Phase I credit. The seven core courses are Theoretical Frameworks, Global Integrated Operations, All Domain Maneuver, Operational Approach, Air Power, Global Strike, and Multi Theater War. All courses include nuclear deterrence/nuclear weapons employment, the electromagnetic spectrum, cyberspace operations, space operations, and human domain operations. Additionally, all courses and classes are red vs. blue teams and students rotate between red and blue teams every course.

The curriculum is executed as a deliberately integrated curriculum where information presented on day one of the course is equally as important as the last day of the program. JADS students move very rapidly from the understanding level of education to application, analysis, evaluation, and creation. To do this successfully requires a multi-disciplinary approach that exposes students to not only planning and operations, but also subjects such as political science, economics, geography, demographics, machine learning, augmented intelligence, and psychology. JADS

values and uses the discipline of history to provide illustrations and lessons learned. However, history is not the core discipline or focal point for the program. The primary reason for this is the potential for students to think that the lessons learned from a particular campaign can be automatically leveraged in a similar campaign. In the words of Sir Michael Howard, “History does not repeat itself, historians repeat one another.”¹¹ Additionally, the focus for JADS is how to create the foresight necessary to meet the demands of radically changing characteristics of war.

Theoretical Frameworks

As a result of this, the curriculum begins with a Theoretical Frameworks course. This course introduces students to theories and concepts for solving complex problem sets that will emerge during the decade 2025-2035. Students are introduced to Thomas Kuhn’s *The structure of scientific revolutions* and are then asked to apply the formulation of paradigms to concepts such as joint all domain operations.¹² The course also instructs students on design theory to create vision and foster innovation, as well as systems theory to ensure proposed solutions are comprehensive.

The vehicle used to assess students’ progress consists of a series of practicums and papers written in executive style. Students use executive style writing versus traditional argumentative essays to develop a precise writing style for senior leaders. The executive style format used in JADS is a very clear and concise bottom line up front followed by description of how that assessment was derived. Students then present relevant counter arguments and conclude with their final argument and recommendations. Analysis of counter arguments is an essential ingredient of JADS. It teaches students to think through complex problem sets in an objective and holistic manner. This also assists them in preparing senior leaders for interactions with Congress, the press, and provide cogent explanations to allies and other Services.

The Theoretical Framework course concludes with an examination of classic coercion theories. Students read works by Schelling, Brodie, Pape, and Jervis to develop a deeper understanding of coercion, deterrence, and compellence and the correlation to cost imposition. This framework provides a bridge to the next course Global Integrated Operations.

Global Integrated Operations

The Global Integrated Operations course teaches students to develop and employ an advanced strategic design process to create long-term strategies that guide policy formulation and execution. Students are taught to examine complex problems in terms of developing an observed system model, forming an understanding of the desired system, identifying problem sets, and creating a comprehensive design vision for implementation. Additionally, students learn to use strategic design products to communicate effectively with the interagency and international organizations.

11. M. H. Esq. M.C., M.A., “The Use and Abuse of Military History,” *Royal United Services Institution. Journal*, No. 625 (1962): 4-10.

12. T. S. Kuhn, *The structure of scientific revolutions* (Chicago: University of Chicago Press, 1962).

During the course students develop and recommend strategic response options to senior leaders that are aligned with short, intermediate, and long-term strategic objectives. In addition to this, the course educates students to identify and recommend global level asymmetric options in all domains to deter adversaries and if deterrence fails, gain positional advantage for the defeat of the adversaries.

All Domain Maneuver

After completing the Global Integrated Operations course, students begin a pre-requisite that prepares them for them for a follow-on Operational Approach course. The pre-requisite is All Domain Maneuver. This three-week course introduces students to mission analysis, the five- paragraph field order, and most importantly how to maneuver within six domains (air, land, maritime, space, electromagnetic spectrum, and human). Based on a real-world operational scenario, students apply maneuver concepts in each of these domains separately and at the culmination of the course synchronize all of the domains to destroy the interdependencies within an adversary's system.

At the conclusion of the course, students are expected to demonstrate the fundamentals of maneuver in air, land, and maritime domains. They are also required to plan offensive and defensive space maneuver and develop cyber logic maps in support of air, land, and maritime operations. Additionally, students are exposed to dynamic bandwidth allocation, maneuver within the electromagnetic spectrum, and how to employ a human domain taxonomy to deter, compel or leverage suasion. The foundation established by the All Domain Maneuver course prepares students for the Operational Approach course and the employment of key operational level concepts.

Operational Approach

The Operational Approach course guides student through an extensive examination of integrating operational design into the joint planning process (JPP). Based on an operational scenario, students develop strategic and operational designs, execute the JPP, wargame an approved course of action (COA), determine preplanned and emergent opportunity decisions, and conduct risk analysis for an operational level commander. The students then develop a written concept of operation (CONOP) for phases I and II of the operation and wargame the CONOP. During the preparation for the wargame, the students use an internal red team to inform their planning, however, when they wargame they compete against a red team from an entirely different JADS seminar.

Although the wargame assists students with refining their operational maneuver, the wargame also helps students to identify pre-planned and emergent opportunity decisions. These decisions are then translated into decision support matrices (DSM) that capture named areas of interest, target areas of interest, the event that causes the decision, explicit warning order and execution order decision criteria, and combined joint task force actions. The DSM also identifies the adversary's possible assump-

tions when the friendly decision is executed, the adversary's possible decisions, and the adversary's commander's critical information requirements (CCIR) related to their decisions. The students then assess the adversary's CCIRs and refine friendly operational security, deception, and reflexive control. Based on the assessment of the friendly and adversary decision framework, the students are then expected to provide a risk analysis. The minimum analysis requirements are a clear statement of what the risk is; the impact of the risk on the mission; the probability of the risk occurring; how to mitigate the risk; and the residual risk after mitigation. In conjunction with decision analysis, students refine their logistics and command and control concepts in support of the CONOP. Once students have demonstrated a proficiency at conducting operational maneuver they transition their focus to Airpower.

Airpower

The Air Power course concentrates on the application of air power within a combined joint task force (CJTF). Based on an existing classified theater-level operational plan, the students develop a supporting air component plan using the joint planning process - air (JPP-A). This plan must incorporate agile combat employment (ACE), provide an air component-level design, include wargame information from the approved COA, identify key air combined force air component commander (CFACC) decisions, and conduct risk analysis for the CFACC.¹³ Additionally, students are required to examine a future all domain tasking order (ADTO), produce a joint air operations CONOP for phases I and II, write an air operations directive, and develop a master air attack plan (MAAP). It is important to highlight that the ADTO does not currently exist. However, students are empowered to design an ADTO construct that incorporates existing technology into future operational concepts. An example of this would be an F-35 fighter jet linking to an ally's HIMARS system to engage a dynamic target or distributing sensing data from a near space hybrid air ship located above 60,000 feet to the control reporting center. The last part of the Airpower course is a three-week Global Strike mini course.

Global Strike

The Global Strike course applies air power in a nuclear scenario as part of USSTRATCOM's nuclear TRIAD. This course is conducted in a sensitive compartmented information facility (SCIF) and introduces students to the employment of deterrence options, escalation, and the use of nuclear systems. The course culminates with a US Strategic Command (USSTRATCOM) Wargame at the TS/SCI level and is supported by general officers, flag officers, and interagency staff. The out-brief for the 2023 USSTRATCOM wargame was presided over by the Chief of Staff of the Air Force.

13. JADS defines agile combat employment (ACE) as an airpower deterrence mechanism designed to gain positional advantage and transfer the risk calculus to the adversary.

Multi Theatre War

The final JADS course is Multi Theater War. This course examines and evaluates what the students have learned throughout the academic year. Based on a two multi theater war (2 MTW) scenario, the students are divided into red, blue, and green/white cells for two of the United States' combatant command theaters. The faculty replicates the National Security Council, the Department of Defense, and the Chairman of the Joint Chiefs of Staff. The first phase of the course focuses on developing strategic and operational designs, conducting the JPP, wargaming, and developing a CONOP. The second phase concentrates on crisis action where the students must anticipate, adapt, and respond to complex and ambiguous strategic and operational environments. The third phase centers on execution of a coordinated 2MTW strategy where the blue team must fight with limited forces and exterior lines of communication. During phase three the students prepare a daily CJTF commander's guidance brief, produce a CJTF commander's guidance letter, and make recommendations on key preplanned and emergent opportunity decisions.

Leadership and Research

Leadership is integrated into every core course and taught throughout the academic year. Students are taught both staff and command leadership. Every student will have a minimum of three major leadership positions and be responsible for leading their peers through the development of staff products. The students will receive both peer level and instructor feedback on their leadership positions. At the beginning of the AY, students are educated on how to receive guidance, ask questions of clarification, provide a read-back of major points, identify and evaluate tasks, assess personnel for distributing tasks, set up a schedule and in-progress reviews, and present final products.

Each AY students are offered a diverse range of year-long research opportunities. These opportunities include personalized research on a topic approved by the faculty or the editorial staff of JADS's Over the Horizon (OTH) digital journal. Students are also invited to participate in faculty led research teams on a number of subjects requested by combatant commands, major commands, Department of Defense, and the inter-agencies. In the past, students have studied and developed resilient mesh networks, provided assessments for agile combat employment in the European and Indo-Pacific regions, and conducted an examination of a future all domain tasking order. The students have also participated in real world planning efforts for combatant and major commands. During 2023 students researched Dynamic Force Employment in the Indian Ocean, joint all domain command and control, logistics for deterrence, and numerous other subjects. They also worked with MIT Lincoln Labs, Georgia Institute of Technology Research Institute, the Rapid Capabilities Office, and the Defense Advanced Research Projects Agency (DARPA).

By way of temporary conclusion

Since its inception in 2006, JADS has come a long way. Its graduates include at least 12 general officers and one US Congressional Representative. The program has won several awards for innovation and the Secretary of the Air Force has bestowed leadership awards on a faculty member and one student. Graduates are also selected at a higher rate than their peers for commands, fellowships, and advanced schooling. During 2023 alone, 16 current and former students were selected for a second year of education at advanced study group (ASG) institutions and two were selected for the US Air Force Advanced Academic Degree program to pursue PhDs.¹¹⁴

Although JADS recruits good students, the faculty is the program's center of gravity. Instructors are carefully selected from a mix of skilled military and civilian professionals and recent graduates of the program. The recent graduates are paired with the military and civilian professionals and put in charge of a seminar consisting of 12 students. Each course the faculty and students are mixed into different seminars. This enables the faculty to meet and know the entire student body. This mix also exposes the students to all of the faculty and gain from the collective wealth of the entire faculty's experience. The instructor preparation requirements and teaching load are significant and instructors must be dedicated to student achievement. Balancing seminar work, research, publishing, and annual leave requires sound management and coordination. Despite this complexity, the faculty teamwork, performance, and morale are exceptionally high. The JADS faculty publishes on a regular basis and are routinely selected to be presenters at highly selective forums. These forums include: the US Joint Special Operations Command; the Führungsakademie der Bundeswehr; Royal Danish Defence College; the Indian Centre for Land Warfare Studies; the Polish War Studies University; Allied Command Transformation NATO; and the Joint Advanced Warfighting School.

In spite of these successes, JADS has a long way to go. The first and foremost challenge confronting JADS is demonstrating it is scalable. One of the comments repeatedly levied on JADS is that JADS is only successful because it is small. This perception is inherently false. JADS is successful because it is organized, focused outcome based military education, and founded on sound educational principles. JADS can be scaled upward within larger institutions. The organizational model is simply creating JADS clusters within the larger organization. In addition to this, 80% of what JADS does can be done at a much larger scale. Organizing seminars or syndicates into red and blue thinking, using scenarios to guide discussions, and conducting direct assessments through student application of core concepts are neither novel nor innovative. Using design theory to analyze complex problems and recommend solutions is an analytical tool set every PME faculty member should have. Additionally, faculty should be instructed on basic learning theories beyond adult

14. Advanced Studies Group institutions include the US Air Force School of Advanced Air and Space Studies program, the US Army School of Advanced Military Studies, and the US Marine Corps School of Advanced Warfighting.

learning. These educational theories include behaviorism, cognitivism, constructivism, connectivism, and humanism. Understanding the basic principles imbedded in learning theories assists educators in recognizing that individuals have different pathways to effective learning and this can lead to a more comprehensive teaching environment and better educational outcomes.¹⁵

Another challenge for JADS is the integration of international fellows into the program. The Air Command and Staff College has approximately 80 international fellows attend the college each AY. However, security clearance requirements for JADS prevent international fellows from taking part in the program. JADS has annual exchanges with the Luftwaffe at the German Führungsakademie and the Polish War Studies University, but these exchanges are limited to two weeks per AY. To rectify this, JADS is requesting that the Secretary of the Air Force-International Affairs grant security clearance waivers for select international fellows each year. JADS is also considering creating a JADS seminar expressly for international fellows.

The last major hurdle JADS faces is faculty turbulence. Each AY JADS loses approximately 80% of its faculty. These losses are attributed to military and faculty promotions, selections for command, military members returning to operational units, and selection for advanced level education such as PhD programs. Although JADS's personnel turbulence attests to the quality of the faculty, it creates an extraordinary burden on the remaining faculty and must be managed carefully. Unfortunately, there is no easy solution to this problem.

As JADS finishes AY 2025, it recognizes both its challenges and flaws. The program, however, will continue to move forward. The decade 2025-2035 is projected to be one of the most dangerous decades in the history of mankind. The danger will emanate from a host of events including climate change, mass migrations, and disruptive technology. In addition to these unfolding events, the evolving geopolitical alignment between Russia and China threatens to impose a divided world order similar to the Cold War. Russia's ambitions in the Ukraine will continue to challenge NATO and could potentially spiral out of control. At the same time, the Chinese Communist Party (CCP) is adamant about its claim to Taiwan and the nine-dash line. The CCP is also preparing China to move to a wartime footing. Evidence supporting this assertion is manifested in the transition of commercial enterprises into state owned enterprises, the creation of government owned stores, and the unprecedented purchasing of gold by the CCP. All of these actions are designed to withstand potential sanctions imposed by the West in the event of a military invasion of Taiwan. Additionally, China's expansion of its air, land, and naval forces, missile systems, and nuclear weapons do not bode for the future. As a result of these strategic and operational changes in the global environment, PME must be prepared to innovate and develop strategic thinkers who can operate at OODA point.

15. M. Smith, M. Doyle *et al*, "David a. kolb on experiential learning" (2007) <http://www.infed.org/biblio/b-explrn.htm>.

***INTERNATIONAL HUMANITARIAN LAW
AND URBAN FIGHTING***

Interview with Geoffrey S. Corn

By Jean-Christophe Noël



*Geoffrey S. Corn is the George R. Killam Jr. Chair of Criminal Law and Director of the Center for Military Law and Policy. Professor Corn comes to Texas Tech University School of Law from South Texas College of Law Houston where he spent 17 years on the faculty, and was the Gary A. Kuiper Distinguished Professor of National Security. Prior to joining the South Texas College of Law Houston faculty in 2005, Professor Corn served in the U.S. Army for 21 years as an officer, and a final year as a civilian legal advisor, retiring in the rank of Lieutenant Colonel. He has appeared an expert witness at the Military Commission in Guantanamo, the International Criminal Tribunal for the Former Yugoslavia, and in federal court. He has co-authored many books, of which *The Law of Armed Conflict: An Operational Approach*.¹*

Could you tell us in what circumstances you had the opportunity to meet IDF officials?

I have a long-term relationship with several Israeli military lawyers, especially those working in the international law division of the Military Advocate General's office. But in relation to the Gaza campaign, my interactions with IDF officials have been the result of my role as a legal expert for two high-level fact finding missions. The first was in March, sponsored by the Jewish Institution for National Security in

1. G. S. Corn, V. Hanse, R. B. Jackson, *The Law of Armed Conflict: An Operational Approach* (Alphen aan den Rijn: Wolter Kluwer, 2012).

America (JINSA) as part of their hybrid war task force. Alongside four retired US three and four star flag officers, I spent a week in Israel interacting with officials at all levels: tactical, operational, and strategic. We also interacted with NGOs to include UNWRA and the ICRC. This culminated with a report titled “The October 7 War: Observations, October – May 2024.”²

I returned in July for a similar mission as part of the High Level Military Group, which included a more multi-national group of generals, colonels, and diplomats. This trip included spending a day with the operational command conducting operations in the Rafah area, and several hours inside Gaza to observe these operations. Following our visit, we produced an amicus submission for the ICC.³

While Israel seems to have won from a military point of view, it has lost the narrative war. How can this be explained?

The IDF has never been very effective at external messaging. The IDF Spokesperson Office is historically focused on keeping the Israeli population informed about what is happening with conflict. That population understands the threat, and almost all of them have served in the IDF, so they understand the nature of military action.

This is not true for most external observers (for example, less than 2% of the US population volunteers to serve in the armed forces), who consistently form opinions based on often flawed or distorted understandings of the challenges of war and the law that regulates war. The IDF has tried to improve this dynamic but has not, in my opinion, been very effective. I think they need a more dynamic field commander in front of media cameras every day, like the practice NATO coalitions followed in prior conflicts.

Another factor is that the IDF cannot afford to be casual with truth; their enemies have no such constraint. So the dis and misinformation pervasively used by Hamas and other enemies almost always places the IDF in a position of responding to lies. But to do so, they must respond with facts and truth, which is often difficult to do rapidly. So the distorted narratives gain rapid traction and the IDF is consistently struggling to correct them.

There is also obvious skepticism about anything the IDF provides to the public. Even when they provide video or recorded Hamas communications that rebut false narratives, they are widely dismissed as fabricated.

What could the IDF have done better?

I think it is unfortunate the IDF has not adopted the practice of “embedded” journalists. The U.S. knows from experience this creates some risk – it may expose incidents of misconduct. But it is better to get that information and respond to it with

2. “[The October 7 War : Observations, October – May 2024](#),” *JINSA* (30 May 2024).

3. “[Amicus Curiae observation of High Level Military Group pursuant of Rule 103](#),” *CPI* (5 August 2024).

disciplinary action than to not know about it, or to learn about it through secondary sources, often controlled by the enemy. The big benefit is that it humanizes the soldier and the challenges they confront. In this context, I believe this would have helped the public understand the true nature of the realities and difficulties for IDF soldiers fighting Hamas.

All militaries that serve legitimate democracies (like France and the US) need to heed one obvious explanation: the impact of *misconduct magnification*. We know there is always soldier misconduct in war. But in the world we live in today, with the access to information and the speed of transmission, a low-level mistake or act of misconduct is immediately magnified and used to discredit any military that tells the public it is committed to legality and morality. This has been called the phenomenon of the “strategic corporal”: a corporal on a checkpoint can make a bad decision this morning that will have strategic consequences this afternoon. Nothing the IDF (or any military) can do will guarantee no such incidents occur. What is essential is rapid, transparent, and credible disciplinary investigation and action. And here, there is more communication failure. The IDF is engaged in numerous such investigations but there is very little public information about them.

There is also what I’ve called the ‘bigotry of disparate expectations.’ Enemies like Hamas seem to be held to a different standard than those applied to the IDF. Pervasive violation of international law, and even deliberate efforts to exacerbate the risk to Palestinian civilians in order to generate human fodder for their strategic delegitimization campaign against Israel are widely ignored or shrugged off. In contrast, every error – and even lawful but destructive actions by the IDF – seem to be immediately condemned as illegal and immoral. There is no good answer to this phenomenon, but to be fair it must be recognized and constantly reinforced that the law applies equally to both sides of any conflict, and that a defender bears as much responsibility to mitigate risk to civilians caught up in hostilities, as does an attacker.

What about the Israeli casualties?

Israel has done a poor job of communicating the burden of casualties on their own side. All the public narrative since a few weeks following October 7 has been about Palestinian suffering. The IDF has lost about 1,000 soldiers killed in action. No one knows this outside Israel. Considering the comparative populations between France and Israel (70 million v. 7 million), that would be like France losing 10,000 soldiers killed in action in a 15 month military campaign. How would that impact the French public? And that number is pretty remarkable considering the proximity of top-level trauma care for casualties. If it were Afghanistan, the number would probably be much higher.

Artificial Intelligence use by the Israeli armed forces has been widely criticized, especially after the revelations of the +972 site which notably spoke of a “mass assassination factory.”⁴ What can you say about this?

I will say that we heard virtually nothing about “AI targeting” when we visited in March, and the same when I visited with the High Level Military Group in July. And we interacted with operational commanders from battalion level all the way up to the general staff.

I don’t, however, doubt that intelligence assessments are being aided substantially by AI. But as a former tactical intelligence officer I am perplexed at the anxiety over this development. Tactical intelligence has always been a process of prediction based on relevant “indicators” as you know. It seems to me that using AI to contribute to that process is logical and probably beneficial. The real question is what indicators are being used and how reliable the analysis is.

I think the +972 article was exaggerated in its condemnation. From what I observed, human judgment is integrated into attack decisions at every level. Indeed, it is ironic that regulating those human judgments by imposing constraints on what levels of command are permitted to make proportionality decisions was the focus of a significant criticism by a New York Times expose at the eve of 2025. I co-authored an editorial with [General Wald](#) (one of the members of the group that wrote the JINSA report and a former Deputy Commander of US European Command) that explains why the NYT’s authors presented a narrative that was somewhat misleading. That narrative focused heavily on the alleged decision by senior IDF commanders to modify proportionality authorization thresholds in a way that vested lower level commanders with expanded authority to make proportionality judgments in relation to attack decisions. Specifically, the article explained that attack decision authority that prior to the campaign was restricted to higher level commanders was delegated to more junior commanders.

The suggestion from this focus was that the IDF essentially authorized lower level commanders to direct attacks that they knew would kill or injure a greater number of civilians than would have been tolerated prior to the Gaza campaign. But this was misleading. Proportionality assessment thresholds do not, as many erroneously believe, establish an automatic standing authority to kill or injure a defined number of civilians incidental to attacking a military objective. Instead, they are control measures that place ceilings on the authority of a commander to make the ultimate proportionality judgment in the context of an individual attack: if the assessed risk of civilian casualties is within that threshold, then the commander is permitted to make the proportionality judgment; if it exceeds that threshold, then the commander must elevate the attack decision to a higher level of command. But just because a commander *may* authorize an attack within the threshold does not mean he *will or must*.

4. Y. Abraham, “‘[A mass assassination factory](#)’: Inside Israel’s calculated bombing of Gaza,” +972 Magazine, (30 November 2023) ; Y. Abraham, “‘[Lavender](#)’: The AI machine directing Israel’s bombing spree in Gaza,” +972 Magazine (3 April 2024).

It simply means that he or she is the level of command entrusted with the proportionality judgment. And, even when the assessed civilian risk exceeds the threshold, it does not mean the attack would violate the proportionality rule. Instead, it simply means that the proportionality judgment must be made by a higher-level commander.

This control measure is, ironically, an indication that human judgments are deeply integrated into all targeting decisions. It is also an indication of a good-faith effort to enhance IHL compliance in a way that addresses the realities associated with a combined arms maneuver operation against a determined enemy embedded in an urban area. Most military professionals will appreciate that once the nature of the operations against Hamas evolved into this situation, it would have been illogical to restrict command attack authorities to the same standard that applied to a primarily air-oriented campaign. Yet, even considering the necessity of time-sensitive attack decisions related to close combat, the IDF still placed limits on when commanders at different levels were authorized to make the ultimate attack judgments. Doing so ensured that as the risk to civilians increased, higher-level commanders – commanders with more resources and broader operational and strategic perspective – were able to make these immensely difficult life and death decisions.

I would add that, in July, we were briefed by the Colonel leading the air operations cell for the IDF Southern Command. Nothing from that very candid briefing suggested an over-reliance on AI. He also told us that up to 50% of all air attacks were canceled or suspended based on real-time observations that changed the civilian risk calculus. I don't think this could be done with AI alone.

Precisely, regarding this editorial, you develop a whole original reflection on the notion of proportionality. Could you tell more about it?

International humanitarian law prohibits as 'indiscriminate' any attack on a military objective (to include civilian structures assessed as having been transformed by the enemy into military assets) that, in the judgment of the authorizing commander, is *anticipated* to cause civilian casualties that are excessive in relation to the anticipated concrete and direct military advantage derived from the attack. Note that this rule is focused on the attack judgment, not the attack result. Yet, the most common criticism of the IDF and other militaries is based on a focus on the results of attacks that cause civilian casualties. But condemning an attack as violating this rule by simply looking at the result is like saying, '1 + an unknown number = 10.' Unless all the information available to the commander at the time of the attack decision is considered, the conclusion of illegality is as speculative as the conclusion that 10 is the result of adding 1 to an unknown number. In other words, unless you consider all the tactical facts and circumstances related to the target known or reasonably available to the commander when the decision was made, you can't genuinely assess compliance with this rule.

Furthermore, the rule is focused on individual attacks, not aggregate results. So when the common refrain that "too many civilians have been killed" is made, it is based on a flawed methodology. It also suggests that there is some number of civilian deaths that would have been permissible. Thus, when people make that assertion, it

is interesting to respond by asking, “how many were acceptable?” The answer to that question is just as arbitrary as the assertion itself. Each attack must be assessed on its own merits, and there is simply no template that indicates what each target’s value is in relation to civilian risk.

As amorphous or subjective as the rule may be, it does not mean it is irrelevant. Proportionality is the most significant manifestation of the truism that even in war, the ends cannot always justify the means. But where that line is drawn is inherently blurry. So the rule becomes a useful tool to criticize and condemn, because it can mean whatever someone wants it to mean. Add to that the instinct to rely on ‘effects-based condemnations’ and it is no surprise this is the most common criticism of the IDF.

In my view, this is why a much better focus for assessing compliance with IHL in relation to the conduct of hostilities is the precautions obligation: are commanders implementing all feasible precautionary measures to drive down civilian risk. Of course what is feasible – which includes the assessment that it will not compromise military advantage – is itself somewhat subjective. But overall, things like weapons selection, warnings, timing of attack, attack tactics, alternate options, suspending attacks to gather more information or provide more time for evacuation, are all far more objective than the proportionality assessment. On this score card, the record is clear: one side of the conflict has tried consistently to mitigate civilian risk, and one side has tried consistently to increase that risk or ignored the obligation altogether.

While the world was shocked by the 10/7 massacre, condemnations have also multiplied to stigmatize the IDF way of war. Do you know if pilots had instructions to avoid collateral damage, for example? How can we explain the number of civilian deaths, particularly of women and children?

So much packed into these questions. But let’s start with the fact that even the UN has acknowledged it exaggerated the women/children casualty numbers. But more fundamentally, they are just illogical. If at least 1/3 of all casualties were in fact enemy belligerents, that would mean almost every other casualty was a woman or child. That is statistically near impossible.

The reliance on numbers is actually deeply misleading. First, the numbers normally cited come from the Hamas controlled Palestinian health authority. We have no way of verifying those numbers. Nor do we know what percentage of deaths were enemy belligerents (if we take the Palestinian numbers at face value, the IDF is the worst military in the world because it has apparently failed to kill even one enemy fighter); what caused each death (there is no question that some civilian casualties are the result of Hamas activities – just consider how booby trapped homes impact civilian casualty rates). We also know that in a 15-month period there must be many naturally caused deaths. Ultimately, raw numbers are inconclusive absent careful assessment of the nature of deceased and the cause of death.

But even if we take numbers at face value, the actual conclusion to draw is opposite from that of IDF indifference to civilian casualties. Let’s assume 35K civilians have

been killed as a result of hostilities. Now let's assume 15K of them were Hamas belligerent operatives. That is a bit more than a 1:1 civilian to enemy death ratio. This is actually historically *low* for urban combat. The historic norm is more like 8:1 civilian to enemy casualties. And this doesn't even account for the illicit and illegal conduct pervasively used by Hamas to *increase* risk to Palestinian civilians,⁵ nor the fact that Hamas has had two decades to transform Gaza into a massive fighting position.

Once again, part of this focus on civilian casualties is a consequence of failed IDF information operations. Most people have no idea of the scale of the Hamas tactical and operational threat, their capabilities when the campaign began, and the scale of the IDF campaign that was launched in response. Most people see Hamas as a weak, disorganized and ineffective group. That is absolutely erroneous. *If* people really understood the nature of the IDF tactical and operational challenges, the scale of destruction and number of casualties would be in better context.

What we really should be focused on is a simple question: which side of the conflict is *trying* in good faith to mitigate civilian risk, and which side is *trying* to increase that risk? We know the answer to that question, and it is because of IDF risk mitigation efforts that the ratio is so low.

According to you, was the international humanitarian law respected during this war?

By the IDF, a categorical yes. Have there been some IDF violations, almost certainly. But systemically, the IDF has done a very effective job of IHL implementation. The most important indicator of this has been the extensive civilian risk mitigation measures that the IDF has implemented. In fact, in our assessment the IDF often accepted more risk to mitigate civilian risk than was legally required as 'feasible' because it created that increased risk. Another example are the limits on which levels of command are permitted to make certain proportionality decisions, a precautionary measure that was ironically characterized by the NYT's as an indication of indifference to civilian casualties.⁶

By Hamas, never. I have written extensively on this and think it is best to refer you to some of those writings.⁷

5. G. S. Corn, "[Beyond Human Shielding: Civilian Risk Exploitation and Indirect Civilian Targeting](#)," *International Law Studies* (1st June 2020).

6. J. Spencer, "[Israel Has Created a New Standard for Urban Warfare. Why Will No One Admit It?](#)," *Newsweek* (26 March 2024).

7. "Geoff Corn on ["The Disproportionate Confusion About Proportionality"](#)," *Lawfire*, (26 October 2023); G. Corn, "[Those who criticize Israel for using indiscriminate or excessive force in Gaza are wrong](#)," *Thinc*, (15 April 2024); G. Corn, Lt. Gen. A. Deptula, "[War, Legitimacy and Context in the Middle East](#)," *The Cypher Brief* (19 August 2024).

Interview with Amélie Férey

By Jean-Christophe Noël



Dr. Amélie Férey is a researcher at the French Institute of International Relations (IFRI), where she leads the Defense Research Laboratory (Laboratoire de recherche sur la défense). Her publications focus on the ethics and law of war, the Israeli-Palestinian conflict, and the legitimisation of armed forces. She teaches at Sciences Po Paris and the School of Polytechnique.

The classical view of war holds that its fate is determined militarily on the battlefield and its outcome in chancelleries. Are you suggesting that an additional dimension should be considered?

Operation Iron Swords, conducted in the Gaza Strip by the Israeli army, following the Hamas attacks of 7 October 2023, was not confined strictly to the kinetic field. It also extended into the legal domain, which has become increasingly significant in contemporary conflicts. The legal corpus of international humanitarian law (IHL) has emerged as a central factor in constructing or deconstructing the legitimacy of operations, particularly when it comes to assessing the Israeli military's adherence to its provisions. While Hamas, as a non-state armed group, is already recognised as violating IHL, the question of the Israeli military's compliance with its own legal commitments in this area has been the subject of an extensive debate.

This legal warfare manifested primarily through initiatives with substantial media impact, such as South Africa's referral of the matter to the United Nations International Court of Justice (ICJ) for the alleged violations of the Convention on the Prevention and Punishment of the Crime of Genocide. In addition to this, the International Criminal Court (ICC) issued an arrest warrant for then-Israeli Prime

Minister Benjamin Netanyahu and his Defence Minister at the time, Yoav Gallant, who has since been succeeded by Israel Katz.

The principle of proportionality is at the heart of the debate on the law of armed conflict. Could you explain what that is?

The principle of proportionality is a cornerstone of the international law of armed conflict, embedded in both *jus ad bellum* (the right to resort to war) and *jus in bello* (the rules governing the conduct of war). Its origins can be traced back to the doctrine of double effect, which was formulated by Saint Thomas Aquinas, who was a key figure in the “just war” tradition and the progenitor of many current legal principles. This doctrine provides an ethical framework for evaluating actions that yield both positive and negative outcomes. Namely, the primary intention must be the achievement of good, and any negative consequences must be outweighed by the anticipated benefits.

How is this principle applied to military targeting?

This framework requires a careful assessment of whether the military objectives of an operation justifies the anticipated collateral damage, particularly in regard to civilian casualties. Proportionality is intrinsically tied to the precautionary principle, which mandates that all feasible measures be taken to minimise harm. Such measures may include issuing warnings to the population, creating humanitarian corridors, or suspending attacks when there is doubt. For instance, in Ukraine, an agreement was reached between Kyiv and Moscow in March 2022 to establish humanitarian corridors, particularly for the purpose of evacuating civilians from Mariupol.

However, the principle of proportionality is contentious due to its subjective nature. Its evaluation necessitates decisions made by military commanders, whose art lies precisely in their ability to exercise judgement—even when death is a working hypothesis. Furthermore, the calculation of proportionality, considering that it involves the sacrifice of innocent human lives, places responsibility not only on military commanders but also at the political level. Assuming that conducting operations deemed disproportionate constitutes a war crime for which a nation’s highest authorities can be held accountable, it underscores the reason why the assessment of this principle is such a sensitive matter.

How is proportionality viewed in Israel?

Due to its frequent military engagements, Israel has made significant contributions to the international legal discussion on the calculation of proportionality, particularly in operations against non-state actors.

Proportionality is therefore an integral part of the military manual, and all soldiers are briefed on this topic during their initial training. Their manual, in its revised 2006 edition, stipulates that “proportionality must be respected: an act must not be carried out if the harm caused to civilians or the environment exceeds the concomitant military advantage.”¹

1. Israel Rules of Warfare on the Battlefield, Military Advocate-General’s Corps Command (Tel-Aviv: IDF School of Military Law, Second Edition, 2006): 49.

Similarly, proportionality has also been shaped in Israel through landmark decisions, such as the 2006 ruling on targeted killings, issued by Aharon Barak, then-President of the Supreme Court. Unsatisfied with simply reiterating the law, this ruling went so far as to set up *ad hoc* committees, composed of former military personnel as well as members of civil society. They were then tasked with assessing the proportionality of strikes that resulted in significant civilian casualties on a case-by-case basis.² Efforts were made to limit the exclusive discretion of military personnel by creating working groups that included philosophers, ethicists, and legal experts working alongside military officers. These groups sought to propose thresholds of acceptable collateral damage for high-value targets, consequently making Israel a pioneer in this area.

Another notable example is provided by the Turkel Commission, which examined the interception of the Turkish flotilla Mavi Marmara that attempted to breach the maritime blockade imposed on the Gaza Strip in 2009. The Israeli military boarded the flotilla, resulting in the deaths of nine civilians.

Tsahal has innovated in this area, hasn't it, for instance, by introducing the "knock on roof" procedure?

In effect, this procedure involves warning the inhabitants of a building prior to an airstrike by delivering a preliminary charge. While this method adheres to the letter of the precautionary principle, it nevertheless diverges from its spirit. Indeed, in cases where the warning period is too short—generally around five minutes—for an effective evacuation, and where civilians, surprised in the middle of the night, are slow to leave the premises, they are reclassified by the IDF's legal department (MAG) as "voluntary human shields." As a result, they are therefore not included in the calculation of proportionality, which has the effect of reducing the assessment of the number of civilians killed during an operation.

How is proportionality viewed by other armies?

Western democracies exhibit differing sensitivities to civilian casualties (*civcas*). For instance, France and the United Kingdom maintain a zero-tolerance policy for civilian losses during their deployments. On the other hand, the United States has allowed limited ratios. A case in point is during Operation Neptune Spear, where the United States' "Public Enemy No. 1" was targeted and an order of magnitude was set at 30 civilians. In Iraq, for a High-Value Target (HVT), the ratio during the most intensive combat phases stood at 18 civilians.³

It is also worth noting that armies exchange information about their practices and their understanding of norms to ensure their positions carry more weight before national or international jurisdictions. In many democratic legal systems, there ex-

2. Israel, *High Court of Justice, Public Committee against Torture in Israel case*, Judgment (14 December 2006): §§ 41-44.

3. N. Crawford, *Accountability for Killing: Moral Responsibility for Collateral Damage in America's Post-9/11 Wars* (Oxford: Oxford university Press, 2013).

ists a clear separation between military and judicial authorities. This means that any military personnel being questioned must answer to civilian judges. However, this is not the case in Israel, where military personnel are judged by military personnel and not by independent bodies.

We now turn to current events. How was the principle of proportionality interpreted by the Israeli military during Operation Iron Swords?

As the phases of Operation Iron Swords progressed, Israel's evaluation of proportionality appeared to have also evolved. In the immediate aftermath of the shock caused by the scale of the 7 October attacks, testimonies from soldiers suggest a loosening of boundaries, which by consequence, led to a worsening of civilian-to-military ratios. For instance, Michael Ofer-Ziv, 29, who served as a "control" officer in a command room, told *Le Monde*: "Negligence is the right word: the negligence regarding Palestinian lives. I would not go so far as to say the army deliberately targets civilians. But it doesn't care enough about them".⁴

In the early weeks of the conflict, Tsahal agreed to the killing of nearly 20 civilians to neutralise a "junior operative" of Hamas, and up to a hundred civilians were killed in the case of a senior official. On 2 December 2023, 100 people were killed during the operation for Wissam Farhat, commander of Hamas's Shuja'iyya Battalion. Similarly, Ayman Nofal, commander of the brigade responsible for central Gaza, died in an Israeli bombardment that destroyed more than sixteen buildings in the Al-Bureij refugee camp, resulting in the deaths of more than 300 civilians. By comparison, the July 2002 bombing with a one-tonne bomb of the building where Salah Shehadeh, leader of the Izz el-Din al-Qassam, the armed wing of Hamas, was residing killed 14 civilians. At the time, this was deemed disproportionate.⁵

Is strictly adhering to the principle of proportionality during urban or complex operations not often considered a challenge? This perspective seems certainly to be shared by experts who criticise an overly rigorous approach.

Interestingly, the principle of proportionality is frequently criticised by opponents of international humanitarian law, who fear that the principle is overly restrictive for armed forces because of it being too subjective. This is because it relies on the judgement of military personnel, often at the highest political level.

Conversely, for others, they argue that the principle of proportionality is too formalised and overly quantified, leading to the dehumanisation of individuals. The principle of proportionality is ultimately based on a calculation left to the discretion of each state, depending on the fundamental interests being defended. However, as Mathias Delori laments in his work *Ce que vaut une vie. Théorie de la violence libérale* (English: What a life is worth. Liberal Violence Theory),⁶ liberal democra-

4. S. Forey, "Ce n'est pas une guerre existentielle mais de pure vengeance": en Israël, des réservistes annoncent leur refus de continuer à servir dans l'armée," *Le Monde* (24 October 2024).

5. S. Weill, "The Targeted Killing of Salah Shehadeh: From Gaza to Madrid," *Journal of International Criminal Justice*, Vol. 7, No. 3 (2009): 617-631.

6. M. Delori, *Ce que vaut une vie. Théorie de la violence libérale* (Paris: Éditions Amsterdam, 2021).

cies “tend to fetishise this principle”. They believe that they have mastered the use of force as long as it has been measured, regardless of the outcome of that measurement. In this context, the use of artificial intelligence as a decision-making tool for producing target dossiers further reinforces this fetishisation. It creates the impression of a perfectly rational calculation.⁷

One of the statements made by the officers interviewed by +972 is emblematic of this belief, particularly when he expressed that “I have much more confidence in a statistical mechanism than in a soldier who has lost a friend two days ago. Everyone here, including me, lost people on 7 October. The machine acts dispassionately. And that makes things easier.”⁸

However, Mona Shtaya, a researcher at the Tahrir Institute for Middle East Policy, expressed a different view during her interview with +972. “These systems turn Palestinians into numbers,” she argued. “They allow the authorities to evaluate us, dehumanise us, and not to think about the fact that we are people, justifying our deaths on the basis of a statistic. That’s why we have seen an increase in violence since Israel began relying on these systems.”⁹

What does the future hold for this principle?

In my view, the principle of proportionality remains a pillar of the law of armed conflict, but its application raises crucial questions. Although it is criticised for being subjective or perceived as dehumanising, it nevertheless remains central to the use of force. The excesses observed, particularly in regard to Gaza, call for a reflection on how to preserve its essence, while adapting to the new realities of modern conflicts.

7. A. Ferey, L. De Roucy-Rochegonde, “From Ukraine to Gaza: artificial intelligence at war,” *Foreign Policy*, No. 243, Vol. 3 (2024): 39-50.

8. Y.I Abraham, “‘A mass assassination factory’: Inside Israel’s calculated bombing of Gaza,” + 972 *Magazine* (30 November 2023). Available at <https://www.972mag.com/mass-assassination-factory-israel-calculated-bombing-gaza/>.

9. *Idem*.

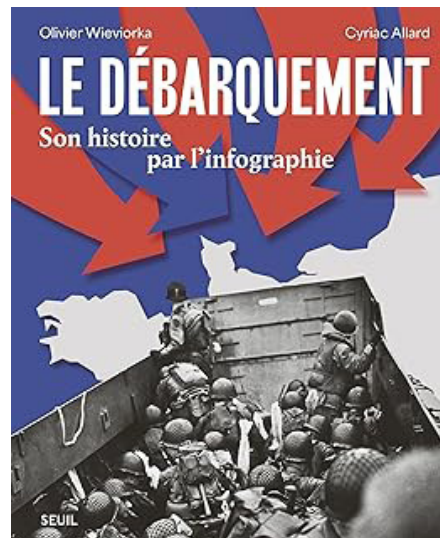
HISTORY

Interview with Olivier Wieviorka

By Jean-Christophe Noël



Professor at the Ecole Normale Supérieure in Paris-Saclay, Olivier Wieviorka is a specialist in the Second World War. He recently published Histoire totale de la Seconde Guerre mondiale (Perrin) and Le Débarquement. Son histoire par l'infographie (Le Seuil). He has also co-written several documentaries, including 100 jours pour la liberté, dedicated to D Day and broadcast on French TF1 channel on June 6, 2024.



While a few Anglo-American authors have tried their hand at writing a one-volume history of the Second World War, such endeavors are much less frequent in France. Henri Michel at the turn of the 70s and 80s - in two volumes¹ - comes to mind, but the tendency was more towards collective, thematic works, such as the dictionary *Les années de tourmente* in 1995² or the two volumes of *La guerre-monde* in 2015³. Why did you take on such an undertaking alone? Given the breadth of the bibliography, does it seem a tall order?

I wanted to offer readers a unique point of view, something that studies conducted by multiple authors cannot offer. Whatever their qualities, these books offer a fragmented viewpoint, lacking unity and sometimes consistency, for which a single pen can provide counterpoint. For example, dealing with all the war economies homogenizes the narrative. As I insist on the problems of forced labor in Germany, I also evoke this aspect when I deal with Japan, which might not have been the case in a group effort.

Which areas of historical review do you think have changed the most, say since the turn of the century? Under what influences?

Historiography has undergone profound changes, starting with the Holocaust. Until the mid-1980s, the Holocaust was of little interest to either the academic world or the general public, and the great pioneers, such as Raul Hilberg and Léon Poliakov, long remained solitary researchers. Claude Lanzmann's film *Shoah* (1985) profoundly reshaped the field, creating a social demand and a resulting impulse on the part of historians to fill the gap, so that our knowledge today bears no resemblance to our knowledge of yesterday.

On a completely different level, the war in the East was ignored for many years, not least because of the Cold War. Both the fall of the Berlin Wall, and the temporary opening of Soviet archives in the era of *Glasnost* ("transparency"), both gave a decisive boost to research, significantly improving our knowledge of the Eastern Front.

Which areas do you feel still need to be further developed, or are even largely unexplored? Has your research for this book led you to reconsider certain aspects of warfare, military or otherwise?

In my opinion, there's still a lot to discover. Firstly, because the questions that interest us shift over time. As Benedetto Croce wrote, "*all history is contemporary*". To give just one example, in the years to come we'll no doubt be giving sustained attention to Ukraine during World War II, due to Moscow's attack: how did Ukrainian soldiers fight? What was the attitude of the civilian population? Did nationalism prevail over communism? How did the post-war period unfold? These are just some

1. H. Michel, *La Seconde Guerre mondiale I: Les succès de l'Axe (septembre 1939 - janvier 1943)* (Paris: PUF, 1977); H. Michel, *La Seconde Guerre mondiale II: La victoire des alliés, (janvier 1943 - septembre 1945)* (Paris: PUF, 1980).

2. J.P. Azéma, F. Bédarida (dir.), *1938-1948: Les années de tourmente* (Paris: Flammarion, 1995).

3. R. Frank, A. Aglan (dir.), *1937-1947: La guerre-monde, 2 vol.* (Paris: Gallimard, 2015).

of the questions that historians will strive to answer, and which would not necessarily have occurred to them twenty or thirty years ago.

Then, the ignored archives will turn up. From this point of view, the People's Republic of China's archives are likely extremely extensive and examining them will undoubtedly enable us to make real progress in understanding the war in Asia.

In keeping with *Vortex's* editorial policy, let's concentrate more on aerial warfare. One of the most stimulating books written recently is P. P. O'Brien's *How the War Was Won*⁴. Although somewhat unnoticed in France, this work's very different slant on history is worthy of discussion. Rather than the Eastern Front or the land war, the author argues schematically that it was the Allied victory in the air and on the seas that was decisive against Germany and Japan. In short, the defeat of the Axis powers in these two commons led to their defeat on the ground. What do you think?

Phillips P. O'Brien's book is incredibly stimulating. It underlines the decisive role of logistics. More, he argues, than the great battles, the ability of the warring parties to get the necessary men and equipment to the theatre of operations was decisive. In this respect, control of the air and sea was all important.

To make a long story short, I tend to agree with this thesis, which emphasizes the importance of logistics. From this point of view, D-Day and the Normandy campaign confirm my colleague's thesis, as does the situation in Ukraine today.

General de Gaulle used to say, "*L'intendance suivra*" (meaning roughly "the rest will follow"). This was not always the case. When the Germans had to stop short of Moscow, it wasn't because of General Winter, since temperatures didn't drop until December 5. It was just that *Generalfeldmarschall* von Bock simply didn't have enough fuel to continue his advance.

That said, we shouldn't overstate the case. Battles such as Midway (1942) and Kursk (1943) also played important roles. We must therefore consider the military as a total fact, and avoid focusing solely on the armed conflict, while also analyzing its economic, political, social and cultural components, which carry overwhelming weight.

The French Air Force was quickly singled out as one of the ideal culprits in the defeat of 1940. Historians have shown that these accusations are highly simplistic, to put it mildly. But how do you explain this sudden and inconceivable defeat on May 10, 1940? The strategic failure of the plan of the head of the French armies, Generalissimo Gamelin, as recently claimed by American military historians such as R. A. Doughty⁵ Or deeper causes, as emphasized by M. Bloch in *L'Étrange Défaite*?⁶

4. P. P. O'Brien, *How the War Was Won* (Cambridge: Cambridge University Press, 2015).

5. R. A. Doughty, *The Breaking Point: Sedan and the Fall of France, 1940* (Hamden: Archon Books, 1990). Confer also J. A. Gunsburg, "The Battle of Gembloux, 14-15 May 1940: The 'Blitzkrieg' Checked" in *The Journal of Military History*, No. 1 (2000): 97-140.

6. M. Bloch, *L'Étrange Défaite*: témoignage écrit en 1940 (Paris: Franc-Tireur, 1946).

The defeat of 1940 was due first and foremost to the imperialism of the high command, which simply didn't understand modern warfare. Frozen in the certainties of the 1918 victory, it had hardly evolved, as shown by its reluctance to listen to innovative minds such as General Estienne or Colonel de Gaulle, and the confidence, not to say faith, placed in the Maginot Line. Similarly, the Dyle-Breda maneuver (the idea that French forces should come to the aid of Belgium and the Netherlands) made no sense, since the result was that Gamelin dangerously thinned out the French Ardennes sector, despite the warnings of General Pretelat, commander of the 2^e army group stationed along the Maginot Line.

On the other hand, it is true that France's industrial base was unable to support the rearmament effort, particularly in the aviation sector, and that part of the population supported the pacifist cause, and that the political parties, deeply divided, didn't play the game of the "sacred union". But if I had to choose, I'd opt for Gamelin's strategic failure rather than Marc Bloch's root causes.

Distancing yourself from the heroic narratives of the air battles of the summer of 1940 or the role of the "So Few" so brilliantly extolled by Churchill, you emphasize in your book that the Battle of Britain was a battle of attrition for which the British were better prepared? Could you elaborate on this point?

Historians have shown that Churchill's famous phrase - "*Never have so many men owed so much to so few*" - deserves to be revised. Indeed, in what became a battle of attrition, the British had more resources at their disposal: more aircraft (which they managed to build), more pilots (thanks to the contribution of foreigners, their allies from the Commonwealth or old Europe), not to mention their radar and the fact that *Royal Air Force* (RAF) aviators fought over their soil, enabling them to recover downed pilots. But this dispassionate assessment does not preclude recognition of the incredible courage of the men of the RAF. They multiplied their sorties, fought with bravery and panache and, in this sense, lived up to their legend.

The history of strategic bombing has recently been brilliantly revisited by authors such as A. Tooze⁷ and R. Overy⁸. There seems to be a consensus today, where it is generally agreed that the systematic conventional bombing of the population was a serious mistake, both doctrinally and morally. But are there any positive aspects to this brutal air campaign?

Air warfare was condemned on moral grounds, as it deliberately targeted civilians. Even Churchill distanced himself after the raid on Dresden in February 1945. The head of *Bomber Command*, *Air Marshal* Harris, still enjoys a sulphurous reputation. But to judge the effects of this air war, we need to break down its terms.

On the one hand, the terror bombings did not lead the population to disassociate themselves from the Nazi regime. Quite the contrary, one might even say, since

7. A. Tooze, *The Wage of Destruction: Formation and Ruin of the Nazi Economy* (New York: Viking, 2006)

8. R. Overy, *The Bombing War: Europe 1939-1945* (London: Allen Lane, 2013)

by protecting the inhabitants, compensating them, rehousing them... Hitler's power made them dependent on his power. Moreover, the raids did not destroy the war economy: industrial production grew until July 1944, and the Germans had equipment, notably aircraft, until the end of the war. Hence the disappointment of the experts commissioned by the United States in 1945, who were astonished to discover that the *Reich* had successfully countered the effects of strategic bombing.

But these two facts tell only part of the story. First of all, the fight against the bombers mobilized hundreds of thousands of Germans serving, for example, in the DCA (anti-aircraft defense). It also forced the *Luftwaffe* to stand guard over German territory, which prevented it from fighting in other theaters of operations, such as Normandy. This fight was costly: it took an average of 16,000 shells to shoot down an enemy aircraft! Moreover, the analysis tells us what happened, not what was prevented. By dispersing production sites, burying them and protecting them, the *Reich* expended precious resources which, if committed to war production, would have offered significant gains. The bombing campaign was therefore effective, even if it was not in itself victorious.

How do you explain the fact that air warfare on the Eastern Front was essentially to the benefit of ground operations?

It's true that air operations played a minor role in the East, apart from the tactical support provided by the air force during ground offensives. The Soviet air force had no bombers, and its leaders had not advocated the option of strategic bombing. Moreover, the military leadership had great difficulty in mounting combined operations - a shortcoming that still penalizes Russian forces in Ukraine today. On the German side, those in charge did not opt for strategic bombing either, despite a few trials. It's true that weather conditions, the remoteness of industrial targets often relocated behind the Ural mountains, logistical problems and Soviet defenses made it particularly complex to implement.

The Pacific theater is less well known in France. However, the potential difference in industrial production between Japan and the United States gives the impression that everything was a foregone conclusion. Could Japan have pushed back the United States in air and sea and more generally from Japan's "sphere of co-prosperity"?

Japan did not have the economic, demographic or military means to repel the United States in the skies or on the waves. On the other hand, it could have inflicted such damage on the Americans that Washington might have been tempted to negotiate. To do so, Tokyo would have had to have been less ambitious: rather than extending its conquests, the Empire of the Rising Sun should have limited itself to its vital perimeter, which would have enabled it to shorten its supply lines and prepare its defenses well. But it followed a completely different policy, one that led to its downfall.

Finally, a more personal question, if I may. Is there a World War II aircraft for which you have a particular fondness? And for what reasons?

Like many people - but I make no claim to originality - I have a great fondness for the *Spitfire*. It was the aircraft that won the Battle of Britain and gave captive France its first glimmer of hope. It was served by extraordinary pilots, who were able to embody this epic battle. Unless I'm mistaken, no one knows the names of the bomber crews who administered an anonymous mass death, with the obvious exception of Hiroshima and Nagasaki; but everyone knows a hero who served on this mythical aircraft. Here, military efficiency has been adorned with a certain romanticism, which no doubt explains my attachment to this aircraft, whose lines are both elegant and appealing.

The conflicts of all fears

Overview of the historiographical debates on the Israeli nuclear alerts of 1967 and 1973

Pierre Vallée

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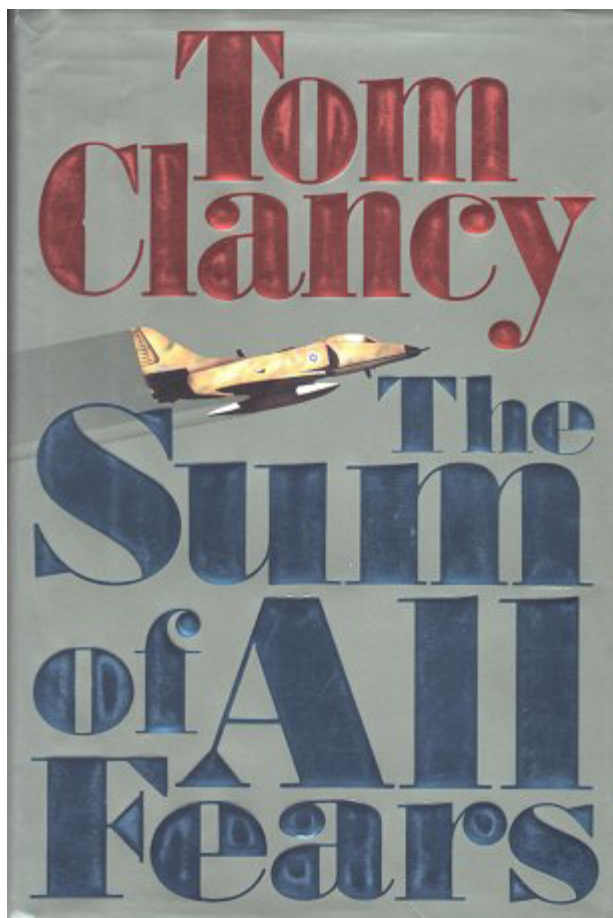
*Israel – October 7, 1973.
Second day of war.*

Despite the personal commitment of the Israeli pilots to fighting off Syria's tanks at the northern border, the enemy's capture of the Golan Heights is inevitable. Simultaneously, the Egyptian armed forces continue to advance in Sinai and compel *Tsahal* to abandon its positions. Twenty-four hours of fighting is all it took to determine the outcome of the war.

Bewildered by this turn of events, the Israeli leadership decides to set off Operation *Joshua*. In the vicinity of Be'er Sheva, on the airstrip of a base, aircraft mechanics are fussing with the central hardpoints of several *Skyhawk* to fit them with nuclear weapons forthwith.

Minutes later, they are countermanded: *Joshua* is canceled. Almost from the moment they were mounted, the warheads were taken off. Then came a series of sudden developments adding to the chaos surrounding the airstrip. Distracted for a fleeting instant, the armorers fail to remove the warhead from one of the *Skyhawk* before it takes off for a mission in the Golan. To make matters worse, the aircraft is shot down by an enemy *SA-6*. As it comes apart, its valuable payload crashes into the sand, unscathed, with a knot of farmers as spectators.

The techno-thriller connoisseurs will have recognized this excerpt: it is the prologue to *The Sum of All Fears* by American Novelist Tom Clancy.¹ In a style that ensured the success of the Ryan saga, the author opens onto a new adventure in which fiction and reality become intermingled in an efficacious manner. While letting his imagination wander for the sake of the narration, the author draws his inspiration from a very singular moment of the early days of the 1973 War, whose actuality remains controversial to date: that of the Israeli forces-led nuclear alert.



Cover of T. Clancy book's first-edition copy displaying an Israeli Douglas A-4 Skyhawk with what appears to be a nuclear warhead.

Source: "[The Sum of All Fears](#)," *Jack Ryan Wiki*.

These controversies are attributable to the highly sensitive nature, if not the crucial importance, of the subject matter at hand. If said alert really transpired, if it were a proven fact, then the ambiguity of Israel's leadership regarding its nuclear potential would become completely meaningless.

1. T. Clancy, *The Sum of All Fears* (New York: G. P. Putnam's Sons, 1991).

Those debates are also kindled by the existence of a body of ambivalent and often dissenting primary or secondary sources, the earliest of which emerged on April 12, 1976. An anonymous tipster, who appears to have an in with Israel's decision-making circles, told the *TIME* that Tel Aviv was believed to have hastily assembled thirteen nuclear bombs within the first 78 hours of the conflict². First-rate information for some, mere fabrications for others? Nonetheless, the debate kicked off. It jump-started a few years later with the publication of Journalist Seymour Hersh's works in 1991, then Historian Avner Cohen's in 1998 and 2010.³ Confirming that this alert occurred, their books feature a version of events that, in certain respects, departs from *TIME*'s disclosures.

Their critics are manifold. They oppose against the anonymity of a great part of Hersh's interviews that does not allow for substantiation. Others blame Cohen for addressing the particulars of the alert more than twenty years after it took place while many recollections have disappeared, or worse yet, have been corrupted. The author himself admitted as much, deploring, "*the frailty of human memory*."

Their investigations also faced the stringency of Israel's official censorship hampering knowledge dissemination with respect to this unique event. The fear of being charged with "*endangering State security*" deters the more daring ones from defying authority and breaking their silence. The impediments that Avner Cohen had to overcome to eventually publish *Israel and the Bomb*, or the Mordechai Vanunu case, can serve as a reminder that the relevant subject matter is particularly sensitive⁴.

Thus, there is no official word – in 1973 or later – on whether this nuclear alert was conducted or not.⁵ Several officials refrained from any comment, or, at best, did not deny anything. The few unfortunate people who sometimes overstepped their bounds were coerced into either backtracking or apologizing.

As a result, it is difficult to establish a precise sequence of events, or the identity of the stakeholders involved. The truthfulness of some of the testimonies and writings once heralded as crucial has been tirelessly questioned.

2. "[How Israel Got the Bomb. Special Report](#)," *TIME* (12 April 1976). Some commentators believe that the "source" is none other than Moshe Dayan; T. N. Nashif, *Nuclear Weapon in Israel* (New Delhi: APH Publishing Corporation, 1996): 112, footnote 2. Others view it as an intentional leakage to enhance Israel's ambiguity; L. Toscano, *Triple Cross. Israeli, The Bomb & The Man Who Spilled the Secrets* (Secaucus: Carol Publishing Group, 1990): 100.

3. S. H. Hersh, *The Samson Option. Israel's Nuclear Arsenal and American Foreign Policy* (New York: Random house, 1991) and A. Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998); *The Worst-Kept Secret: Israel's Bargain with the Bomb* (New York: Columbia University Press, 2010).

4. Former employee of the Dimona facility, imprisoned from 1986 to 2004 for passing information and photographs related to its activities to *The Sunday Times*, Mordechai Vanunu remains, to this day, under close surveillance. Find out about his story in L. Toscano, *Triple Cross: Israeli, The Bomb & The Man Who Spilled the Secrets...*, op. cit.

5. A summary of these debates is provided by E. Colby, A. Cohen, W. McCants, C. Morris, W. Rosenau, "[The Israeli 'Nuclear Alert' of 1973: Deterrence and Signaling in Crisis](#)," *Center for Naval Analyses* (April 2013).

Bearing in mind those significant shortcomings, the hereby article intends to address the potential October 1973 alert in Israel by comparing Cohen's and Hersh's accounts. To this end, it is essential for us to step back in history, in May-June 1967. From the eve of the Six-Day War, against the backdrop of heightened tensions with its neighbors, Israel's officials professedly discussed the procedures for a first nuclear alert. This earliest stage provides valuable insight in three respects.

To begin with, it reflects that the program progressed and attests to the readiness level of the domestic nuclear capabilities at a given moment, while raising several issues pertaining to the weapons and launchers of deterrence. Then, it provides a unique viewpoint to appreciate Israel's post-1967 efforts to operationalize its arsenal and, to achieve this, the pivotal role of airborne assets. Finally, it enables key insights into a coherent analysis of the alert – or alerts, depending on the version – during the 1973 conflict. Related evidence allows not only providing an overview of how Tel Aviv considers firing nuclear weapons, but also assessing the role of the two Great Powers on the dynamic of events to place this crisis in the broader context of the Cold War.

First fear of nuclear attack: the Six-Day War

In 1967, the third Arab-Israeli War, also known as the “Six-Day War,” is believed to have been the setting for a first Israeli-led nuclear alert. That hinges on the climate of fearmongering experienced during the weeks leading up to the outbreak of hostilities.

In early May, warning signs of an impending attack against the Arab countries built up. On the 15th, several Egyptian divisions were moving towards Sinai. The next day, President of the Republic of Egypt Gamal Abdel Nasser called for the United Nations (UN) to withdraw its troops, even though the latter had been deployed in the peninsula since November 1956. On the very same day, a couple of high-flying *MiG-21* were reported for the first time over the Dimona nuclear facility.⁶ This incident infuriated the Israeli Staff, claiming that these reconnaissance missions signaled Cairo's intent to neutralize strategic infrastructure.

Another cause for concern is the tactical situation analysis prepared by the military intelligence. Whether on land or in the air, Israel's armed forces are outnumbered: added up, Egypt's assets boast twice as many tanks and aircraft as them⁷. Ultimately, the use of mustard gas and phosgene by the Egyptian forces in northern Yemen a few years earlier ascertained the existence of a sizable chemical arsenal that the *Reis* may put to use in a conflict.

6. Built in the late 1950s with France's assistance and originally heralded as a “*textile factory*” by Tel-Aviv, the Dimona facility is reckoned to be part of the major research centers dedicated to Israel's nuclear program, whether in the civil society or in the military.

7. T. N. Dupuy (*Elusive Victory: The Arab-Israeli Wars, 1947-74* (New York: Harper & Row, 1978): 337) claims that Israel's armed forces comprise 250,000 troops, 1,000 tanks and 286 aircraft. As for the Arab Coalition, it features nearly 330,000 troops, 2,300 tanks and 682 aircraft.

This forms the highly volatile backdrop to Israel's decision to give substance to the research on the atomic bomb initiated in the late 1950s and cross the threshold⁸. The second-in-command of the Israeli Defense Forces (IDF – *Tsahal*), General Weizman, and his deputy General Ze'evy, instructed the Staff officials in charge of the Weapons Means Department (*AMLACH* in Hebrew) to cater for all eventualities and be in a position to advise the authorities on the broadest possible set of military options. Colonel Yitzhak Ya'akov did as they asked. With a view to addressing the worst-case scenarios,⁹ he started planning "*Operation Samson*."

The latter pivots on the demonstration of Israel's nuclear capability to compel the warring parties to reassess their intentions. Two groups – a civilian team tasked to assemble the bomb with a military escort – are to be convoyed to the blast site by a *Super Frelon* duo from the Israeli Air Force (IAF) for so doing. An unoccupied and hilly terrain east of Sinai, only a few minutes away from Abu Aweigila where Egypt's 2nd Infantry Division had recently established its barracks, was identified as ground zero. This site – as an uninhabited, up-top location, whose description coincides with the Jabal al-Halal mountain – would allow the troops located a dozen kilometers out to see the flash from the explosion.

Moments before the helicopters landed, airborne units allegedly attacked the opposing forces to create a distraction. That deception was meant to give the commando sufficient time to assemble the weapon and implement the firing device. The commando then reportedly dug in a small makeshift battle position a few hundred meters away, awaiting the fateful order of the IDF Chief of Staff (CoS) and the Prime Minister (PM). Thereon, a limited rifle platoon comprising Special Forces from *Sayeret Matkal*¹⁰ was entrusted with the responsibility of protecting the partakers throughout the *Samson* maneuver.

As the course of action (COA) was being drawn up, the manufacture of the nuclear weapon was assigned to Physicist Israel Dostrovsky, head of the Israel Atomic Energy Commission (IAEC). From the Dimona facility, he oversaw both Rafael's engineers in charge of the weapon system's development¹¹ and the scientists responsible for the production of plutonium cores.

8. Find out more about the beginnings of Israel's nuclear program in P. Péan, *Les deux bombes* (Paris: Fayard, 1991).

9. A. Cohen, "[Interview with Yitzhak 'Ya'tza' Ya'akov](#)," *Wilson Center*. On the basis of his investigations, Cohen establishes four "*red lines*" beyond which a nuclear response could be triggered: 1) a successful Arab military foray in the inhabited areas of the ceasefire lines of 1949; 2) the collapse of the IAF; 3) the operation of chemical/biological weapons and the conduct of mass or continuous air raids on Israel's population centers; 4) the use of nuclear or nonconventional weapons against Israel; in A. Cohen, *The Worst-Kept Secret...*, *op. cit.*, 77.

10. *Sayeret Matkal* (also dubbed "General Staff Reconnaissance Unit") is an Israeli special forces unit directly reporting to *Tsahal*'s Staff.

11. This incident appears to be included in the diary of Murda Mador, founder and leader of *Rafael*. On May 28, 1967, he introduced the hard work of "*engineers and technicians, most of them young [...] focused on their task, with serious, introspective expressions on their faces, like people who were aware of the great – perhaps fateful – value of the weapon system they had succeeded in bringing to operational readiness*," in M. Mador, *Rafael*, Tel-Aviv, Misrad Habitachon, 1981. See also M. Karpin, *The Bomb in the Basement. How Israel Went Nuclear and What That Means for the World* (New York: Simon & Schuster, 2006): 299-300.

The civilian and military teams report to their respective chains of command: the IDF CoS for Ya'akov, and the PM for Dostrovsky. However, since controls of Israel's nuclear weapons fall under civilian authorities, the director general of the IAEC is accountable for the whole program. Furthermore, meeting everybody's scope will become a subject of dispute between Colonel Ya'akov and Lieutenant Gleiser, seconded to Dostrovsky.¹²

After the final arrangements were made, the colonel referred the plan to his superiors. Upon agreement of General Ze'evy and signing of the IDF CoS, the document was issued to the policymakers for approval. As part of the creation of a national unity government in early June and the appointment of Moshe Dayan as minister of defense, the Cabinet reshuffle did not call the operation into question. Aside from a handful of minor adjustments, IDF Deputy CoS Tzvi Tzur eventually endorsed the Concept of Operations.¹³

In the days leading up to the outbreak of war, Colonel Ya'akov took off aboard a *Super Frelon* from Tel Nof, in the Central District of Israel, with a view to conducting reconnaissance of ground zero. The pilots however had to turn back to evade Egypt's aircraft deployed their way as soon as they crossed the southern border.

In all likelihood, Operation *Samson* was submitted by Shimon Peres¹⁴ to the new government during an emergency meeting in the first days of June 1967. Against all odds, it was dismissed by Moshe Dayan due to its uncertainty (armament incompleteness), its hazardousness (what of the regional and international responses?), and even self-defeating implications (signs of weakness).¹⁵ In his memoirs, Peres recounts this crucial meeting and mentions the minister's denial of a "*proposal*" that he thinks, "*would have deterred the Arabs and prevented the war.*"¹⁶

For all that *Samson* was not proceeded with, it did not appear to be discarded. Leastways, that is what Colonel Ya'akov's testimony suggests. According to him, on the morning of June 5, the whole members of the operation were on call, standing by

12. Lieutenant Elie Geisler was instructed by Dostrovsky to take delivery of "*a package*" in a small secure compound in the vicinity of Gedera and protect it. On June 2-3, he had to disobey Colonel Ya'akov who had come on site to order him to hand control of the compound. Gleiser will view this event as an illegitimate attempt of the military to receive charge of a nuclear weapon. See E. Geisler, "[The Israeli nuclear drama of May 1967: a personal testimony](#)," *The Nonproliferation Review*, Vol. 25, Issues 5-6 (11 April 2019): 399-404. As regards nuclear C2, see "Command and Control Systems in Nuclear Middle East," in Y. Evron, *Israel's Nuclear Dilemma* (Abingdon: Routledge, 2011); A. Cohen, "[Israel's NC3 Profile: Opaque Nuclear Governance](#)," *Technology for Global Security* (10 October 2019).

13. Another version of the operation is also provided by Tzvi Tzur in D. Raviv, Y. Melman, *Spies Against Armageddon. Inside Israel's Secret Wars* (New York: Levant Books, 2012).

14. Shimon Peres is regarded as the chief architect of the beginnings of Israel's nuclear program. During the 1967 conflict, he was one of the figureheads of Israel's domestic political life.

15. P. Razoux, *La Guerre des Six Jours (5-10 juin 1967). Du mythe à la réalité*, 2^{ème} édition (Paris: Économica, 2006); P. Tyler, *Fortress Israel. The Inside Story of the Military Elite Who Run the Country and Why They Can't Make Peace* (London: Granta Publication, 2012).

16. S. Peres, *Battling for Peace: Memoirs* (London, Weidenfeld and Nicolson, 1995): 193. "*My contribution during this dramatic period was something I still cannot write about openly, for reasons of state security.*"

and ready to follow through with the steps of the plan. However, within a few hours, the “hit-and-run” maneuver of Israel’s fighter aircraft dispelled the pre-war existential fears. Opting for a nuclear show of force quickly became unnecessary. Hence the cancellation of the operation.

Lessons to be learned from the 1967 alert

This first nuclear instance is replete with hints of Israel’s incipient program. Above all, it reaffirms the fact that the U.S. intelligence services were totally unaware of it. Following the Six-Day War, it is estimated that Israel had two to three nuclear bombs at its disposal¹⁷. Yet, in December 1967, during a briefing by the Department of State (DoS) to the White House, the Bureau of Near Eastern Affairs insisted that it was “*reasonably, though not entirely, confident that Israel ha[d] not embarked on a program to produce a nuclear weapon.*”¹⁸

Then, the COA expounded by Colonel Ya’akov reflects the purely defensive, demonstrative approach of Israel’s leaders with regard to such weapons at the time. Still, in contrast to the root rationale that warranted Operation *Samson*, the nuclear option introduced by Peres appears to serve more as a means of restoring deterrence or compelling the warring parties to reconsider their plans, than as a tool to be exercised in the context of disastrous events¹⁹.

Ultimately, this incident provides a basis for assessing Israel nuclear program’s state of development. Nevertheless, the technical and technological background of the alert begs the question: considering the status of Israel’s nuclear capabilities in 1967, could Colonel Ya’akov have submitted another alternative to his superiors?

Based on the information collected by Cohen, the explosive casing manufactured by Rafael was visually akin to a “*spider*” due to the related electrical connections for blasting. As for Lieutenant Gleiser, he refers to something metallic and hemispherical giving off atomic radiation and encased in a container of one cubic meter. Such descriptions are analogous to the warhead and so-called Christy pit used for “*Gadger*”; the first plutonium-based atomic bomb tested in Los Alamos. These details offer an insight into a bulky and heavy weapon with a basic operating

17. *Inter alia*: S. Weissman, H. Krosney, *The Islamic Bomb. The Nuclear Threat to Israel and the Middle East* (New York: Times Books, 1981): 107; A. Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998): 273-274; W. E. Burrows, R. Winderm, *Critical Mass. The Dangerous Race for Superweapons in a Fragmenting World* (New York: Simon & Schuster, 1994): 208.

18. Department of State, “[Israel: the Nuclear Issue and Sophisticated Weapons](#),” *Briefing Paper for Eshkol-Johnson talks* (31 December 1967). It was not until 1968 that CIA Director Richard Helms notified President Johnson of the existence of Israeli-manufactured nuclear weapons. For the ensuing informal agreement between the two countries (“*The secret Nixon-Meir understanding*”), see W. Burr, A. Cohen, “[Israel Crosses the Threshold](#),” *Bulletin of the Atomic Scientist*, Vol. 62, No. 3 –May-June 2006): 22-30. The Soviets did not presume that Israel had a military nuclear agenda then. See I. Ginor, G. Remez, *The Soviet-Israeli War. 1967-1973. The USSR’s Military Intervention in the Egyptian-Israeli Conflict* (New York: Oxford University Press, 2017): 68.

19. B. Tertrais, “[“Nuclear ‘show of force’: the case of Operation Samson in context.”](#)” *art cit.*, 7-8, in E. Maitre, *Observatoire de la Dissuasion*, Monthly report No. 44 (June 2017).

mode. By the same token as the challenge faced by U.S. scientists in August 1945, Colonel Ya'akov rapidly found himself struggling with the transportation of the nuclear warhead²⁰.

When they met, Cohen addressed this issue with Ya'akov. Responding to a question on whether the possibility of releasing the bomb from a fighter aircraft had been studied, the former colonel said that it had not. The limit was not of a political but of a technical nature: "*We didn't think we were there yet.*"

Indeed, back in 1967, the IAF boasted a few *Mirage III CJ* and *Vautour*. While the latter was, as per its operation in the French Air Force, qualified to carry a tactical nuclear weapon, several technical boundaries remained. Not only the existence of an arming mechanism compatible with Israeli-made aircraft was unknown, but these aircraft were merely capable of carrying a payload whose weight is equivalent to those of the "Fat Man" or "Little Boy" bombs.

Ya'akov did not address the possibility of conducting ground-to-ground fire either. And for a good reason: in 1967, Israel still lacked an operational weapon system with adequate range²¹. In any case, as a result of the Six-Day War and France's embargo on its weapons deliveries, Tel Aviv will be constrained to intensify its efforts to acquire a domestic nuclear capacity. It will take up the *MD.620* research, a missile that had been under development by the *Générale Aéronautique Marcel Dassault* since 1963, capable of transporting a warhead over 500 kilometers.

Finally, by all accounts, road transport appears to be far too risky. Besides being too slow a mode of transport, trucking an atomic bomb across an area bound to become one of the focal points of clashes poses a significant risk of destruction or, worse yet, theft, causing the weapon to fall to ill hands.

For all these reasons, Colonel Ya'akov had no choice but to tap into the IAF's heavy transport helicopters. Every *SA 321K Super Frelon* could take aboard up to thirty troops or a seven-ton warhead. Such a capability was consistent with the conveyance of the bomb's components, the civilian team and the military escort.

20. "Little Boy," first used on Nagasaki on August 6, 1945, was 3 x 0.7 meters and weighed 4.4 tons. The *B-29* stowage will be purposely designed to enable bomb carriage (Operation *Silverplate*).

21. In 1975, the United States delivered to Israel about 10 *MGM-52 Lance* (120-kilometer range) capable of delivering either a conventional or a nuclear warhead; T. N. Nashif, *Nuclear Weapon in Israel...*, *op. cit.*, 32.



IAF Super Frelon.

Source: "[Aerospatiale SA-321K Super Frelon](#)," *Israel Aviation*.

In 1967, they belonged to the 114th Squadron stationed at the Tel Nof Airbase, a hundred kilometers from ground zero (half an hour's flight), just upwind from Gedera where Lieutenant Gleiser was to keep a close watch on a "*package*" during the days leading up to the war.²²

With a program that lacks maturity and the issues for conveying the bomb, Colonel Ya'akov had to display considerable agility while planning Operation *Samson*. However, as he did, the challenges he had to overcome allow weighing the significance of establishing technological readiness for the warheads and their delivery vehicles, a prerequisite for operational flexibility and political credibility in the context of deterrence. The period that began after the Six-Day War witnessed Israel's endeavor to field assets required for the buildup of its nuclear capabilities.

"Bomb seeking delivery vehicle(s)": matchmaking

Across the threshold, one of the key conditions for operationalizing a nuclear arsenal lies in the miniaturization of the armament with a view to considering its delivery with the widest possible range of launchers. For the Israeli scientists and engineers, it entailed designing warheads sized and light enough (between 500 kg and 1.5 tons²³) to render them compatible with existing fighter aircraft and strategic missiles under development. This expertise was then available to a sprinkling of States.

22. Find out more about the pros and cons of carrying a nuclear weapon by helicopter or transport aircraft in P. Pry, *Israel's Nuclear Arsenal* (Boulder: Westview Press, 1984): 97-99.

23. P. R. Chari, "The Israeli Nuclear option: Living Dangerously," *International Studies*, Vol. 16, No. 3 (9 July 1977): 343-355 (349). 1.5 tons is indeed equal to the weight of the first-generation air-to-ground nuclear weapons.

Thus, in 1965, an internal U.S. intelligence memo assessed that it would take “*at least five years, and probably more*” for Tel Aviv to manufacture warheads to the size of *Jericho*’s nose cone. Moreover, “*several [additional] years*” would be needed to certify the payload-launcher combination²⁴ once the missile is declared operational.

Howbeit, in his book *Israel Nuclear Arsenal* (1984), Peter Pry raises a number of arguments suggesting significant progress in this area. He wrote that, on an unspecified date, the Israelis purportedly secured sufficient expertise to create a 0.5-tonne warhead providing a yield of 20 kilotons (kt).²⁵ His assumptions are partly borne out by confidential information disclosed by a former DIA analyst, who anonymously exposed an arsenal comprising 14 450-kilo (20 kt) and six 700-kilo (50 kt) warheads during the October War.²⁶

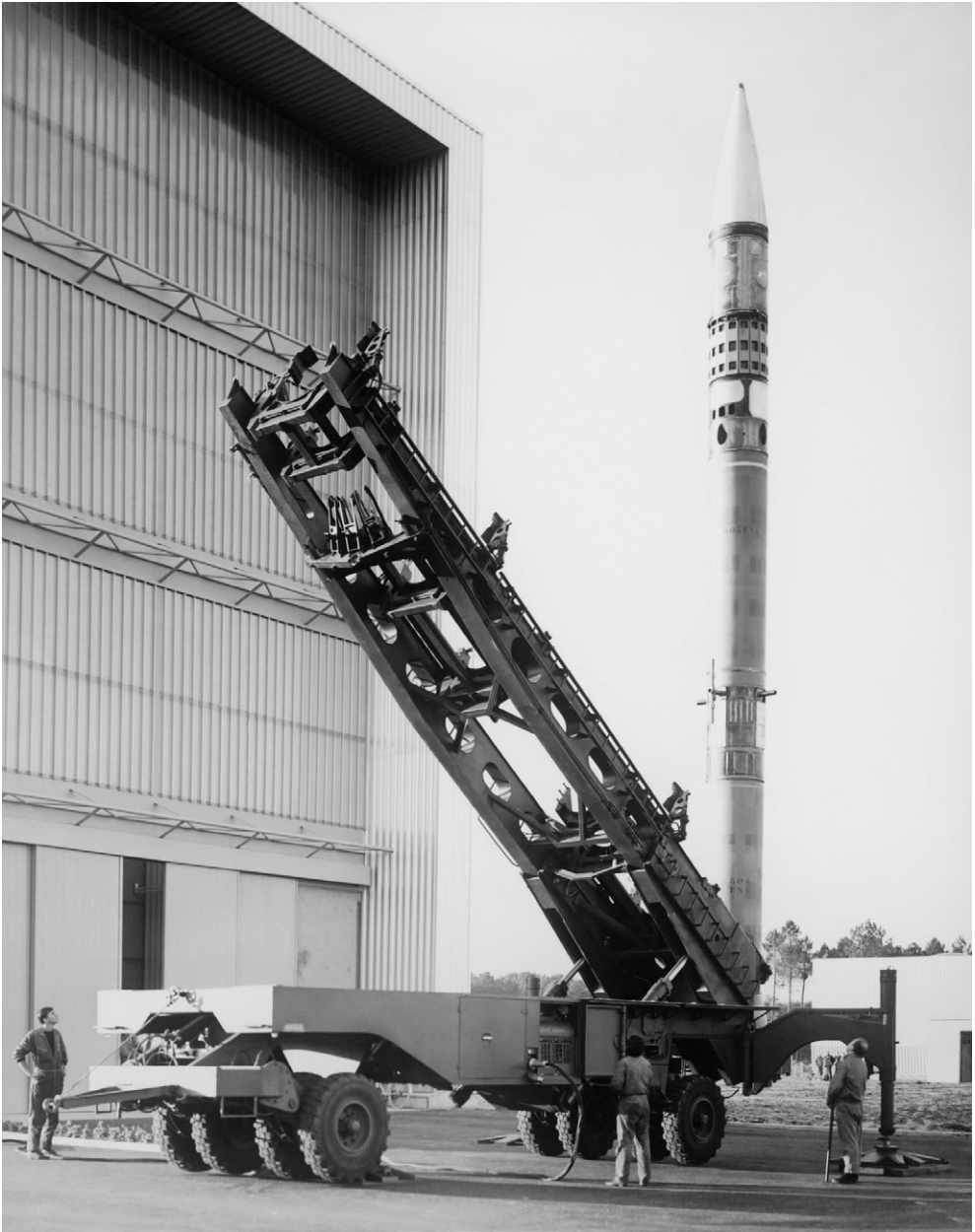
Alongside this critical work, during the 1967–1973 interlude, Tel Aviv arrayed new nuclear-qualified delivery vehicles. With the enhancement of the French ban in retribution for the December 1968 attack launched by an Israeli commando on Beirut International Airport, Dassault transferred the last demonstrators and spare parts from the *MD.620* program to Israel Aerospace Industries Ltd. (IAI) for the latter to complete the missile’s development in its manufacturing sites located in Be’er Ya’akov.²⁷

24. Director of Intelligence and Research, “[Implications of the 1965 Dimona Inspection Finding](#),” *Research Memorandum* (10 May 1965).

25. P. Pry, *Israel’s Nuclear Arsenal...*, 87–94. How elaborate the weapons really were correlates with Vanunu’s disclosures; see L. S. Spector, *Going Nuclear* (Pensacola: Ballinger Publishing Company, 1987): 136–137; L. Toscano, *Triple Cross...*, *op. cit.*; M. Sleiman, “Shutting down Dimona: Israel’s nuclear program, arsenal and environmental threat,” *Contemporary Arab Affairs*, Vol. 3, No. 4 (September–December 2010): 437–479. Owing to the relations between Israeli and American scientists, the warheads fitted on the *Jericho* and the U.S. *XW-58* appear to be similar. See S. Spector, J. R. Smith, *Nuclear Ambitions. The Spread of Nuclear Weapons, 1989–1990* (New York: Routledge, 1990). Find out more about the discussions on the similarities between Israel’s nuclear gravity bombs and the U.S. *Mark-12* in H. Halim, “[Why no one will ever build another Nagasaki Type Bomb](#),” *Arms Control Wonk* (15 July 2014). Clancy was inspired by this very model to write *The Sum of All Fears*.

26. T. Cooper, A. Emran, “1973: The First Nuclear War. Crucial Air Battles of the October 1973 Arab-Israeli War,” *Middle East@War*, No. 16 (2019): 11. According to W. E. Burrows, R. Winderm (Critical Mass. *The Dangerous Race for Superweapons in a Fragmenting World* (New York: Simon & Schuster, 1994): 302) and P. Pry (*Israel’s Nuclear Arsenal...*, 87–94), Israel allegedly boasted a “luggable” bomb model as of 1973.

27. J. Isnard, “[When Marcel Dassault handed Jericho to Israel](#),” *Le Monde* (11 December 1996).

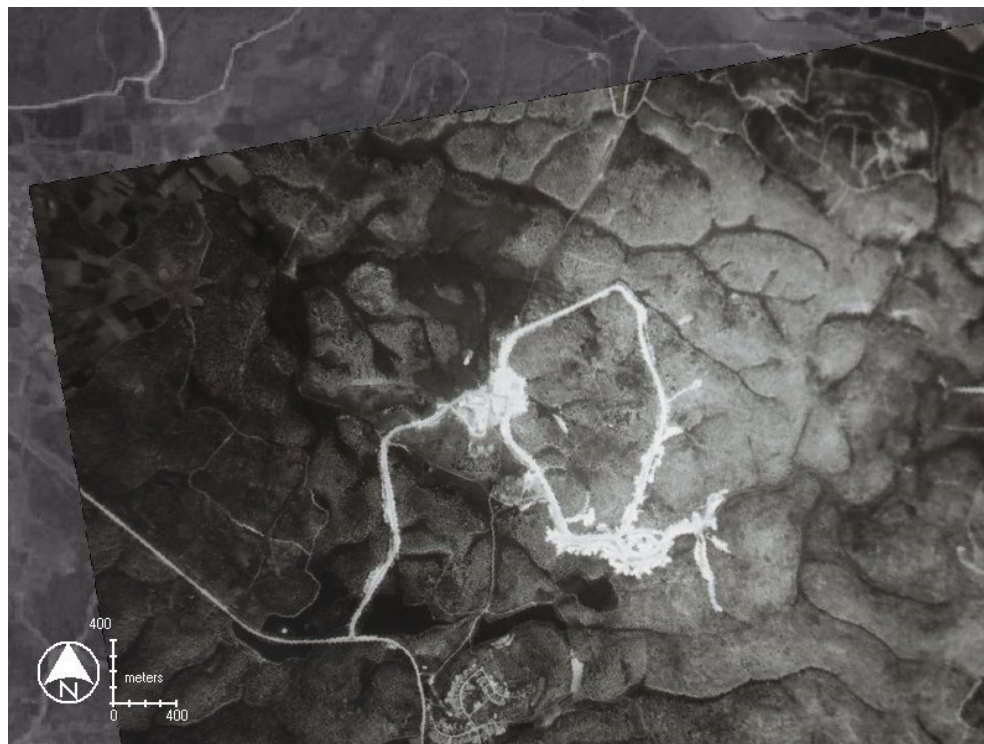


MD.620 on its Transporter-Erector-Launcher (TEL).

Source: "[MD 620 Jericho](#)," *Dassault Aviation*.

Simultaneously, U.S. *Corona* satellites detected bustling activity in the Jerusalem District, at the Sdot Micha Airbase. In the Valley of Ehla, on a hillside, extensive groundwork possibly related to underground shelters meant to house future *Jericho* and their TELs is reported. A few kilometers to the west, adjacent to Moshav Tirosh, satellite imagery then indicated that a large ammunition storage site was being built.

Its proximity to Sdot Micha, as well as Tel Nof and Hatzor airbases, led the interpreters to qualify this location as a warhead storage area intended to weaponize the IAF's ballistic missiles (BM) and aircraft.



A declassified *Corona* satellite imagery of the Sdot Micha under construction.
Source: "[Beit Zacharia/Zekharyeh – Sedot Micha/Sdot Micha](#)," *Global Security*.

The *MD.620* was not the only armament program to be affected by the French embargo. Aside from the rejection of the *Mirage IV* requested by Israel, Paris deferred the delivery of the *Mirage V* it had ordered in 1966.

This about-face gave rise to two implications. Foremost, it constrained the IAF and Israel's industries to develop their own weapon systems. By dint of economic espionage and reverse engineering²⁸, they managed to develop two aircraft based closely on the *Mirage III* and *V*: the *Nesher*, and, above all, the *Kfir*, whose maneuverability, avionics and engine put it in an ideal position for nuclear duties. What is more, it serves as a culmination of the IAF's switchover efforts towards U.S. military hardware at the expense of French suppliers.

Not only did Washington find the opportunity to boost its regional influence in Israel, but it would also address its needs with that much eagerness, for they allowed confronting Tel Aviv with the issue of its nuclear program.²⁹

28. N. Ténèze, *Israël et sa dissuasion : histoire et politique d'un paradoxe* (Paris: L'Harmattan, 2015): 133-134.

29. This strategy was also used during the *M-48A Patton* and *A-4E Skyhawk* talks. See A. Ben-Zvi, *Lyndon B. Johnson and the Politics of Arms Sales to Israel. In the Shadow of the Hawk* (London: Frank Cass Publisher, 2004).

Indeed, at the close of the 1970s, an increasing number of analysts of the U.S. intelligence community started questioning Israel's agenda in this regard. Tel Aviv's major outlay to develop *Jericho* and the missile's technical specifications baffle the experts as to its end purpose.³⁰ Others remark on the fact that *Skyhawk* aircraft conduct toss/loft maneuvers during drills that, as outlined in a CIA report, "*would not have made sense*" if they did not aim at releasing a nuclear gravity bomb.³¹ In that connection, the negotiations between Washington and Tel Aviv regarding the acquisition of the new *Phantom* fighter only reinforce U.S. concern over the essence of Israel's nuclear agenda.

The negotiations kicked off in October 1965 with the IAF Chief of Air Staff's visit to the United States. While the two countries reached a sales agreement for 48 new *Skyhawk*, General Ezer Weizman took an interest in the *F-4 Phantom II*. Manufactured by McDonnell Douglas and entering service with the U.S. Navy in the 1960s, this Mach 2-capable aircraft features a 1,100-kilometer range and nine hardpoints supporting up to 7 tons worth of armament. Together with air-to-air missiles or rocket containers, they can release a wide array of bombs – either conventional or nuclear.

The aircraft's E version particularly convinced the Israeli general. Designed for the U.S. Air Force, it encompasses several improvements over the original model, such as the *M61 Vulcan* cannon, the *J79GE17* engines but, most importantly, an *AN/AJB-7* automated Low-Altitude Bombing System (LABS) designed specifically for nuclear strike missions. His U.S. counterparts, however, did not accommodate his request for a "*nuclear-capable*" aircraft.³²

In 1968, Prime Minister Eshkol brings the *F-4E* issue to the negotiating table again. The focus is on offsetting the losses suffered from the June 1967 clashes, compounded by those of the War of Attrition (1967-1970). Concurrently, as suggested by the IAF Chief of Air Staff, this procurement should aim at acquiring *Phantom* with "*as few modifications as possible*," that is, fitted with their systems and racks allowing for the carrying of an atomic warhead.³³

The DoS and the Pentagon seized this opportunity to make their approval contingent upon Israel's pledge that it will neither manufacture nor deploy nuclear weapons or strategic missiles. Besides, they intend to convince Tel Aviv to sign the new Treaty on the Non-Proliferation of Nuclear Weapons (NPT), so that International

30. M. van Creveld, *Military Lessons of the Yom Kippur War: Historical Perspectives* (London: SAGE Publications Ltd., 1975): 31; W. E. Burrows, R. Winderm, *Critical Mass*, *op. cit.*, 450-451.

31. U.S. Nuclear Regulatory Commission, "[Inquiry Into the Testimony of the Executive Director For Operation](#)," *Interview*, Volume III (February 1978); S. Weissman, H. Krosney, *The Islamic Bomb...*, *op. cit.*, 107; J. Adams, *Israel and South Africa. The Unnatural Alliance* (London: Quartet Books Limited, 1984): 155.

32. S. Green, *Living by the Sword. America and Israel in the Middle East* (Brattleboro: Amana Books, 1988): 17-20. T. N. Nashif alleges that Tel-Aviv willingly leaked that information with a view to enhancing the ambiguity surrounding its capabilities; in *Nuclear Weapon in Israel*, *op. cit.*, 38.

33. S. Green, *Living by the Sword...*, *op. cit.*, 11.

Atomic Energy Agency (IAEA) inspectors survey Israel's facilities and ensure that their activities are of a peaceful nature.³⁴

These terms incurred the Israelis' displeasure and gave rise to heated exchanges during which the U.S. negotiators struggled to gain concessions from their counterparts. While the NPT matter was quickly kept out of the talks, Assistant Secretary of Defense for International Security Affairs Paul C. Warnke was determined to secure guarantees on the abstention from introducing nuclear weapons in the region.

Through its ambassador to Washington, Tel Aviv finally relented: in effect, Yitzhak Rabin, before the U.S. delegation, confirmed that Israel shall not be "*the first to introduce nuclear weapons into the Middle East*." On the flip side, this pledge faced a number of pitfalls from the outset, starting with the absence of an agreed definition of "*introduction*" between the parties.³⁵ Be it as it may, the adjudication lied with President Johnson who, notwithstanding the caveats of his own administration,³⁶ agreed to comply with Israel's request to purchase 100 *Skyhawk* and 50 *Phantom* in November 1968.

On September 5, 1969, the first *F-4E* departed to Israel and landed in Hatzor. Based on some observers, those were the nuclear-capable variant of the aircraft³⁷. A week later, Henry Kissinger received a telegram from the DoS listing the means available to Tel Aviv to release a bomb. Among them, "*Mirage, A4*," but also the recently acquired "*F-4 aircraft*."³⁸ In turn, the IAF pilots were not long in practicing toss/loft maneuvers on board their new aircraft.³⁹

In essence, as we move forward into the fourth Arab-Israeli War, Tel Aviv appears to possess the delivery vehicles (ballistic missiles; fighter aircraft) and the effectors (*Jericho*-tailored miniature warheads; aircraft nuclear gravity bombs) paramount to the technical credibility of its deterrence. It is therefore necessary to investigate the October 1973 War narratives provided by Avner Cohen and Seymour Hersh in the light of these achievements.

No alert, one alert, two alerts...

Relative to that of 1967, the October 1973 alert was subject to several publications, though the latter did not entirely enable filling in the blanks. Part of the

34. Find out more about this issue in Department of State, "[Issues to be Considered in Connection with Negotiations with Israel for F-4 Phantom Aircraft](#)," *Briefing Memorandum* (15 October 1968).

35. "Ambassador Rabin expressed the view that introduction would require testing and making public the fact of possession of a nuclear weapon; Assistant Secretary of Defense Paul Warnke made clear the American definition is that mere possession of nuclear weapon constitute "introduction" of nuclear weapons; Department of State, "[Israeli Nuclear Weapons Program – NSSM 40](#)," *Memorandum of Issues and Basic Study* (30 May 1969): 18. See also Department of Defense, "[Negotiations with Israel – F-4 and Advanced Weapons](#)," *Memorandum of Conversation* (12 November 1968).

36. The DoS also warns against the adverse effects that such a claim may have on the security balance of the Middle East; D. Rodman, "American Arms Transfers to Israel, 1962–1970: The Nuclear Weapons Dimension," *Israel Journal of Foreign Affairs*, Vol. 9, No. 3 (2 september 2015): 483–494.

37. S. Green, *Living by the Sword...*, *op. cit.*

38. Department of State, "[Briefing Book – Visit of Mrs. Golda Meir](#)," *op. cit.*

39. F. Barnaby, *The Invisible Bomb. The Nuclear Arms Race in the Middle East* (London: L. B. Tauris, 1993): 22.

reason for this lack of clarity is the code of silence surrounding the sequence of events: except for one instance,⁴⁰ not a single Israeli leader has officially confirmed that this alert transpired for fear of undermining the conceptual ambiguity of domestic deterrence. However, with access to certain archives and anonymous interviews, several papers have geared towards dispelling the fog of uncertainty associated with this incident.

Historians are caught between two narratives. The first of them builds on Avner Cohen's findings⁴¹. Supported by testimonies, he assesses that a nuclear alert was effectively considered during a Cabinet meeting in the early days of the war, though its anticipated conduct was immediately ruled out by the prime minister. The second hinges on Seymour Hersh's version. His dramatic and criticized account⁴² depicts a Golda Meir overcome with concern and, conversely, very much in favor of the alert. The latter is even said to have been maintained for a few days before an all clear was given. These two perspectives shall be completed with today's sources and mirrored.

The alert never materialized: Avner Cohen's version

Avner Cohen recounts this incident using Arman "Sini" Azaryahu's crucial testimony. As a discreet figure of the first stages of Israel's nuclear program, he was Yisrael Galili's right-hand man during the conflict, one of the most intimate advisers of the prime minister. Azaryahu mentions an informal Cabinet war meeting on October 7, early in the afternoon.⁴³ Further to the latter, he presumedly found Galili in shock, stunned by the content of the discussions he had just attended and that he shared with his friend.⁴⁴

Returning from an inspection tour of the fronts, Moshe Dayan purportedly made a statement describing a dire situation to his audience: a dazzling breakthrough of

40. In a TV interview, Ephraim Katzir, sitting president during the 1973 War, stated "[that] *Israel armed an aircraft with a nuclear bomb*" during the conflict; M. Karpin, *The Bomb in the Basement. How Israel Went Nuclear and What that Means for the World* (New York: Simon & Schuster, 2006); S. Weissman, H. Krosney, *The Islamic Bomb. The Nuclear Threat to Israel and the Middle East* (New York, Times Books, 1981): 106-107.

41. A. Cohen, *The Worst-Kept Secret. Israel's Bargain With the Bomb* (New York: Columbia University Press, 2010). A view shared by S. Weissman, H. Krosney, *The Islamic Bomb... op. cit.*; P. Pry, *Israel's Nuclear Arsenal, op. cit.*; S. Aronson, *The Politics and Strategy of Nuclear Weapons in the Middle East. Opacity, Theory and Reality, 1960-1991. An Israeli Perspective* (Albany: State University of New York Press, 1992); Y. Evron, *Israel's Nuclear Dilemma* (Ithaca (New York): Cornell University Press, 1994).

42. By former Director General of the IAEC Shaleveth Freier, Shimon Peres, the scientist Yuval Ne'eman or French Chemist Bertrand Goldschmidt (one of the founding members of the French Atomic Energy Commission and national representative to the IAEC for more than 20 years) in particular, for whom "*Seymour Hersh has done a very bad book*;" quoted in A. Cohen, "[Interview with Bertrand Goldschmidt](#)," *Wilson Center*.

43. Yigal Allon (deputy prime minister), Israel Galili (minister without portfolio) and David Eleazar (chief of staff) attended the meeting along with the prime minister and the defense minister. Moshe Dayan professedly waited for Eleazar to leave to broach the nuclear topic and invite Director General of the IAEC Shaleveth Freier to the meeting.

44. A. Cohen, "[Interview with Arman 'Sini' Azaryahu](#)," *Wilson Center*. During his interview with Cohen in 2008, Azaryahu claimed that this meeting transpired on October 7. In his book, Cohen will change the date to October 9.

Egypt's troops in Sinai, disrupted lines of defense in the Golan under the pressure of Syria's tanks, Jordan's likely entry into war in the coming days... The defense minister had arrived in Tel Aviv with the confidence that it was only a matter of time before the "*end of the Third Temple*."⁴⁵ To escape this dismal outcome, he proposed that the prime minister should bid Shalhevet Freier, head of the IAEC, to promptly initiate preparations for the conduct of a "*nuclear demonstration*." To Daryan, due to the seriousness of events, this decision had to be reached right away in order to buy "*half a day*."

These pieces of information, stemming from indirect hearsay testimony, allow developing several assumptions regarding the type of show of force that was retained. Cohen assumes that the associated processing time negates the possibility of underground explosion. Beyond addressing the issue of existing, dedicated infrastructure, he argues that formalizing, organizing and carrying such an operation is likely to take too long to be any relevant. Besides, this maneuver would not reflect the illustrative purpose conveyed by the minister's statement.

Opting for a ground-to-ground strike is also very unlikely. In spite of the short timeframe required for *Jericho*'s firing sequence (about 30 minutes), Dayan's speech did not portend any intent to use nuclear weapons as part of a counterforce – the system does not appear to be designed to that end⁴⁶ – or countervalue approach: it was solely meant to be a "*demonstration*."

This aim entailed being able to control the blast effects to the greatest extent possible or, at the very least, delimit the blast area. Yet, assuming the missiles were operational, there was no indication that IAI engineers were fully capable of commanding their guidance system's fin. In 1974, U.S. intelligence reports still held the view that the *Jericho* had an estimated circular error probable of 920 meters.⁴⁷ The latter was too much of a hazard and a risk to draw on the 150th Squadron.

All things considered, when he laid out his plan, Dayan chiefly contemplated the operation of IAF aircraft. Those allowed responding in a timely fashion, granted that the IAEC buckled down to operationalize the warheads forthwith and that the IDF configured the aircraft accordingly.

Vis-à-vis the ballistic missiles, these aircraft offered greater agility. Their reversibility and the facility of modifying their flight plan at all times provided more flex-

45. In connection with the two prior destructions of the Temple of Jerusalem: the first time by Nabuchodonosor II around 587 BC, the second by the Roman legions of Emperor Titus in the year 70.

46. *Jericho*'s accuracy "*close to a kilometer [...]* suggests that Israel will primarily use it to destroy cities," in "[France is manufacturing missiles with a 500kilometer range for Israel](#)," *Le Monde* (26 April 1968).

47. Director of Central Intelligence, "[Prospects for Further Proliferation of Nuclear Weapons](#)," *Special National Intelligence Estimate* (23 October 1974). See also "[Israeli Ballistic Missile Developments](#)," *Report to the Commission to Assess the Ballistics Missile Threat to the United States* (15 July 1998). In a June 1995 article of the *Wisconsin Project on Nuclear Arms Control*, it is said that Israel was allegedly struggling to develop efficient inertial measurement units and highprecision bearings, which are the backbone of onboard missile guidance systems; "[Israel Aims to Improve Missile Accuracy](#)," *WPAC* (1 June 1995).

ibility in the selection of the blast area. More importantly, the demonstrative nature and psychological impact of this maneuver would be ensured. The airburst detonation a few hundred meters off the ground of a twenty-kiloton bomb through toss/loft delivery would have generated a flash visible in a ring several kilometers in diameter.

Unlike Colonel Ya'akov some years earlier, to carry the bomb, Moshe Dayan had plenty of aircraft to choose from. The IAF comprised *Skyhawk* or *Phantom* from three bases: Ramat David (109th, 110th and 69th Squadron), Hatzetim (102nd and 107th), Hatzor (201st) and Tel Nof (115th, 116th and 119th). The best way to cope with the emergency at hand was to operate from the last two strongholds and Tirosh weapons storage facility, located only a few kilometers away from one another⁴⁸. Once the warheads are set up, the fighter aircraft may also scatter to other sites in a bid to mitigate the risk of geographic clustering – as had in fact been planned for the *Jericho*⁴⁹ in the long run.

In a recent paper, Avner explores another avenue.⁵⁰ In his view, in 1973, there was a core group of *Mirage III* CJ pilots within the IAF, comprising its strongest assets trained to release nuclear weapons. Informed of the latest developments in Israel's nuclear program, they belonged to the 101st and 107th squadrons stationed north of the country, in Ramat David. Three grounds support this view. First, this airbase is located some twenty kilometers from Eilabun storage facility, which is believed to be the second nuclear storage site dedicated to strategic weapons in particular. Second, fostering the use of the *Mirage* would enable Israel to deliver on its ambassador's pledge to the United States during the *Phantom* purchase talks “*not to use any [the] aircraft supplied by the U.S. as a nuclear weapon carrier.*”⁵¹ Third, Cohen has his own interpretation of Lieutenant Colonel Avraham “Avi” Lanir's mysterious disappearance. *Mirage III* CJ pilot and commander of the 101st, he was shot down above the Golan on October 13 and captured by the Syrian armed forces. Despite the brutal treatment and torture inflicted upon him, he died without compromising the information that he was thought to possess.⁵²

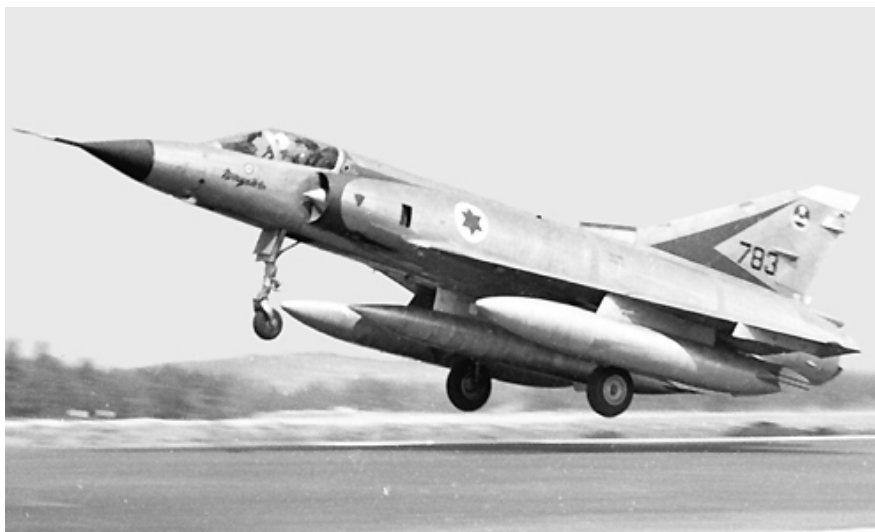
48. Together with that of Hatzetim, the Tel Nof Airbase is often referred to as one of the major military sites assigned to nuclear activities. Its *Phantom* are considered part of the “*Black Squadron.*”

49. A DoS report dating from 1969 claimed that “*there is evidence strongly indicating that several sites providing operational launch capabilities are virtually complete,*” in Department of State, “[Briefing Book – Visit of Mrs. Golda Meir](#),” *op. cit.* This way, “*A five-minute drive from the Black Squadron and the Jerichos, they would be mated with those delivery systems in a time of crisis and dispersed,*” in the words of W. E. Burrows, R. Windrem, *Critical Mass...*, *op. cit.*, 286.

50. J. Lewis, “[Israel, Nuclear Weapons and the 1973 Yom Kippur War](#)”, *Arms control Wonk* (21 October 2023).

51. “[Ambassador Lt. Gen. Y. Rabin to Assistant Secretary of Defense Paul Warnke](#)”, *Letter* (22 November 1968).

52. In the film adaptation of the novel, Ronen Bergman sees the opening scene as an implicit tribute to Lieutenant Colonel Avraham Lanir. The *Mirage III* pilot is shot down by an enemy SA-3 in the Golan on October 13, 1973. Captured by the Syrian armed forces, interrogated and tortured, he died on October 16 without disclosing the least bit of information. He was posthumously awarded the Medal of Courage. The recommendation letter for said decoration, prepared by the chief of Air Staff, refers to “*a fully-fledged, secret partner, the sole prisoner of the Yom Kippur War to retain such information.*” Some argue that “*such information*” referred to Israel nuclear program's state of development. See, “[אל הז' פא' יינציק סיעצמאב שמתשהל ד'רצ, רוזעי מירופיכה מי תמהלם לש ייניערגה תודוסה](#)”, *Ynet* (8 September 2023).



Israel's *Mirage III CJ*.

Source: "[The Mirage III in all its aspects](#)," *Avions légendaires*.

Be it the *Mirage*, the *Skyhawk* or the *Phantom*, these *ש"ס* ("secret partners") could take off and conduct their mission within six to twelve hours, depending on the authorities' decision.

Still, Golda Meir cut short her minister's suggestions: "*Forget it*" she reportedly told him after his address. Aside from the Cabinet's commitment to pursuing conventional warfare and the risk of ruining the incipient nuclear ambiguity, a further reason for this dismissal is the interpersonal feud between Dayan and two other members of the prime minister's inner circle – Allon and Galili – as well as the flippancy with which he purportedly came forward with his agenda.

A weeklong alert: Seymour Hersh's version

Seymour Hersh also recounts a "*stunning*" meeting attended by our stakeholders and Military Assistant to Meir General Yisrael Leor. It professedly transpired late in the morning on October 8 – and not early in the afternoon on the seventh – until nightfall.

In the light of the fast-changing military situation, such a difference in timing is of great significance: knowing the exact date and time of this meeting would expose the Cabinet's mindset and how its members reacted to Daryan's suggestion.

But fear is rife on this third day of war. Regardless of the heartening news in the Golan, the reports from Sinai are a matter of concern. The counteroffensive launched early in the morning proved unsuccessful and costly in men and equipment. Simultaneously, a first material toll is circulating in the Staff's corridors: in just 72 hours of confrontation, *Tsahal* had lost 500 tanks and 49 aircraft.

Air Force Commander General Benny Peled immediately alerted his chain of command: such attrition will barely allow his forces to pursue the war until the end of the week.⁵³ The scale of the losses sustained even compromises the Israeli armed forces' overall ability to continue the fight.

In contrast with the course of events portrayed by Cohen, the Cabinet did not pussy-foot around: it declared nuclear alert. In the judgment of Israel's leaders, if the conventional forces were to collapse, it would allow for a "*Samson-like*"⁵⁴ heroic last stand.

Hersh then indicates an array of details in his account. At the Sdot Micha Airbase, the nuclear warheads are mounted on the 150th Squadron's *Jericho*. At the same time, at Tel Nof, an eight-strong *F-4* flight of the 119th Squadron – engaged in Quick Reaction Alert (QRA) – is fitted with nuclear gravity bombs. At this point, the target package is fore mostly aimed against the enemy forces' Staffs in Cairo and Damascus. The relevant targets are put within range of Israel's ballistic missile launch or aircraft flight.



Mockup of a Tel Nov 119th Squadron's *F-4E Phantom* in nuclear configuration (*ECM ALQ-101* pod, *AIM-9D Sidewinder* air-to-air missiles with a nuclear bomb on the *Phantom's* central pylon).

Source: T. Cooper, A. Emran, "1973: The First Nuclear War. Crucial Air Battles of The October 1973 Arab-Israeli War," *Middle East@War*, No. 16 (2019).

The *TIME* article consisting of the first disclosures of the alert recounts that both the *Phantom* and *Kfir* were weaponized that way. Based on multiple authors, this would suggest that the strike package was comprising different types of aircraft either intended to carry a nuclear weapon or act as airtoair/groundto-air protection escort. This argument is furthered by Robert Harkavy and Peter Pry, and Pry even assessed that it is up to the *Phantom* to ensure the safety of the *Kfir* since the latter are more prone to carry the nuclear gravity bomb due to their superior maneuverability.⁵⁵ With that being said, there is no evidence to substantiate these claims, all the more so as the first *Kfir* will not be part of the IAF's assets before 1975. Yet, still according to Pry, the *Skyhawk* could represent a credible alternative to the *Kfir*. Their lower capabilities would turn them into mere carriers while the outperforming *Phantom* would protect them against any external threat.

53. A. Cohen, "[Opinion – The Last Nuclear Moment](#)", *The New York Times* (6 September 2003).

54. Born in the 12th century BC, Samson is the twelfth and last judge of Judah, gifted with godlike force. Captured by the Philistines, he was imprisoned in Gaza. While he was attending a religious ceremony, he decided to take down the Temple pillars with his bare hands. His suicide claimed the lives of thousands of Philistines. His story is chronicled in the *Book of Judges* – seventh book of the *Torah* – and echoes, with a nuclear deterrence approach, the principle of sealed and mutual destruction.

55. P. Pry, *Israel's Nuclear Arsenal*, *op. cit.*, 106-107; R. Harkavy, *Israel's Nuclear Weapons...*, *op. cit.*

The Cabinet had also agreed to contact Washington in explanation of grounds for its decision. Hersh regards this as nuclear blackmail aimed at convincing the White House to provide material assistance to Tel Aviv⁵⁶ at once. Incidentally, the journalist claims that the Pentagon professedly confirmed Israel's statements with supporting images after a *Keyhole*-type satellite passed over Sdot Micha.

As regards the latter issue, several elements now allow us to set the record straight. During the Yom Kippur War, the United States had but two optical reconnaissance satellites in orbit: *KH-8 Gambit*, and *KH-9 Hexagon*. Beyond the limitations imposed by their systems' revisit times, they are inadequate for effective situation monitoring.⁵⁷ In part, their roll films are delivered by recovery vehicles (two for *Gambit*, four for *Hexagon*) that drop back to Earth for retrieval and transmission to the National Photographic Interpretation Center (NPIC) interpreters in Washington, D.C., for processing. All of this takes four to five days at best⁵⁸.

In addition to infuriating Kissinger,⁵⁹ this "*crisis reconnaissance*" compelled the Pentagon to explore new alternatives. The operation of the SR-71 was subsequently approved, though their take-off area will not be Britishbased as London refused to host those missions. Thus, according to *TIME*'s disclosures, it is only after *Blackbird* overflights on an unspecified date – unsuccessfully intercepted by two IAF *Phantom* aircraft – that the White House obtained the exposures of the QRA *Jericho* at Sdot Micha.

Throughout the war, the U.S. archives solely report two *Busy Pilot/Giant Reach* missions, with a first occurrence on October 13 from Griffiss Air Force Base (AFB) by a SR-71 of the 9th Strategic Reconnaissance Wing.⁶⁰ At any rate, a pilot stated that seven other undocumented flights were carried out.⁶¹

Hence the possibility for the United States to have conducted a mission around October 8 that enabled establishing the existence of such an alert.

56. A critical review of the nuclear blackmail claim is available in E. A. Colby, A. Cohen, W. F. McCants, B. Morris, W. G. Rosenau, "[The Israeli 'Nuclear Alert' of 1973: Deterrence and Signaling in Crisis](#)," *op. cit.*, 29-33.

57. "[KH-8-40](#)" and "[KH-9-6](#)," *NASA Space Science Data Coordinated Archive*. See also D. A. Day, "[Crisis in Space: The 1973 Yom Kippur War and 'Crisis Reconnaissance'](#)," *The Space Review* (2 October 2023); "[Soviet and U.S. satellites conduct aerial photo-reconnaissance missions](#)," *Le Monde*, 19/10/1973, C. P. Wilson, "Strategic And Tactical Aerial Reconnaissance in the Near East," *Military Research Paper*, No. 1, The Washington Institute for Near East Policy (1999): 58-60.

58. M. Russell Rip, J. F. Fontanella, "A Window on the Arab-Israeli 'Yom Kippur' war of October 1973: Military photoreconnaissance from high altitude and space," *Intelligence and National Security*, Vol. 6, No. 1 (1991): 15-89 (25).

59. "[Minutes of Washington Special Actions Group Meeting](#)," *Office of the Historian*, Foreign Relations of the United States, 1969-1976, Volume X, Vietnam, January 1973-July 1975, Washington (7 August 1973): 3:06-4:17 p.m.

60. A flight of 11 hours and 13 minutes with six in-flight refueling occurrences. See "[Chronology. Subj: Middle East Crisis](#)," *Office of the Historian*, Headquarters Strategic Air Command (12 December 1973). Regarding the role of the *Blackbird*, see D. A. Brugioni, "[The Effects of Aerial and Satellite Imagery on the 1973 Yom Kippur War](#)," *Air Power History*, Vol. 51, No. 3 (Fall 2004): 4-13.

61. R. H. Graham, *Flying the SR-71 Blackbird. In the Cockpit on a secret operational mission* (Beverly: Quarto Publishing Group, USA Inc. 2019): 23-26.



SR-71 Blackbird departing from Griffiss AFB.

Source: "[SR-71 OL-Griffiss AFB.](#)"

Tel Aviv made a point of taking the *Jericho* out so they could be seen by U.S.... or Soviet observation assets. In his book, Hersh rightly recalls that Moscow also had access to satellite coverage in this area. When the conflict kicked off on October 6, the USSR implemented two *Cosmos* (596 and 597) that, for the purposes of the war, were supplemented by *Cosmos* 598, 600 and 602 launched on the spot from Plesetsk and Baikonur cosmodromes. While their operation is akin to *Gambit*'s and *Hexagon*'s, the Kremlin's responsiveness allowed it to benefit from a much greater space-based situational awareness than the White House.⁶² In point of fact, Marvin van Creveld assesses that the decreasing speed of the Egyptian and Syrian armed forces' advance on October 8 may be accounted for by a cautionary note sounded by their Soviet backer regarding their opponent's nuclear preparedness⁶³.

At length, from October 12, the establishment of an airlift with the toing and froing of U.S. *Galaxy* and *Starlifter* cargo ships allowed *Tsahal* to offset the material losses suffered from the first days of the conflict.⁶⁴ Concurrently, it regained the initiative on both the Golan front and in Sinai. The doomsday scenario receded and presided over the lifting of the alert.

Nuclear display and new historiographical debates

Cohen's and Hersh's stories are distinguishable on three fundamental grounds: the nature of Moshe Dayan's suggestion, the way it was acknowledged and the re-

62. M. Russell Rip, J. F. Fontanella, "A Window on the Arab-Israeli....," *art. cit.*, 36.

63. M. Van Creveld *Nuclear Proliferation and The Future of Conflict* (New York: The Free Press, 1993): 101-103. Regarding this assumption, see U. BarJoseph, "[The Hidden Debate: The Formation of Nuclear Doctrines in the Middle East](#)," *Journal of Strategic Studies*, Vol. 5, No. 2 (1982): 216; S. Aronson, "The Nuclear Dimension of the Arab-Israeli Conflict: The Case of the Yom Kippur War," *Jerusalem Journal of International Relations*, vol. 7, No. 1-2 (1984): 107-141; Y. Evron, "The Relevance and Irrelevance of Nuclear Options in Conventional Wars: The 1973 October War," *Jerusalem Journal of International Affairs*, No. 7, No. 1-2 (1984): 143-176; S. Aronson, *The Politics and Strategy of Nuclear Weapons in the Middle East*, New York, State University of New York (1992): 143-149.

64. Regarding the airlift, see C. J. Krisinger (Cpt. USAF), "[Operation Nickel Grass. Airlift in Support of National Policy](#)," *Airpower Journal*, Vol. III, No. 1 (Spring 1989): 16-28.

sulting turn of events. By contrast, they coincide as to another “*strategic alert*” without, yet again, reaching consensus on the timeline.⁶⁵ Even so, both their accounts are based on the same source: the testimony of Physicist and future Prime Minister Yuval Ne’eman who, at the time of the events, was the representative of the defense minister to the Pentagon.⁶⁶

Cohen’s version

In Cohen’s view, a new alert transpired from October 17-20. It was triggered by Cairo’s reactions after its troops were pushed back above Sinai. On the 16th, while the first elements of Sharon’s division were establishing a bridgehead on the west bank of the canal, President Sadat warned Tel Aviv: “[*Our missiles*] are on their pads, ready with a signal to be fired into the depth of Israel.”⁶⁷

A few hours later, after a *Blackbird* flew over Egypt, the Pentagon issued the exposures of *TEL MAZ543*, fitted with *Scud* missiles provided by the Soviets, to the Embassy of Israel in the United States. Deployed in the Nile Delta, they were within striking range of Israel’s capital. Even more alarming, some interpreters ascertained that the relevant models were capable of carrying nuclear warheads⁶⁸.

Yuval Ne’eman was dispatched urgently to meet with Golda Meir and Moshe Dayan and inform them of the situation. IDF CoS General David Elazar immediately ordered Sdot Micha airmen to deploy the *Jericho* “so that they could be clearly seen in satellite images. This way, the Russians [...] could photograph them.”⁶⁹

In 1996, upon disclosure of this incident, Ne’eman failed to remember the nature of the warheads used for Israel’s missiles then. Memory lapse or desire to maintain ambiguity, he did not corroborate the warheads’ type, if they were nuclear, conventional or even dummy. In all events, it is likely that the operators followed the steps and procedures pertaining to the *Jericho*’s firing sequence and their launchers as a

65. A. Cohen, *The Worst-Kept...*, *op. cit.*, 80; A. Cohen, “Nuclear Arms in Crisis under Secrecy,” *art. cit.*, 116-118, in P. R. Lavoy, S. D. Sagan, J. Wirtz (eds.), *Panning the Unthinkable. How New Powers Will Use Nuclear, Biological and Chemical Weapons* (New York: Cornell University, 2000). See also Y. Ne’eman, “The USA-Israel Connection in the Yom Kippur War (6–24 October 1973),” in M. Wheeler, K. V. Gay (eds.), “Nuclear Weapons and the 1973 Middle East War,” *Occasional Paper*, No. 3, Center for National Security Negotiations (1996).

66. “יעיבש קלח - 1998 - רופיכ פוי תמחלמ לע ביטטקו נויד - 1 צורע,” *YouTube* (16 February 2008). Ne’eman is a vocal critic of Hersh’s take on the first nuclear alert. He argues that it is part of a standard measure to prepare the war: “Note that it would be normal, for whoever is responsible for anything relating to strategic missiles – even if their warheads are just filled with ordinary explosives – to advance their state of preparedness, in the time of war...” ; Ne’eman quoted in P. R. Lavoy, S. D. Sagan, J. Wirtz (eds.), *Panning the Unthinkable...*, *op. cit.*, 118.

67. W. A. Terrill, “[Escalation and Intra-war Deterrence During Limited Wars in the Middle East](#),” *Strategic Studies Institute*, U.S. Army War College (2009): 44.

68. In 1973, Egypt is reportedly in possession of an unknown quantity of *R-17 Elbrus* (SS-1 *Scud-B*). The Kippur War witnessed the first operational use of this system.

69. R. Bergam, O. Fialkov, “[If that doesn’t help, resort to extreme measures: The nuclear secrets of the Yom Kippur War exposed](#),” *Ynet*, 16/09/2023; “[Israeli Ballistic Missile Developments](#),” *Report to the Commission...* *op. cit.*

sign of commitment against the enemy. Intercepted by one of their *Cosmos* and unable to ascertain the nose cones' content, Moscow is believed to have regarded these maneuvers as a strategic behavior credible enough to keep Cairo in check.⁷⁰

Another rationale may account for the Kremlin's concern. As a *Scud* provider with operational control over deployed warheads, the Soviet Union is equally targeted by Israel's warning. And while the *Jericho* posed a genuine and impending threat to Cairo, the USSR was not immune from retribution. Tel Aviv had a number of options to threaten Moscow with a nuclear explosion on its territory. In *The Samson Option*, the former head of CIA's Directorate of Science & Technology recalls the way Israel insisted on obtaining imagery intelligence from their satellites.

Hersh provides insight that, in retrospect, seems "*a much more direct explanation*" to him: these requests aimed at collecting exposures of the Soviet Union to build up Israel's target packs.⁷¹ He goes as far as contending that some of the best *Phantom* pilots were drilled to reach Moscow as part of a one-way flight mission.

While it is arguable that this aircraft's range is too limited – barely enough to enable flights to Moscow's surroundings – some Soviet countries (Bulgaria, Romania, etc.) and several socialist federal Republics (Ukraine, Caucasus and the southern European side of Russia) however remain within reach of the *F4*. Moreover, their range can be theoretically enhanced by tankers or other fighter aircraft using the buddy-buddy air-to-air refueling method. Certain publications even mention that, pending some modification, transport aircraft were used to release a nuclear warhead⁷². The IAF's *C-97 Stratofreighter* and *C130 Hercules* – if not the *Boeing 707* and *747* owned by EL AL Ltd. – could easily make it to the Soviet command structures west of the Urals and shatter the Kremlin's sense of impunity.

All these scenarios nevertheless require handling a daunting task: penetrating one of the world's deepest and most redundant anti-aircraft apparatus.⁷³ Some authors reckoned that maneuvering through "*weakly defended areas*" with a flight profile "*at treetop level*" could heighten Israel aircraft's penetration readiness.⁷⁴ Failing this, the "*suitcase*" nuke⁷⁵ option remained: the Mossad had made sure to leak the word that its agents may, at all times and if need be, drop a package by the Kremlin walls.

70. R. Parker (ed.), *The October War: A Retrospective* (Gainesville (Florida): University of Florida Press, 2001).

71. "*The Pollard Case*" is yet another testimony of Israel's commitment to securing U.S. satellite imagery. This analyst of the U.S. intelligence community was prosecuted with, among other things, conspiracy to deliver NPIC exposures to Israel's services.

72. S. Feldman, *Israeli Nuclear Deterrence. A Strategy For The 1980s* (New York: Columbia University Press, 1982): 92; Sunday Times Insight Team, *The Yom Kippur War* (New York: Doubleday & Company, 1974): 283; P. Pry, *Israel's Nuclear Arsenal*, op. cit., 97-99.

73. R. Harkavy, *Israel's Nuclear Weapons: Specter of Holocaust in the Middle East* (Denver: Denver University Press, 1977): 33-35. See also "Range and Penetration Capabilities Against the USSR," in P. Pry, *Israel's Nuclear Arsenal*, op. cit., 105.

74. S. Rosen, "[A Stable System of Mutual Nuclear Deterrence in the Arab-Israeli Conflict](#)," *The American Political Science Review*, Vol. 71, No. 4 (December 1977): 1382.

75. W. E. Burrows, R. Windrem, *Critical Mass...*, op. cit., 302, footnote 1; P. Pry, *Israel's Nuclear Arsenal*, op. cit., 98-99.

Hersh's version

As for Seymour Hersh, he believes that Israel's posturing emerged in the final hours of the conflict, "*in response*" to the U.S. strategic forces being placed at Defense Readiness Condition 3 (DEFCON 3) on the evening of October 24.⁷⁶ Two days earlier, Egyptians and Israelis agreed to implement the ceasefire ordered by the United Nations Security Council (UNSC). Just the same, the fighting continued in the field. Left in a predicament, President Anwar el-Sadat feared that the enemy will harness its military advantage to gain even more ground and capture Cairo. Israel's divisions were indeed only a few hundred kilometers away at the time, further surrounding the 40,000-strong Egyptian III Corps.

The situation then escalated rapidly. In the morning of October 24, the Pentagon found out that four Soviet airborne divisions were placed on alert and established that the An-12 toing and froing towards Cairo resumed. In southern USSR (Ukraine) and many Soviet countries, sizeable troop movements heading to embarkation areas foreshadowed that a potential and impending intervention of the Red Army in the Middle East was under way. Cargo ship *Mezhdurechensk*, en route to Egypt from Nikolayev, had also been under scrutiny. It drew attention when it passed through the Dardanelles and activated a series of sensors deployed in the strait and designed to detect radioactive materials.⁷⁷ The ship navigating in the Eastern Mediterranean was only a few hundred nautical miles from Alexandria Maritime Port.

At 9:35 p.m., in a pressure-laden environment, Leonid Brezhnev decided to issue an ultimatum to his U.S. counterpart: the IDF must immediately halt its military activities, or else "*we will have to consider taking appropriate and unilateral actions as a matter of urgency.*" An hour passed before an extraordinary Security Council session was held with Kissinger. At 11:41 p.m., he ordered the armed forces to enter DEFCON 3. *USS John F. Kennedy* aircraft carrier was deployed in the Mediterranean to join on-site *USS Independence* and *Roosevelt*. Simultaneously, the Strategic Air Command recalled a hundred *B-52* prepositioned in the AsiaPacific region to spread them out across four bases located on the American continent. Out of the 1,000 *Minuteman* and *Titan* Intercontinental Ballistic Missiles (ICBM), 99.5% were in readiness at an advanced launch stage. The *SR-71*-led *Giant Reach* missions were rekindled with a new impetus so as to enable the finest situation monitoring achievable.

76. "Israel responded to the American alert by going on nuclear alert for a second time in the Yom Kippur War," in S. Hersh, *The Samson Option*, *op. cit.*, 233. In *The Invisible Bomb. The Nuclear Arms Race in the Middle East* (London: L. B. Tauris, 1993): 24), Physicist Frank Barnaby also believes that this alert transpired on October 24, "*when Soviet US relations over the Middle East crisis sharply deteriorated.*" Likewise for R. Sale, "[Yom Kippur: Israel's 1973 nuclear alert](#)," *United Press International* (16 September 2002).

77. "[Soviet Nuclear Weapons in Egypt?](#)," *Memorandum*, CIA (30 October 1973); J. L. Scherer, "[Soviet and American Behavior During the Yom Kippur War](#)," *World Affairs*, Vol. 141, No. 1 (Spring 1978): 3-23. In retrospect, a number of observations allow questioning the assumption that the ship was positively carrying nuclear weapons. See J. M. Action, "[Is It a Nuke? Pre-Launch Ambiguity and Inadvertent Escalation](#)," *Carnegie Endowment for International Peace* (2020): 44-45.

If, as Hersh suggests, one *Jericho* deployment was carried out in this timeframe, it was but transient. As of October 25, through UNSC resolution 340, the two Great Powers agreed to ensure respect of the ceasefire between the parties. Three days later, the Israeli-Egyptian talks regarding post-war settlements were kicked off at Kilometer 101.⁷⁸

Conclusion

Upon comparison, the accounts of the 1967 and 1973 alerts exemplify how Israel's nuclear arsenal developed and became increasingly credible in the span of a few years. In at least two respects, the air component lies at its core. To begin with, it enhances national deterrence by allowing for the transport atomic bombs far enough to keep Israel's regional chief opponents at bay, along with – theoretically – the Soviet Union.

Next, it underscores the nuclear powers' interest in having a dyad. In the case of Israel, considering that the *Jericho* does not enable top-notch targeting, air assets are to be regarded as additional back-ups if the ground missile systems were to be impaired.

Ironically, Israel's aircraft will also prove to be efficient counterproliferation weapons, as evidenced by the raids conducted in Iraq on the Al-Tuwaitha Nuclear Research Center in 1981 during Operation *Opera*, and, years later, on the chemical facilities of the Assad regime (Operation *Orchard*) in 2007.

For the hurried reader, these two nuclear events question the rationale that led Israel's leaders to deny the existence of their nuclear capabilities. While one may argue that there exist devious ways to “*get know*” – such as spatial imagery or equivocal statements – doing so has enabled Israel to honor its pledge to the U.S. ally and the rest of the world not to be “*the first to introduce nuclear weapons into the Middle East*.” Besides, illconsidered utterances could justify attempts by neighbor and hostile countries to acquire a nuke of their own.

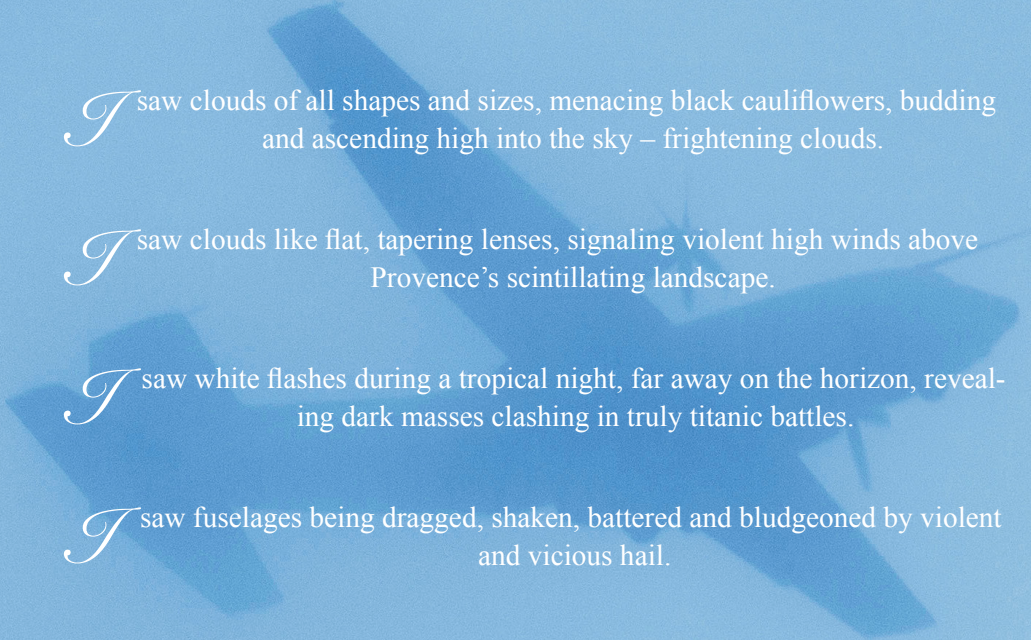
78. Kilometer 101 along the Cairo-Suez road refers to the place where the post-conflict talks between Israel's and Egypt's delegations took place.

TESTIMONIAL

I saw...

Luc de Rancourt

Air Chief Marshal Luc de Rancourt left his position as Inspector General of the Armed Forces to the Minister of the Armed Forces in 2024. His career as an officer saw him exercising operational field responsibilities (command of an air base, overseas operations, air transport pilot), with an international dimension (Deputy general director of International Relations and Strategy of the Ministry of the Armed Forces, Royal College of Defense Studies, European Airlift Centre, US Air Force Academy). He also held senior management positions (Director of the Air Force Transformation, Deputy General to the Special Operations Commander, General chief of staff within the Air Defense and Air Operations Command). He was also Air Force advisor in the minister of defense cabinet. He aims to extend his commitment to serving businesses and more particularly to training their future executives in the geopolitical field.



I saw clouds of all shapes and sizes, menacing black cauliflowers, budding and ascending high into the sky – frightening clouds.

I saw clouds like flat, tapering lenses, signaling violent high winds above Provence's scintillating landscape.

I saw white flashes during a tropical night, far away on the horizon, revealing dark masses clashing in truly titanic battles.

I saw fuselages being dragged, shaken, battered and bludgeoned by violent and vicious hail.

I saw anxious crews, headphones clamped to their ears, unable to speak to each other and deafened by the crackling of a rogue radio, which was on the fritz due to an all-engulfing storm.

I saw stunning rows of long, thin altocumuli, radiating the sun's crimson glow as it ended its course far in the west. Such serene lines offer a gentle transition between the leaden heat of a summer sky and the softness of an emerging starlit night.

I saw, far off in the east on a cold winter's morning, thick sheets of mist glued to the ground, swallowing up every shred of light into a sad, uniform grey veil.

I saw, amid this ooze, bright beacons pass beneath me on a grey tarmac backdrop – slowly at first, then faster and faster – until I finally tore myself away from the ground, only to be engulfed in and a milky, oppressive universe.

I saw, as I suddenly emerged from this thick shroud, a radiant, blinding sun in a crystalline blue sky. Below it, the shadow of my aircraft danced upon thick fog – an immaculate white blanket. From this wide, flush, ground-shackled sheet, hills and lonesome antennae emerged.

I saw white and khaki domes floating above Camp Raffaeli, carrying legionnaires with rather singular accents, freshly released from my hold at the sound of a loud and virile “Go!”

I saw – on the horizon of an azure sky – a black streak exuded by burning oil wells, waiting to savagely swallow up my vibrating fuselage.

I saw dusty clouds in the sweltering heat of the African desert, enveloping the erg, colorful canyons and parched *wadis*, winding through ochre bedrock.

I saw, all too often in the Balkans’ starry nights, farms set ablaze and gunfire climbing up towards the heavens.

I saw – amid the roots of the cheese trees covering Cambodia’s sweltering Ta Prohm – a stormy canopy shrouding the smiles of eternal Khmer Buddhas, the graceful sway of bare-breasted stone Apsaras and... tracer bullets, whoshing beneath my aircraft on their way to puncture it.

I saw beyond the luminous lace of the Hindu Kush, mysterious and murderous valleys into which I plunged.

*F*inally, I saw the smiles and laughter of aircrews, sharing the same grave euphoria as they flew over the world, its beauties and its chaos.

I saw their meditative, dream-filled eyes, turned towards the outside of the cockpit, contemplating those clouds of all shapes and sizes.

REVIEWS

Modern Taiwanese Air Power

Roy Choo and Peter Ho

Modern South Korean Air Power

Robin Polderman



Cross Reviews by Jean-Christophe Noël

The *Vortex* No. 5 issue previously discussed the various publications by the prolific Austrian publisher Harpia Publishing on the Chinese Air Force.¹ In this current issue, two other fascinating works from the same publisher that focus on modern Taiwanese and South Korean air power will be presented.

Let us start with the first text on the Republic of China Air Force (ROCAF). Written by Roy Choo, a Singaporean defence journalist, and Peter Ho, a Taiwanese aviation photographer, the 96-page book, published in 2021, is an excellent introduction to the subject, providing a mastery of the essential concepts concerning this very unique air force.

The book begins with a summary of the ROCAF's rich history. Established in 1920, it initially served as the nationalist Chinese air force. It first saw action in the 1930s, in its attempt to counter the Japanese aviation, which was vastly more supe-

1. J.-C. Noël, “Chinese Air Power in the 20th Century, Modern Chinese Warplanes (Air Force/Naval Aviation/Army Aviation), Red Dragon ‘Flankers’,” in *Vortex. Air and Space Power Studies*, No. 5 (June 2023): 491-498.

rior than itself. It nevertheless distinguished itself on 14 August 1937 when Chinese pilots downed three *Mitsubishi G3M* Japanese bombers without suffering any losses. This date is now celebrated as “Air Force Day”. Its battles in the skies continued later against the People’s Liberation Army (PLA) following the nationalists’ retreat to Taiwan in 1949. During the second Strait Crisis in September 1958, ROCAF pilots became the first in the world to fire air-to-air missiles – *AIM-9 Sidewinders* – at enemy aircraft.

The authors then turn towards the history of the “Black Cat” squadron, which operated the *U-2* aircraft from January 1961 and onwards. Braving *SA-2* fire and *J-7* interceptions, strategic reconnaissance flights were carried out over China up until 1968. Yet, following significant losses, the pilots were forced to be content with only flying over international waters, while using oblique cameras to gather intelligence. *U-2* flights then came to an end entirely in 1974 when Washington and Beijing began their diplomatic rapprochement. This chapter comes to a close with a discussion of Taiwan’s contributions to the development of the air forces of Singapore and the Arab Republic of Yemen.

The next chapter examines the state of the ROCAF in 2021, which details its missions, structure, and organisation. A focus is made on the 5th Tactical Composite Wing, which dates back to 1936 and is made up of four Tactical Fighter and Reconnaissance Groups. The modes of action associated with “Force Preservation” are described, which will interest the aviators of today that study the ways to defend against air or missile attacks. The ROCAF has prioritised rapid restoration of airbases, dispersion, camouflage, and, most notably, the hardening of its facilities. Two sanctuaries have been carved into rock at the Hualien and Chihhang bases to shelter aircraft. Located to the east of the island, these bases are relatively shielded from strikes originating from the west by the central mountain range. However, this facility has become more vulnerable with the positioning of Chinese navy aircraft carriers to the east of the island, as demonstrated during recent exercises. The chapter concludes with two paragraphs discussing Taiwan’s surface-to-air defences and surface-to-surface missiles.

The third chapter provides a concise and vigorous exploration of the strategic challenges facing Taiwan. It is worth recalling that the PLA could project itself beyond the first island chain if it were able to operate freely from Taiwan. The authors discuss the Communist capabilities before painting a scenario that dynamically presents the strategies that each side could follow in the event of war. They note that Taiwanese officials have previously stated that the island could hold out for a fortnight on its own against an attempted invasion, before essential aid arrives.

Of course, this chapter also comments on the current Chinese strategy, which includes attempts to exhaust the ROCAF by regular intrusions into the Air Defence Identification Zone (ADIZ) or by more complete encirclement of the island. In this respect, the authors highlight a significant shift in 2020, marked by a clear intensification of these coercive actions. They emphasise the wear and tear that such modes of

action could impose on a force of approximately 300 fighters, which may potentially have to contend with 4,000 PLA Air Force fighter aircraft. To end, the chapter gives a brief description of the evolution of Taiwan's strategy, particularly through the Overall Defence Concept.² Additionally, it touches on issues, such as Taiwan-U.S. relations (to be redefined with the arrival of Trump), and the local industrial effort.

The fourth chapter, comprising a third of the book, presents a detailed catalogue of ROCAF's aircraft. It includes lengthy sections on the *F-16A/B Block 20*, the *Mirage 2000-5 EI/DI*, and the domestically produced *F-CK-1 C/D Ching-kuo*. Older aircraft, such as the *Northrop F-5 E/F*, the *C-130H*, the *P-3C Orion*, and others, are not left untold.

The fifth and final chapter discusses future programmes, such as the *F-16C/D Block 70*, the *T-5 Yung Ying* trainer aircraft, and Taiwan's drone programme, as well as prospects like the *F-35*. Finally, collectors will appreciate the appendix, which features the various unit patches.

The second book to be presented focuses on the Republic of Korea Air Force (ROKAF) and is titled *Modern South Korean Air Power*. The book, also published in 2021, is written by Robin Polderman, who is a professional aviation photographer. Spanning 256 pages, it is significantly longer than the book on the ROCAF, largely due to its detailed descriptions of all the aircraft that equip or will equip the ROKAF.

This book also begins with a historical overview of the Korean Air Force, this time from a capability-based perspective. Officially established on 1 October 1949, the ROKAF initially had only 22 propeller-driven aircraft, including the *L-4*, *L-5*, and *AT-6*, at the time when North Korea invaded the country in June 1950. To aid their defence, it soon received *F-51Ds* from the United States, who continued selling advanced models, such as the *F-86 Sabre*, *F-4 Phantom*, and *F-5 Tiger* during the Cold War. Under Washington's instigation, Seoul, in turn, transferred 44 of its *F-5 Tigers* to South Vietnam in the early 1970s to help Saigon counter its northern adversaries. Remaining a steadfast ally of the United States, the ROKAF later procured *F-16* and *F-15* fighters and eventually opted for the *F-35*. This historical chapter concludes with a unique discussion of North Korean and Chinese defectors who sought political asylum in South Korea by air.

Following a chapter dedicated to the numbering of aircraft and units, the author offers a comprehensive review of ROKAF aircraft and weaponry in 2021 in just under 100 pages. The previously mentioned U.S. aircraft are naturally discussed, but the text also highlights the *IAF Harpy* drone and, notably, the aircraft manufactured by Korean Aerospace Industries. The full range of this aircraft is detailed, from the *KAI KT-1* used for initial pilot training, to the *KAI T-50*, an advanced trainer and light fighter aircraft that also equips South Korea's acrobatic patrol, the *Black Eagles*. As

2. The Overall Defense Concept (ODC) was developed in 2017 by Admiral Lee. He proposes abandoning the traditional strategy in favour of asymmetric warfare. From a practical point of view, this means abandoning the traditional and costly *F-16C/D Block 70* weapons in favour of a wide range of low-cost missiles that would rain down on communist forces attempting to land on the island.

far as armaments are concerned, the chapter is exhaustive, detailing all the air-to-air and air-to-surface missiles, bombs, pods and other surface-to-air missiles used by the ROKAF. For example, it has purchased *AIM-120D* missiles for its *F-35* fleet and *Meteor BVRAAMs* for its future *KF-21* jets. Additionally, it possesses *AGM-84H SLAM-ERs*, *AGM-88 HARMs* and *Taurus KEPD 350Ks*. This chapter underscores the Air Force's excellence in air-to-air and air-to-surface capabilities. It also highlights the determination of the South Korean authorities to diversify the origins of its armaments, despite the dominance of U.S.-made equipment.

The following chapter looks at the training of South Korean aircrew. It begins by discussing the initial training provided, noting that this is now carried out on modern equipment. The *KT-1*, for instance, is far better equipped than the previous *T-37C* it replaced. It features a heads-up display, which prepares aviators for operating the most advanced aircraft. The *T-50* has the particularity of its low approach speed, making it much easier to land than the older *T-38*. All pilots are permitted to wear a red scarf as soon as they are licensed. It represents a sign of rallying and of belonging to an elite that active and retired pilots exhibit with pride. The author also highlights the training missions carried out by South Korean aviators in Red Flag exercises held in the Nevada desert, where their first involvement dates to March 1979. More recently, South Korean *F-15 K Slam Eagles* have been involved in Red Flag-Alaska training. Additionally, the bilateral Max Thunder exercises, conducted twice a year, involve units from the Pacific Air Forces (PACAF) and the ROKAF. These exercises are often met with vehement protests from Pyongyang.

The next two chapters address the modernisation of the ROKAF (2021-2035) and the South Korean aerospace industry. Readers cannot help but be struck by South Korea's ambition and move upmarket in the latter area. From 2026, for example, South Korean manufacturers are due to supply their forces with a *KF-21 Boramae* generation 4.5 fighter, which will evolve with the *F-15K* and *F-35*. 120 of these are due to equip squadrons by 2032. Developed in cooperation with Indonesia, this aircraft is attracting interest from European countries, such as Poland.

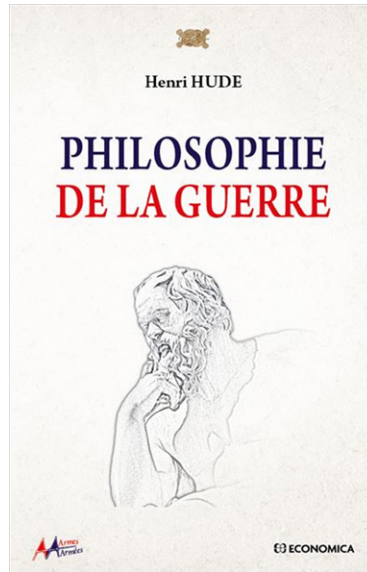
The subsequent chapter examines the regional strategic situation, devoting eight pages to North Korea's air power that are more than welcomed. As expected, the author notes that North Korea's air capabilities are technologically outdated. However, its aircraft could still serve as delivery systems for chemical or biological weapons. Intriguingly, the most "dangerous" aircraft in the Korean Popular Army Air Force (KPAAF), notes the author, might not be the *MiG-29* but the much older *An-2*. Equipped with satellite communications and possibly terrain-following radar, this aircraft could transport small teams of special forces into South Korea to sow chaos. Finally, the chapter also covers joint Russian and Chinese bomber flights near South Korea's ADIZ and the U.S.-South Korea partnership. The book concludes with photographs of patches from ROKAF units and those of the United States Air Force (USAF) in Japan and South Korea.

These two volumes will undoubtedly delight readers who wish to learn more about these Asian air forces while enjoying the magnificent photographs that accompany the text. Once again, Harpia Publishing succeeds in achieving its ambitious goal. It satisfies lovers of aviation photography with remarkable visual reproductions, offers military aircraft enthusiasts a precise and demanding summary of the equipment in use, and provides an overview of the strategic dilemmas faced by local actors.

While it is worth noting that these volumes regrettably date from 2021, a period during which the regional strategic situation has evolved rapidly, they nonetheless inspire curiosity in the readers. After flipping through these pages, they will gain the foundational knowledge needed to further explore the subject. It is afterwards where they can then turn to specialised literature, journals, or the countless reports from think tanks on the region to delve deeper into one point or another.

A Philosophy of War

Henri Hude



Read by Jean-Baptiste Manchon

“One cannot have a methodical desire for peace without a scientific understanding of war. Decision-makers thereby approach war with the intention of avoiding it, while methodically preparing – at their own level – the cultural, economic and political conditions for peace¹.” This aphorism by Henri Hude – who wrote *Philosophie de la Guerre*² (A Philosophy of War) – features in one of the author’s previous works. It illustrates the extent to which questions surrounding war, including how it is justified and conducted, are at the heart of all political thought. As far as the author is concerned, these issues also constitute the core of a philosophical movement that took root at the end of the last century, after Hude published *Prolegomènes* (Prolegomena) in 1991. Thus, this book is the culmination of genuine philosophical research on the issue of war – one that he has already addressed in a number of previous works on ethics and command, such as *Éthique des décideurs* (Decision-maker

1. H. Hude, *La formation des décideurs. Méditations sur un humanisme qui vient* [Training decision-makers: Meditations on humanism to come] (Paris: Mame, 2018): 120.

2. H. Hude, *Philosophie de la guerre* [A Philosophy of War] (Paris: Économica, 2022).

Ethics, 2004) and *Formation des décideurs* (Training Decision-makers, 2018). Thus, *Philosophie de la Guerre* comes as a new form of meditation – in the Cartesian sense of the word – on the question of war itself: how can one conceptualize war, and why? Is there such a thing as a just war?

It must be said that these notions are commonplace to this *normalien* (a graduate of France's École Normale Supérieure), certified Teacher, philosophy PhD and Research Director from Paris-Sorbonne University (Paris IV). As the former Director of the "Ethics and Legal Environment" department at Saint-Cyr-Coëtquidan Military Academy's Research Center (or CREC), he taught military ethics to future French army officers – among others – for some fifteen years. Nevertheless, *Philosophie de la Guerre* offers a novel approach to the issue. This thorough and fruitful assessment is far from one-sided, as illustrated by the depth of Hude's reasoning and the numerous bibliographical references he provides. In fact, the book's topicality and widely-acclaimed quality are self-evident: after being published in November 2022, the book had already been translated into English, Spanish and Russian by the summer of 2024.

The 122-page essay is divided into 345 clearly numbered paragraphs, thereby enabling the reader to easily come back to points that may have struck them. Thus, the book's primary asset is that it is accessible to all. You don't need to wield extensive knowledge of philosophy and its main systems to grasp the author's approach. The bibliography makes for easy reading, as it is kept at the end of the book: one can thereby focus one's critical attention on the author's meditations about war, without being distracted or stunted by footnote references to the many authors being quoted.

Another one of the book's strengths is its sheer clarity; the author's reasoning is easy to follow. Readers are given an opportunity to launch their own personal examination of the issues raised by war and, by extension, those posed by peace and the latter's preservation.

In his introduction, Henri Hude recalls the theories supporting the idea of a "just war", i.e. the principles of military ethics and namely notions such as the "good cause", the "right to self-defense", "legitimate authority", "proportionality in the use of force", "discrimination of objectives", etc. Meanwhile, the author acknowledges the fact that in many conflicts, "the end justifies the means". He then proposes a relatively critical assessment of "just war", by placing it in the context of humankind's position within the cultural and societal space that shapes it. Hude believes that the principles of war, "*when considered abstractly without connecting them to a culture, a hierarchy of values [...] and a form of universal normativity, [...] can be used to justify just about any decision, as long as there is a consensus – on one side, not on both*" (§ 40) ! Thus, the end of the book's introduction puts forward the founding axiom of the author's rationale, according to which "*war is an activity in which the common good tragically outweighs individual rights. Therefore, to be outraged at this state of affairs equates to being outraged at the fact that war exists at all*" (§ 39).

The book then takes on the form of a reflective process, divided into four stages:

- “The Definition of War, from the Outside and the Inside. The Problem of War. The Leviathan Solution” (chapter I),
- “Leviathan is Not the Solution to the Problem of War” (chapter II),
- “The Other Solution: Political Peace without Leviathan” (chapter III),
- “The Alternative: Cultural Peace without Leviathan” (chapter IV).

In the opening chapter, the author reflects upon the nature of war and how it can be avoided. He draws upon Hobbes’ philosophical model – dubbed “Leviathan” – as a guarantor of peace, but goes on to apply it at the supranational level; Leviathan becomes a sort of superpower or empire that dominates the world. The process results in a truly original definition, one that structures the rest of the author’s ideas on war: *“This is what Leviathan is: a universal Empire, a totalitarian political regime with a culture of power and war that supports the elite; an economy that is fundamentally unequal, liberal and technocratic in varying proportions; a culture of powerlessness for society at large (by reducing those who partake and believe in it to a state of impotence); and a social state compatible with this culture of powerlessness (i.e. semi-slavery without forced labor)”* (§ 90).

This explains the title of the second chapter, in which Henri Hude questions Leviathan’s feasibility and ability to maintain power. Contrary to what the Leviathan might claim, the author believes that it is in fact incapable of guaranteeing peace. It is more likely to bring about war, as it can only maintain power through fear and force – due to its totalitarian nature and its elites’ determination to hold on to power at all costs. Indeed, though the fear of an impending nuclear apocalypse and Leviathan’s sheer power – which imposes a “culture of powerlessness” by having the population renounce its freedom to act – may be put forward as the only means of guaranteeing lasting peace, the fact of the matter is that nothing is less certain. The author explains that *“the more the postmodern culture of powerlessness spreads, the more classical and modern cultures are censored [by the society of generalized surveillance established by Leviathan], the less credible deterrence becomes [and] the more war becomes a viable option”* (§ 159).

In the third and fourth chapters, the author develops the rationale underpinning the book’s main theme: how can peace be guaranteed without this universal Leviathan? This leads Hude to consider the notions of “nationalism”, “antinationalism”, “imperialism” and “pacifism”. He sketches out “a political solution without Leviathan”, before broaching the creation of a “culture of peace”, in which humanity’s religions and “wisdoms” are called upon to play a decisive role. Once Leviathan has been ruled out as a solution, peace necessarily rests upon the shoulders of each nation, but must be restructured and reconsidered according to a “culture of peace”. Yet, *“the philosophical keystone of the culture [of peace] we seek can only be philia, i.e. social friendship, as it is the only value that: a) is clearly universal and objective; b) has peace as its obvious main effect; and c) inextricably unites righteousness with*

freedom, nature with freedom, nature with culture and happiness with responsibility" (§ 232). This leads us to the very the heart of Henri Hude's philosophy, one that is permeated by meditations on ethics and politics: *philia*, in its role as a "keystone", replaces freedom as the supreme value, while preserving the latter's characteristics. According to the author, true friendship between humans – i.e. this notion of *philia* – is the very expression of humankind's utmost dignity and of its ability to act with reason for the common good and thus, for one's fellow man and peace itself. Therefore, preventing war and – at the very same time – avoiding Leviathan's oppression are indispensable to the "culture of peace" that Hude is calling for.

Nevertheless, a question lingers: is this project realistic or utopian?

Echoing André Malraux's intuition according to which: "*the 21st century will be religious, or won't be at all*", Henri Hude seeks to answer this question by rethinking the place of religion in contemporary society. He believes that religion can be a factor of peace, provided that it remains authentic and humanistic. He readily reflects upon the notions of "fanaticism", "holy war" and "theocracy", while addressing the three following objections:

- "Belief in the Absolute cannot be Reconciled with the maintenance of Peace",
- "Religion cannot be Reconciled with Freedom of the Mind",
- "Religion cannot be Reconciled with Secularity".

In a well-founded argument that addresses the first objection, the author demonstrates that "*accounting for personal freedom within our relationship with the Absolute is the essential prerequisite to transform religion or wisdom into a factor of peace*" (§ 272), whereas relativism, on the other hand, leads to intolerance and thus promotes war. For Hude, "*authentic intellectual and spiritual freedom presupposes attention to objective truth*"; this explains why "*respect towards truth and freedom of conscience must be both balanced and mutually limiting*" (§ 279) in order to avoid war and build a peaceful world. In response to the second objection, Henri Hude goes on to show that "*reason is nothing outside of its essential relationship to truth*", because "*the demanding nature of the scientific mind is perfectly aligned with the impulse that carries man towards the Absolute. Thus, religion is no longer necessarily violent, since it is harmoniously united with philosophical wisdom.*" However, the author recognizes the fact that this is "*not always the case, even among religious elites*" (§ 290). Nevertheless, freedom of the mind – i.e. reason – is not incompatible with faith; these two concepts are not antithetical from the outset. By enabling humankind to relate to the Absolute, religion enables us to attain objective truths – ones that can be agreed upon by the good-willed. Religion can act as a factor of peace that must be acknowledged by decision-makers; all the more so when there is no clearly-identified religion, as everything unconsciously becomes religious, thereby rendering the state's secularity impossible. Through this rationale, Hude provides an answer to the third objection.

In his closing epilogue, the author offers the reader a chance to put the principles laid out in the book into practice, by subjecting them to four situational thought experiments. The reader is led to reflect upon the rationality and abilities of fanatical or desperate decision-makers. The reader is also brought to consider the case of a leader who is irrational, due to them being incapable of dispassionately judging conflicts in which they are involved, or one who demonstrates cowardice, in virtue of a desire to live no matter what: “*Better red than dead*”, as some said during the Cold War. This allows the author to pursue his thoughts on the question of war – particularly on the issue of nuclear deterrence – without being constrained by a definitive solution, thereby making the book a truly philosophical piece.

Among other things, Henri Hude invites us to ponder Leonid Brezhnev’s words, as reported in the *New York Times* on October 21, 1981, at the height of the Euromissile crisis: “*only he who has decided to commit suicide can start a nuclear war in the hope of emerging victorious from it*” (§ 340). He also leads us to explore the moral motives and cultural imperatives underlying this type of desperate reaction – ones that are not devoid of rationality, as one might intuitively expect – on behalf of a nuclear power and its leader.

Ultimately, *Philosophie de la Guerre* presents a fresh and original approach to war and the conditions for peace. For this reason, the book should not be overlooked by the military, or anyone else interested in the question of war, at a time when armed conflict is resurfacing on the forefront of the international scene – be it in the form of high-intensity warfare in Ukraine, or counter-insurgency warfare in Israel, in Africa and in the Middle East.



