THE RUSSIA-UKRAINE WAR

Towards Resilient Fighting Power

Viktoriya Fedorchak

ROUTLEDGE

‘Russian aggression in Ukraine in 2022 provided an unwelcome reminder to many that war has not disappeared as a tool of statecraft, although most in Ukraine needed no reminding of that fact given that they first experienced Russian invasion in 2014. The ability of Ukraine to withstand the Russian attack, to inflict heavy casualties and later to liberate significant parts of their country caught many by surprise (not least the Russians). This book examines in detail the character and conduct of the war to date and offers important insight into the nature of modern war across all warfighting domains. The author explains how Ukraine has managed to break away from the limitations of old Soviet military culture to develop and sustain resilient fighting power. This is an important book for anyone who wishes to understand the current war in Ukraine. It will also be very useful to anyone interested in the evolution of war today and into the future, the central point about resilience has relevance far beyond Ukraine.’

Ian Speller, *Maynooth University, Ireland*

‘Although it might be too early to talk about lessons learned from the war in Ukraine, this book nonetheless gives us both a framework and content for understanding why Russia failed in its full-scale invasion of Ukraine. These are two countries that share the same Soviet doctrinal past. Still, Ukraine has managed to take advantage of relevant conceptual lessons from the Soviet doctrine, Western best practices, and consequent NATO standardisation of the military for the requirements of modern warfare. Ukraine has learned and adapted. The book is structured in a manner to encourage learning. It is a must-read for academics, civilian and military practitioners who want to improve their understanding of both the war in Ukraine and warfare in general and the need for building resilience into one’s society and military as a part of that. This is simply an outstanding and timely book that I highly recommend.’

Karl Erik Haug, *Head of the Department of Modern History and Society, Norwegian University of Science and Technology (NTNU), Norway*

‘This book is both a timely and an important assessment of why Russia has failed to coerce and control Ukraine after its initial aggression in 2014 and subsequent large-scale invasion in February 2022. Fedorchak compares the Russian and Ukrainian military systems and approaches to warfare. She also explains how robust resilience has evolved to become an inherent characteristic of the Ukrainian state, military and society. The framework and concept of resilient fighting power is a key aspect of her analysis. Fedorchak’s comprehensive book is an excellent early evaluation with many lessons to ponder for NATO and in fact all states neighbouring Russia.’

Col. (Ret’d) Per Erik Solli, *Senior Defence Analyst, Norwegian Institute of International Affairs (NUPI), Norway*

‘The Russian war against the Ukraine has been going on for 8 years and has gone through several phases. The last being the high-kinetic war since February 2022. The Ukrainian resistance to the Russian invasion has filled the world with admiration as well as brought strong material and vocal support. We have seen the use of new technology on a massive scale, but have at the same time witnessed an almost World War I fighting in Donbas. This book by Dr Fedorchak is an analysis of the experiences from this war. She lands in many interesting conclusions, several of them actually point in the direction of a return to concepts from the Cold War. It is for instance seen the return of mass armies combined with what has been called “fifth generation warfare”. This illustrates the need for a broad as well as deep understanding of warfare. The book also highlights the need for morale and civilian resilience, the importance of ingenuity, military use of civilian resources and international support. The conclusion by Dr Fedorchak is an important contribution to the state of the art of warfare. It shows that war does not follow singlefile theory or general expectations. Instead, it calls for more comprehensive studies of the Russia-Ukraine war, to be used in future conflicts.’

Fredrik Eriksson, *Assistant Professor Military History,*
Swedish Defence University, Sweden

THE RUSSIA-UKRAINE WAR

This book provides a systematic analysis of the Russian-Ukraine war, using the concept of resilient fighting power to assess the operational performance of both sides during the first year of the full-scale invasion.

The Russian war in Ukraine began in 2014 and continued for eight years, before the full-scale invasion of 24 February 2022. It is not a new war, but the intensity of the warfighting revived many discussions about the conduct of inter-state warfare, which has not been seen in Europe for decades. This book does not aim to offer an exhaustive operational analysis of the war, but rather provides a preliminary systematic analysis across various domains of warfare using the concept of fighting power to assess the operational performance of both sides. First, the book discusses the conceptual component and the post-Cold War adaptations of the Soviet strategic tradition by both the Ukrainian and the Russian Armed Forces. Following that, it gives an evaluation of the various aspects of warfighting in the land, air, maritime and cyber domains. Then, the book examines the role of international allied assistance, sanctions and weapons delivery in strengthening the resilience of the Ukrainian Armed Forces. The book concludes with some comments on the role of inter-state warfare in the current strategic environment and future warfare.

This book will be of much interest to students of military and strategic studies, defence studies, foreign policy, Russian studies and international relations.

Viktoriya Fedorchak is a lecturer in War Studies at the Swedish Defence University. She is the author of *British Air Power* (2018) and *Understanding Contemporary Air Power* (2020).

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Who we are and where we are going to…
For Ukraine, the land of free people…
For Ukrainian people, with deep roots in Ukrainian soil…
For Ukrainian land, liberated and blooming…
For Ukrainian skies, free and peaceful…

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Most of all, I am grateful to my mother, Fedorchak Olga Semenivna, who was with me every step of the way.

Dr Viktoriya Fedorchak

DISCLAIMER

Views expressed in this monograph are the author's alone, and do not represent the official positions of the Swedish Defence University and the Swedish government.

ABBREVIATIONS

ADP	Army Doctrinal Publication Operations
AEW	Airborne Early Warning
AI	Artificial Intelligence
AJP	Allied Joint Doctrine (Allied Joint Operations)
AOR	Area of Responsibility
APC	Armoured Personnel Carriers
ASW	Anti-Submarine Warfare
ATACMS	Army Tactical Missile System
ATO	Anti-Terrorist Operation
ATV	All-Terrain Vehicles
AWACS	Airborne Warning & Control System
A2AD	Anti-Access and Area Denial Capabilities
BDA	Battle Damage Assessment
BTG	Battalion Tactical Group
C2	Command and Control
C3I	Command and control, Communications and Intelligence
C4ISR	Command, Control, Communications, Computers (C4) Intelligence, Surveillance and Reconnaissance (ISR)
CAR	Conflict Armament Research
CAS	Close Air Support
CGS	Chief of General Staff
CINC	Commander in Chief
COIN	Counterinsurgency
EEZ	Exclusive Economic Zone
EPF	European Peace Facility
FSB	Russian Federal Security Service

GRU	Chief Intelligence Office (abbreviation used both in Ukraine and Russia)
HARM	High-Speed Anti-Radiation Missiles
HIMARS	High Mobility Artillery Rocket Systems
HUMINT	Human Intelligence
IDCC	International Donor Coordination Centre
IFV	Infantry Fighting Vehicles
IFU	International Fund for Ukraine
ISR	Intelligence, Surveillance and Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
ISW	Institute of the Study of War
JCC	Joint Coordination Centre
JFO	Joint Force Operation
MDI	Multidomain Integration
MANPADS	Man-Portable Air-Defense Systems
MMCM	Maritime Mine Counter Measures
MOD	Ministry of Defence (UK)
MP	Member of Parliament (UK)
NAFO	North Atlantic Fellas Organization
NATO	North Atlantic Treaty Organisation
NCO	Non-Commissioned Officer
NEC	Network Enabling Capability
NFZ	No-Fly Zones
NGO	Non-Governmental Organisation
NGW	New Generation of Warfare
NLAW	Next generation Light Anti-tank Weapon
NSA	NATO Standardized Agency
NSDC	National Security and Defence Council (of Ukraine)
OSINT	Open-Source Intelligence
PGM	Precision-Guided Munition
PMC	Private Military Company
POW	Prisoners Of War
PSO	Peace Support Operations
RAAM	Remote Anti-Armor Mine
RAF	Royal Air Force
RPV	Remotely Piloted Vehicle
SAR	Search and Rescue
SBU	Ukrainian law enforcement
SOF	Special Operations Forces
SSSCIP	State Service of Special Communications and Information Protection of Ukraine
TDF	Territorial Defence Forces
TOW	Tube-Launched, Optically-Tracked, Wire-Guided
UAF	Ukrainian Armed Forces

UAV	Unmanned Air Vehicle
UDCG	Ukraine Defence Contact Group
UkrAF	Ukrainian Air Force
UCAV	Unmanned Combat Air Vehicle
USAF	United States Air Force
USV	Unmanned Sea Vehicles
UUV	Unmanned Undersea Vehicles
VDV	Russian Airborne Forces
WMD	Weapons of Mass Destruction

INTRODUCTION

Russia's illegal war in Ukraine has lasted for more than nine years. In the perception of the global audience, the events of the annexation of Crimea, followed by the more kinetic war of 2014–2015, are remembered the most. The Minsk Agreements froze the conflict for wider international audiences, with the common perception of a ceasefire to be agreed on and implemented. However, the reality was 'less fire than ceasefire,' and the warfighting continued in the East for eight years, culminating in the full-scale Russian invasion of Ukraine on 24 February 2022. Living through historical events has a distinctive effect on societies and how these events are perceived. Systematic understanding of historical events requires both taking into account perspectives and assessments during those events (or relatively so) and analysis of the future scholars that have the advantage of distancing themselves more from the events, people and the entire preceding eras.

This book is intended to serve several purposes. It explains differences in the construction of the fighting power of the two sides, paying attention to various units, force cohesion, different technologies and different developments across domains. The book shows various factors in sustaining the resilience of the fighting power in this war, illustrating the ability of the Ukrainian Armed Forces (UAF) to survive the first year of the full-scale invasion and intense warfighting and to recover for the summer 2023 counteroffensive. This book is aimed as a contribution to further exploration of this war in its entirety and the phenomena of Ukrainian fighting power and strategic culture in general. The time frame of the main research is one year since the full-scale invasion in 2022. Although the book explores the fighting power of the two countries, the primary argument is that the UAF managed to develop and sustain resilient fighting power in support of various operational objectives and prepare for regaining military momentum in the battlespace in the summer of 2023 as this book was being finalised.

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The primary analytical tools used in this book are ambitious, since they combine the traditional military concept of fighting power with the more abstract concept, and in this case attribute, of resilience. In this regard, the framework of resilient fighting power allows exploring the sustainment, recovery and reestablishment of the Ukrainian fighting power during this one year of the full-scale invasion in its further preparation for the summer 2023 counteroffensive. Hence, the focus is very much on the fluidity of recovering the ability to effectively fight once more on the next even more kinetic stage of the war. The concept of resilient fighting power is then further explored through the main themes of modern warfare: the trinity of political will, people and technology, total/comprehensive defence, mass approach in structuring armed forces, and interservice and cross-domain integration. The aspects of asymmetry, force multiplication, precision and mass barraging are inherently part of various discussions and explorations of these domains.

This book is structured to encourage consistent learning about fighting power. Chapter 1 explains the analytical tools used within this book. First, the three components of fighting power – conceptual, physical and moral – are explained using various military doctrines and formal documents. Then, the concept of resilient fighting power is discussed in detail. The main post-Cold War developments in warfare are provided as a wider context for distilling the key themes of modern warfare, which are later on traced across further chapters.

Chapter 2 is devoted to the conceptual component of the fighting power – military doctrines and the thought process behind the structuring of the armed forces and preparing the personnel for the warfighting. The common Soviet past is explained, illustrating the different extents of Soviet tradition and doctrine present in the military thinking in the two countries. The place of military doctrine in the post-Cold War military reorganisation is discussed here.

Chapter 3 provides the historical context of the war, paying attention to the warfighting experiences of the opposing sides during the first eight years of the war. The chronology of the events is followed through different experiences and learning points of the UAF and the Russians. This time frame is also explored for the reinforcements of the two militaries for further full-scale Russian aggression against Ukraine. The question of the Russian militarisation of Crimea is addressed here.

Chapter 4 focuses on the people aspect of the physical component of the fighting power, illustrating the numerous groups of combatants fighting for both sides. While both sides were characterised by different groups with varied training and experience, the cohesion of troops differed primarily due to different leadership approaches in Ukraine and Russia and the extent to which Ukraine had moved away from the Soviet military culture, while the Russian military remained largely Soviet in organisational culture and performance.

The next four chapters focus on the four domains of warfare: land, air, maritime and cyber (plus information warfare), respectively. Although space capabilities played an enabling role for various capabilities on both sides, their extent could not be traced to devote an entire chapter to the space domain. The

three chapters on the traditional physical domains of warfare are structured as follows: the main developments in the domain are followed by the primary points for consideration. Hence, Chapter 5 focuses on the land domain, the complexity of the warfighting in spring, consolidation of the frontlines, the Ukrainian summer 2022 counteroffensives, the specifics of different approaches to artillery between two countries, and the consolidation of forces for the next stage of the war.

Chapter 6 explores the air war over Ukraine, illustrating the place of Ukrainian aviation in defending Ukrainian skies during various stages of 2022. The questions of degrading Russian mass and technological advantages in the air fleet with the employment of Ukrainian layered air defences and dispersal and establishment of mutual air denial on the frontlines are discussed here. Russia's long-range ballistic missile attack campaign against the Ukrainian civilian infrastructure is also addressed here.

Chapter 7 illustrates the more scarce events in the maritime domain, focusing on the key highlights in the extent that ground-based defences effectively undermined the Russian control of the sea in the studied time frame. The sinking of the *Moskva* and the use of USVs are discussed in terms of asymmetry in undermining the firepower of a more numerically superior enemy.

Chapter 8 is divided into two parts. The first part addresses Russian disinformation and propaganda, and warfighting in the information environment. The second part is devoted to the cyber domain of warfare, illustrating the shifts in Russian cyberattacks.

Chapter 9 is devoted to the resilience of the Ukrainian people. This chapter illustrates the importance of a national strong rear to support the normal functioning of society and various aspects of warfighting. The resilience of the Ukrainian society is discussed together with various sources of innovation and crowdfunding initiatives of the Ukrainian civil society and individuals.

Chapter 10 outlines the importance of international partners in providing military assistance to Ukraine and its role in strengthening Ukrainian capabilities. The chapter starts with a discussion of the No-Fly Zone over Ukraine which did not happen. Then, military assistance by various stakeholders is analysed in terms of correspondence to various developments and consequent demands in the battlespace.

The final chapter (Chapter 11) provides a wider discussion of the main themes of modern warfare identified in the first chapter. Furthermore, factors contributing to the development of the resilient fighting power in this war are considered, taking into account differences between the two sides across the three components of the fighting power.

1

ANALYTICAL FRAMEWORK

This chapter explains the main analytical tools of the book and the main trends and themes in modern warfare, which will be further discussed in their specifics across domains and experiences of the war. The analytical framework for this book is rather distinctive. It is ambitious to combine two concepts: the traditional military concept of fighting power (including the three traditional components) with a more abstract and interdisciplinary concept of resilience. Accordingly, the combined concept of resilient fighting power shifts the focus on the ability of the military (owner of the fighting power) to bounce back and recover to the point of continuing fighting, gaining military advantage and progressing in the battlespace to achieve posed objectives. Since the war is not over and the focus is on the one-year time frame, this combined conceptual framework allows focusing on the continuous process of reviving the fighting power at different stages of this year, exploring factors contributing to strengthening its resilience.

The concept of fighting power

Traditionally, fighting power consists of three interconnected components: conceptual, physical and moral. The concept emphasises the importance of balancing the three components to achieve greater military effectiveness in the battlespace. From an analytical perspective, this concept provides an opportunity for systematic analysis of developments in the battlespace and the cause–effect relationship between them. It is worth noting that the description of components given below is a collective reflection combining various takes on the concept in different doctrines. Hence, some elements of each component might be outlined in one doctrine, while omitted in others. Similarly, some doctrines include education as a conceptual component, while others as a physical one. From the analytical

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and practical perspectives, these discrepancies are of little importance because the essence of the components and fighting power in its entirety remains the same. British Allied Joint Publication-3.2: Allied Joint Doctrine for Land Operations is used to reflect the most recent formal reflection of the concept.[1]

I. Conceptual component. This refers to 'the thought process regarding how to fight contemporary wars, taking into account new challenges, national specifics, and scarce resources.'[2] This component includes the knowledge and practical improvements derived from previous operational experiences, distilled best practice, experimentation and innovation linked to the modern threats and characteristic features and demands of the operating environment. It should encourage analytical and critical evaluation of new situations on both the operational and tactical levels.[3] While it provides a common ground for understanding the context of the operation, it also serves as a common basis for innovation, creativity and adaptability to the specifics of the operating environment.[4] This component can be considered as a bridge between past experiences in warfare revised for the requirements of today's practices to improve the outcomes and distil best practice for the future. Like any thought process, in order to be relevant and timely, the conceptual component should always be in transition, revised and adjusted to the arising features of a distinctive operating environment, as well as the overall strategic environment.[5] There are various takes on which elements constitute the conceptual component. As a result, different editions and various service and environmental doctrines tend to emphasise different elements and that emphasis is often conditioned by various factors of organisational culture and dominance of one approach over another at a given time. According to earlier doctrines, the conceptual component consists of the principles of war, doctrine, conceptual innovation, and understanding of context and conflict.[6] In more recent army doctrine, a more holistic approach has been taken, identifying doctrine and adaptation as the main elements of the conceptual component.[7] In essence, the wider elements, such as the principles of war, understanding of context and conflict are envisaged to be already part of the text of the doctrines – that is, doctrinal concepts just as those in the taught courses in military education. Hence, the essence of the conceptual component does not diverge significantly in different doctrines.

The principles of war are lessons on warfighting acquired from factors of warfare. They are universal for any domain of warfare and illustrate the enduring nature of warfare despite its changing character due to technological advancement. On the other hand, military doctrine includes 'fundamental principles by which military forces guide their actions in support of objectives.'[8] Unlike the principles of war, doctrines tend to be more specific for a given domain of warfare (e.g., environmental doctrines), perceptions of contemporary threats and the technologies available for managing those threats. Hence, doctrines are often conditioned by national strategic traditions, the organisational culture of the armed forces and their technological advancement. Traditionally, doctrines aim to teach how to think rather than what to think and should provide common ground for further innovation.

Conceptual innovation or adaptation is an inevitable part of the conceptual component and the thought process in general because the operating environment is never inert. Adversaries and enemies learn and adjust their tactics and consequent behaviour in the battlespace. Adaptation of planning and innovation in actions in response to those changes improve military effectiveness in the battlespace and often save soldiers' lives. From an organisational perspective, conceptual innovation is also a driving force for organisational renovation and adaptation to the new requirements of the time – that is, national political and external strategic environments. One more element that different doctrines move between conceptual and physical components is military education. In recent editions of doctrine, it is attributed to the conceptual component. **Military education** is 'aimed at improving individuals' knowledge and skills to strengthen their adaptability, improvisation, and critical and innovative thinking.'[9] Military education provides the common ground embodied in doctrines and best practices allowing for further critical thinking on innovation and adaptability. Moreover, the common tradition in the conceptual component allows for improvement of interoperability between allied nations across services and domains of warfare.

II. Physical component. This refers to the more tangible physical means of fighting. It includes five main elements: personnel, equipment, training, readiness and sustainment (maintenance).[10] In other words, armed forces must have the right number of people with the right skills and mindset, sufficient equipment to do the task, and continuous supply of provision, spare parts and servicing for the operating platforms and equipment in order 'to achieve the necessary level of readiness and consequent enduring quality of performance in the battlespace.'[11] **Personnel** is a key element in the physical component because warfare remains a human activity. Motivated, skilled and trained people fighting across domains are the ones who make operational art happen. When they lack the skills and motivation to fight, even the availability of the most advanced technologies will not compensate for the shortfalls of poor personnel and poor morale. Hence, investment in developing the most up-to-date and advanced skill set for the requirements of modern warfare is paramount for effective operational performance. In this regard, striking a balance between numbers of personnel, their readiness and adaptability to the unpredictability of warfare is particularly important.

Equipment is another element of the physical component and factors of military success. Although equipment is a tangible variable that can easily be quantified and, at first glance, considered sufficient based on mere numbers, the real practical value of equipment depends on situational requirements. In other words, armed forces require functional, effective and well-maintained equipment corresponding to the necessities of fighting a specific enemy or adversary within a given operating environment. Moreover, equipment that does not match the requirements of the operating environment would make little or no contribution to the establishment of combat power and the achievement of posed military objectives. Furthermore, like any other element of the physical component, sufficient quantity of equipment based

on the demands of the operating environment is of utmost importance. It is also worth mentioning that the effect of firepower or fulfilment of any other operational role can depend on the combination of equipment and platforms across domains. For instance, a smaller quantity of aerial capabilities can be overcome by more profound presence of ground-based defence for the country that counters invasion. On the other hand, the long-term effectiveness of this symbiosis would depend on the intensity of enemy attacks and the further strengthening of ground-based air defences (GBAD). Hence, when equipment is discussed, more attention should be paid to evaluating the specific demands of the operating environment.

While military education shapes the mind, **military training** combines all three components of fighting power and applies them to practice. Training is essential not only for improving one's ability to operate complex equipment in various operating scenarios but to drill it to the point when it becomes instinctive, while the mind can consider adaptation when the unpredictable circumstances of the operating environment demand it. Moreover, training is essential for establishing and improving jointness across services and interoperability across allied nations. A common approach to training and similarity of equipment allow strengthening of Allied interoperability and, as the case of the Ukrainian Armed Forces has shown, was a prerequisite for equipment transfer and consequent employment in the battlespace.

In addressing **readiness**, AJP-3.2 discusses this element in a systematic and well-rounded manner:

> The physical component of fighting power must be sufficiently responsive to the operating environment to achieve their mission. Troop-contributing nations are responsible for providing trained, equipped and certified forces at appropriate readiness to meet the minimum military requirements. Readiness includes all components of fighting power: the physical readiness of the force; their conceptual readiness; and a strong moral component, ready in time to complete their operational task.[12]

Readiness cannot be taken for granted. It might be unrealistic to be prepared for all possible case-scenarios, but the characteristic features of the strategic environment and the adversary or enemy that the country faces tend to suggest some of the more likely scenarios. A balanced approach to the structuring, training and positioning of armed forces tends to provide more opportunities for flexible responses and adjustments to the demands of the operating environment.

One of the less glossy elements of the physical component, but not less significant, is **sustainment**, which is the systematic support of military activities from maintenance of equipment, logistics, medical services, provision of necessary supplies and services to the personnel to financing and continued budgetary commitments. No matter how advanced and capable technologies and well-trained personnel might be, logistics and the stability of supply chains remain crucial in

supporting combat power in a given operation. As history and contemporaneity illustrate, hopes for a blitzkrieg do not transfer into the reality of sustaining the momentum without well thought-out and continuous logistics. Wars of attrition tend to kill the momentum of surprise and intensity that invading forces count upon, not to forget that fighting in home territory often favours the defender.

III. Moral component. This is about the human aspect of warfighting and the ability to motivate armed forces to fight and perform in the battlespace appropriately. It includes morale, leadership, ethical foundations and ethos. **Morale** is the individual or group commitment, conviction and discipline to fulfil an assigned task at a particular time. This is an essential element, because high morale can overcome shortfalls in other aspects of warfighting. High morale rests upon a strong fighting spirit, shared identity (moral cohesion), discipline, pride, comradeship, confidence, trust in one's weapons and equipment and spiritual foundation (belief in the cause).[13] War remains a bloody and violent activity, and psychological pressure, fear and doubts are an inevitable part of warfighting. Numbers of people and equipment are important, but high morale can often be the main difference between those who stay in the battlespace and fight until the end, and those who flee because their spiritual foundation – the cause of war – is illegitimate and there is no moral cohesion but only fear and survival instinct. Hence, the side that defends their homeland against invaders tends to stand strong with high morale, because they are defending their land, families and identity against invaders.

Army doctrine defines **leadership** as 'a combination of character, knowledge, and action that inspires others to succeed.'[14] Warfare brings people into basic relationships, where trust and reliance on a comrade in arms are often conditioned by common experiences of fighting war and discipline. A strong leader who takes responsibility for his/her men and women and is not afraid to act, who leads by example instead of hiding behind subordinates' backs, inspires people to follow. As important as discipline and chain of command are, exemplary leadership makes a huge difference for people on the ground and across the entire chain of command. Sustaining leadership across all ranks and organisational structures is essential for effective force employment, because leaders are responsible for taking care of their subordinates and inspiring them to go the extra mile or survive in the most severe circumstances.

Ethical, moral and legal foundations and ethos should be at the heart of military operations and performance in the battlespace. Although warfare is messy, bloody and violent, there are still certain rules in warfare and an internationally recognised legal framework to limit use of force: one that distinguishes between combatants and non-combatants in the conflict. The entire moral component depends on the forces' belief in the ethical and moral causes of war and the manner of its conduct. In this regard, ethos is the

> collection of values and beliefs that guides the application of force and conduct of operations – and helps ensure the legitimacy of those operations and campaign.

> This includes belief in the justness of the cause and the ability to maintain the support of nations.[15]

Just as a strong ethos can help overcome the horrendous reality of war, lack of moral and ethical grounds for using violence can undermine forces' will to fight or subdue to fear, thus increasing the likelihood of desertion.

A strong moral component is essential for cohesion of the fighting force. Lack of common beliefs, motives and comradeship combined with poor discipline and absence of interoperability and jointness between various units can also result in reviving internal disputes between units during warfare, which undermines their military relevance and does the job for the opposing side. Similarly, if the invading side is motivated by looting, then the likelihood of internal fighting for the looted goods is very high, if not guaranteed. Consequently, 'if military actions contradict or are perceived as contradicting these foundations, the legitimacy of the campaign might be undermined, jeopardising the overall achievement of the political objectives posed.'[16] This consideration equally applies to legitimate campaigns and those that use fake excuses for revisionist expansionist invasions.

In its turn, fighting power is assessed by combat effectiveness:

> the ability of a unit or formation, or equipment to perform assigned missions or functions. Note: this should consider leadership, personnel strength, the state or repair of the equipment, logistics, training and morale and may be expressed as a percentage.[17]

The aforementioned description of the three components thus illustrates that while the physical components can be easily evaluated quantitatively, the conceptual and moral components are more qualitative and require a qualitative approach to analysis. Assessment of the three components of fighting power also involves ***collective performance***, which refers to a high degree of unity, trust and proficiency achieved by units or headquarters that have trained or operated together. Partners and contractor units can be effectively integrated into the force through training, optimising collective performance.[18]

This concept of fighting power was chosen as the primary analytical framework for this research for a few reasons. First, it provides the needed flexibility in addressing various aspects of the preparation and consequent performance of armed forces of the two countries in a theoretically sequential order. The conceptual component allows investigation of the thought process behind military education and the consequent building of the strategy and operational performance of the belligerents. The physical component allows assessment of the capabilities of both countries in a systematic and detailed manner, taking into consideration modern trends in military equipment and personnel training. The relevance of the moral component cannot be overestimated in this war, because it provides a tool to explore the heroic war of the Ukrainian people under the most disadvantageous

conditions of full-scale invasion and the decreasing will to fight among the Russian combatants, their poor morale and consequent performance in battlespace.

The wider concept of resilience and resilient fighting power

Resilience is a widely used term in various disciplines and practices. The term generally refers to 'an ability to withstand and quickly recover from a difficult situation. This comes hand-in-hand with the idea of "bouncing back", returning to "normal", and picking up where we left off before whatever difficulty or challenge we experienced.'[19]

In psychology, it is defined as 'the process and outcome of successfully adapting to challenging life experiences, especially through mental, emotional, and behavioural flexibility and adjustment to external and internal demands.'[20] In other disciplines, it can refer to the political, societal or economic withstanding of various challenges. In environmental studies, ecological resilience is often used as a synonym for ecological robustness, referring to 'the ability of a system to continue functioning amid and recover from a disturbance.'[21]

Even in the security and strategic studies and military fields, there are varied approaches to its definition and application area. In military psychology, 'military resilience can be defined as the capacity to overcome the negative effects of setbacks and associated stress on military performance and combat effectiveness.'[22] From the perspective of national security, resilience is approached as a system of tools 'to understand our vulnerabilities, pre-empt challenges before they arise, ensure we are prepared for them, and mitigate the impacts. Then, when events occur, we should be ready to withstand and recover.'[23] In the context of fighting power and its doctrine reflection, resilience is referred to as one of the aspects of either flexibility or agility, depending on which doctrine is discussed.[24] Hence, British Army doctrine defines it as 'the degree to which people and their equipment remain effective under arduous conditions or in the face of hostile action.'[25]

As these definitions illustrate, different aspects are emphasised, and there are numerous contexts in which an individual, system or organisation recovers from the disadvantageous effect of a disruption. While the military doctrine stresses the degree of effectiveness of the physical component, most of the definitions and approaches to resilience are related to the process of recovery and regaining the preliminary condition. The application of the term 'resilience' to the fighting power per se is aimed to explore the continuity of the fighting power in this war, that is, to explore which of the two fighting sides demonstrated resilience in fighting power, how it was achieved and how it was sustained at various stages of this one year of the full-scale invasion within the nine years of the actual war. This term allows the focus to be on various fluid elements of the fighting power that were changing during this year of the war and contributed to the strengthening of the resilience of the fighting power and to Ukrainian national resilience in support of the UAF. One might assume that the 'flexibility' principle of war would have

provided even more opportunities for analysis but it would have shifted attention to too many attributes/composing elements within flexibility, such as versatility, responsiveness, resilience and adaptability of the whole force.[26]

Using the concept of resilience as a process allows for an examination of the constant sustainment, recovery, and rebuilding of Ukrainian military capabilities in achieving various objectives at different stages of this year of war. The focal point is the return to effective fighting because resilient fighting power becomes the prerequisite to various operational achievements in the war. Hence, the focus is very much on the fluidity of bouncing back to the ability to fight again and even more effectively. In other words, the point for recovery is the effective employment of the fighting power, just as it is stated in the military doctrine, but the focus is on the process and continuity of the transformation of the fighting power in this war.

The concept of resilience also allows a look into the context of the establishment of the fighting powers of the two countries prior to the full-scale invasion and the factors defining the state of affairs. As an umbrella term, it also allows an exploration of the significance of a strong rear – national and international – support in sustaining the physical and moral components of the fighting power. In essence, this book illustrates various aspects and contributing factors to establishing and sustaining effective fighting power in this war. The following themes of modern warfare provide additional layers for exploration of this topic.

Key trends/themes in modern warfare

This section explores different trends and themes that can be traced in a variety of discussions on modern warfare. Some trends and themes are traced in domain chapters and culminate in the discussions in the last chapter. Other aspects are aimed at determining the place of the current war within the thinking on modern warfare in the post-Cold War era.

It became evident in the first few years after the collapse of the Soviet Union that the peace dividend did not pay off. More wars and conflicts were to characterise the post-Cold War world, and due to the wider experiences with the counterinsurgency (COIN) operations, the focus on Western military experience and practice shifted to out-of-area operations and wars of choice. The immediate implications of this were shorter military involvements, more intensive but shortened kinetic stages of the wars and wider opportunities for the national governments of the Alliance or partner nations to decide the time at which to shift from the more kinetic to a more humanitarian side of the operations or when to pull their troops and assets out of the conflict. This reality of fast achievements and intensive but short-term kinetic stages was reflected in the military industry operating on the contractual basis of peacetime realities, which would often be illustrated in stockpiles of some arsenals running low due to involvement in high-intensity tasks.[27]

Cutting-edge technologies inevitably resulted in an increased tempo of warfare, with various implications on the significance of tactical-level decision-making

and impact of these decisions on the conduct of operations. Greater attention to war as one of the flashy news topics significantly increased at this time, adding new challenges in conducting operations under greater public and international scrutiny.[28] While discussions surrounded the significance of one military power and domain of warfare over another on various occasions, COIN and Russian invasions in Georgia and Ukraine in 2014 illustrated the importance of the ground element combined with other domains. Nevertheless, the increased speed and tempo of warfare and new technologies dictated the need for greater multidomain integration (MDI) following the system-of-systems approach and interoperability on national and international levels.

While the peace dividend of the 1990s and the use of COIN in the following two decades revealed scepticism regarding the likelihood of inter-state warfare, even in principle, the shift in the strategic environment towards the revival of the peer and near-peer conventional inter-state conflict raised some traditional questions regarding the mass approach to structuring one's national armed forces and generated discussions of asymmetry between a more technologically advanced or mass-focused adversary. In this regard, the focus began shifting to the importance of the littoral manoeuvre and amphibious warfare in the Indo-Pacific Area of Responsibility (AOR). Despite this relatively new shift and focus on inter-state warfare, the land-centric war witnessed in Ukraine since the full-scale invasion was not the most anticipated type of inter-state war nor was it discussed in international expert circles before 24 February 2022. Hence, this war illustrated many shifts in the modern understanding of inter-state warfare and warfare in general. While new operational experiences might refute some expectations about modern and future warfare, there are enduring trends that prevail.

In his book, published in early 2022, Mick Ryan identified trends in seven segments of conflict in the twenty-first century that he considered were likely to trigger the most significant changes in the character of war in the future[29]:

1 The factor of time is appreciated in a new manner. The spread of more cutting-edge technologies, the increased speed of planning, demands for fast decision-making AI-enabled technologies across the entire spectrum of capabilities, and the spillovers of competition into the information space require military organisations and institutions to employ time more effectively to improve decision-making.
2 The battle of signatures. Since each item of military equipment possesses a distinctive signature within the visual, aural or electromagnetic spectrum, and distinctive patterns of operations also characterise military organisations, future warfare should emphasise minimising one's own military signatures using recorded signatures to deceive the adversary and taking advantage of identifying adversary's signatures across different domains of warfare.
3 New forms of mass refer to balancing military equipment, taking advantage of both cutting-edge technologies and less expensive means to establish the

required mass. The focus is on combining manned and unmanned capabilities to achieve a force multiplication effect: 'large and expensive systems may well still be needed, but they must be procured in fewer numbers and balanced with large numbers of small networked, and inexpensive systems.'[30]

4 More integrated thinking and action mean that future military organisations should be able to operate simultaneously across all domains.
5 The trend of human–machine integration stresses the use of AI and autonomous technologies not only as a means across the full spectrum of development of the modern and competitive fighting power but also as a way of making them 'full partners with human beings in the conduct of military missions.'[31]
6 There is a gradual shift towards competition for influence, meaning the ability to sustain support for one's actions at home and internationally. It is also a matter of being able to sustain it over time.
7 Greater sovereign resilience refers to ensuring that national logistics and supply chains are sustainable and protected from the adversary's control and disruption attempts.

While Mick Ryan focused on the future United States–China competition in his book, many of his identified trends can be traced in the full-scale segment of the Russia–Ukraine war within the year studied in this book. Some of the themes discussed in this book align with Mick Ryan's main trends, while a few additional themes are identified. Many of the trends/themes are entwined or are conditioned by the same factor of causality.

People, technologies and political will

This triangle is one of the most traditional reflections of various elements of warfare and the consequent components of its success. Very seldom can the gains in one segment completely compensate for the shortfalls in two others. Hence, a balance in the presence of all three elements is required. Looking at the history of warfare and the contemporary advancement of cutting-edge technologies, it might be tempting to say that warfare has become more technology-centred and dependent. However, technologies in essence became more sophisticated and overarching across more than one domain of operation and consequent effect rather than becoming the core element in warfare. In other words, Colin Gray's argument of the enduring nature of war versus its changing character remains valid today just as it was when wars were fought with less sophisticated weapons than today. Technologies develop together with human civilisation, and their sophistication requires more time and effort in their production and maintenance and the training of skilled personnel. However, most technologies remain in people's hands no matter the distance or extent of control. Warfare is still a human activity. The war in Ukraine illustrated this in more than one way.

People are the ones who execute the act of war with the technological means they are given for the objectives posed by their political and, by extension, military

leadership. As they are central to the process of warfighting, people are the face of war, they either make it more humane or dehumanise it depending on their behaviour in the battlespace. They are the final users of the weapons that are available in warfare. People are the ones who often compensate for technological shortfalls and malfunctioning, they adapt to the constantly changing circumstances of the operating environment and the unpredictability of the fog of war. Despite multiple discussions of moving people out of the loop and limiting their participation in warfare, the war in Ukraine showed the continuation of full-scale cross-domain warfare with people remaining in the centre of it, while provision of cutting-edge technologies allowed even more of the human spirit to manifest along with the will to fight to defend their homeland. The symbiosis of the cutting-edge technologies and people who were taught to fight with what they had – outdated Soviet technologies – illustrated not only that advanced technologies require more training and time for training but also that motivation to fight for the survival of one's nation can result in less time-consuming and targeted learning of how to use those technologies. One example discussed later is the acquisition of Ukrainian artillery brigade training for the use of Polish Krab artillery pieces and their consequent use in the battlespace.

Political will, environment and leadership are crucial to enable the effectiveness of the other two elements. Supportive political will and leadership can stimulate further successful developments in the battlespace, while the wrong objectives and micromanagement can impede progress of the armed forces even if they were initially characterised by numerical and technological advantages. Although the term 'mission command' is primarily applicable to military command and control, the idea of decentralised execution can be extended to the civil and political spheres, which in their turn would affect civil–military relations during various stages of war. Further chapters will show various manifestations of the mission command and comprehensive approach in this war. Inevitably, political will, leadership and national environment are linked to public opinion and support, illustrated in patriotic public and media campaigns supporting the UAF and the fight against invaders and the Russian propaganda to preserve support for their aggressive war in Ukraine. Hence, media or information warfare of narratives was one of the segments of this war, which showed both the extent of the power of narratives in the information sphere and varying degrees of its impact closer to the ground and Eastern Europe.

The theme of total/comprehensive defence

The concept of total defence dates back to the experience of World War II, which showed that warfighting could not be contained only within the military sphere; its devastating effects influenced civilian lives in many ways. In essence, total war means that the entire society is engaged in various roles to support the warfighting and to sustain the country and its military through the war. This also means that

previously peacetime arrangements and business conduct must be adjusted to the wartime requirements. As an extension of the total war, total defence means mobilising civilian and military assets to support the national defence.[32]

The conventional thinking on the topic of total defence was developed during the Cold War, which, in essence, continued to have the imprint of the threat of total war. Accordingly, the two primary pillars of total defence were civilian and military ones. However, in the post-Cold War environment, the changes in the perceptions of threats, the peace dividend and the consequent perceived unlikelihood of total warfare resulted in reshaping the concept into a comprehensive defence. NATO defined comprehensive defence as 'an official Government strategy, which encompasses a whole-of-society approach to protecting the nation against potential threats.'[33] In this regard, the change from the total defence is in refocusing on the whole-of-society and the-whole-of government approaches. In the Allied context, total and comprehensive defence is related to the collective defence, as national resilience contributes to the Allied collective defence. After the Russian annexation of Crimea in 2014, at the NATO Warsaw summit in 2016, Allied nations agreed on enhancing national resilience with the aim of achieving seven baseline requirements for civil preparedness:

- 'assured continuity of government and critical government services;
- resilient energy supplies;
- ability to deal effectively with uncontrolled movement of people;
- resilient food and water resources;
- ability to deal with mass casualties;
- resilient civil communications systems;
- resilient civil transportation systems.'[34]

The Allied context illustrates the enduring connection between national societal resilience and continued functionality of the society and country in general and the ability to project power and use military force in warfighting. Whether the military engagement is in out-of-area operations or in homeland defence, preparedness, resilience and adaptability of the society serve as wider support and pillars of the national defence.

Either version of the concept is essential under the condition of protracted warfare, in which the primary focus is on continuous sustaining of the national society and providing support to the fighting force through different stages of intensification of the warfighting and varied degrees of threats to the civilian population, infrastructure and normal functioning of the society across different spheres. Various segments of cross-agency or intersociety collaboration can be preliminarily defined and put distinctive contingency planning in place. However, industries tend to be one of the crucial elements of reorientation from peace to wartime. War places significant pressure on restricting various productions, with some requiring more time and resources than high-intensity warfare realities allow.

Hence, it is often crucial to have industry reorientation planning in place during peacetime to achieve effective functionality during war.[35]

The theme of mass and structuring of the Armed Forces

This theme is not new, and as one of the distilled principles of warfare, has been present in most of the classical strategic thinking from Sun Tzu to Clausewitz, with further reflections in the modern doctrines. In traditional strategic thinking, the principle of mass can be referred to as 'the concentration of people and capabilities at a given place and time.'[36] Neither Sun Tzu nor Clausewitz were convinced that numeric superiority could guarantee victory with mass as only one of the influential factors, and Sun Tzu was more in favour of manoeuvre and flexibility in force employment.

The principle of mass has been reconsidered in the post-Cold War Western doctrines and approaches to structuring national armed forces. The initial focus on total numeric superiority shifted towards attaining artificial mass through layering and massing effects by using cutting-edge technologies for force multiplication.[37] In the Allied context, the mass is to be attained through the Allied joint integration:

> The UK maintains highly credible air power but cannot provide the full breadth of air power capabilities and enablers to generate, coordinate and sustain the mass required to conduct high-intensity operations alone. For that reason, we must always be innovative in our development and application of air power, and the way we integrate it across all operational domains and with our international allies and partners.[38]

This example of doctrine illustrates the significant change in the perception and consequent development and employment of mass in the last three decades. While the Cold War illustrated greater focus on the numeric superiority between peer adversaries across domains, platforms and technological specifications, the post-Cold War environment was characterised by a reduction in the numbers of the armed forces and a belief in the peace dividend. Hence, the concept of the mass approach shifted from pure numeric superiority to a focus on a few more capable and higher-quality assets. Therefore, cutting-edge technologies with precision, long-range and system-of-system potential allowed the achievement of force multiplication or what can be called artificial mass. In this regard, the emphasis was on improvements of the command and control (C2), lethality, achievement of information and technological superiority.[39] This change has had an immediate effect on structuring armed forces worldwide, focusing on reducing the numbers, and procuring fewer but more technologically advanced and multirole platforms within the traditional cycles of modernisation and changes of the platforms and equipment.[40] This also meant that the costs of cutting-edge technologies would be constantly increasing questioning the cost-efficiency of various projects.[41]

With the revival of peer and near-peer conflicts, the question of mass shifted to discussing how warfighting would unravel among countries with different approaches to the mass. In other words, further conceptualisation aimed at exploring how the side with advanced technologies would face an adversary with more numeric capabilities but a relatively lower technological edge. For instance, David Alman and Heather Venable argued that the United States Air Force (USAF) gained an advantage through cutting-edge technologies combined with surprise and rapid results in the earliest stages of the conflict. However, once an adversary reinforces its capabilities with the additional technological edge of relatively similar technological characteristics, this would result in a war of attrition, which inevitably requires more of the traditional mass to sustain more prolonged inter-state wars.[42]

As a result of the revival of peer conflict discussions, the question of reconceptualization of mass in the context of the U.S. offset strategies became paramount. Lt. Gen. (Ret.) David Deptula and Maj. (Ret.) Heather Penney discussed the importance of quality, quantity, diversity, adaptation and speed when decisions on force design to match the requirements of the modern strategic environment are made. Quality refers to the cutting-edge technologies inherent to the Western tradition of structuring its military; however, with the increasing tempo of adversaries building up their technological side of the capabilities, inter-state peer or near-peer conflict symmetry is more likely to be symmetrical.

Regarding the numeric segment of force design, the primary challenges include:

> 1) effectively covering range and geography with tempo and mass; 2) presenting the adversary with sufficient system complexity to complicate their targeting and operational strategy; and 3) withstanding attrition in contested environments to remain operationally resilient and effective. A symmetric competition of attrition is no longer the only objective of this attribute. Instead, defense leaders must understand how to best leverage quantity in its force design to offset adversary strategies.[43]

Another attribute of effective force design is the diversity of one's equipment. Different types of equipment strengthen resilience because if one type is unavailable, a different type can be used. Hence, diversification can create additional challenges for an adversary's targeting. The attribute of adaptation combines the abilities to deploy new capabilities, modify existing weapons and seek new force structural adjustments to the requirements of the battlespace. The speed attribute is also extended to a full cycle from capability development to its adjustments in the battlespace:

> Speed is the pace at which the United States can develop new capabilities, produce and field them in operationally significant quantities, and then adapt them to battlespace exigencies. It might also be considered the rate of change. This attribute is crucial to disrupting adversary awareness, understanding,

> decision, and action. This pace must exceed an adversary's ability to adapt. It is also key to maintaining operational relevancy.[44]

Inevitably, time becomes an overarching factor interconnected with the effectiveness of force structuring and the consequent employment of fighting power. According to the two authors, artificial mass and force multiplication through cutting-edge technologies and multirole features of various platforms require more time to develop. While previously, they could provide a decade of asymmetric advantage, nowadays the strategic environment and adversaries' capabilities building illustrate the need to focus on 'rapid adaptation,' meaning the ability 'to field a force that can present unexpected force mixes with unanticipated operational architectures at speed.'[45]

Therefore, structuring of the armed forces with mass in mind should be approached as a system. Attention should be paid to a full cycle of timely capabilities, development, employment and adjustments or restructuring to the requirements of the battlespace taking into account the wider context of the civilian and military industrial segments in improving adaptability and readiness of the available equipment and its sustainment. **Critical mass** in modern warfare can be defined as the ability to rapidly produce and/or have sufficient numbers of military capabilities to deploy, modify, sustain and integrate into the force structure of a given operating environment according to the operational requirements. Thus, the scale would largely depend on the adversary and the type of conflict or war at stake. The capabilities also have to be addressed in their wider context of military–industrial readiness for the wartime production cycles: 'The mass approach, more than any other, requires self-sufficiency in manufacturing the required mass for the instances of protracted warfare, and the lack of connection between the mass approach and achievement of posed objectives.'[46]

Cross-domain integration, interoperability and combined arms approach

The question of interservice integration has been an important theme in discussions of warfare since the gradual additions of new domains to warfare, starting with land-centric views that were gradually shaped by maritime and aerial physical domains, and then by cyber and space domains. Any modern military doctrine, strategy or policy paper discusses the necessity of strengthening interservice collaboration and integration to avoid duplication of effort and conflicting orders, improve effectiveness of budgetary spending and prevent blue-on-blue fire in operations. Interconnectedness and interservice collaboration allow for more effective use of intelligence across services and levels of warfare and more effective employment of cutting-edge technologies. In its turn, interservice collaboration and cross-domain integration are aimed to facilitate and improve interoperability among different allied nations in the multinational cross-domain operating environment.

In the first few decades of the post-Cold War reforms, greater attention was paid to interservice collaboration and integration. At that time, the term of jointery or jointness became prevalent in Western national doctrines. Jointery or jointness (American spelling) was traditionally defined as 'a series of initiatives across defence to coordinate the activities of the three services more closely, pooling their expertise and maximizing their punch, while at the same time eliminating duplication and waste.'[47]

Except for its more positive aspects of reducing duplication and improving interservice operability, this phenomenon caused concerns regarding the independent status of the single services. As some national experiences illustrated, jointery can be counterproductive when some single services are merged and substituted by a single joint one. Another concern of this phenomenon is that the entire national system will evolve around a single service, making others redundant or developed only for the supportive purposes of that single service. In order to be effective, jointness requires a balance between single services' autonomy and contribution to the joint objectives and planning. Accordingly:

> the successful implementation of jointness requires effective single-service thinking and resultant performance with jointness in mind rather than implementing jointness with little consideration of single-service requirements and the nature of each domain. There are two ways of thinking about and implementing jointness. In the first, a joined plan can be developed and then distributed between the three services. This joined-up approach may not reflect an in-depth understanding of each domain. The second approach is to look into each environment, shape single-service responses within each domain, and incorporate them into a joint strategy.[48]

Another consideration in terms of jointery and its effectiveness refers to how it is implemented across the services. The traditional top-down rigid approach might result in setbacks, while the bottom-up solutions are likely to have greater effect across various levels. From the structural perspective, jointery often results in the introduction of joint C2 structures. The UK Joint Operations Doctrine defines a joint force as 'a force composed of significant elements of two or more Services operating under a single commander authorised to exercise operational command and control.'[49]

Overall, the process of interservice integration and jointery can be manifested in various ways. It can be an ad hoc improvement of inter-agency collaboration and reduction of duplication. It can include merging some functions of the single services into joint entities. It can also result in establishment of permanent joint structures with the full incorporation of training, military education and structuring of the Armed Forces. Finally, it can be manifested in the establishment of joint frameworks for the improvement of operational performance.

The concept of MDI can be viewed as a natural progression from the previous interservice integration and jointery. The focus is even more on the interconnectedness

of various domains of warfare and the crucial necessity of cohesion across various segments in achieving layered, cross-domain effects. The foreword to the Joint Concept Note 1/20 Multidomain Integration explains MDI as follows:

> This multidomain integration (MDI) will change the way we operate and war fight, and the way we develop capability. Effective integration of the domains will achieve a multidomain effect that adds up to far more than simply the sum of the parts. This integrated force must also be fused across government and interoperable with principal allies.[50]

In this regard, following the vision of the Integrated Operating Concept,[51] the aim of this exploratory concept is to facilitate modernisation of warfighting 'moving beyond "joint" to an era when modern manoeuvre in any domain will be enabled by effects from all domains. This integrated force must also be integrated nationally and with our key allies and partners.'[52]

Intensification of modern warfare due to numerous factors, spreading of cutting-edge technologies and rapid data sharing in the information space to mention but a few inevitably requires layered effects from different domains of warfare. The effects of different weapons originating in different domains cannot be completely separated from their effects on other domains. The battlespace is integrated by its very essence, and the side that can better integrate its assets, reduce duplication and achieve effective deconfliction can obtain more productive layered effects across different domains and levels of warfare and, hence, attain a military advantage. This aspect is of even greater significance under conditions in which there are significant gaps across military equipment in various domains. The layered approach of combining arms in one domain or across domains can compensate for immediate gaps in other domains.

The concept of combined arms is not new in warfare and has undergone various transformation stages. In a traditional sense, combined arms refers to simultaneously combining different capabilities in order to achieve posed objectives. From one perspective, it can be perceived as focusing on manoeuvre and an indirect approach rather than mass, thus aiming to undermine the enemy's cohesion through the advantages of tempo and precision targeting. From another perspective, it can be approached as a merging of effects:

> fire and maneuver, direct and indirect approaches across domains, orthodox and unorthodox ways and means. Combined arms reduce the decision space of the adversary. The more effects a force brings to bear in time and space, the more likely the enemy system is to collapse.'[53]

Overall, these analytical framework and themes are further used across later chapters in order to illustrate resilient fighting power in this war and the primary factors defining the success of this resilience.

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2

THE CONCEPTUAL COMPONENT

Soviet strategic thinking and military doctrine in the post-Cold War reforms

This chapter has three objectives. First, to identify Soviet strategic thinking and the predominant trends in the development of military doctrine as a context for understanding the common Soviet military background of Russia and Ukraine. Second, to show the post-Cold War conceptualisation of the role of the military in the two countries, their restructuring in the post-Soviet recovery and the place of doctrine in these reforms. Third, the national defence and warfighting approaches of the two countries before February 2022 are explored through their recent doctrines and strategy documents. This chapter is structured as follows: first, Soviet strategic thinking and doctrine are discussed in the time frame from the inter-war period until the collapse of the Soviet Union, followed by a discussion of post-Soviet doctrines and their role in reorganising the armed forces in Ukraine and Russia and the extent to which the two countries either moved away from or followed the Soviet traditions.

Soviet strategic thinking and military doctrine

In order to understand the influence of Soviet military thinking on modern events, it is essential to look into the origins of that thinking, its main principles, the extent of its embedding in official documents and its transfer into practice both in times of peace and war. Hence, it is worth beginning with the origins of Soviet thinking on how to fight wars and its reflection in the military doctrines throughout the history of the Soviet Union.

After the victory of the Red Army over the Imperial Army in the Civil War, the newly established state and its armed forces needed a direction for its structure, development and formalisation. On one side of the spectrum, there were veterans of the Civil War, such as Mikhail Frunze and Mikhail Tuckhachevskii, who aimed

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to tear down any old bourgeois structures in the Armed Forces and establish everything in a new 'Red Army style,' taking the experiences of the Civil War and glorified successes of the Red Army as a model to follow. They wanted to develop a new doctrine for the new Army. On the other side, the Commissar of War at the time, Lev Trotsky, questioned in his 1921 article the very utility of having any doctrine for the Red Army or any unified doctrine. He was also sceptical of learning from the past, believing that past events and exact historical situations could not be repeated.[1]

Besides the debate on the utility of doctrine and the path of transformation for the Red Army in the inter-war period, there was also a debate on the relevance of offensive or defensive strategy and objectives for the armed forces in a future war. Trotsky had a moderate view on the subject, supporting a balance between offensive and defensive actions. In the inter-war period, the Soviet Union went through substantial societal transformation from the Tsarist rule to the rule of the proletariat, which required merging contested classes of peasants and workers. Both classes were needed to make the Soviet apparatus work, and any suggestions for indoctrinated offensive revolution during demobilisation could undermine any motivation for building communism[2] and public support for the newly established communist rule. Further conceptualisation of the balanced approach to offensive and defensive actions was reflected in the work of A. A. Svechin, a former officer of the Imperial Army and a military theorist of the time. He focused on the importance of the economic strength of the rear for both offensive and defensive actions. Furthermore, he distinguished between structural differences and the consequent necessity of readiness and economic support for a war of destruction and a war of attrition. The former was to be conducted through rapid operations using reserves created during peacetime, while the latter was to include prolonged waves of attack using the capacities of the industrial rear. Consequently, the first case required substantial military expenses, while the second had a strong economic base to sustain a war of attrition long term.[3]

One of the features of the Soviet regime and its history is that political leadership had full control of decision-making with an immediate effect on 'disagreeable' individuals. The volatile moods of the Soviet leadership and the inter-party struggle would often result in the military and other professional leaders being deported or losing their lives in prison or by execution. Trotsky lost his influence due to the party struggle; Svechin lost his due to the too realistic and critical assessment of a war of destruction, while his opponents used more exaggerated estimations that supported the Soviet political leadership and fit well with five-year plans. Struggles within different schools of thought at the General Staff Academy and the demise of Svechin's authority through various rounds of criticism in the 1920s and early 1930s gave rise to the idea of being offensive as the primary way of conducting war and how the Red Army had to be structured.[4]

Despite the shift from balancing offensive and defensive conduct of war to a major offensive one, Svechin's contribution to the continuity of Soviet military

thinking of the time was the idea of a transitional stepping-stone of war between strategy and tactics – operational art for the Soviet context. Further, theorists like N. E. Varfolomeev and Vladimir Triandafilov under the leadership and intellectual influence of Tuckachevsky continued the conceptualisation of a new doctrine for the Soviet Armed Forces, which would come into history as the doctrine of 'deep operation.'[5]

The core of the overarching doctrine of the Soviet military in the decades to come and in the post-Soviet times consisted of the following ideas. First, the trends in the military affairs of the time suggested that gaining victory over the enemy in a single decisive battle or a single blow was unlikely. Instead, success was to be achieved by a series of sequential operations that would be more damaging to the enemy than the Soviet side. Second, the success of the offensive action depended on rapid assault that would not give the adversary a chance to organise a retreat and regroup their armed forces. Hence, the rapid speed of penetration into the depth of the enemy's battlefield was to provide the same stunning, disorganising and paralysing effect on enemy troops that the principle of surprise could provide at a given time.[6]

This theory was then further formalised in the first official Red Army doctrine Provisional Field Regulations 1929 (PU-29), Temporary Instructions on the Organisation of Deep Battle (PU-33) and Provisional Field Regulations for the Red Army (PU-1936). In conceptual succession, Tuckachevsky's ideas were further developed by Gregorii Issersson in his work on operational art. He argued that the challenge of Soviet operational art was to defeat the enemy through each part of its defences in depth. He emphasised the threat of dissipation of force as it was advancing into the enemy's defence. Moreover, he argued that campaigns of the time consisted of many successive operations that pierced the enemy's thick defence deep into the battlefield.[7] These successive operations included temporal and spatial integration of air, land and maritime efforts. This thinking was further formalised by Triandafillov in *The Nature of the Operations in Modern Armies* published in 1937 .[8]

Like many intellectuals during various eras in Soviet history, especially in Stalin's time, the forefathers of the theory of deep battle were not immune to the change in political will in the Soviet Union, and they soon were labelled as traitors and purged like their predecessors. The direct implication of their fall from grace was that their thinking and concepts were abandoned in the formal documents. However, as often happens with any suppressed ideas, they tend to arise in practice since they were part of the organisational culture and teaching curriculum for a certain period. The experience of World War II showed that the deep operation concept and the offensive were to stay in Soviet practice and consequent thinking for decades to come.

In the aftermath of the two World Wars, conceptual changes in the Soviet Union were still driven by political leadership with varying degrees of acknowledgement and learning from the past experiences, technological developments, previous

strategic thinking of Clausewitz and the German doctrine of blitzkrieg, the external international environment of the Cold War and internal trends within the Soviet Union. From the doctrine development perspective, post-War Stalin rule (1945–1953) was characterised by the development of doctrine to fight the last war. Hence, the focus was on the protracted warfare of World War II, with support of the ground troops with firepower from all other domains. Of course, surprise was at the heart of a successful start. Unlike traditional Western doctrine that tends to evaluate the achievements and shortfalls of various actions, Stalin's doctrines would only glorify the successes, without critically evaluating the costs of achievements and failures during 1941–1942. The victory was achieved through slowly moving fronts with frontal breakthroughs occurring 'by deliberating massing forces on a main axis of attack.'[9]

Khrushchev's era (1954–1964) was characterised by the greater conceptualisation of nuclear weapons. The nuclear strike gained the function of surprise followed by conventional means to achieve posed objectives. The focus had shifted from the dominance of the ground troops and tactical aviation to the nuclear tool but mainly as a preliminary means to destroy the enemy's forces followed by assault of the ground forces in the form of tanks and mechanised units. Thus, the principle of the offensive and surprise prevailed with the addition of a pre-emptive nuclear strike. In Brezhnev's era (1964–1982), there was further discussion of nuclear warfare with the potential for exchanging nuclear strikes, with the renewal of large-scale conventional operations in a full-scale war. This shift was conditioned by the strengthening of conservative narratives and KGB participation in the decision-making of Brezhnev's Politburo and the external factor of the American shift in nuclear policy from massive retaliation to flexible response.[10]

The revival of serious thought on strategic defence took place during Gorbachev's era (1983–1989) with the realisation that pre-emptive conventional strikes could, in fact, result in nuclear escalation that, in reality, the Soviet Union could not withstand. The new doctrine of 1985 emphasised the defensive phase to be followed by a strong counteroffensive. While the regular force was given a defensive role, the counteroffensive was reliant on mobilisation of reserves and their follow-up movement:

> Once forces from the strategic reserve moved forward, they would exploit the success achieved by the early front counterstrikes. Without fire superiority, the surprise, manoeuvre, and decisiveness of the counterstrike were impossible. Enemy deep fire systems and reconnaissance had to be destroyed, mostly by air, so that the manoeuvre forces had freedom of action.[11]

Although this doctrine illustrated a somewhat balanced approach to defensive and offensive approaches, Soviet military thinking of the time as reflected in various publications showed a mismatch with a rather political doctrine. Offensive and deep operation thinking were deeply embedded in the Soviet military mind and were there to stay in the post-Cold War era.

One of the elements of the Russian approach to surprise was deception ('maskirovka'). Colonel David Glantz in his work on Russian deception during World War II argued that the Soviet approach to surprise addressed nine areas: concealing one's intentions, hiding plans, masking combat preparations, employing new technologies and ways of combat, careful choice of the timing and direction of the attack, surprise employment of all available forces especially those with more kinetic firepower (air, artillery and armoured forces), rapid manoeuvre and decisive action to pre-empt enemy responses, the use of fake constructions and communications and taking full advantage of the situational characteristics, such as terrain, weather and seasonal indicators.[12] In essence, Glantz argued that elements of deception could be applied to five out of these nine points of surprise. In the context of the Cold War, these elements were incorporated into every aspect of Soviet foreign policy and the military, with constant concealment of actual capabilities and their functionality. For the Soviet political leadership, the perception of their Western counterparts was one of the major centres of gravity to reach, and various means of deception with its multiple tools allowed them to reach it.[13] Deception was to be used at the preliminary stage and during the entire duration of the conflict. It was then to be combined with the divide and rule principle: 'Disinformation, in this context, might have allowed the Soviet leadership to exploit divisions within an opposing coalition whose members lacked consensus on goals and methods.'[14]

The origins of the Soviet classical military thinking illustrate a few trends in the overall Soviet environment of military thinking and doctrine development. First, the connectedness between political and military leadership was far from the traditional Western cooperation between policy objectives and using military means to fulfil those objectives. The political regime of authoritarian or dictatorial rule, depending on which segment of the Soviet era is discussed, restrained the extent of innovative, critical and even unorthodox thinking among the military and many other professionals in the Soviet Union. The experience with the development of the deep operation illustrated the enduring struggle within the party and among the General staff and officers for the supremacy of their ideas and approval from the political leadership. While the former required accepting a theory and its formal reflection in doctrine, the latter meant the simple necessity of survival in an authoritarian regime with leadership that could purge anyone at any time. While during the inter-war period, a greater extent of military science and evidence-based thinking on the conduct of war could be observed followed by the development and spreading of various theories, numerous purges during Stalin's rule established a tendency towards laying low and not taking initiative, since initiatives often would punish initiators, as was the experience of Trotsky and Tukhachevskii. In general, this trend of conformity before the ruling elite can be extended to the modern times of Putin's regime, the nominal utility of doctrines, their rudimental reflection in the actual reforming of the Russian Armed Forces and the constant fear of the military leadership falling out of grace.

In this context, the second observation is disconnection between what is written in formal doctrine and what is trained and performed on the ground. This discrepancy might have seemed minimal during the inter-war and World War II periods, and the practical necessities of war would dictate relevant adjustments. However, this dichotomy of what is on the paper and what exists in reality has been haunting Soviet and post-Soviet Armed Forces until today, with the current war illustrating how wide the gap between formal papers, propaganda and real capabilities, trained skills and adaptability is.

Third, innovative thinking requires some freedom, support from leadership or at least a lack of punishment for unconventional approaches to solving a problem. Although there was a relatively susceptible environment for this innovative thinking in the inter-war period, the reality of the Stalin regime showed the limitations on innovative and critical thinking in the Soviet Union with a clear message of the driving forces for any military thoughts and ideas – political leadership is always right even if it is not. In a way, this early military thinking and doctrine development experience became formative for the entire Soviet tradition in the decades to come.

Fourth, all these factors in combination created an environment susceptible to greater conformity in the conceptual component of the offensive tradition of deep operation, which in its essence, continued throughout the entire existence of the Soviet Union and in many post-Soviet countries. Conformity and the fear of challenging the thoughts of political leadership stimulated a single concept of the offensive to dominate strategic thinking, doctrines and consequent practice in the decades to come. An important feature of dogmatisation and indoctrination of the Soviet ideas on the offensive was that although the formal documents could switch from offensive to nuclear and then to balanced offensive and defensive actions, these changes had little impact on the actual transformation of the Soviet Armed Forces or the stimulation of any type of critical thinking and, hence, flexibility and adaptability in the battlespace.

Finally, although Soviet theorists made extensive contributions to the development of the concept of operational art and emphasised the significance of flexibility in manoeuvre and its adjustments to the requirements of a given situation, the rigid command and control inherent in Soviet Armed Forces would undermine the very essence of the flexibility and agility that could be taken advantage of in achieving operational art. As the Soviet actions in the Winter War illustrated, the offensive approach and operational art had various shortfalls. First, the mass approach of the offensive required the need for further coordination of action and amassing of the effect of the attack; the obvious shortfall of aiming for attack alone is the need to sustain the effect and further progress the offensive. Second, if not as a major strategy, defensive action should at least be trained and prepared for in case various stages or segments of war require it, especially when a deep battle transforms into a war of attrition. Swift action does not guarantee an immediate victory. Focusing on surprise as a means of taking operational advantage over the enemy can achieve only so much, but it cannot guarantee anything after the first

stage of war and mobilisation of forces by the defending side. In the case of the Finish Winter War, the Soviets had the benefits of operational surprise in terms of timing, weight and location of their attack.[15] Still the issue is always what happens after the initial advantage of the surprise when the intended paralysing effect wears off and the offensive has to be sustained over a prolonged time.

Ukrainian military doctrine and post-Cold War reorganisation

In Ukraine's post-Cold War military reforms, doctrine had a slightly different use than in the Western practice during the same period. In the Western tradition, military doctrines refer to the set of principles for how the military conducts their operations to achieve stated objectives. Doctrine is authoritative but requires judgement in its application. There are different types of doctrines across levels of warfare, services, operational environments and types of operations. Doctrines are revised when various political, strategic and operational environmental changes occur. Often doctrines in their respective hierarchy are driven by the national strategy and objectives of the country's foreign policy. Although doctrines are authoritative, they normally are not equal to the normative act and are not law-binding documents. On the contrary, in Ukrainian post-Cold War practice, documents titled 'military doctrines' are part of the normative acts, which are the main source of law in Ukraine.

The legal mechanism of doctrine establishment and enactment refers to two main entities: the President of Ukraine and the National Security and Defence Council of Ukraine (NSDC), which is a co-coordinating body (state agency) to the President of Ukraine in the sphere of national security and defence. Activities of the NSDC are regulated by Article 107 of the Constitution of Ukraine.[16] The President of Ukraine chairs the NSDC, and its decisions are 'put into effect by decrees of the President of Ukraine' (Art. 107, para 7). New decrees of the President can abolish the previous ones, thereby changing the approach and direction of the defence policy and the ways to achieve the objectives reflected in military doctrine. Hence, it is important to emphasise that Ukrainian military doctrines are styled and read as legal documents that establish both the direction and the means of achieving stated objectives in the defence and security spheres, with the Ministry of Defence responsible for enacting these principles and reporting on their progress. In essence, the documents of military doctrine on a strategic level are a formal estimation of the country's national strategy, defence and security policy, containing some elements of the Western-style military doctrines. Due to its prescriptive legal status, the documents outline the direction in some detail, but are not as detailed as, for instance, British Defence Reviews, which also identify the direction for the national Armed Forces to follow with an assessment of capabilities within an estimated budget. There were also documents on national strategy. Normally, the two documents would detail and complement each other.

Considering the formal specifics of documents called military doctrine in Ukraine, it is essential to emphasise some observations on the doctrine's purpose, use and consequent content. First, due to the entwined nature of the NSDC and the post of the President of Ukraine, military doctrines have often embodied a President's approach to national defence, security, Ukrainian foreign policy and Ukraine's place in regard to NATO, the European Union (EU) and Russia. Second, since the country had to readjust its military posture from being a part of the Soviet Union to a newly established independent state with its own military budget, armed forces and consequent defence policy, various doctrines have addressed military reorganisation, usually indicating the extent of numerical reduction in the armed forces and shrinking military budgets rather than a conceptualisation of defence and warfighting. Finally, most of the doctrines did not focus much on actual warfighting or defence per se, but rather on the justification of inconsistency between the military budgets, force reduction, a move from conscription to a volunteer professional army and ageing of the capabilities. While some of the doctrines that are further discussed tried to introduce systematic military reforms to follow the Western model, others would scrap the achievements of the previous ones, making the situation even worse. Thus, it can be argued that the reforms that the military doctrines of Ukraine contained and promulgated were far from linear, with various setbacks and multiple inconsistencies. Furthermore, most doctrines were reactive, while only the last one in 2021 showed a proactive stance and introduced the concept of Comprehensive Defence into Ukrainian national defence and warfighting.

Leonid Polyakov defined three stages in the development of the Ukrainian Armed Forces (UAF) in the post-Cold War era: non-alignment between NATO and Russia (1991–2000), reforms and NATO ambitions (2001–2009) and from non-alignment to Russian aggression (2010–2016).[17] As the author of this book, I would add the final period of NATO orientation and professionalisation of the UAF (2014–2022 onwards) during the eight years of low-intensity war and full-scale invasion in February 2022.

Ukraine's first post-Cold War military doctrine was published in 1993. It established the policy of Ukraine's non-alignment between NATO and Russia, the defensive nature of Ukrainian foreign policy and Ukraine's views on nuclear weapons. This document addressed the general terms of the defensive approach, military–political aspects, the causes of military insecurity and Ukraine's attitude towards war, military–technical and military–economic aspects.[18] In the light of the enduring fear of Russian aggression in Ukraine since the first days of independence, the non-alignment and defensive nature did cause some debate in the Parliament, with the focal point of discussing the nuclear status of Ukraine. The adopted doctrine proclaimed that Ukraine had no intention of employing nuclear weapons, but 'it will not reduce its nuclear armament, unless others, too, take "adequate steps" and unless Ukraine receives security guarantees from other nuclear powers and world community.'[19] As history has shown, these preconditions

to disarmament were fulfilled, and Ukraine gave away its nuclear arsenal, signing the Budapest Memorandum on 5 December 1994.

The non-alignment period of 1991–2000 depicted in the doctrine was characterised by the process of denuclearisation of the country and reorganisation of its Armed Forces. Further details of both were indicated in 'the state programme of Armed Forces Construction and development by 2005' (January 1997), which focused on the elimination of strategic nuclear weapons by 2002 and a reduction in the Armed Forces to 310,000 by 2000; as of 1991, Ukraine had the largest Armed Force in Europe with 800,000 personnel.[20] Although further normative acts followed, in reality the Armed Forces had to manage their reduction within the constantly shrinking military budgets on their own. As a result, the main structural reform was the numerical reduction of conventional strength to 400,000 personnel in 2001. In terms of equipment, it had an ageing Soviet-era arsenal with little to no modernisation.[21]

Rather limited reforms to the Armed Forces in the first decade of independence dictated the necessity of a more comprehensive approach. In 2000, 'the State Programme for Reforming and the Development of the Armed Forces of Ukraine by 2005' was adopted. It demonstrated the usual trends of significant budgetary cuts, closure of military bases and merging of the Air Force and the Air Defence. The time was characterised by substantial malnutrition of the Armed Forces:

> Estimates at that time suggested that, in accordance with standard requirements, the armed forces had decreased to 300,000 military personnel, while over 3,000 tanks and over 500 aircraft required a much bigger budget to maintain their readiness. However, the Ukrainian state budget of that time (2000–4) regularly allocated only 10–20 per cent of the required amount—about $500 million–$700 million. It was barely enough to feed the conscripts and to pay a low salary to military officers.[22]

This grave situation substantially undermined not just readiness but also the very existence of the Armed Forces of Ukraine, with their primary training and operational skills gained in peacekeeping operations and international military operations. In order to reorganise the military, in 2001, President Leonid Kuchma adopted the concept of transformation of the Ukrainian Armed Forces into a volunteer/professional force of 240,000 militaries by 2015. However, in 2002, the number was adjusted to 180,000.

The end of the non-alignment era is associated with President Viktor Yushchenko and changes brought to Ukraine by the Orange Revolution. The obvious reorientation towards the EU and NATO was embodied in the new doctrine of 2005. Reforms were aimed to reorganise the military according to the NATO standards: development of NATO-style command and control structures; finalising the merging of the air force with the air defence, thereby making three single services instead of four; establishment of a Joint Operations Command;

and movement towards volunteer professional armed forces. Furthermore, a more Western model of military training, education and personnel organisation were to be introduced. The target number for the Armed Forces was 140,000. Collaboration within international programmes and contingent intensified in this period. Although the implementation of this initiative faced numerous setbacks, such as the economic crisis and the Russian invasion of Georgia, the direction for reforms remained clear – the professionalisation of military to the NATO standard.[23]

The linear progression of the reforms was scrapped by the new President – pro-Russian Viktor Yanukovych. Hence, he made a U-turn in the direction of Russia and scrapped all previous reforms. The military doctrine published during his presidency eliminated the NATO direction of the Ukrainian military and prioritised a 'constructive partnership' with Russia. Moreover, he extended the contested stationing of the Russian Black Sea fleet in Crimea from 2017 to 2042 and labelled the threat of regional aggression as unlikely. In essence, under Yanukovych's presidency, besides the obvious reduction of the armed forces to 130,000 personnel, the overall readiness was further reduced not only by closure of various military bases and support facilities but also by further deepening of corruption[24] and redirection of scarce military funds to non-military procurements and activities. Yanukovych followed the Russian example of that time and established numerous anti-riot police units and security services to protect his regime, which numbered three times more than the regular Ukrainian Armed Forces. Hence, everything was done systematically so that the Ukrainian military was in the poorest condition possible for the Russian invasion in 2014.

The next doctrine was published in 2015 under the presidency of Petro Poroshenko. It once again abandoned the policy of non-alignment and reinstated the NATO and EU direction of Ukraine's foreign policy and military reforms. Russia was identified as the primary adversary and threat to Ukraine's security, with its full-scale invasion as the main scenario for which to prepare. The operational experiences in Crimea and Donbas were reflected in NSDC's Concept of Ukraine's Security and Defence Sector Development (2016), which prioritised the need for intelligence capabilities, professionalisation of the military, ways of developing and sustaining military reserves and strengthening of the territorial reserve. In practical terms, these reforms increased the military to 250,000, with the intensification of their combat training and logistics support and the establishment of the Joint Operations HQ and the Special Operations Command.[25]

These four post-Cold War military doctrines do not particularly illustrate the traditional thought process on how to fight wars or the detailed conduct of a country's national defence based on an assessment of the strategic environment. Instead, the military doctrines served as a means to formalise the country's foreign policy direction and its impact on defence, security and military reforms. While the overall trend was most certainly a reduction in the military in the post-Cold War reorganisation due to a lack of funding and the obvious need for professionalisation in the military, there was also the obvious tendency of pro-Russian governments to

weaken the Ukrainian military, so that they would not pose such a great threat to further Russian aggression.

'The Military Security Strategy of Ukraine' (25 March 2021) was developed under the Presidency of Volodymyr Zelenskyy by the secretary of the NSDC Oleksiy Danilov. Unlike any other document on military doctrine or national strategy in Ukraine's entire post-Cold War history, this one introduced a clear concept of how Ukraine's military security should be approached and how defence should be conducted in the case of a full-scale invasion. Although this was a strategic level document, it was more military and practice-oriented than the previous socio-political doctrines and national strategies. The concept of comprehensive defence (Vseokhoplyuyucha oborona) included the following measures:

- Preventive actions and persistent resistance to the aggressor on land, at sea and in the airspace of Ukraine, countermeasures in cyberspace and against imposing one's will in the information space;
- Using the entire potential of the state and society (military, political, economic, international-legal (diplomatic), spiritual, cultural, etc.) to repel aggression;
- Employment of all forms and methods of armed struggle against the aggressor, in particular asymmetric and other actions in defence of Ukraine in compliance with the principles and norms of international law.[26]

Comprehensive defence was to be built on three pillars: deterrence, resilience and cooperation. Deterrence envisaged the readiness of all civilian and military potential of Ukraine to counter various military threats and inflict political, military and economic losses upon an adversary, forcing it to abandon escalation and stop aggression. The second pillar is resilience, which entails the ability of the governmental authorities, the Armed Forces, the national economy, infrastructure and society to recover and adapt to the changes in the security environment in repelling an aggressor and providing support for further effective activity of the territorial defence of Ukraine, resistance movement and the conduct of various types of operations, and renewal of the infrastructure and communication to strengthen people's livelihood. The third pillar is cooperation, which entails coordination of actions within the country during the preparation of armed defence against armed aggression, reconstruction activities in the post-hostilities period and the actions taken by the EU, NATO, international organisations and individual states to support Ukraine.[27]

The overall narrative of this strategy (which substituted military doctrine and other related normative acts of the previous president) is about systematic defence of the country from aggression using all available means within the country and abroad, with a clear identification of Russia as the main aggressor. Unlike any other strategic doctrine or strategy previously discussed, The Military Security Strategy of Ukraine suggested actual preparation for defending the country in the

case of future escalation as well as preparedness and improvement of resilience. Hence, the defence rested upon strengthening the resilience of all civil and military entities in the country and the preparedness of the armed forces, territorial defence and other fighting units for rapid deployment against the invading forces of Russia. In this regard, three waves of action were envisaged. In the first wave of repulsing and deterring armed aggression, to prevent the enemy's advancement deep into Ukrainian territory and restrain further escalation of the conflict, the Ukrainian Armed Forces were to conduct various special operations, including on the adversary's territory. In the second wave, the military reserve was to be utilised to strengthen the defence, followed by further mobilisation in the country. An important element of the second wave was the deployment of the resistance movement in the event of temporary occupation of certain territories of Ukraine. In the third wave, additional military units, established through the mobilisation of reserves, were to be employed in further repulsing and deterring the armed aggression against Ukraine. In this wave, the end of aggression was envisioned with the assistance of the international community. Cessation was to be on favourable terms for Ukraine. Not a separate wave, but a recovery stage of post-conflict settlement identified both activities and goals: 'post-conflict settlement, demobilization, restoration of control of compliance within the regime of the state border of Ukraine and reintegration of temporarily occupied territories during the reconstruction period after the end of hostilities.'[28]

To achieve these objectives and the improvement of the national joint military capabilities, reforms in the Armed Forces were to be speeded up. Once again, NATO principles and standards of professional military were chosen for these endeavours. The main focus was on

> achieving and maintaining capabilities of Armed Forces of Ukraine and other components of the defence forces in terms of strategic mobility, conducting asymmetric, network-centric, multi-sphere and indirect actions that will eliminate the numerical and technological superiority of the adversary on land, in the air, at sea, in information space and cyberspace.[29]

Overall, the strategy illustrates a more realistic and practical suggestion on how Ukraine can defend itself under the conditions of a full-scale Russian invasion. While the comprehensive approach in general follows the post-Cold War tradition of various countries that were likely to face a more numeric adversary, the specifics of the response and waves of defence were built on distinctive features of the Ukrainian terrain and its history of warfighting. Historically, the Ukrainian people have always had to fight greater conventional standing armies both in the Imperial and pre-Soviet times. Hence, various characteristics of partisan warfare are inherent to Ukrainian warfighting, and military traditions date back long before the very inception of the Soviet Union. Diversion and dispersion of force and efforts provide an excellent opportunity to undermine the enduring hope of Russians for blitzkrieg

and overarching benefits of a surprise attack. Furthermore, the covert operations in the territory of Russia identify and consequently target the core centres of gravity for any attacking force: its logistics and supply chain.

Finally, this strategy has a systematic approach to defending one's country using a full spectrum of capabilities, the modern professional military concepts of network-centric, multidomain and joint warfare, and the wider concept of comprehensive defence. This feature of the strategy formally illustrated the processes of strengthening interservice cohesion in the battlespace and reforms to strengthen this integrity initiated after the beginning of the Russian war in 2014. Moreover, this element of the strategy also illustrated a more systematic learning from the professional military practice of the NATO countries.

Russian military doctrine and post-Cold War reorganisation

Like any former Soviet country, Russia had to readjust its Armed Forces and military complex to the new realities. While the peace dividend might not have been as profoundly sound in the newly established state, internal struggles and the necessity of uniting a country that had never been homogenous in any way required a clear message on foreign policy and the place of Russia and its military in the post-Cold War world. Accordingly, military doctrines were used to deliver more of a socio-political stance[30] of the government and its vision of foreign policy and the place of the military in it. The role of military doctrine in the Russian military context was identified in one of its doctrine editions, stating that the Russian military doctrine

> represents a system of officially adopted by the State views on preparations for armed defense and on the armed defense of the Russian Federation. The Military Doctrine contains the main provisions of the military policy and of military-economic support for defense of the State based on the analysis of military risks and military threats facing the Russian Federation and the interests of its allies.[31]

While in Ukraine, the development of doctrine was a roller coaster with non-alignment, in the case of Russia, it was a steady decline in the perception of the West and NATO from the rhetoric of modest points of cooperation with Western countries to deterioration into threats, perceptions and manifestations of antagonism between Russia and the West. The transitional period of some uncertainty and associated opportunities in the 1990s soon returned to the Soviet rhetoric and methods; no matter what glossy images and buzzwords were used in doctrines, the practice remained Soviet and KGB in its essence.

As the Soviet section of this chapter showed, in the last decade of its existence, the Soviet Union was moving towards adopting defensive doctrine and reorganisation of its military accordingly. Since the process was not finalised and the collapse of the Union resulted in broken logistics chains and the division of various units of the

Soviet military between different newly established independent states, there was a vital need for reforms. From one perspective, the question was finding a balance between nuclear and conventional military tools. From another perspective, there was the traditional post-Cold War military debate on how the Armed Forces would be structured: whether to follow a technological or a mass approach.[32] In the case of Russia, two camps of the debate were presented by General Vladimir Slipchenko, who lobbied in favour of cutting-edge and precision technologies over the land component, and Makhmut Gareev, who was sceptical of ballistic missiles and was more focused on the principles of defensive sufficiency in structuring the Russian Armed Forces: 'priority in outfitting troops and naval forces is given to highly effective weapons and equipment capable, according to their quality, of substantially reducing the quantity of arms needed to maintain the combat might of the Armed Forces.'[33]

The first post-Cold War Russian doctrine of 1993 was an interim document to formalise the existing state of affairs and prevent the pendulum from swinging too far. The emphasis was that Russia would continue to preserve both nuclear and conventional weapons in its arsenal and that the main threats to Russia at the time would be the strengthening of military presence in the neighbouring countries and military alliances, regional conflicts in the neighbourhood, the proliferation of weapons of mass destruction (WMD) and terrorism. A trend towards greater mobility, technological advancement and professionalisation of the Russian Armed Forces was formalised in this document.

While the doctrine of 1993 could have been viewed as moderate and open-minded considering the Soviet past and the Cold War, rolling back to Soviet antagonism can already be associated with the draft of the 1999 doctrine published in military magazines for its professional discussion. The draft indicated the threats of 'monopolarism' to Russia and the potential for its change using military means. In various discussions, then-Prime Minister Putin emphasised the necessity of strengthening the national military and the consequent Russian grasp over the Caucasus. The draft doctrine and speeches of the time served the obvious deterrent role of preventing any interference by the United States and NATO in the Caucasus (meaning the ongoing Russian war in Chechnya) in the way NATO got involved in Yugoslavia.[34] The actual doctrine that was published in 2000 took a slightly more modest form than its draft indicated. However, from the nuclear perspective, it moved from the use of nuclear weapons in the case of existential threat, as was stated in the National Security Concept of 1997, to their use in the case of full-scale aggression against Russia with conventional weapons or a WMD attack.[35]

From the conventional perspective, the main external threats included any territorial claims against Russia or interference in its internal affairs; preventing Russia from its participation in resolving international security problems in the multipolar world; armed conflicts or military build-ups on the Russian border or borders of its allies; and expansion of military unions. In essence, this doctrine continued the traditional Soviet rhetoric of preserving Russian spheres of influence

and the 'entitlement' of Putin's government to 'resolve' international conflicts as it considered fit. The detailed and more aggressive nuclear stance suggested the traditional 'or else' argument that always existed in Soviet and Russian foreign policy and strategic thinking. However, the doctrine was labelled to be defensive in its nature, with the traditional Soviet military offensive twist. More attention should be paid to this doctrine than to any other that followed because it is the starting point of the Putin era in Russia and its embodiment of Putin's approach to the military and what could be called Putin's doctrine, which dominated Russia for the next 22 years: subversion of the principles of international law; territorial grab; nuclear blackmailing; and KGB methods of conducting business internally and internationally.

The next doctrines that followed only further crystallised Russian antagonism towards the West, vis-à-vis NATO. The 2010 edition explicitly emphasised the threat of NATO expansion instead of using the generic term for military alliances used in the previous edition. The 2014 edition of the doctrine continued the same anti-NATO narrative, distinguishing between military threats and risks, with varying degrees of escalation and responses. This doctrine also mentioned Russian interests in the Arctic and its space capabilities. The fear on the part of Putin's regime that it could lose power through the internal changes was evident in its equalling of any internal threats to the ruling regime with threats to the state. Furthermore, this doctrine emphasised the multitude of means to achieve stated objectives, including information, political, economic and other tools besides military force.[36] In addition, this doctrine mentioned for the first time private military organisations and mercenary units that flourished in the Russian wars. As no coincidence, Gerasimov dismissed the reforms of professionalisation of the Russian Armed Forces initiated by Serdyukov when Russian military shortfalls became evident in Georgia. In 2014, the federal-level national guard was established to protect the integrity and endurance of the Putin regime by withdrawing 400,000 members of the professional military force from the Armed Forces and moving them to the National Guard.

The overall discourse of the doctrine could be considered as a continuation of the mass fire offensives with a greater emphasis on improving intelligence, surveillance and reconnaissance (ISR) capabilities and the precision of their strike capabilities. The previous vulnerabilities of the Chechen War[37] and Georgia[38] were partially addressed by emphasising the necessity of integration among various districts of the Army and across services. One of the weak points in Russian defence was a surprise attack of the Western adversary enabled by speed and technological superiority of the Western capabilities. Integrated defences were to respond rapidly and punish the attacker already during the first stage of the conflict by preliminarily disrupting and deflecting their advancing efforts. Furthermore, 'these defenses are designed to operate in coordination with Russia's other capabilities to ultimately target and degrade an adversary's critical infrastructure and ability to sustain combat.'[39]

This doctrine also broadened the concept of deterrence, previously primarily applied to the nuclear context. The new term of strategic deterrence included the usual nuclear weapons, conventional weapons and non-military tools of the concept of New Generation of Warfare (NGW). According to NGW, the preliminary stages before the start of military confrontation would involve psychological and information suppression of an adversary's morale and will to fight through various anticipatory actions. Hence, the asymmetric and non-kinetic elements of this concept.[40] Although the essence of the NGW is not explained in the official doctrine of 2014, its further conceptualisation and presentation were done by Chief of the General Staff General Valery Gerasimov and the Russian military in a number of speeches and lectures given at the military college and in the pages of professional journals. This use of non-military means at the preliminary stage of warfare became known in the academic and professional literature as Gerasimov's doctrine or hybrid warfare. However, in one of his speeches, Gerasimov called the Russian approach to defence by a more traditional term, that of **active defence**:

> A defensive strategy emphasises maneuver defense, and counterattack. It is a defensive offense that envisions persistent engagement of an opponent throughout the he theatre of military action, to include critical infrastructure in their homeland, executing strategic operations that affect an adversary's ability or will to sustain the struggle. Consequently, Russian military strategy is comprised of operational concepts that represent defensive and offensive constructs without clear distinction. Active defense devalues strategic ground offensives, privileging the aerospace domain, maneuver defense, and forms of noncontact warfare.[41]

Some other features of the active defence strategy included pre-emptive actions in neutralising potential threats to national security. Although the pre-emptive measures could vary from non-kinetic to kinetic ones, they were still to take advantage of surprise, decisiveness and continuity in inflicting unacceptable damage upon the enemy and hence gain strategic initiative. Interestingly, the usual kinetic and intense warfighting tactical level of engagement was foreseen at a distance, clearly referring to varying artillery ranges on both sides. The battlefield was perceived as fragmented without fixed battle lines. Land forces manoeuvre defence was prioritised over ground offensives to undermine and degrade opponent's strength and preserve one's own force. Interestingly, Russia's own territories could be given away to gain stronger positional defence and counteroffensive effort. Furthermore, the purpose of all actions in the active defence was not territory gain but making the political cost of attack too high. Hence, adversary's main centres of gravity and consequent targets for the long-range strikes were to be both military and economic elements:

> The overall Russian objective is to prevent an opponent from achieving a decisive outcome, forcing them into a conflict with high levels of attrition. The vision is

> to inflict damage to military and economic infrastructure such that opponents will seek war termination on acceptable terms, and become preoccupied by the ensuing internal instability.[42]

Overall, various elements of Russian military thinking in the NGW and active defence generally labelled as the Gerasimov doctrine, or hybrid warfare, substantially influenced academic and professional discussions on modern warfare for almost a decade. While some considered these ideas and various aspects of its manifestation in Russian actions in Ukraine in 2014 ultra-innovative, more realistic strategic thinkers and scholars were sceptical about the new buzzword and conceptual hype:

> Gerasimov was trying to do was allude to the traditional Russian concept of non-linear warfare—which refers to the use of both regular and irregular forces along with psychological, economic, and diplomatic means—and the traditional concept of deep operation, which is based on a systematic and national effort combining diplomatic, social, and military elements. In fact, in his infamous speech, he cited Isserson and Svechin, although both in reference to general propositions like military combat readiness and preparing for future conflicts.[43]

Although there was no formal military doctrine before the pre-invasion, a new national security and strategy document was issued on 2 July 2021. The overall narrative of the document has largely been analysed by different scholars, with various points of emphasis. First, the overall focus of the strategy was the independent self-centred actorness of Russia in the global world in which the previous cooperation with friendly states, which was substituted by interactionalism and antagonism with the United States and Europe, was less sound than in the 2015 edition.[44] However, in the 2015 edition, the reach of Russian influence had an extraterrestrial scope, while in 2021, the agenda extended to spreading its presence and influence further into the Arctic and extending it to 'unclaimed' Antarctica. Besides extending hands to unclaimed continents, this strategy emphasised Russian culture and its identity and, by extension, protection of the Russian people.[45] In essence, the doctrine provided ideological, ethnocultural grounds for the further blurring of the principles of international law and employment of lawfare in support of the Russian expansionist wars.

Comparison of the two approaches to doctrines

As the post-Cold War use of doctrine shows, in both countries, strategic doctrines were closely linked to the political decision-making and had remained closely integrated into the normative frameworks of both countries. Although this tendency can be perceived as a mere national tradition or modus operandi, it immediately affects the use and functionality of military doctrines. First, the doctrine reflected

the views of the ruling political elites, resulting in a roller coaster in the case of Ukraine and the strengthening of anti-Western sentiment in the case of Russia under Putin's rule. Second, despite being rather vague at the strategic level, military doctrine as a normative act can be equated to an order and an obligation for all other national entities related to security. In essence, despite its vagueness and general nature, it was aimed at providing an exact framework for the Armed Forces to operate and means to monitor that performance against the allocated budgets.

Third, while the pre-2021 Ukrainian doctrines had a rather generic socio-political nature that discussed Ukrainian foreign policy in its link to defence and security, the 2021 strategy that was a substitute for this doctrine specifically addressed how warfighting and defence against Russian aggression would be conducted. Compared to the Western practice, this document illustrates more features of a national strategy or a military doctrine at a strategic level because it soberly evaluates the existing strategic environment from the military and security perspectives and provides an exact approach to defence and a strategy of warfighting. In contrast, Russian military doctrines were used to express the extent of animosity towards Western countries and NATO, but despite the changing rhetoric, they did not introduce many new ways to counter threats other than nuclear blackmailing and a mass offensive. Even what many began to call Gerasimov's doctrine was more developed in his speeches and lectures delivered to cadets and officers than in what was written in Russian military doctrine and strategy per se.

Fourth, if military doctrine is too closely linked to the socio-political environment and becomes more of a political tool in foreign policy, its utility for the military becomes limited. While general strategic-level doctrines tend to provide enough room for flexible and decentralised execution, often in the post-Soviet countries, a lack of clear instructions on the methods and quality standards can result in adherence to only the numeric reflection of the reforms and objectives posed in respective doctrines.

Fifth, the last pre-full-scale invasion doctrines of the two countries captured important strategic thinking of the countries, showing very different trends. In both cases, the combination of history, national ethos and geopolitical endurance of the terrain would dictate how warfighting was to take place. While Russian geopolitical location over a vast territory has always encouraged land-centric mass offensive thinking on warfighting, Ukraine has always had to defend itself from the Russian imperial ambitions by taking advantage of what Ukrainian terrain provided. The Ukrainian tradition of warfighting has historically been a combination of diversified semi-autonomous units and partisan warfare taking advantage of mountainous areas in western Ukraine, woods and swamps in the northern part and various hills, rivers and floodplains across the country. The three waves described in the Ukrainian strategy of 2021 illustrate the employment of asymmetry at its best. While Russia was likely to follow its traditional mass offensive surprise attack, it also continued to bring its enduring vulnerabilities in sustaining the effect and advancement over a prolonged time, with the consequent logistical challenges and

greater dependence on the rear. Diversion activities in the Russian rear combined with frontline manoeuvre of the Ukrainian regular forces and partisan warfare on temporarily occupied territories would, in sum, provide a crumbling effect on the integrity and very functionality of the invading force, which in fact was seen in 2022 and is discussed in the following chapters of this book.

Finally, although strategic-level documents illustrated more formalised and up-to-date thinking in Ukraine and the endurance of previous Soviet traditions in Russia, another trend needs to be emphasised in the context of doctrine and consequent military practice. Since there were no systematic reforms in professionalisation at all levels of the military, various Soviet paper-style practices would endure. However, innovative thinking and the persistence of leadership from people like General Valery Zaluzhny would be fighting this practice to introduce more modern and professional mechanisms. More time will be needed after the war for the institutions to completely adjust. This context is essential to emphasise because the absence of systematic reforms from top down resulted in the development of practice-oriented innovations and activities from a bottom-up, grassroots approach. Various know-how and training, especially of special operations units like the Azov regiment, would be developed based on the practical experiences personally gained in 2014–2015 by the future leaders of the new regiments and units. They would build their training and tactical preparation based on that experience of what worked and what did not. Hence, in the war of 2022, innovations to warfighting and the improvement of fighting power of the Ukrainian warriors were coming from both directions – from above and from the grassroots of the tactical necessities of warfighting. Immediate necessities of war dictate mission command in more than one sphere of execution. In the case of Russian military, strict hierarchy and subordination did not allow much room for manoeuvre in any field and most certainly did not encourage mission command, critical thinking nor innovation, especially in the first months of the full-scale invasion. Hence, as later chapters will illustrate, many of the Russian innovations were, in essence, learnt from the warfighting itself and were adaptations to Ukrainian tactics during military engagements.

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3

HISTORICAL CONTEXT

This chapter explains the context of Russian aggression against Ukraine during the 2014–2022 time frame. Overall, the period of 2014–2022 can conditionally be divided into three stages. The period of 2014–2015 was the first stage of invasion – the annexation of Crimea and the orchestration of the 'separatist' war in Donbas. The 2016–January 2022 period can be identified as the interim stage of the frozen conflict, or the stage of reinforcement and build-up for the full-scale invasion. Accordingly, the third stage would be from the full-scale invasion until today. In this chapter, each stage is explained through a brief chronology of events followed by a discussion of the military experiences of both Ukrainian and Russian combatants. Thus, the chapter provides insights into the extent that the military engagements of 2014–2015 shaped the interim transformation years of 2016–2022 before the full-scale invasion in 2022. Equal attention is paid to the Russian and Ukrainian parties to the conflict.

Chronology of events 2014–2015

President Viktor Yanukovych's pro-Russian regime culminated in his refusal to sign the Association Agreement with the EU in November 2013. This action resulted in pro-European and pro-Western protests and consequent calls for his resignation. The regime's response was similar to the Russian tradition – the use of violence against peaceful protesters in Kyiv in February 2014, with more than a hundred dead and many injured. The killing of the 'Heavenly Hundred,' as it went down in Ukrainian history, and the atrocities on the streets of the capital turned even the most apolitical people against Yanukovych's regime. Losing control over the country, he fled to Russia on 22 February 2014 as the Ukrainian Parliament unanimously voted to remove him from power and establish an interim government. By extension, the

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lack of a pro-Russian government in Kyiv meant a loss of Russian influence and the ability to lobby for its interests in Ukraine, at least in the vertical hierarchy of power. The immediate response was the triggering of plans for the annexation of Crimea. Few scholars are convinced that no contingency planning took place over the years and that the annexation of Crimea was planned overnight.[1] The excuses were also not new – protection of the interests of the ethnic Russians because the interim government in Kyiv abandoned the Russian language as one of the official languages in Ukraine on 23 February 2014; and calling Ukrainian protests and the change in government an illegitimate coup.

On 27 February 2014, the infamous 'little green men' (various units of Russian Airborne Forces [VDV], Special Forces and Spetsnaz) began to appear in key positions in Crimea, putting pressure on the local authorities by seizing the parliamentary building in Simferopol and other main governmental buildings across the peninsula with a consequent change in the local government to the pro-Russian one led by Sergey Aksyonov. This government announced its separatist sentiments against Kyiv and proclaimed that the status of Crimea was to be decided by a local referendum scheduled for 25 May 2014. On 28 February, the day after this announcement, more Russian units took control of the key infrastructure and blocked Ukrainian military bases, while seizing command and control of air defences to facilitate the safe spread of Russian troops across the peninsula.[2]

Taking further advantage of the surprise and hesitant response of the interim government in Kyiv, the Crimean Parliament under Aksyonov shifted the date of the referendum to 16 March with the consequent staged vote results of 97% in favour of seceding Ukraine and joining Russia (the vote and result were widely contested internationally). The annexation was then formally finalised on 18 March, when the Russian Parliament adopted the decree. This distortion of the normative process was in parallel with further strengthening of the military control of the peninsula: more green men of various organisations arrived on 5 March. A Russian cruiser blocked the Black Sea exit on 6 March. The fall of the Ukrainian naval base in Novofedorivka opened Russian access to Crimea through Kerch on 12 March. From a military perspective, Russia strengthened their control over the peninsula during 18–24 March, leaving no option for Ukraine but to prepare for the withdrawal of its troops from the peninsula. Although preparations were already underway on 19 March, the announcement was made on 24 March. Once annexed, the transformation of Crimea from a mere concentration of Russian military presence in the Black Sea to its full militarisation and *de facto* Russian military base began.[3]

Further military build-up continued on the Ukraine–Russia border in April 2014, with approximately 40,000 troops. While in Crimea, green men without insignia were used to secure Russian interests, in eastern Ukraine, pro-Russian separatists were used as proxies for the same purpose. They seized government buildings in two districts and proclaimed the independence of the Luhansk and Donetsk regions from Ukraine.

In response to these actions, the National Security and Defense Council of Ukraine (NSDC) announced on 13 April the beginning of an anti-terrorist operation (ATO) against illegitimate activities of Russia-sponsored separatists and regular Russian troops assisting them. The decision came the day after pro-Russian separatists led by Igor Girkin (former FSB) captured Sloviansk and later Kramatorsk. Strelkov/Girkin and his accomplice became known as 'The Executioners of Slovyansk' for killing Ukrainians by firing squad.[4] The ATO involved both Ukrainian law enforcement (SBU) and the Armed Forces. In April–July, Ukrainian forces suppressed separatists and regained much of the previously occupied territories.

At the early stage of the Russia-sponsored separatist movement, the aim of Russian regular troops seemed to be to 'conduct a train-and-equip programme to provide capabilities to the local separatists.'[5] However, the suppression of pro-Russian separatists by Ukrainian forces led to the crossing of the border by Russian troops under the pretext of 'humanitarian convoys' and their reinforcement of the separatists by artillery shelling and direct engagement in warfighting against Ukrainian forces. The employment of conventional Russian forces further resulted in the siege of Ilovaisk and the consequent massacre when Russians did not honour the green corridor arrangement and killed hundreds of Ukrainian soldiers and volunteers retreating from the captured town on 29 August 2014. The captured territories, fallen cities, increased direct involvement of Russian troops in Ukrainian territory and the constant threat of full-scale invasion forced Ukraine to sign the first ceasefire accord of Minsk I on 5 September 2014. The symbolic nature of the ceasefire was already demonstrated on 28 September when the second battle for Donetsk airport began, continuing until January 2015, with Ukrainian forces losing the airport to Russian-sponsored separatists with multiple losses on the Ukrainian side. The Ukrainian servicemen defending Donetsk airport during May 2014–January 2015 became known as the Cyborgs for repelling intense assault by Russian artillery, infantry and armour fire in the siege that lasted 242 days, with 101 soldiers killed, 440 wounded and nine missing.[6] The Cyborgs were volunteers.

Soon after, the Minsk II Ceasefire Agreement was signed on 12 February 2015. As Lawrence Freedman accurately described the situation, it was 'more of less fire than a ceasefire'[7]: 'From 2014 through today [before the 2022 invasion], more than 14,000 people have been killed, tens of thousands wounded and more than a million displaced.'[8]

The Russian side in this period

Academic and professional experts on warfare were divided over whether Russian actions in Crimea and south-eastern Ukraine were 'hybrid,' and hence the new form of modern warfare, or were instead the employment of the various already available tools of limited war. Despite the disagreement on the conceptual framework and its implementation in two distinctive operating environments in Crimea and

Donbas, various features of the Russian performance can be identified for further understanding of the war in general. The Russians used different approaches in Crimea and Donbas. In Crimea, a surgical approach was adopted. The omnigenous special operations units had the full advantage of military basing on the peninsula, full intelligence on Ukrainian military bases in the area, many years of infiltration into Ukrainian society, authority structures and even the Orthodox Church of the Russian Patriarchate that has traditionally been the core of the FSB intelligence gathering in the territory of Ukraine. Hence, the surgical approach was most likely based on two considerations. First, it made the annexation look more like self-identification of the local people; pure coercion would have looked very different on the news footage. Furthermore, the surgical approach was necessitated by the objective of getting rapid control over the peninsula to change its affiliation before Ukrainian leadership and the military would respond.

Besides the presence of the green men, another factor that contributed to Russia's success was that many high-ranking officers were deployed to convince their Ukrainian counterparts to act more consensually or to defect. Moreover, it should not be forgotten that there were always Russians and pro-Russian sympathisers in all organisations and spheres of life in Ukraine, and their facilitation of Russian achievements should not be underestimated, especially if it refers to the military, government or law enforcement institutions.[9] All these favourable factors stimulated rapid and timely deployment of Russian troops across the peninsula, bringing it under full control within a few weeks.

Although at first glance, the advantage of surprise and sustaining momentum of the deployment of the first green men from the Russian base in Crimea to Crimea's annexation and the withdrawal of Ukrainian troops looked smooth and instantaneous, in reality, it was facilitated by various pro-Russian governments and Russophile elements that weakened Ukrainian military and authorities in their ability to defend the country since it gained its independence in 1991. In the three decades of its independence, each move of Ukraine to strengthen its military would face fifth-column resistance and the scaremongering of deteriorating Ukraine–Russia relations. It can thus be concluded that Russia's long-term presence significantly conditioned Russia's success on the Crimean peninsula, its contingent planning for Crimea's annexation and its long-term infiltration into key decision-making structures in Ukraine.

Crimea illustrated the spearheaded cross-unit success of green men in gaining control over an – if not small, then semi-detached – area with Russia controlling the Black Sea coastline; however, the case of Donbas showed a different approach and the immediate limitations of surgical Special Ops units. Donbas is of a very different terrain than Crimea in that it is open and flat mainland and not a peninsula. Although firepower from other domains, especially from the sea, could have compensated for the lack of numbers of troops on the ground, in the case of more mainland territory, a greater presence on the ground was required to secure its control and subordination. The surgical units could take over buildings used

by the local authorities, but expectations for obedient transition to Russian rule faced various obstacles, especially with pro-Ukrainian opposition strengthening across the country after the annexation of Crimea. The best example of the SBU confronting separatists took place on 12 April in Slovyansk. In this case, Russian-grown, hired, previously infiltrated and then backed separatists acted as a useful proxy for power projection and was also meant to reduce the employment of 'professional' Russian forces to a bare minimum. It was also a case of surprise not having the same effect if applied twice.

Mixing previously Russia-groomed and sponsored separatists with imported Russian mercenaries under the rule and training of the Russian 'professional' Special Operations Forces (SOFs) showed mixed results. First, giving former criminals weapons and basic military training does not make them good fighters or soldiers. The best example to support this point was the shooting down of Malaysia Airlines Flight MH17 by Russia-sponsored separatists on 17 July 2014.[10] Eight years later the Hague District Court found Russians Igor Girkin, Sergey Dubinskiy and Ukrainian Leonid Kharchenko responsible for the case. At the time, Girkin was defence minister, hence in charge of the separatists of the self-proclaimed Moscow-backed Donetsk People's Republic.[11]

Second, training given by mercenaries like the Russian Arseniy Pavlov, known under his nickname of 'Motorola,' was of questionable quality and was missing any moral-ethical component. He gained his military experience during the Second Chechen War, then came to Crimea in 2014 and took part in stirring the pro-Russian uprising in Kharkiv in 2014. With Girkin, he was among the 'Executors of Slovyansk' and was then appointed a 'people's mayor' of Donetsk. This was also an example of how a Russian mercenary was 'governing' one of the temporarily occupied territories in Ukraine. He was also involved in the Ilovaisk massacre.[12] Third, although proxies provided the needed mass to project power with relatively limited involvement, it was costly in other ways. Its effectiveness was questionable due to the successful progression of the Ukrainian counteroffensive in May–July 2014, and the number of Russians killed in combat ('cargo-200' in Russian code) at that time still remains unknown. Consequently, regular Russian troops' direct involvement was required to repel the Ukrainian counteroffensive. Fourth, the mixed nature of the Russian separatist and SOF contingent allowed for more agile units of tactical battle groups versus the Ukrainian force formation of battalions.[13]

Overall, Donbas was not Crimea. It was not semi-detached and could not be so easily controlled. The use of SOF of various kinds and proxies could not guarantee the same extent of control and accuracy of execution as was achieved in Crimea. Moreover, the Ukrainian counteroffensive in spring–summer 2014 demonstrated that the use of proxies and SOF had limited effectiveness in the advancement of the Russian invasion. The successful regaining of Ukrainian territories from the separatists and Russian SOFs showed shortfalls of the separatist proxy forces. As a result, to suppress the Ukrainian counteroffensive the involvement of more conventional Russian forces was required. Hence, the further invasion of the regular

troops under the 'humanitarian support' excuse and more intense employment of artillery took place from late August 2014 onwards. Poor professionalism and performance meant the proxies proved ineffective in the actual warfighting and in the achievement of their tactical objectives. However, they could be useful for sustaining the frozen status of the conflict long term. This inconsistency between expectations and their actual performance can also help explain Putin's giving a cold shoulder to the separatists' hopes of gaining immediate independence and joining Russia, as Crimea did. The status of frozen conflict provided a multitude of opportunities for manipulation both inside Russia and internationally.

The Ukrainian side

Despite the immediate paralysing effect of surprise, the interim government of Oleksandr Turchynov made various decisions to conduct a proportionate military response to the Russian aggression. On 1 March, the military were put on full alert and initiated partial mobilisation. The Ukrainian military were ordered to hold their bases in Crimea without firing shots. This approach was to prevent further escalation and triggering Russian full-scale use of force. The repetition of Transnistria, Chechnya and Georgia scenarios was to be avoided. This approach also allowed some time for mobilisation and reorganisation of the Ukrainian military. On the other hand, Ukraine lost 12,000 defected troops, more than 50 vessels and a variety of equipment, not to mention the actual infrastructure of the military bases in Crimea.[14] For the Ukrainian Air Force, the annexation resulted in the immediate loss of 126 aircraft to the Russians, of which only 92 were later returned with Russia keeping the rest.[15]

Despite the loss of Crimea, Ukraine managed to mobilise, train and equip forces and increase its preliminary 130,000 military to 200,000 within two months. Approximately one-third was then used in the ATO to suppress separatism in Donbas. From the first days of the ATO, it had a mixed nature. As an anti-terrorist operation, it was not entirely a military operation and combined both civilian and military units. The very narrative of the 'non-military' character of warfighting played along with the Russian narrative of under-threshold conflict conduct and lawfare. The ATO also illustrated a trend that will be later emphasised in the military strategy of Ukraine 2021 and the reality of warfighting in 2022. This trend was the presence of multiple units of varying backgrounds and origins fighting for Ukrainian sovereignty and liberation from the Russian occupation. Accordingly, the early days of the ATO saw the expedited formation of volunteer battalions (Dobrobats) coming from various backgrounds, often from the participants in Maidan 2013. Soon these battalions were subordinate either to the Ministry of Internal Affairs (Special Tasks Patrol Police) or the Ministry of Defence (territorial defence battalions), with very few active under no authority or affiliation.

The obvious limitation of the Ukrainian ATO response was vagueness in its status in the civil–military divide, which resulted in conflicting claims of authority

over various units. Although the legal authority of the military side of the ATO was under the Security Service of Antiterrorist Centre, various agencies often attempted to take control over these troops.[16] Furthermore, at the initial stages of ATO, the Ukrainian military and volunteers lacked basic equipment, sufficient professional training (often they had to learn best practice in the fight, paying for them with their own blood and lives), basic logistics, effective command and control (C2) and secure communication. The often *ad hoc* nature of the response frequently suggested using what was available at a given time without a second thought about the security of communication. In addition, there had always been the presence of traitors and pro-Russian elements giving away the positioning of Ukrainian forces.

The grave situation of centralised equipment and supply provision to all fighting units on the Ukrainian side resulted in another phenomenon which will reappear in the next stage of the war in 2022 – volunteer movement in support of the military needs on the frontline. This movement had a crowdfunding nature and provided financial, logistical and equipment support to various volunteer and military battalions at the frontline in 2014–2015. It was truly a grassroots initiative of people who personally knew volunteer fighters in distinctive battalions and their needs in different locations. These were not abstract people but ordinary members of the Ukrainian society taking arms to defend their country, and the public supported them with what they had.[17] Although the scale was not the same as in 2022, diverse know-how and techniques were acquired at this time with their further improvement and full effect in 2022–2023.

Materiel-wise, Ukraine certainly had the remaining Soviet equipment, which had not yet been chopped into pieces under the arrangements of the post-Cold War disarmament of Ukraine.[18] It had also preserved its military manufacturing capacities; however, time was needed to reorient production to meet the war demands. Nevertheless, between 2014 and 2016, Ukroboronprom, a consortium of Ukrainian manufacturers of weapons and military equipment, provided different Ukrainian security structures with the following renovated weapons and military equipment: 4,704 units, of which 899 were weapon ordnance; 2,564 armoured vehicles, special vehicles and engines; 356 aircraft, engines and aggregates; 6 pieces of naval equipment; 902 communication, AA cover and radio warfare. In addition, 8,012 units were produced and modernised, of which 1,412 were weapon ordnance; 160 armoured vehicles, special vehicles and engines; 56 aircraft, engines and aggregates; 3,956 missiles and ammunition; and 2,454 communication AA cover and radio warfare.[19]

Some thoughts come to mind in evaluating the Ukrainian response of 2014–2015. The very idea of total or comprehensive defence is inherent in Ukrainian thinking about and their practice of defence, and can be traced back to the two World Wars, if not earlier. The primary assets of Ukraine have always been its people and the land. At this stage of the war, these assets were people who volunteered to join fighting battalions, volunteers who provided soldiers and volunteer fighters with various supplies, ordinary citizens who donated and crowdfunded activities of the

national fighting battalions, foreign aid and the military industry that tried to assist with modernisation and repair of the much-needed equipment. Although the scale was not the same as in 2022, the knowledge of various initiatives and ways of providing support and supplies remained. Furthermore, many volunteer fighters remained on active duty during the entire eight years of war, which resulted in gaining substantial operational skills and relevant knowledge of the opponent and the operating environment.

The first two years of the war evidenced the shortfalls in neglecting the military for three decades. A lack of common professional training up to modern standards, systematic joint exercises for interservice and across-unit integration posed challenges across various levels of warfare. However, while the issues with the command and control and communications would undermine cooperation on an operational level, tactical-level solutions would often be developed out of necessity rather than specific training or following of a certain doctrine.

Another feature of the beginning of the war was the establishment of a different path to warfighting. The experience of 2014 introduced two paths to warfighting in Ukraine: conventional military service (conscription, mobilisation) and volunteering for different national battalions. Although later all volunteering battalions would be under governmental authority and would follow the appropriate chain of command, the tradition of volunteer battalions banding together from the same city or region or university continued when groups volunteered and joined territorial defence battalions or SOF battalions like the Azov regiment affiliated with the National Guard of Ukraine. These two distinctive paths would also result in the differentiation of roles and consequent performance during the full-scale invasion of 2022. Although the military that remained serving during all eight years of war would gain more systematic training and operational experience, the new recruits (conscription and mobilised) in the conventional path would gain more traditional and basic training on warfighting if they did not have any military or operational experience beforehand. In contrast, those who joined SOF battalions like Azov would be trained in special operations, focusing on survivability task accomplishment instead of more formalised drills.

Reinforcement period of 2016–2022: 'less fire than a ceasefire'

Shelling of Ukrainian positions in the east continued until the full-scale invasion in 2022. On top of that, in 2016 and 2017, massive cyberattacks were launched against the Ukrainian infrastructure, such as the National Bank of Ukraine and the electricity grid. On 25 November 2018, the Russian FSB's coastal guard fired shots against Ukrainian Naval ships aiming to transit from the Black Sea via the Sea of Azov to the Ukrainian port of Mariupol. Members of the Ukrainian crew were injured, and three vessels were seized by the Russians.[20] Service personnel were detained and sent to Moscow and released in a prisoner exchange only at the end of 2019. Vessels were also returned the same year. In reality, Russia was flexing

its muscles in controlling the Sea of Azov and, by extension, the Back Sea and denying access in the maritime domain. Unsurprisingly, the release of crew and vessels occurred after US vessels visited the Black Sea earlier in 2019.[21]

In 2018 and 2019, the shortfalls of Poroshenko's approach to doing business as usual and ignoring the continued losses of Ukrainian lives in Donbas were beginning to show. The array of scandals associated with the military industry and weapons procurement, and even more widespread corruption and nepotism in the rigid Soviet-style decision-making at the top resulted in a changing of the country's leadership, with Volodymyr Zelenskyy becoming the new President in 2019. Zelenskyy tried to move away from the frozen conflict status, especially when Ukrainian soldiers continued dying under the constant Russian shelling. He hoped to achieve peace in Donbas. Accordingly, Zelenskyy supported the contested Steinmeier Formula[22] calling for elections in the separatist territories in accordance with Ukrainian elections. However, many in Ukraine viewed such a statement as a factual capitulation and appeasing of the aggressor.[23]

Despite the 2020 pandemic, Donbas did not become any calmer, and in 2020 alone, 50 Ukrainian service personnel were killed and 339 wounded at the frontlines against Donetsk and Luhansk separatists.[24] Further escalation and the likelihood of invasion were already evident in 2021, with the Russian use of the usual excuse of military exercises to cover its military build-up near the Ukrainian border. In March–April, 100,000 troops were brought into the area. According to Russian official sources, 'exercises' involved 300,000 military personnel.[25] While various political back-and-forth statements regarding their withdrawal took place in the next few months, their complete presence was renewed in November. Russia also made a diplomatic row about the passing of the British Royal Navy destroyer HMS *Defender* that on 23 June 2021 'briefly sailed through territorial waters off the coast of the disputed territory of Crimea'[26] on its route from the Ukrainian port of Odesa to Georgia. In December, President Biden warned Putin not to invade Ukraine, preparations for which were already evident. Putin demanded that Ukrainian NATO membership be banned and that NATO capabilities be withdrawn from various areas in Eastern Europe.[27]

On 21 November 2021, an article published in the *Military Times* contained an interview with the head of the Ukrainian National Defence Intelligence Agency, Brigadier General Kyrylo Budanov. In this interview, he warned that Russia was using its Zapad 21 exercises in actual preparation for a full-scale invasion. He argued that it would be of a larger scale and come from the three directions – the south (Crimea), the east (Donbas) and north (from Belarus), involving aerial strikes, artillery and ground forces: 'increasing troop levels and weapons systems in occupied Crimea and staging systems like Iskandar short-range ballistic missile systems and other weapons elsewhere near the border.'[28] He considered that the timing of the attack could be the end of January or the beginning of February 2022. He was also convinced that unfavourable weather conditions would be unlikely to stop the invasion or the Ukrainian response.

Further discussions and diplomatic attempts took place in January 2022, with the United States being the first country to order families of diplomatic staff to leave Ukraine. The order was issued on 23 January. Having received a formal response from NATO and not getting what he wanted, Putin proceeded with the already planned 'military exercises.' This resulted in the stationing of 30,000 Russian troops on the northern Ukrainian border. In mid-February, return fire to separatists shelling in the east was recorded, which Putin then presented as an escalation from the Ukrainian side. Intensification of Russian shelling in the east continued until the actual full-scale invasion on 24 February 2022. At night on 24 February at 4 am (the preferred bombing time of Hitler), Putin began a full-scale invasion of Ukraine by combining bombing raids on its key cities, military facilities and infrastructure with movement of the ground forces and armoured convoys across the border from three directions: north (from Belarus), south (from Crimea) and east (reinforcing their sponsored separatists and previously established units in Luhansk and Donetsk) targeting the eastern frontline. The first barrage included approximately 100 missiles from both land and sea. They included short- and medium-range missiles, cruise and surface-to-air missiles.

Russian build-up and militarisation of Crimea during this period

After the annexation, Russia began rapid militarisation of the peninsula into an actual military base. The obvious limitations of the semi-detached nature of the area and its cessation from Ukraine raised immediate issues with logistics – provision of electricity and water supplies were coming from the mainland Ukraine. In these eight years of war, Russia showed that its priority in Crimea was military build-up and not providing a high-quality life for its Russian-speaking population in Crimea that it so eagerly claimed to defend. While many Crimean citizens were given Russian passports with registered living addresses in far eastern Russia, the main effort was placed on strengthening its military presence and means for power projection in the Black Sea region and Europe with closer basing of various platforms delivering long-range missiles. Since it is hard to assess the actual capabilities of an enemy only based on open-source information, there are varying numbers on the extent of militarisation. According to Lieutenant-General Serhii Naiev, the Commander of the Joint Forces of the Armed Forces of Ukraine, in late February 2021, there were around 33,000 together with naval and air components on rotation. The actual ground forces were estimated as 11,500 military personnel.[29] Besides strengthening the military infrastructure of the existing military bases and former Soviet infrastructure on the peninsula, more equipment was sent to Crimea, with some 900 combat armoured vehicles, 195 tanks, around 283 artillery and multiple-launch rocket systems, 50 helicopters and 100 aircraft of varied purposes.[30]

As part of the militarisation of Crimea, Russia modernised and strengthened its Black Sea fleet, prioritising it among other fleets. The cruiser *Moskva* and two Krivak-class frigates were reinforced with three modern Admiral Gregorovich-class

(or Krivak V-class) frigates. Six new submarines joined the Soviet Kilo-class submarines. Smaller artillery vessels like Buyan-M corvettes were doubled. Regarding landing ships, the fleet included three Alligator-class and four Ropucha-class landing ships. Not surprisingly, Russia used its March–April 2021 'exercises' to relocate more craft from the Baltic fleet to the Black Sea fleet. Accordingly, the three landing ships *Minsk*, *Kaliningrad* and *Korolev* and the corvette *Boikiy* crossed through the Danish strait on 21 April 2021.[31] There were also four ships for intelligence gathering, including the most modern *Ivan Khurs*, which was finished only in 2018 and was the most advanced ship of this type in the entire fleet.[32] The fleet's HQ was in Sevastopol, with parts stationed in Rostov.

Ukrainian transformation during this period

Although this period of the war was characterised by certain reservations about the conflict in its frozen state allowing the Russians to regroup and strengthen their capabilities in preparation for a full-scale invasion, certain transformations and strengthening of the UAF also took place. The establishment of the ATO and its civil–military nature corresponded to the necessity of the ad hoc situation of the time and could provide rapid response to the posed challenges without aggravating the existing complex situation with Russia. However, by focusing on the terrorist action of separatists, little attention was given to the actual Russian involvement. This approach was counterproductive, since it practically acknowledged the Russian advantage in the grey zone or under-threshold conflict and accepted the vagueness of the Russian actions in the east. Besides the reluctance of the Ukrainian politicians to announce an actual war with Russia, there was international pressure from the European leaders led by the German Chancellor Angela Merkel, who wished to preserve the existing status quo in order to avoid disruptions in the building of the Nord Stream II gas pipeline to transport cheap Russian gas.

President Poroshenko announced the end of the ATO in May 2018. Although traditionally the end of an operation would mean achieving some specific objectives or at least the establishment of a ceasefire, this was not the case for the war in Donbas. Instead, a Joint Force Operation (JFO) substituted ATO. This change had various practical and legal implications. First, control over the operation was no longer civil–military but only military, which would allow a reduction in the existing inter-agency frictions and post-Soviet bureaucratic practice that multiplied the more agencies were involved. Second, the legal status of the war in Donbas shifted from the 'non-governmental-controlled areas,' officially described and accepted by Ukrainian and European authorities, to 'temporarily occupied territories in the Donetsk and Luhansk regions by Russian occupation administration.'[33] The normative act further clarifies the acts of Russian aggression, stating as follows:

> The Russian Federation is carrying out armed aggression against Ukraine and the temporarily occupied parts of its territory with the help of the Armed

> Forces of the Russian Federation… [occupied territory is defined] as an area of ground within the boundaries of which units of the Armed Forces of the Russian Federation, illegal armed formations established under the auspices of, subordinate to, managed, controlled and funded by the Russian Federation and the occupying administration of the Russian Federation have set up authority and exercise their power.[34]

This refocusing from terrorists/separatists to the Russian aggression was essential, since it in fact called a spade a spade in both warfighting and legal terms, meaning that, despite the ongoing warfighting and dubious status of any territories illegally taken by Russia and its sponsored and infiltrated separatists, Ukraine was taking and continue taking actions in returning those territories to its legitimate control. Hence, this shift reinstated the legal status of Donbas as an integral part of Ukraine and officially named Russia an aggressor and occupier of Ukrainian territories. In the long run, this would also mean that any appeasement of Russia-sponsored separatists and attempts to take these territories away from Ukraine would not be accepted by the Ukrainian government. From a military perspective, this shift provided better clarity of objectives and returned control to the military in organising and conducting the operation, which had little to do with antiterrorist tasks but were in fact combat engagements.[35]

This interim stage of war also illustrated various reforms and transformations in the Ukrainian military. In 2017, 'The State Program for the Development of the Armed Forces of Ukraine until 2020' identified the necessity of reforming the Ukrainian military according to NATO standards to defend national sovereignty and fulfil necessary prerequisites for joining NATO.[36] These objectives were to be achieved through modernisation and automation of management and accounting procedures, unification and modernisation of weapons and equipment, the creation of necessary reserves and systematic supplies, professionalisation of personnel, employment of international military-technical assistance, enhancement of the regulatory framework, a move to capability-based defence planning according to NATO standards for codification of weapons and property, training and readiness evaluation based on the NATO benchmarks.[37] The document then further detailed each step.

From the organisational perspective, these reforms allowed the separation of the Commander in Chief (CINC) and Chief of General Staff (CGS) posts. The primary responsibility of the CINC was to improve combat readiness and military capabilities of the Armed Forces, the National Guard and the State Border Guard Service. The CGS reported to the CINC. He was responsible for determining military capabilities and the required resources, operational planning and modernisation arrangement, military training and the allocation and distribution of equipment.[38] In addition, the post of Minister of Defence was to be separated from the military following the standards of civil–military distribution of power in liberal democracies and one of the criteria for NATO accession.

Specific emphasis was placed on reforming the reserves. In 2020, three types of reserves were to be developed: operational, mobilisation and civilian reserves. The first was aimed at immediate support to the frontline units. These would be people with existing military experience who could be immediately deployed. The second category would be assigned to distinctive military units and would require additional training for the specific requirements of their units. The third category of civilian volunteers was to be used for defence and national security purposes.

In terms of capabilities and procurement plans, the emphasis was placed on the ground forces, with various modernisations of the artillery. Regarding anti-tank capabilities, between 2014 and early 2022 Ukraine received Javelin missiles as part of the US assistance in equipment and weapons transfer worth $2.7 billion. The Ukrainian industry also produced Stugna-P and Korsar missile systems, and Ukraine designed and manufactured Vilkha Multiple Launch Rocket System (MLRS). For accurate targeting, drones were to be used for forward observation and fire coordination. Accordingly, deals were made to procure Bayraktar TB2 drones from Turkey. Regarding air power, priority was given to upgrading air defence systems, such as S-300, 9K330 Tor, 2K12Kub and S-125 Neva. Attention was also given to improving sustainment of the combat capabilities. Thus, modernisation of command and control, communications and intelligence (C3I) of the air defence networks and basic modernisation of combat air fleet of MiG-29, Su-27, SU-25 and Su-24 took place. Regarding the navy, it adopted 'the Mosquito doctrine' in 2018, which entailed the procurement of small, agile attack patrol boats aimed for hit-and-run activities.[39]

Issues and scandals

Despite the chosen NATO direction of reforms and their systematic intentions, there were various bumps on the road to professionalisation and appropriate equipping of the Ukrainian military for the upcoming war. First, on paper, the leadership of the Ministry of Defence was to be appointed from among the civilian politicians or those retired from the military with a cool down of five years. However, in 2018, during Poroshenko's presidency, the General of the Army Stepan Poltorak retired from the military but remained in charge of the Ministry of Defence as a civilian, without any cool down time.[40] He was the Minister of Defence from 14 October 2014 until 29 August 2019, when newly elected President Zelenskyy asked for his resignation. The next Minister of Defence was Andrii Zahorodniuk, a civilian with no military background (29 August 2019 to 4 March 2020), followed by Lieutenant General Andriy Taran (4 March 2020 to 3 November 2021), who served in the Army until 2016. Finally, the Minister of Defence Oleksii Reznikov was appointed on 3 November 2021. He had some Air Force service experience in the 1980s.[41] Recently, Reznikov was dismissed in September 2023, succeeded by Rustem Umerov.

During these interim years, other damaging occurrences of questionable origin were ammunition depot explosions. For instance, four explosions in

the warehouse destroyed heavy artillery ammunition at the 6th arsenal in the Chernihiv region in October 2018. As a result, the strategic arsenal of 120mm mortar shells, 122mm howitzer shells, 125mm tank shells and 122mm Grad rockets were affected with other ammunitions left untouched. An act of sabotage was one of the official hypotheses. The loss was estimated at hundreds of millions of US dollars. Worse than that, these ammunitions could not be produced in Ukraine. Other similar incidents had previously occurred at the arsenals of Kalynivka and Balaklia.[42]

The culmination of the period was the chain of scandals related to former President Poroshenko and various allegations of weapons smuggling and the making of money on the war, not excluding the fact that the son of his business partner was 'selling smuggled Russian components to Ukrainian defence factories at wildly inflated prices.'[43] Such a scale of corruption had direct negative implications for the availability of the actual military materiel for the UAF in the upcoming intensified stage of the war. This level of systematic corruption indicated not only wide gaps between the formal path to a NATO professional military and the reality of its implementation but also the necessity of a different leadership across agencies for effective reforms, the new conceptualisation of defence and its consequent implementation. Not without setbacks, such a team of modern leaders and innovative decision-makers came into power with new President Zelenskyy. Although more than one reshuffle was needed, Ukraine had the right people in the right places to withstand the upcoming new stage in the war. Chapter 4 discusses the people as one of the parts of the physical component.

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4

COMBATANTS

As the nature of war endures and only its character changes, people remain the core of warfighting. Human physical and mental readiness, motivation to fight and endure the limitations and hardships of war, skill sets and experience can make a difference between success or failure in the battlespace and whether a nation survives aggressor's attempts at its annihilation. This chapter explores the main combatants on both sides, the diversity of units with different backgrounds, their overall military and operational experiences, and the consequent training of the combatants and its correspondence to the challenges and requirements of this stage of war. The chapter also addresses the morale of the two fighting sides and what motivated each side to engage in warfighting.

The Ukrainian Armed Forces

In one of the few interviews that Gen. Zaluzhnyi gave in the last year, he commented that for the Ukrainian military the war started in 2014, and the next eight years of warfighting were used in order to find solutions how to fight a numerically and to varied extent technologically more superior enemy. In this regard, there was only one solution, which entailed training the relevant skills, combined with the reshuffling of the military equipment and air defences across various parts of the country. While most of the troops were engaged first in ATO and then in Joint Operation, the smaller number of the UAF were working on restoring the combat capabilities in the points of permanent deployment. These arrangements had to be made across the entire country with a few rounds of changes. In order to make this work unnoticed for the wider public, such activities had to be conducted secretly often at night.[1]

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These preparations also required significant training of the military personnel across domains. Various exercises and training in support of better mobility and agility of fighting power across domains took place over these eight years of the war. Although the Soviet times were long gone, the remnants of the Soviet tradition were still evident in the UAF. Accordingly, reforming of the Ukrainian military from the Soviet practice and organisational culture towards modern fighting power had to be done. Hence, the UAF was going through transformation in two parallel processes: developing the relevant skills for fighting the numerically superior enemy and revamping the force from Soviet-style practices and attitudes to a modern force with Ukrainian traditional strategic culture and international standards at its heart. Practical skills were developed during national and international training and exercises.

The main focus of various training courses and exercises was on fighting Russia as the primary enemy in the Ukrainian terrain. The emphasis was placed on the modern characteristics of urban warfare, taking advantage of the dispersion or concentration of SOF when and where it was needed substituting the Soviet-style rigid hierarchy. Although the primary focus was on training ground forces in land-centric warfare scenarios, the training and exercises were not limited to the ground forces. Various exchanges took place and courses were taught for other services. For instance, Scandinavian countries provided courses on strategy and air warfare for the Ukrainian Air Force (UkrAF) personnel and Scandinavian air specialists visited Ukraine with various initiatives.[2]

One of the most systematic and structured international training and support efforts for the UAF was the British effort within Operation Orbital 2015–2022, which provided exercises and training for 22,000 Ukrainian personnel. After the full-scale invasion, it was substituted by Operation Interflex – a UK-led operation of multinational personnel preparing training for the UAF in the territory of the United Kingdom. One of the biggest air-centric exercises conducted between the UkrAF and the USAF was in October 2018 at Starokostiantyniv Air Base called 'Clear Sky 2018' that aimed for training interoperability with neighbouring air forces according to NATO standards. Accordingly, trained components included 'tactical airlift, aeromedical evacuation, pararescue, cyber defence, air sovereignty and air-to-ground joint fire integration.'[3] On the UkrAF side, the exercise involved 30 aircraft and 350 military personnel. The main effort was by UkrAF and UAF, but also involved seven other allied nations: Belgium, Denmark, Estonia, Great Britain, the Netherlands, Poland and Romania.[4] In the maritime domain, regular training took place through the entire eight years of war, usually involving Romania, Bulgaria, Turkey, Ukraine and Georgia as regional partners. One of these trainings occurred between 10 and 14 March 2021, conducting a post-visit series of passing exercises.[5] As the interim period of war illustrated, the UAF focused on systematically strengthening the fighting power in order to deter the likely Russian full-scale invasion. Besides the discussed reforms, this was also evident in the increase in the armed forces and widening of the potential of the skilled reserve,

territorial defence, which became in actuality a separate branch in the Ukrainian military.

Various regional initiatives for territorial defence originated from the experiences of 2014–2015 and had varying degrees of finalisation and training in 2018. The current organisational features and subordination of the Territorial Defence Forces (TDF) were formally finalised with the law coming into force on 1 January 2022. TDF was mentioned in strategy 2021, and President Zelenskyy signed the corresponding law on national resistance on 29 July 2021.[6] There were also some **territorial self-defence units** subordinate to the administrative and self-government authorities in administrative districts. However, the TDF is subordinate to the Minister of Defence. The former commander of the TDF, General Ihor Tantsura, was in direct subordination to the CINC of the UAF. The force was to consist of 25 brigades following the traditional 24 oblasts administrative division of the country, with the addition of the 112th Territorial Defence Brigade for Kyiv. The initial idea was that TDF would include former military and people with military experience and then would train civilian volunteers for various tasks.[7] However, with the beginning of the full-scale invasion, anyone willing in the age range between 18 and 60 could join. TDF were subordinate to the Ministry of Defence and sooner or later were to reinforce Ukrainian troops where it was required across the country and frontline. Some of the identified issues would be varying degrees of available equipment, weapons and different training across regional TDF units.

Although the phenomenon of Ukrainian **volunteer battalions** raised multiple discussions about governmental/civilian control of the use of force in the war, and during the interim period, various battalions were dismantled, volunteer battalions indeed saved Ukraine in 2014 and became the core of the warfighting in 2022. In this regard, some battalions continued recruiting and training soldiers during the interim period of 2016–2022. The preliminary operational experience of fighting the enemy in the east had given them first-hand knowledge of how the enemy behaved in the battlespace and what to expect from them. Unlike the general best practice in the inter-war preparation of soldiers in the military, when training is aimed at various scenarios and different types of adversaries, the volunteer battalions (although already subordinate to the Ukrainian authorities) were preparing their soldiers to fight an exact enemy – the enemy they faced in 2014–2015 in Eastern Ukraine. This type of training and preparation had a few benefits. First, it provided an exact focus on the modus operandi of the enemy. Second, volunteer battalions and ATO veterans involved in training provided practical, tactical level training and sharing of know-how for specific terrain characteristic of Eastern Ukraine. In essence, these smaller battalions that had the military experience of 2014, knowledge of the area and SOF features and training would become the core of Ukrainian partisan, surgical units operating both in the frontline and at the enemy's rear and as partisans/saboteurs in the semi-occupied territories.

Smaller units tend to gain strengths of the distinctive background of their members, and these features become evident sooner and hence can be improved

and utilised earlier. As a result, each battalion gains its specific features and specialisation in the war, which cannot necessarily be expected from another unit. Although such diversification can be challenging for the more unified standing armies' engagement of the last century, in the battlespace of this war, smaller units combined with territorial defence units provided excellent means for dispersion, infiltration into the enemy's rear and encircling the enemy as was done on multiple occasions during the Kherson and Kharkiv offensives.

Azov regiment

One of the most famous volunteer battalions formed in 2014 that still operates today is the Azov Battalion. It was created on 5 May 2014 in the city of Berdyansk as a battalion of the special police patrol service of the Ministry of Internal Affairs. By order of the Minister of Internal Affairs of Ukraine, the 'Azov' battalion was reorganised on 17 September 2014 and expanded into the 'Azov' special purpose militia regiment of the Ministry of Internal Affairs. On 11 November 2014, the battalion was transferred under the jurisdiction of the National Guard of Ukraine and was reformed per the standards of readiness and task requirements of their brigades. It is a special operations squad within the 3057th military unit of the National Guard of Ukraine.[8] They actively participated in warfighting in 2014 in Mariupol, Illovaisk and in the liberation of five cities in Eastern Ukraine in February 2015. From 2016 to 2022, the battalion performed various combat tasks of anti-amphibious defence on the coast of the Sea of Azov. They bravely defended the Azovstal plant in besieged Mariupol from February to May 2022. When the plant fell, all defenders were taken into Russian captivity. In the biggest prisoners of war (POW) exchange on 21 September 2022, many Azov members and their leadership were released.

The activity of the Azov battalion illustrates not only the military achievements of the SOF in Ukraine within the scope of the entire eight years of war, but also the bottom-up initiatives of sharing and improving military education across the ranks and developing instructors to transfer knowledge to the next generations of recruiters and, consequently, soldiers. In 2015, after two years of ATO and frontline fighting, the leader of the Azov, Andriy Biletskyi, gathered Georgian instructors of the regiment and tasked them to develop the first officer course. Following its completion, the initiative of opening a Sargent school was taken forward, aiming to educate and organise a sergeant corps first at the regiment, with further opportunities of extending it to other regiments and the entire armed forces. The military sergeant school established in 2016 was named after the prominent Ukrainian military commander of the Ukrainian National Army, Yevhen Konovalets.[9] The task for sergeant education was twofold: develop instructors for passing knowledge onwards and develop squad leaders. The core of the three-month course is to combine the practical experience and specifics of the war in Ukraine with Western standards of military education. Furthermore, the emphasis was placed on agility

and developing critical and unconventional thinking essential for gaining an advantage over the enemy in the asymmetric battlespace.[10] The curriculum took advantage of diversified members of the regiment and instructors with knowledge of both Soviet and Allied operations. In essence, the school partially fulfilled the basic role of non-commissioned officer (NCO) training and education that the UAF needs across all services:

> At the time of the invasion, Ukraine did not have a fully developed professional non-commissioned officer (NCO) corps, which it had been seeking to develop along NATO standards before the war. The UAF continued to face issues with retention, professional development, and funding. As described previously, the high proportion of trained veterans, many with combat experience, mitigated to some degree the need for an established NCO corps to train and command new recruits.[11]

The Azov regiment's recruitment, training and military education activities became evident during the war of 2022. SOF squad Kraken, a separate intelligence-gathering, subversive unit of the Ukrainian Ministry of Defence, was founded by former Azov members in Kharkiv when the full-scale invasion started. It is led by Konstantin Nemichev, and it gathered many people from the Kharkiv region.[12] They took an active part in the Kupiansk offensive operation in September 2022 – the liberation of the eastern parts of the Kharkiv oblast including the deliberation to cross the Oskil River, creating a bridgehead for further advancement of the Ukrainian troops.[13] In the interview, Konstantin Nemichev reflected on the formation of the squad. They began mobilising and training people six months before the invasion when Russians started accumulating their troops on the Ukrainian borders. People would often be trained on the weekends. Civilian recruits would be given basic training in tactics and survival skills. In the first hours of the invasion, the squad mobilised 800 people and started placing them along the district road around the city of Kharkiv. On the second day, there were already 1,200 people. Many people were willing to defend Kharkiv. The immediate inflow of the willing was divided into two groups: those that would fight and volunteers assisting various aspects of logistics.[14]

The Ukrainian Foreign Legion

One of the distinctive phenomena of the war was the presence of foreign fighters from the very beginning of the Russian invasion in 2014 and the full-scale invasion in 2022. While in 2014, the status of foreign fighters on the Ukrainian side caused multiple legal questions of belligerents' status, rights and protections, in the years that followed, legal and administrative improvements took place. Accordingly, from 2016 onwards, foreign fighters in the UAF could sign a contract with the Armed Forces[15] that provided them with the status of legal, temporary residents

of Ukraine within the duration of the contract.[16] Hence, they did not need to apply for additional documents for a residence permit from the migration authority. In contrast, volunteers for various humanitarian organisations still had to apply for a residence permit with the relevant document to prove the place of residence registration in Ukraine.[17] Although the experience with foreign fighters and improving their formalisation and legalisation in Ukraine was ongoing during the eight years of war, the International Legion of Territorial Defence of Ukraine was announced after the Russian full-scale invasion. On 27 February 2022, President Zelenskyy appealed to foreign citizens to join the fight against Russian aggression in Ukraine.

The process was well-organised and conducted through the military attachés in Ukrainian embassies abroad. The focus was placed on foreign citizens with relevant military experience, although many people without such experience also volunteered. Within a week after the announcement, 20,000 people volunteered to join the legion from 52 foreign countries.[18] However, the experience of the first cohort in the fight illustrated that many people were not prepared to face Russian atrocities, constant artillery shelling and trench warfare. Even military veterans from NATO countries faced the challenge of fighting with very different equipment and more sporadic supply capacities than they experienced in NATO operations.[19] This experience emphasised the greater necessity for the enrolment of people with military experience and military veterans, who would not only have relevant experience and skills but also could adapt to the distinctive requirements of warfighting in Ukraine. Another obvious challenge in joining people from varying backgrounds and countries is their motivations and intentions. If preliminary screening and interviews did not detect dubious intentions among some extremist elements joining the legion, then commanders of the battalions would often weed them out.

Despite various challenges, the Foreign Legion provided an opportunity for people worldwide to unite under the common aim – to fight Russian aggression and stand for the common values of freedom and humanity. Many combatants were from countries that Russia had previously invaded and annexed territories. Battalions from Georgia, Chechnya, Belarus and even Russia are of particular interest since they were numerous enough to form their own units based on their territorial and ethnic belonging. Some of them started as separate volunteer international units as early as 2014 and then became an integral part of the UAF, while others were established as part of the international legion in 2022.

The Georgian Legion

The Georgian Legion is not only one of the most prominent foreign battalions in Ukraine, it is also the oldest one. It was formed in April 2014 by Mamuka Mamulashvili. With his father of military background, he fought against Russians in the Abkhasian war when he was 14, having spent three months in Russian

captivity. Following his father's military career path, he then gained military experience in the wars of the 1990s. Just as Ukrainians fought on the side of Georgians in the 1990s and 2008, Mamuka and his men responded to the Ukrainian plea for help against Russia in 2014; one of the Georgian legionnaires explained that the independence of Ukraine meant the independence of Georgia.[20] In April 2014, they were involved in training activities, with further direct engagement in warfighting in Luhansk.[21] Throughout the entire eight years of war, most foreign fighters coming to Ukrainian aid went through the training and accommodation of the Georgian Legion. In the first few years, the status of foreign fighters was ambiguous; however, the 2016 law facilitated more highly skilled professional military people to join the unit, which became the largest foreign unit in the UAF. The legion includes military professionals from 32 countries, with the majority from Georgia, the United States and the United Kingdom. In an interview on 10 July 2022, Mamuka shared that the legion included around 1,000 people. Just as for many in the UAF, for the legion, the war started eight years prior. The legion was substantially involved in training new incoming foreign volunteers because its members had the relevant experience in training new waves of recruits and had an organisation structure fit for the purpose. In terms of specific tasks within the full-scale stage of the war, they focused on taking down Russian command centres and logistics. Although the legion consisted of a thousand soldiers, they avoided concentration of force and dispersed across the frontline. This was because Russians were targeting them specifically[22] and due to the nature of their tasks.

Chechen foreign battalion

Another foreign battalion that already came to aid Ukraine in 2014 was also made up of people who knew the Russian way of war – Chechens who fought for the independence of Ichkeria from Russia on the side of General Dudayev. Most of them were European Chechens who fled the second Chechen war and settled in Europe. They were led by Isa Munaev, who then lived in Norway. He gathered fellow Chechen men and women and came to Ukraine to form an international battalion named after Dzhokhar Dudayev to oppose Russian aggression in Ukraine. In this regard, the battalion opposed Russians and pro-Russian Chechens of Kadyrov, also known as Kadyrovtsy, who were used among Russian troops and separatists in 2014–2015 and then in 2022. Just as did Georgians, members of the Dudayev battalion knew Russian methods of fighting, repressing and targeting civilians in the occupied territories.[23] They knew their enemy and could share relevant information and skills with their Ukrainian counterparts. Their numbers increased in the eight years of war, especially after the full-scale invasion, reaching five battalions.[24] Given their previous operational experience of urban warfare in the two Chechen wars, they were often involved in area-clearing operations after the UAF retook previously occupied territories.

Kastus Kalinouski regiment

This volunteer battalion joined Ukraine in the fight in 2022. It consisted primarily of Belorussian dissidents of the 2020–2021 protests against Lukashenko's dictatorial regime and Russia's influence in Belarus. Until May 2022, it was a single Belarus battalion, but then more people joined, and it turned into a regiment consisting of two battalions, 'Volat' and 'Litvin' (named after the call sign of their deceased commander and Belarusian volunteer, respectively). The main mission of the regiment is 'Liberation of Belarus through the liberation of Ukraine.'[25] These volunteers were actively involved in the liberation of Irpin and the Ukrainian counteroffensive in the battles of Sievierodonetsk and Lysychansk.

The war in Ukraine demonstrated a truly international effort in fighting Putin's regime and war, and it even has a Russian ethnic legion fighting on the Ukrainian side. Freedom of Russia Legion was formed by the former Russian military, prisoners of war and volunteers defecting from the Russian Army in March 2022. Then some Belarusians also joined the legion. The legion became popular, with 5,000 applications at one point.[26] However, this legion's selection process is very thorough and strict since the Russian authorities specifically targeted it. Insider information that members of this unit provided was useful in the allocation of the Russian forces at the beginning of the war. Except for the actual warfighting, this unit was also conducting an effective information campaign among the younger Russian population and spreading accurate information about the war in Ukraine. Furthermore, their Telegram channel provided information for Russian soldiers on how to defect and surrender to the UAF.

The Russian Armed Forces

Much has been written in the professional military and academic literature on the transformation of the Russian Armed Forces and its modernisation in the last 10–14 years. Following various estimates across the entire 2022 stage of war, many analysts expected more from the Russian Armed Forces in Ukraine. More is meant not so much in terms of scale or application of mass but in more modern and joint performance of at least the conventional armed forces across various domains. A higher extent of professionalisation, integration and modernisation was expected based on decades of committed reforms and Russia's successful performance in limited wars.

While in Ukraine, leadership changes with different allegiances to Russia undermined the post-Cold War continuity of military reforms, in the case of Russia, internal skirmishes between civilian and military elites undermined continuity. The post-Georgia reforms were led by civilian defence minister Anatoliy Serdyukov (2007–2012), who, with full political backing, introduced hard-line reforms per modern warfare requirements. He focused on small and flexible brigades versus heavy divisions, and on the requirements of modernising Russian practice and

training for operational needs, such as interservice integration and jointery, improved mobility and rapid reaction. Partial professionalisation was emphasised, while the officers' corps was significantly reduced. The rationale was that not all recruits were committed to a professional military career. Conscription was reduced from two years to one year in 2008, hoping to move towards contracted soldiers of the size of 425,000 by 2017. Released funds were to be used to improve the technological side and R&D and to acquire 70% of modern equipment by 2020. The C2 structures were also reformed with greater autonomy of the services. Six military districts were substituted by four, and the Soviet four-tier system was substituted with a more Western-style three-echelon chain of command. A step towards modern Command, Control, Communications, Computers (C4) Intelligence, Surveillance and Reconnaissance (ISR) (C4ISR) was also made just as was an increase in more frequent and sizable exercises and training.[27] Despite this initiative, the process stumbled due to organisational resistance, uneven distribution of resources and structural corruption. In 2012, targeted numbers were 200,000 recruits short.

This period of modernisation was ended and partially reversed by the new defence minister appointed in 2012, Sergei Shoigu. He continued his predecessor's trend towards more numerical and complex integrated exercises and the recruitment of a professional force. However, the experience of war in Ukraine and the fact that Ukrainians put up a fight suggested that limited war might not be so limited and might be more prolonged. In 2014–2015, a U-turn in Russian reforms was observed, with the revival of ideas of various systems of reserves and mass mobilisation. Thus, the experience of Ukraine 2014–2015 illustrated the necessity of critical mass for further advancement and fighting a large-scale war. Accordingly, the Western military pointed out the shift in Russian military exercises from the more agile units aimed at limited wars to full-scale exercises picking 300,000 soldiers in 2018. According to Johan Norberg,

> what is important is what they are doing. They have a lot of personnel. They have a lot of materiel, even if much of it is old and from the Soviet period. But the exercises build capability, that is, units that can carry out assigned missions on combat operations.[28]

Besides the intimidation purpose, large-scale military exercises and training were also aimed at providing Russian soldiers with the relevant skills and practice. In terms of operational experience, Russians were involved in many wars in the last three post-Cold War decades. They had mixed outcomes from these experiences. The invasions in Chechnya and Georgia illustrated the immediate flaws in their performance – deficiencies in urban warfare, the lack of precision in air warfare and very poor air–land integration. In contrast, they used more SOF and artillery-backed forces in the east of Ukraine. They showed the utility of their air force against anti-Assad insurgents and civilian infrastructure in Syria, once again under the conditions of backing the Assad regime, hence limited war with no significant

opponent across domains. Russians had the operational experience of fighting against conventional and unconventional opponents but still on a very small scale in Georgia, Syria and in Ukraine during 2014–2015. However, none of these wars provided experience with protracted engagement and the sustainment of Russian presence and fighting across domains. In Georgia, the engagement was very short, while in Syria, they supported the Assad regime, using SOF and air capabilities in the complete obliteration of Aleppo and Idlib. In Ukraine 2014–2015, Crimea provided another argument in favour of SOF. Still, already in Donbas, the limitations of smaller, less integrated and joint units proved insufficient for further advancement and sustainment of protracted warfare against a more numeric opponent than the Russians had ever faced in their post-Cold War military endeavours.

The need to amass the military personnel and materiel became evident in the first few months of the 2022 invasion. Depending on the sources, half of the 150,000 troops gathered on the Ukrainian borders were used in the first attack. Four to five months later, in June–July 2022, the need for a constant supply of manpower to the Russian Army was to be fulfilled by announcing recruitment for the volunteer battalions across 85 Russian administrative units. Each battalion was to consist of 400 men in the age range from 18 to 60. They were to be given 30 days of training before the deployment to Ukraine. Recruits were taken with or without previous military experience. The main incentive was the promise of $3,000 per month to each soldier. According to the Institute of the Study of War (ISW), although 85 battalions could provide 34,000 volunteers, their salary would result in a monthly cost of $102 million. Hence, this force was to be more expensive but more poorly trained than the usual Russian conscripts.[29] Later, many of these volunteers and regular soldiers complained of either being paid less or not being paid at all.[30]

One of the ethnic units with a distinctive regional belonging – Kadyrov's Chechens – was used in various Russian wars and already in Ukraine in 2014. Their image of scary and ruthless Putin's loyal assassins was often used to suppress any disobedience in Russia. However, it proved more challenging for them to fight the UAF than to terrorise civilian population. The best evidence of this dismantling of the myth of invincible Kadyrov Chechens was their losses in Irpin, Bucha and Vorzel. However, the very utility of Kadyrovites and other ethnic minorities recruited for regional volunteer battalions had to do both with adding to the numeric manpower and with the construction of the image of a unified Russia standing against Ukraine. This ethnic diversity combined with the recruitment of 'volunteer' foreign fighters from European and African countries among other things was aimed at building the image of international support for the Russian aggression and its excuses. Once again, various means were used to strengthen propaganda and lawfare employment to justify the Russian aggression.

With further losses during Ukrainian counteroffensives in Kharkiv and Kherson, Putin announced 'partial' mobilisation of 300,000 men. In the Soviet tradition of executing an order to the fullest, mobilisation focused on taking hold of men of different ages, with or without military experience. Mobilisation was

also geographically uneven, just as the focus was previously placed on mobilising the ethnic minority groups from the central and far eastern regions of Russia. Essentially, this was a continuation of Russian colonialist rule over other ethnic groups. This mobilisation illustrated the return to the traditional mass with poor skills and performance. First, the quantity of materiel and availability had significantly deteriorated, especially regarding supplies for the infantry – the images of rusty World War II rifles went viral. Second, supplies for the newly mobilised basic kits were no longer available. Instead, they were given the list of basic first-aid supplies – from clothes, protection gear and food supplies – to be bought by their families.[31] Third, the newly mobilised were promised two weeks of basic training, which was even less than the volunteer battalions gathered during the summer. As it has been in the Soviet Union and continues in Russia, the reality is very different from the formal commitments, hence, many newly mobilised (known as 'mobics') were sent to Ukraine within a few days of their mobilisation. Besides the men in Russia, Putin also forcibly mobilised men from the occupied territories to serve on the Russian side.[32] The reality of the autumnal mobilisation contributed to both immediate losses and the high level of Russians surrender to the UAF.

Russian private military companies (PMCs) and mercenaries

The experience of the Arab Spring and the supremacy of irregular warfare brought the attention of the Russian leadership and military to the utility of irregular, light, manoeuvrable forces in modern warfare. This resulted in two trends: reforms of the Russian SOFs with a completely new look and organisational characteristics in 2013[33] and the establishment and flourishing of PMCs. The attempts to employ irregular actors in non-linear conflicts were illustrated in Ukraine, making the war a real-time polygon (training ground) for employing PMCs on their own and in integration with separatist units and more conventional forces. Their activities varied from diversion and sabotage missions and frontal attacks to different elements of urban warfare to intelligence gathering and psychological operations to training recruits and youth.[34]

Gained experience in Ukraine was then used in Russian support of the Assad regime in Syria. One of the first PMCs formed was the Slavonic Corps, members of which, after its defeat in Syria, joined the main PMC of the Wagner Group, sponsored and controlled by a Russian oligarch, Yevgenyi Prigozhin, also known as Putin's chef. In the next few years, the group gained more operational experience and modernised its structure for the requirements of irregular and limited warfare, while preserving some army characteristics. According to Sergei Sukhankin, a Jamestown Foundation analyst, the years in Syria demonstrated various operational qualities of the Wagner Group, such as:

> First, it showed it could be successfully employed in military-related tasks (assuming a relatively weak opposing force). Second, it could be used jointly

> or in conjunction with regular formations (the Special Operations Forces and the Aerospace Forces) for intelligence gathering and reconnaissance. Third, this force could be used to protect objects/critical infrastructure. Fourth, another useful area of application for Wagner has been training local military personnel.[35]

Wagner's defeat in Deir ez-Zor Province in February 2018, when they faced the superior force of US marines and Kurds, showed the traditional Soviet/Russian shortfalls, such as weakness against a technologically more superior force, limitations in air–land integration, and integration with the regular forces of the Assad regime.[36] In addition, their conventional Army background undermined their effectiveness in more complex terrains, especially since they were always on the invading side and could seldom have the full advantage of the terrain. Nevertheless, they gave Russia the advantage of plausible deniability in various operations when they were used in Ukraine, Syria, Libya and sub-Saharan Africa.[37]

The Wagners were involved in almost all aspects of the invasion and territory capture in 2022. Like most Russian troops, they suffered more losses as the war progressed. Despite their concentration in Bakhmut, one of the most contested and bloodiest spots in the eastern frontline, their offensive there was supressed by the UAF as of the end of November 2022. On 8 August 2022, they also lost their base in Propasna in a High Mobility Artillery Rocket Systems (HIMARS) strike when the photo of their location was accidentally posted on the Telegram channel.[38] Although many of Wagner's mercenaries were called from their foreign locations in Africa, their numbers were significantly reduced during the first six months of war, resulting in recruitment from not the most conventional recruitment pool. In September, Prigozhin's video aimed to recruit Russian prisoners and foreign nationals (Tajiks, Belarusians and Armenians) to join the fight in Ukraine went viral. They intended to recruit 1,500 felons in exchange for freedom after spending the designated two years warfighting in Ukraine. While many refused, prisoners with the most gruesome crimes were specifically targeted. As in any environment, organised crime has its own rules, and Wagner's plea to recruit prisoners to kill civilians in Ukraine caused criticism among organised crime leaders. In a video address on 12 July 2022, one of the Russian criminal authorities, 'Thief in Law' Grisha Moskovsky, called upon Russian prisoners not to accept Wagner's offer to fight in Ukraine, since men who consider themselves as decent would never use weapons to kill women, children and the elderly.[39]

Comparison of the Ukrainian and Russian combatants and the battlefield requirements

An important dividing factor in the Ukrainian and Russian military organisations and their consequent practices was the change in military leadership style in Ukraine and its further separation from the rigid Soviet practice. According to Gen. Zaluznyi, the main focus of the transformation was on learning how to listen to one's

subordinates and to treat them like human beings.[40] Such a cohesive culture was to be built on respect, inclusion and cooperation instead of fear and bullying like in the Soviet and, by extension, the Russian Army. Gen. Zaluznyi also mentioned exemplary leadership-inspired changes that visionary individuals made in the UAF before the beginning of the war and through its eight years. The exemplary leader who shaped the current military decision-makers in Ukraine, including General Zaluznyi, was Colonel General Hennadiy Petrovych Vorobyov, who was commander of the ground forces of Ukraine from 2009 to 2014 and significantly influenced the modernisation of the Ukrainian Army. Recalling his acquaintance with Colonel General Vorobyov, Lieutenant General (Ret.) Mark Hertling, former Commander of US Army Europe, wrote:

> Henadii was closely tracking the combat activity of his soldiers and units serving in the Balkans as part of KFOR and in eastern Afghanistan as part of the Polish Brigade. He outlined an innovative plan to improve his junior officer corps and complained about the low quality of his senior officers. In a one-on-one discussion over beer, he confessed that his senior officers were his biggest problem, and he needed to find a way to replace the corrupt generals who were "Russian-trained" and too close to Ukraine's older politicians. Again, he asked if I could help him get more young colonels into the exchange program at the U.S. Army War College in Pennsylvania.[41]

General Zaluznyi emphasised that at the beginning of the war, 50–60-year-old senior officers tried to push the old Soviet methods in drilling 30-year-old or younger soldiers, but it immediately became evident that the Soviet approach to leadership and archaic procedures would not work in the modern Ukrainian Army since young Ukrainian soldiers were not Soviets. This transformation is far from complete, and the UAF has many Soviet relics to eliminate from its organisational practice. However, various attempts at modernisation and the reduction of red tape stimulated mission command and greater cohesion of various Ukrainian ground forces. Colonel General Vorobyov has also redirected the future leadership of the UAF towards learning and gaining more experience from Western military practice, which has been and remains the future, while the Soviet military tradition is of the past, which the Russians demonstrated in this war.

Another distinctive feature of the UAF is that it was more susceptible to adopting decentralised performance in the battlespace. A few reasons conditioned the fast adoption of mission command in the UAF. The bottom-up initiatives that existed in Ukraine from the recent experiences in Maidan and eight years of warfighting dictated the necessity of mission command. While the terminology of the practice might not have been well-known to all, the essence of decentralised execution when an order is given or the task is posed dates back to the times of the Zaporizka Sich, when Ukrainian units operated in a very decentralised manner when fighting against the Russian Empire. Hence, Ukraine's rebellious history was

very much characterised by the decentralisation of execution – mission command. Furthermore, the essence of resistance and sabotage is in the core principles of partisan warfare, two of which are dispersion and decentralisation. They become especially essential when fighting a numerically superior enemy.

On the contrary, the Russians continued with a rigid hierarchy and strictly centralised control conditioned by the fear of losing control over the military and the lack of relevant operational skills to facilitate such training and consequent performance on the battlefield. Furthermore, overwhelming corruption in the military was based on a strong rigid hierarchy and the elimination of unconventional thinking to discourage questioning authority and further mutiny. Thus, thinking outside the box was very alien for both the Russian military leadership and the conscripts. Even their SOF and PMCs would still follow the Soviet army tradition in terms of command and control.

From the perspective of traditional state-on-state warfare, different types of units from various services or volunteers could have been very difficult to manage under the rigid command and control system characteristic of the Soviet tradition. But in the case of Ukraine, such personnel structure and diversification of units from the UAF, international legion and TDF provided greater flexibility and agility of the units on the ground under the conditions of implementing mission command. Of course, the key to achieving successful performance is the knowledge of the unit's specifics and expertise. As various aspects of training and deployment of the SOF and light units illustrated, they all know their specific tactical and operational tasks, such as distinctive responsibilities in clearing areas around cities and the environment of urban warfare. The key to the successful integration of diverse conventional troops and the SOF and to achieving deconfliction and avoiding duplication of effort was effective communication, clear-cut distribution of tasks according to specialisation and availability of the tactical ISR.

One of the inherent challenges of units coming from different paths of life and diverse backgrounds is bringing them to a common ground for relevant fighting skills. Although the addition of the TDF and International Legion to the traditional three branches of the UAF provided more opportunities to bring more units up to speed on the war necessities; regional preparation and training would often vary due to the remoteness from the frontline and disparity in provision of equipment at the earlier stages of invasion.

The Russian side had numerous challenges in integrating diverse multi-ethnic groups. This division and lack of integration of the combatants on the Russian side had various implications for their battle readiness and consequent performance. First, just as there has been a strict and rigid hierarchy and a tradition of bullying in the Russian Armed Forces, there was inequality and differences between various structures, ethnic groups and PMCs. When the first occupation of the territories began and a greater movement of Russian troops extended across Ukrainian land, mass looting started with different Russian soldiers fighting for the looted goods and even starting their own skirmishes. The longer the war continued,

the more conflicts between different ethnic groups escalated, with instances of internal fights, defection and killing of commanders by newly mobilised Russians. Furthermore, the old Soviet methods of using firing squads to follow the frontline soldiers (recruited prisoners) were reported to have been revived by Wagner PMC in various areas.[42]

The Ukrainian military and combatants' inherent advantage was the knowledge of the enemy they were fighting and the unique specifics of the terrain. Although it might be argued that the Russians knew the maps of Ukraine from Soviet times, they did not live in that terrain. Even saboteurs and those directing Russian fire could not compensate for the advantage of the terrain. While the Eastern and Crimean frontlines before the full-scale invasion can be considered as well-known by the Russians, the more secluded areas of their advancement showed the utility of traditional ambushing by the UAF and the advantage of precision artillery or drone strikes used by the UAF against them. The main difference between 2014 and 2022 was that in 2014, there were fewer people among the civilian population with at least some military training and operational experience, while in 2022, in addition to the serving military, there were many trained and experienced ATO veterans among Ukrainian civilians who could easily join volunteer TDF or the regular reserves without the necessity of extensive training:

> The high level of experience and training among recruits meant they were able to operate artillery, tank, and support systems that traditionally require more time for reservists or volunteers to master. These units have been crucial in supporting regular UAF units and enabling them to spearhead operations and counteroffensives.[43]

This was an invaluable operational experience of fighting Russians under severe circumstances, without supplies or equipment. This experience was paid in blood, but it helped Ukraine to withstand the first months of the 2022 invasion.

Regarding the operational experience of the Russian combatants, it was greatly uneven and was not based on the experience of preparing for the fight against a distinctive enemy nor having the prolonged and active experience of fighting this enemy. The units that were involved in 2014–2015 were not engaged on the same scale as in 2022. Using Russia-sponsored separatists resulted in a lack of the actual warfighting experience that the Ukrainian soldiers gained through rotation. Furthermore, Russia's constant shelling of the Ukrainian side on the Eastern front cannot exactly be called a multifaceted operational experience to prepare their soldiers for a full-scale fight against experienced Ukrainian soldiers. Russian SOF and PMCs gained experience in sabotage, diversion and urban warfare, but PMCs like Wagner operated in very different countries in the Middle East and Africa, with varying degrees of resistance to their actions from the opposing sides. Although Crimea and the war in Donbas 2014–2015 were a training ground for them, their further evolution and operational experience in the Middle East and Africa did not

prepare them for the full-scale war in Ukraine against various SOF and volunteer battalions on the Ukrainian side. Finally, the quality of conscripts had significantly fallen, since the first waves had a year of training while further waves had even less than that. It is important to emphasise that the poor fighting skills of the young conscripts were a result of many factors conditioned by Putin's regime. The experiments with the military reforms resulted not in professionalisation but rather in a reduction of the length of training, with doubtful improvement in its quality. Since most conscripts would often be from the poorer and more deprived parts of Russia, warfighting was not an intention and objective for conscripts, and receiving a salary for doing as little as possible was more important for them than obtaining relevant skills.

In terms of motivation, Ukrainian people are driven by a simple objective – the survival of the Ukrainian nation and its independence from Russia. For many others fighting on the Ukrainian side, it is a war to defeat Russia so that the pro-Russian elements that gained power in their home countries would lose the Kremlin's support, and these nations would then get to choose their own path of development. For still others, this is a war for true democratic values and to show comradeship to fellow soldiers with whom they fought in other wars of the last three decades. This war shows the continuity and strength of Ukrainians' high morale and conviction in fighting for national sovereignty, territorial integrity and liberal values. By contrast, Russian atrocities committed on Ukrainian soil were similar to what the Russians did in Syria, Chechnya and Georgia. Despite observing these war crimes, Ukrainian soldiers still managed to preserve their high morale, fighting spirit and their cohesion by dancing for TikTok videos to cheer up civilians, treating sick animals and helping each other with pieces of food. This human spirit endures in the acts of courage in defending your comrades, such as taking fire or falling on a grenade to save your unit. It is evident in giving away your own body armour to protect evacuating civilians or in encircling civilians, to protect them from direct fire. The motivation of doing what is right along with the fact that there is no alternative but to win this war for the next generation to live in peace stimulates people to do seemingly impossible things. From the first day of the war, Ukrainian soldiers and society became committed to the motto: 'We will break through!'

On the other hand, when combatants are motivated only by looting and carnage, have no discipline or morale and can be commanded only with fear, their endurance will be tested and will soon collapse. In addition, if troops are dropped on the frontline, according to their ethnicity, to prevent 'superior' groups from coming to harm, then once again, the morale and survivability of such units will remain questionable at best. There is also the factor of comradeship, such that no matter where one's fighting brother is from, he is your closest person in the world because if you fight for the right cause and you need to survive together, and if one of you dies, you honour the memories of the time you have spent fighting together. Battle comradeship is one of the most primaeval features

of the warrior ethos that remains until today, although it has been refined to the soldier culture of today. But when troops are motivated only by looting and another combatant on the same side is seen as a competitor and not as a comrade; or when a wounded soldier, instead of being saved, is finished off; and even dead bodies of fellow combatants are not collected or are collected and then cremated so that they will be considered missing and the Russian government would not have to pay compensation to their families, then their morale will be poor. When their commanders defect, leaving their entire units to their own devices, it says a lot about the prevailing morale of the leadership. These different levels of morale and motivation to fight describe very well the differences between the UAF and the Russian combatants.

The core of the military profession is readiness for warfighting and the ability to sustain the warfighting for as long as a given war requires until the posed objective is achieved. While limited wars and distinctive fixed-time overseas deployment have their own rules of development, conduct and ending, full-scale inter-state warfare is not so easily controlled nor easy to finish until the actual military victory and defeat of the enemy are achieved. Warfighting is not about perceptions of what and how war might or should look, nor about views or varying perceptions of what victory should be. In the total war of survival, the core of the military profession becomes very existential and clear – to fight to defend the homeland (civilian population and land) from devastation. In essence, such wars make military practitioners, politicians, academics and ordinary people realise that national defence and security require a strong military capable of fighting under severe circumstances, because there are no guarantees that one's enemy will abide by the same rules or indeed any rules of war.

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5

THE LAND DOMAIN

This chapter addresses the land domain of the war. It focuses on different stages of the war, including Russian territorial gains in the first days of the invasion followed by the establishment of a relatively more static frontline in the spring, Russian withdrawal from the north while losing the Battle for Kyiv and the siege of Mariupol followed by its refocus on Donbas. Next, the land aspects of Ukrainian counteroffensives are discussed, followed by Russia's winter intensification in different locations and the consequent regrouping of forces for the next stage of war in spring-summer 2023. Various aspects of fighting power are discussed throughout the chapter, with some points for further consideration provided at the end.

The initial stage

Aiming for the advantage of surprise, Russia attacked Ukraine from the north, east and south, with wide-ranging objectives, such as capturing the capital and seizing major cities across these directions to occupy as much of the territory as possible within a short time. Within a few days, these objectives were revealed to be too broad for the Russian military to achieve. The inability to destroy expected military targets of C2 and recruit Ukrainian military leadership in the first few days as was done in the Crimean scenario was one of the many Russian miscalculations. Similarly, political leadership did not leave Ukraine but remained to defend and fight for it.

The Russian attempt to take Kyiv was illustrated in the long columns of armed machinery, some reaching 65 km and moving towards the capital. The major vulnerability was Hostomel airport, one of Kyiv's gateways. The Russians tried to seize it by using helicopter transportation of special operations of VDV into the area. By seizing the airport, the Russians could use it to land larger cargo transport

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aircraft to deliver more troops and weapons into the area. However, in the first wave of attack, helicopters were taken down by man-portable air-defence systems (MANPADS), while in the second wave after landing, the Russian VDV was greeted with Ukrainian artillery fire. Russian ground advancement from the Gomel direction towards Kyiv was still rapid despite the use of the same roads and the concentration of Russian forces in the same areas due to poor orientation in the area. This was also due to a lack of sufficient Ukrainian troops. For instance, the UAF troops in the Chernihiv area left various Ukrainian units behind Russian lines.[1]

At that time, the primary asset to defend Kyiv was the 72nd mechanised brigade and two artillery brigades. However, the UAF used most of its SOF and special units on the Gostomel direction. The UAF managed to organise people from military training facilities (cadets and military teachers) into temporary battalions and utilise artillery systems normally used for training in those facilities. Furthermore, reserves from the territorial defence units were employed. Even with these efforts, the force ratio on the Gomel direction was 12:1 in favour of Russia. Such force disparity resulted in various instances of territorial defence taking all-around defensive positions.[2]

The defence of Kyiv illustrated various innovative tactics of the UAF that allowed them to achieve the desired outcome with the scarce resources available. The speed of movement of the Ukrainian soldiers was often improved by using All-Terrain-Vehicles (ATV), which also allowed access to the more complex terrains of forest areas. Russian columns were eliminated by hitting the first and the last vehicle in the column. Then the rest of the column was destroyed by artillery or drones. This approach often allowed the seizure of vehicles that were not damaged.[3] The advancement of Russian troops was also slowed by the use of hydraulic systems in the area – by damaging dams and bridges, the river Irpin flooded the area making it unsuitable for further movement of the Russian troops.

For security reasons, Russian troops were not told where they were going and what they were doing until 24 hours before the invasion, and their high hope for instantaneous gains and low expectations of heavy fighting resulted in a significant lack of supplies needed for three days. Poor logistics of supply and communication soon resulted in Russians getting supplies from the locals, including using locals' phones for calling home. This provided an opportunity for the UAF – by detecting the concentration of signals in the forests – to coordinate artillery fire accordingly.[4] After 36 days of the full-scale invasion, Russian troops withdrew from the north and focused their efforts on Donbas and southern areas.

According to Mick Ryan, various Russian miscalculations played into Ukrainian hands at the early stage of the invasion. In close combat, the Russians aimed at 'conducting sweeping manoeuvres that coordinated airborne and airdrop operations with ground offensive operations.'[5] However, their air–land integration and combined arms tactics were very poor, partially because domains and directions from the command perspective were separate wars fought under different commands.[6]

Regarding Russian advancement in other areas, little progress was made in Donbas to further advance against the Ukrainian defences, but the UAF had to be engaged in this theatre and could not be redeployed elsewhere. The primary success Russians achieved was in capturing Melitopol and Kherson with minimum resistance, and they managed to encircle Mariupol. Regarding Kharkiv, a very hasty move of the Russian SOF on light vehicles into the city resulted in their troops taking heavy casualties. The expectation that Kharkiv would be taken easily was erroneous, and the occupiers were soon encircled. According to a Ukrainian soldier taking part in the defence of Kharkiv, Russians barricaded in the local school were asked to surrender, but they claimed that Ukrainian soldiers would be surrendering to the larger Russian troops that were to enter the city. This Russian unit was soon eliminated. The primary explanation for this Russian failure is the disparity in preparedness and the lack of integration between Russian SOF groups and their consequent conventional supporting troops. Since then, Russia has continued its attempts to break into the city using artillery shelling.[7]

The siege of Mariupol

The port city of Mariupol has been strategically relevant to Russia since it opened the ground path to connect with Crimea. It also was the remaining part of the previously Russian-occupied Donetsk district. Its significance and very close location to Russia and Russian-occupied territories allowed Russia to advance towards the city from four ground directions and eventually encircle and besiege the city. The case showed the same approach applied in Grozny, which included massive, continuous, combined fire originating in various domains and assault groups terminating defensive positions.[8] In the beginning, the Russians experienced losses due to poor integration of armour and infantry, but this was soon fixed. The defence of the city also illustrated a significant issue among the Ukrainian forces – the division of unit boundaries among the army, navy and territorial defence units of the UAF.[9] Since Russians could identify those boundaries, they isolated Ukrainian defences into smaller pockets and attrited them.

One of the most significant acts of valour was the defence of the Azovstal plant by the Azov regiment and Ukrainian marines and other units that dug into the facility for three months. Surrounded and having gathered wounded soldiers from other pockets of defence, this was the last stand of the besieged Mariupol. The primary advantage of the facility was its old Soviet design, which meant that as a strategic object, it was built to last, with numerous bunkers and a complex system of tunnels leading to various areas outside the plant. But like any siege, the issue was food and medical supplies, especially since many wounded were gathered in the plant.

In addition, as they were deep behind Russian lines, any support or breakthrough on the ground from the UAF would take a long time and would require significant achievements across the newly established frontline. This also meant that the air

space over the city was under Russian control. Any attempts to provide supplies and troop evacuation would have had a very low success rate. This does not mean that resupply missions were not conducted. According to Brigadier General Kyrylo Budanov, the head of the Defence Intelligence of Ukraine, seven missions were conducted, with 16 Mi-8 helicopters involved. During two missions, two helicopters were shot, and a third helicopter was destroyed coming to the rescue. Overall, the flights provided the besieged with weapons, ammunition, food and medicine and an additional 72 soldiers of the Azov regiment while evacuating most of the severely wounded from the plant. The flights were eventually stopped because information about them became public, and the Russians strengthened their air defences,[10] focusing more on the helicopters flying low at night. Eventually, Azov defenders were ordered to surrender and were taken into Russian captivity. Only some of them were returned during the major prison exchanges on 21 September 2022. Besides the symbolism of the Ukrainian heroic defiance, the resistance of Azov soldiers also distracted Russian forces from redeployment into other areas and kept air defences around the city instead of refocusing them closer to the frontline.

Artillery

The role of artillery is hard to overestimate; it was crucial in providing desired fire to support the ground forces in preserving frontline positions, degrading Russian logistics and facilitating further advancement of the UAF in the counteroffensives. According to the RUSI report, at the beginning of the invasion, the disparity in the numeric estimates of the artillery between Russia and Ukraine was insignificant: 2,433 barrel artillery systems compared to 1,176 and 3,547 MLRS versus 1,680.[11] The primary challenge for the UAF was the reduction in ammunition, which would only be enough for six weeks of intense warfighting. The reduction in ammunition available to the UAF was conditioned by Russian sabotage activities a few years before the invasion by exploding primarily storage facilities with the 152 mm shells used in most of the Soviet artillery.

The primary difference between Russian and Ukrainian use of artillery was that the Russians employed the traditional Soviet mass approach, which covered larger areas compared to the more sporadic surgical strikes conducted by the UAF. In this regard, the Russian mass approach and fire superiority were conditioned on the greater availability of artillery systems and ammunition, especially at the early stage of war. The UAF had to be smart in using their available resources, primarily due to their scarcity, especially during the first few months of the full-scale invasion while international military assistance was yet to arrive.

The Russian refocus on Donbas beginning in mid-April allowed it to concentrate forces and assets in a smaller area. Despite the high morale of the Ukrainian soldiers, the fight for Donbas revealed signs of fatigue due to diminishing amounts of equipment and ammunition, the losses of brothers in arms and issues in organising rotation since these were the early months of war. It was later revealed

that April was a turning point in the war. Russians were also demoralised and some of their better trained and experienced soldiers were already gone. This stage of war reinforced the importance of artillery in the land-centric war – despite the Russian numeric superiority in available artillery, their advantages and actual unit survival depended on precision on the tactical level using all available resources. Russia and Ukraine also had to mutually adapt to each other's tactics. For instance, it became evident that the Russians could not conduct counter-artillery fire from the targeted battery but instead from another one that was not under fire. The Russians proved heavier and hence slower for quick repositioning and would often displace only under fire. Having fire dominance allowed for this static approach that caused relatively little harm to the Russian forces until the UAF gained more sophisticated long-range artillery. Then static and less agile Russian batteries became easy targets. During the Donbas offensive, Russian artillery was firing on average 20,000 rounds per day and on some days, 32,000 rounds, while the UAF seldom went over 6,000.[12]

The scarcity of resources and vital necessities often encourage the most practical innovations both in times of peace and war. In the case of the UAF, scarcity of ammunition meant a greater need for improvement in precision and systemisation of fire from different domains. The solution for Ukrainian artillery was the Android app named Kropyva which was developed by volunteers in the Army SOS. It gives users an opportunity to mark enemy positions using a tablet: 'The software then transmits the indication to nearby artillery pieces while allowing the coordination of their fire, resulting in synchronised fire against the same target from several separate positions.'[13]

In addition to improved precision, this app also significantly reduced the vulnerability of Ukrainian artillery to counterfire since it reduced the time needed for different activities. The deployment time of the howitzer battery was reduced to 3 minutes, the engagement with an unplanned target to 1 minute and the opening of counter-battery fire to 30 seconds.[14] Hence, the systematic improvement of artillery performance was conditioned on the use of this app and on drone coordination of fire in tactical ISR missions, which allowed greater flexibility in engaging various pre-planned and time-sensitive targets of opportunity.

One of the prominent employments of Ukrainian artillery in spring 2022 was the use of artillery against the Russian attempt to encircle Ukrainian troops by crossing the Siverodonetsk River near the village of Bilohorlivka in May.[15] The Russians established pontoon bridges to allow their troops and vehicles to cross the bridge. However, heavy Ukrainian artillery destroyed the enemy forces in the process. This was achieved by close collaboration between Ukrainian intelligence and engineering units that assessed the potential places for the Russian crossing with further drone surveillance verification of the actual Russian movement and activities. Thus, artillery units were well informed when and where to strike – they engaged Russian targets when their movement slowed down on the two banks of the river. The fleeing remnants of the troops were destroyed by Ukrainian aviation.

Despite Ukrainian innovations and the gradual supply of the UAF with Western artillery systems in May 2022, the ratio of artillery had shifted towards even greater Russian numeric superiority by the end of spring and early summer. According to a statement by General Valery Zaluzhny on 28 June 2022,

> the most intense hostilities are ongoing in the north of Luhansk and Kharkiv oblasts. In this area in the past 24 hours alone, Russia carried out 270 artillery raids, using 45,000 rounds of ammunition, and launched 2 missile strikes and 32 airstrikes.[16]

Furthermore, the intensity of the Russian concentration of artillery was different across the frontline, which resulted in some areas being more defended, while others were more vulnerable to constant shelling.

Despite obvious numerical superiority in the number of artillery and ammunition, the inherent weakness in Russian fighting was blindly following Soviet doctrines and traditions of fighting a war. This was evident in the matter of logistics and sustainment of the troops on the frontline. First, although the character of the war in Ukraine required decentralisation and the ability to act in various directions, the location of Russian reserves and support elements were still within a 50 km range of the frontline. This approach was changed only after two months,[17] again illustrating the rigid Soviet hierarchy in decision-making within the Russian military. Second, a lack of planning for attrition warfare is often illustrated in poor supply routes and too deeply moving into the territory of the defending country. Although Russia managed to supply fuel, munitions and living necessities via trains in the occupied territories, these were reachable targets for artillery with the right precision and range, just as were Russian ammunition storage facilities established in ordinary houses in the occupied territories. Thanks to the Ukrainian partners, it was only a matter of time before the UAF used such artillery systems on the battlefield.

The main game changer in the battlefield at the time was the introduction of the American HIMARS in early summer. The UAF quickly acquired the necessary skills to operate the system. HIMARS provided even greater precision and, most importantly, further reach, depending on the ammunition type provided. Hence, the UAF targeted Russian logistics infrastructure deep behind their lines, such as artillery supply depots in the east. Soon after the introduction of HIMARS, there was a reduction in Russian ammunition expenditures from 12,000–15,000 rounds per day to 6,000 rounds per day.[18] However, the supply of HIMARS came with restrictions on their use – they were not provided with 200-mile Army Tactical Missile System (ATACMS) and they were not to be used against Russian territory.[19] The importance of HIMARS was in having the firepower to defend Ukrainian territory, hold the frontline and have fire support for counteroffensives. In the weeks before the launch of Ukrainian counteroffensives, HIMARS and other Western weapons were used to degrade Russian supplies and logistics – ammunition depots, C2 locations, bridges and railway connections.

The counteroffensives

Although the Russian offensive in Donbas resulted in additional territorial gains in the Luhansk district (Svitlodarsk, Lyman and Sviatohirsk) in early July, advancement was very slow and costly both in terms of lives and materiel. According to the estimations of the Ukrainian Ministry of Defence, from the time of the invasion until 21 August 2022, Russia lost 45,200 servicemen in Ukraine, 1,912 tanks, 4,224 armoured combat vehicles, 1,028 artillery, 266 MLRS, 234 military jets and 197 helicopters and other assets.[20] In essence, the summer months can be considered a stage of regrouping the UAF for counteroffensives. The summer months were effectively used to degrade the Russian rear and supply chains with the extended reach that the HIMARS provided. Due to heavy losses, Russia brought more of its newly mobilised mass of soldiers onto the battlefield, often with little to no training. The UAF developed some ways to rotate its soldiers, allowing them to recover from months of uninterrupted fighting and constant shelling. Another distinctive feature of the Russian frontline observed by the UAF was the paradoxical lack of the same sufficient force concentration and mass build-up across the entire extended frontline. In other words, when some areas became more problematic for the Russians to hold, more troops were moved from another area, weakening that position.[21]

Many scholars will study the Ukrainian counteroffensives in Kharkiv and Kherson for decades to come as a modern illustration of the principle of deception, the continuity of the Soviet 'maskirovka' doctrine in Ukrainian military thinking and the employment of the operational art in the modern information age of almost a transparent battlefield that presumably almost dispelled the fog of war.[22] The research by the *Washington Post* involving 35 interviews of personnel from the UAF revealed that one of the axes of a counteroffensive was initially to be a decoy, with Kharkiv distracting attention from the Kherson offensive. However, Colonel General Oleksandr Syrsky suggested using Kherson as a partial distraction while conducting the Kharkiv counteroffensive. The idea was daring and unexpected since Izyum was not only significantly fortified (24 battalion tactical groups [BTGs] or approximately 18,000 troops with weapons and ammunitions), but also more Russian troops were across the border in Belgorod.[23] According to Syrsky,

> the enemy … thought that, because so many forces had been built up in Izyum and more were stationed over the Russian border in the Belgorod region, 'you'd have to be crazy to move and try to strike right in the middle and split the two'… but the thought was there.[24]

The highlight of the late summer months were the discussions of the role of HIMARS in further degrading Russian forces, their demoralisation and high losses. There were also open public and media discussions of when the UAF would finally regain the Kherson region and soldiers would enjoy the taste of the

famous Kherson watermelons. From the military perspective, these discussions might have been counterproductive since they highlighted the next objective of the UAF. However, such a move was part of the deception strategy of distracting attention from another direction of action, meaning the Kharkiv region. In addition to the public domain discussions, a few weeks before the counteroffensive, a game of bridges was taking place in the Kherson region, with Ukrainian artillery destroying rail and highway bridges in Kherson, reducing logistics traffic by 70% across the Dnipro River, leaving Russian soldiers without a sufficient food and water supply a few days before the UAF breaking through the first lines of Russian defence on 29 August 2022. The distractions and formal focus on Kherson resulted in the relocation of half of the Russian troops, especially more experienced ones, at the end of July and the beginning of August, from the northeast of the Kharkiv region and the Izyum stronghold to the Kherson region.[25] Further primary advancement of the UAF on the Kherson direction in late August–early September only encouraged the Russians to preserve their focus and efforts on the southern direction.

The Kharkiv counteroffensive was the best illustration of a combination of surprise, speed, rapid adaptation and spearheading of action in breaking through the enemy's frontline by joining two simultaneous advances: one towards Kupyansk pointing north and the second towards Izyum pointing south, which in essence divided the Russian troops into two, allowing further encirclement in both directions. The primary enabler of success was the speed of the UAF movement. As Syrsky stated, 'Everything depended on the first day—how far we could break through.'[26] It was instantaneous movement; as of 9 September 2022, the UAF had captured 2,500 square kilometres in Kharkiv Oblast,[27] and the counteroffensive had started only three days prior on 6 September.

Part of the Kharkiv counteroffensive was a rear raid conducted by the 80th separate amphibious assault brigade that moved together with the 25th and 92nd brigades. According to the brigade commander, Colonel Ihor Skybiuk, the brigade acted in the direction of the main assault after the first echelon units broke through the enemy's defence. The primary objective was to get the city of Izyum under control, with a secondary objective of joining with other units to encircle the Izyum concentration of Russian forces. Russian troops that were engaged with the Ukrainian first attack echelon and artillery did not expect simultaneous infiltration of the UAF units into their rear position and speedy action towards their encirclement. The very movement of the unit was gradual, consisting of smaller engagements with the enemy and the employment of ambushes all the way to Izyum. Russians were retreating to the Oskil River crossing that was under the control of the Ukrainian artillery. So, they were destroyed there.[28]

One of the distinctive features of the operation was that Russians were running in a hurry, leaving behind their vehicles, ammunition supplies and even sleeping bags. As a result, the UAF gained much materiel during this raid: more than a hundred tanks, infantry fighting vehicles (IFVs), armoured personnel carriers

(APC) and various self-propelled and towed howitzers.[29] Therefore, there was some distraction of the technical sections of the unit towards the trophy equipment. In order to avoid this distraction during the second stage, a special unit responsible for handling trophy equipment was formed. According to Col. Skybiuk, Russians primarily depicted quantitative superiority rather than qualitative superiority, and even the most trained and elite Russian Fourth Tank Division did not show any significant achievements. Nevertheless, there was constant tactical learning about the performance of different Russian divisions and the development of ways to counter their advantages.[30]

Unlike the Kharkiv case, the Kherson counteroffensive followed its own dynamic and was much slower in its path and territorial progress. After weakening Russian supply and logistics support in the area, gradual and systematic grinding through Russian forces was taking place. The most important factor was preventing Russian resupply and reinforcement from the other bank of the Dnipro River, which was achieved by damaging the bridge over the river. The breakthrough started with mass fire against the Russian position, aiming to degrade their artillery, and once its numeric superiority was overcome, more freedom of action on the ground. The UAF movement was slower than in Kharkiv for a few reasons. First, as was previously mentioned, Russia moved more of their units from Kharkiv to the Kherson area, which meant a greater concentration of force. Second, according to Oleksii Reznikov, Ukrainian Minister of Defence, the rainy autumn weather slowed vehicle advancement because the terrain would easily turn to mud. Third, according to Brigadier General Oleksandr Tarnavskyi, the commander of the operational and strategic group of troops known as 'Tavria,' the Russians had mined 900 thousand hectares of liberated territories in the Kherson and Mykolaiv regions.[31] Finally, each metre of liberated Ukrainian land came at a high price of the blood and sweat of the UAF. While Russia does not value the lives of its soldiers, Ukraine does, so liberating territory at any cost could end up costing even more. Eventually, the Russians were substantially degraded and cut off from their support on the opposite bank of the river, and they announced their withdrawal to the southern bank. Kherson and the entire northern bank of the river were liberated on a very symbolic date of 11 November 2022.

The two successful counteroffensives had great significance for the course of the war. They not only boosted the morale of the military and civilian Ukrainian population but also showed that the UAF can push back and achieve significant victories in addition to pushing enemies from Kyiv and the northeast. Kherson was also the only new regional capital that Russians managed to occupy during the invasion, so it had significant political symbolism. From the military geography perspective, control of Kherson and the northern bank secured control over one of the gateways to western Ukraine. Furthermore, closer advancement of the UAF in the direction of Crimea provides more opportunities for reaching new Russian positions on the other bank of the Dnipro River and Crimea itself. However, since the UAF did not gain control of the other river bank, Russian artillery could still

target the city of Kherson and Ukrainian positions from across the river, which continued into 2023.[32]

After the two counteroffensives and the formal announcement by Russia of mobilisation on 21 September 2022, and with the consequent immediate drop of newly mobilised troops on the frontline, the Russians strengthened their focus on the area where they were the most well-established, namely Donbas, with continued fighting across the entire frontline. As the next chapter on air war illustrates, Russia compensated for its ground losses with aerial and long-range bombing of the entire territory of Ukraine, with a specific focus on targeting civilian infrastructure. Besides its demoralising effect and the exhaustion of the Ukrainian ammunition stockpile, the offensive was also aimed at keeping Ukrainian leadership and rear support busy, distracting from the next stage of the war at hand – regrouping and consolidation for further actions. Hence, the period after the two counteroffensives, especially during the winter months of December 2022 and January 2023, can be characterised for both sides as gathering strength for the next stage of the war. Russia tried to buy time by publicly manipulating announcements about peace negotiations and a potential truce. In the meantime, missile attacks on Ukrainian cities continued from both Russian and Belarussian airspaces, with Belarusian aviation becoming more active in January 2023 when it began conducting 'military exercises' with the Russians.[33]

As for the Ukrainian preparations for the next stage of war, General Zaluznyi summarised the situation and requirements for the UAF in his interview with the *Economist* on 3 December 2022. Overall, he concluded that the Russians were regrouping their forces and gathering assets for their next attacks and potentially even trying to retake Kyiv, most likely by attacking from the territory of Belarus. He emphasised that the Russians were trying to buy time to mobilise more troops and gather material for the next strike, while preventing the UAF from regrouping for further advancement. Accordingly, the Russians intensified their assaults across the entire frontline with varying degrees of concentration of fire, primarily to keep the UAF busy and exhaust them before the next stage of war that would potentially occur in February–March 2023.

Therefore, General Zaluznyi identified three strategic objectives for the UAF. First, the primary objective was to hold the lines and positions and preserve liberated territories under Ukrainian control. It is 10–15 times more difficult to liberate territory than to hold it. Second, in the next stage of the war, any further engagements with the Russians or the conduct of the liberation operation would require substantial assets – thus, the objective was to build a critical mass; that is, accumulate resources sufficient for the liberation operation and a return to the borders that existed on 23 February 2022. From the materiel perspective, this would require more of international military assistance focused on the heavier equipment needed for land warfare. From the personnel perspective, the critical mass would have to be built by increasing the number of reserves with high levels of training. Finally, it would be crucial to strengthen Ukrainian air defences with

more advanced capabilities to once again build up the required critical mass to overcome the 0.76 coefficient of efficacy and take down the more sophisticated Russian long-range ballistic missiles.

In discussing further options for the liberation of Crimea, General Zaluznyi stated that the key to its liberation is seizing 84 km of territory to Melitopol, which would allow firing control over the ground connection to Crimea. In order to conduct further liberation operations, which would most certainly have to be on a large scale, the UAF would need 300 tanks, 600–700 APCs and 500 howitzers.[34]

Bakhmut holds

The battle of Bakhmut is one of the bloodiest in this war. It was characterized by the intensification of the Russian attempts to take the city of Bakhmut in Eastern Ukraine and saw mass casualties and attrition warfare in its worst manifestations. Intensification of Russian assaults began in August and was reinforced in November with the Russian troops withdrawn from Kherson. From then on, the place became known as the hottest spot of the frontline with Wagner PMC trying its tactics of using waves of prisoners and recruits. The intensity of warfighting and never-ending mass waves of expendable Russian troops and the concentration of various firepower assets on this segment of the frontline made the place one of the biggest meat grinders of the war.

In the interview, Col Gen Syrsky explained the significance of Bakhmut for both sides. From the Russian perspective, the city was of importance to facilitate their further advancement in the direction of Kramatorsk and Siversk in their further plans of fully occupying Donbas. From the Ukrainian perspective, the location was important because it was a focal point of the Ukrainian defence and holding of the frontline. Geographically being the traditional fortress standing on the hill, surrounded by rivers, it allowed inherent advantages in holding the ground. Another advantage was the tall buildings which facilitated defence in the urban warfare environment and undermined usual Russian advancement on the more plane-land areas of Eastern Ukraine. Finally, 'Bakhmut constitutes a part of Konstiantynivka-Kramatorsk agglomeration, the retention of which will prevent the enemy from hitting our forces in the flank or rear on the Lysychansk and Donetsk fronts.'[35]

Due to the intensity of warfighting and constant closeness of engagement, this battle showed numerous occasions of mutual learning and constant adjustment of fighting tactics. As a grinder of Russian ground forces, the constant necessity of firepower and ammunition became crucial to the survival of the UAF in the area. While the Ukrainian skills in urban warfare and reinforcements provided advantages in holding the city for nine months of the battle, the Russians learned and adapted their tactics accordingly. According to Col. Gen. Syrsky, Russians began to establish 'Storm' assault units to restore lost positions. They also showed better integration of their firepower with artillery and tank units in attacking Ukrainian positions, unmanned air vehicles (UAVs) for sweeping the area with subsequent

follow-up engagement of Russian assault units. In early spring 2023, in order to undermine Ukrainian advantage in the urban environment, Russians adopted the tactic of 'scorched earth' with prolonged artillery barrages of the chosen target followed by a small group of ten people storming the target.[36]

Points for consideration

The manpower aspect of the war illustrated multiple points for discussion in identifying relevant characteristics for preparing the right personnel. The importance and disparity of training, skills and force cohesion between the two sides have been discussed in earlier chapters. From the perspective of the land-centric war, the presence of firepower originating from various domains can act as force multiplication and facilitate territorial advancement, but the absence of the critical mass and sufficient concentration of force across the frontline and occupied territories significantly undermines long-term control of that territory. Russian employment of its traditional mass approach to the use of force and its advantage due to its numeric superiority in terms of its forces proved futile for several reasons.

One of the evident deficiencies in Russian performance was the inconsistency between the numeric representation of its armed forces on paper its skills and readiness. Total numbers on paper do not necessarily transfer into actual fighting power, and various partial attempts at modernisation focused on achieving rapid success with heavy equipment and much lighter BTGs lacked sufficient infantry for their effective performance on the roads, open spaces and urban environments.[37] As was previously outlined, the Russian approach to structuring its ground forces was based on more traditional perceptions of manoeuvre warfare and, hence, focused on having more artillery and tanks, while force generation in the last ten years proved to be a significant issue.[38] This was illustrated in the insufficient number of forces recruited for the contracted/professional service even before the 2014 invasion. The actual lack of force was demonstrated in the insufficient staffing of the BTGs, which in the course of reforms, significantly reduced the manpower and consequent readiness of BTGs by cutting infantry to the minimum. According to Kofman and Lee:

> As a tiered-readiness force, Russian ground formations (including the airborne and naval infantry) were staffed somewhere between 70 to 90 percent. Consequently, a 3,500 sized brigade might only have 2,500 men at peacetime. When accounting for 30 percent conscripts likely to be in the unit, this meant that no more than 1,700 would be considered deployable. If actual readiness levels were being padded, or there were insufficient numbers of contract servicemen to fill out two battalion tactical groups, then the real number of forces available was even further reduced.[39]

Hence, force employment had been driven by force design and determined the numerous flaws that followed. The first days of invasion illustrated a significant

number of materiel but insufficient personnel to effectively employ it. For example, long convoys were particularly vulnerable at the beginning of the invasion because they did not have sufficient infantry and off-road coverage.[40]

Regarding the Russian numeric or mass approach, it quickly became evident that personnel and materiel mass were soon significantly degraded in the war. During the spring–summer, the numeric superiority of artillery compensated for the high losses of the Russian military, but the military burned through a significant amount of ammunition, while HIMARS and howitzers helped to eliminate ammunition storages. By losing significant mass in terms of people and artillery, the lack of an uninterrupted supply of ammunition weakened the Russian ability to control a large frontline in Kharkiv and to have sufficient artillery to control Kherson.[41] The effectiveness of numeric superiority largely depends on how the numbers are being structured and employed, both in terms of personnel and materiel.

With respect to troops' cohesion and skills, all traditional Russian exercises showcased a more static numeric presence instead of sophisticated modern skills, adaptability, force cohesion or the conduct of near-real warfighting exercises. Even deployed units with some operational experience did not have much cohesion within larger formations since they originated from various regions and were too diversified, with some inherent ethnic rivalry among them. As their numbers degraded through spring–summer, integration of newly mobilised personnel without much training and reconstituting of forces during the heavy fighting was very poor.[42] Despite Russian attempts to modernise its military, the hierarchy and leadership style remained very rigid and hostile to critical thinking and alternative opinions. The Stalin tradition of treating generals prevailed in Putin's Russia and was well illustrated in the constant changes in commanders in the war in Ukraine. Due to the consequences of taking responsibility for innovations, Russia, especially its Army, often took a long time to adapt their counteractions to the Ukrainian tactics. The rigidity of command and control and the punitive leadership style significantly undermined the use of mission command and tactical-level initiative, and with significant losses among Russian senior- and medium-level leadership, their skills and roles in sustaining the ranks was lost.[43]

Another issue in the Russian case is the disparity among different troops and their consequent status in the Russian forces. This time the incoherence was between ordinary soldiers and the newly mobilised soldiers and the Wagner PMC, Kadyrov's Chechens that would use prisoners or the newly mobilised as cannon fodder in the first wave of their assaults. Besides the obvious lack of survivability of these troops, the spread of this news through various channels in Russia also undermined the mobilisation numbers, and many in the recent waves immediately surrendered to the UAF. The Ukrainian surrender hotline for Russian soldiers ('I want to live') witnessed mass surrenders in spring 2023 (the pick of 3,000 per each month of March and April), with increasing fear among Russians of the upcoming spring\summer Ukrainian counteroffensive.[44]

From the perspective of modern warfare and the discussion of numeric standing armies versus smaller and more well-trained and agile forces, the example of the Russian experience illustrates that the readiness for diverse warfighting scenarios requires a more balanced and multifaceted approach to building a critical mass of skilled Army that has both modern skills and the numeric weight to withstand the preliminary engagement and continue effective performance. The level of training and tasks might differ, but cohesion and across-unit integration must be in place for it to function.

In contrast, the UAF illustrated the supremacy of the principle of economy of force and dispersion as the primary counteraction to the Russian mass approach. At the beginning of the invasion, Ukraine did not have equivalent numbers of people to those that the Russians were dropping on them. However, the required numbers were soon built through the previously prepared reserves and the involvement of cadets from the military education facilities, such as during the battle for Kyiv. Dispersion and delayed battles along with the advantage of the terrain allowed Ukraine to stop the enemy's advancement into Ukrainian territory and to begin to gradually push Russians out of the occupied territories. The role of the human factor in this context is immense. Unlike the Russians, Ukrainian cohesion and the consequent integration of the troops was much higher. There are a few reasons for this. First, many survival, self-organisation and integration skills were developed during the two Ukrainian revolutions. People in their 30s spent their entire lives in the transition of Ukraine through different stages of turmoil and now new stages of the war. Many people who went through the Revolution of Dignity were the same ones to fight in ATO in various places and roles over the eight years, and these very people were then in various roles on the frontline. In this regard, cohesion was conditioned not only by the commonality of patriotic beliefs and Ukrainian fighting spirit but also by the shared experiences of fighting this war for eight years, comradeship built through those years and training of the military skills. Furthermore, ATO veterans and more experienced men in their 50s who went through other wars could be found in different units – regular military, defence reserves and volunteers. Of course, this does not mean that cohesion across all units and consequent waves of mobilisation was at the same level; this most certainly varied, especially in the latest intakes. However, the core of the UAF that withstood the most difficult time in spring 2022, when ammunitions were at their lowest – were people united by their experiences of the Ukrainian life and warfighting during the previous decade.

From the perspective of materiel, several observations can be made. As in any domain of warfare, the Russians once again used numeric superiority, this time in equipment with varying levels of technological sophistication. Their firing superiority significantly increased throughout the spring, primarily due to more equipment being brought to the relatively consolidated frontline and the depletion of the UAF ammunition in Russian sabotages of Ukrainian arsenals during the eight years of war. While Russia could adopt more area bombing, the UAF had to choose

targets more carefully and focus on precision strikes and unconventional tactics to undermine the Russian advantage. Gen. Zaluznyi summarised the significant difference in targeting: 'they act as horde, while we had to count each projectile.'[45] As always happens, human capital had to compensate for the limitations of the technologies and their scarcity. Hence, Ukrainian soldiers innovated with MANPADS to engage Russian convoys in a way that allowed some intact equipment to be taken from the enemy. The vital necessity to survive with scarce resources dictated numerous tactical innovations, while Russian overreliance on numeric superiority in personnel and firepower led to their indiscriminate use of force and mass in the employment of fire instead of precision. According to US Army Gen (Ret.) Petraeus, Ukraine managed to take full advantage from combining various assets in achieving combined effects:

> By combined arms operations, I'm referring to the use of tanks together with infantry to keep the enemy infantry and their anti-tank guided missiles off the tanks, with artillery and mortars suppressing the enemy, and with engineers and explosive ordnance disposal to reduce obstacles and defuse mines, with air defence right up with the tanks to keep the enemy's air off of them. [With] their close air support, supported now by the MiG [fighter jets] provided by Poland and other NATO nations, logistics right up behind them with additional ammunition, food, fuel, water, medical support, and supplies, [and] good command-and-control on the Ukrainian side, electronic warfare to degrade the communications of the Russians.[46]

In immediate and short-term necessity cases, people's skills tend to compensate for the limitations or scarcity of resources, and protracted warfare and land-centric warfare dictate the need to introduce new equipment with characteristics that could change the parity or undermine the enemy's numeric advantage. International partner supplies of different howitzers and HIMARS to Ukraine demonstrated how more precise and mobile artillery can make a difference in the balance of fire power and facilitate further progress in the war. This case illustrates the significance of cutting-edge technologies on the modern battlefield, but it comes with a reservation. In the ongoing discussion of numeric superiority versus fewer numbers of cutting-edge technology, the focus is on building a sufficient critical mass in terms of systems with more numeric and cost-effective arsenals that can provide desired firepower at a needed scale of inter-state warfare. The objectives posed by General Zaluznyi along with further pleas from Ukraine for international military assistance demonstrated that while one can defend the country with the given means by building upon advantages from other sources, such as knowledge of the terrain and dispersal, in order to have a game-changing or break-through effect, advanced capabilities need to be accumulated and built up to create the critical mass required for the inter-state warfare of today and tomorrow. The shape of that critical mass might vary from domain to domain, but it should be enough for

the given scale, and the most obvious scale can be the territory of the country that is building its defence capabilities.

Another significant feature of the land warfare that became evident in Ukraine is that terrain is significantly more urban than it was in World War II and, therefore, gaining territory in swift large-scale manoeuvres of heavy ground forces was more contested since large cities were on the way and required very different force formation and skills of urban warfare. According to Michael Kofman, the Russians did not have an urban warfare doctrine, nor systematic training for urban warfare across its military – a very small number would be specifically trained for this type of warfare. Even the Russian VDV would not be fit for the purpose of being airdropped into cities to conduct urban warfare; they were still too heavily equipped for such purposes. Urban areas are far from friendly for heavy equipment like tanks, and ambushes by the UAF equipped with Next generation Light Anti-tank Weapons (NLAWS) would destroy Russian tanks, not to mention lighter vehicles. Furthermore, the heavily shelled buildings provided new positions for UAF infantry and snipers to target Russian forces.[47]

Urban warfare requires relevant professional training and knowledge of the urban area. In the case of Ukraine, some of its SOF units were trained in urban warfare because elements of the foreign legion had this type of training and incorporated it into the training programmes conducted during prior eight years of the war. This does not mean that this type of training was systematic across the entire Ukrainian military. However, there was another experience related to urban warfare – the experiences of two revolutions in the capital's urban areas. Basic skills such as barricading, blocking roads and finding relevant overview positions were learned from practical, tactical experiences. Another enabling factor was John Spencer's sharing of his manual on urban warfare with the UAF that, due to the modern information age, reached the Ukrainian soldiers on the ground and contributed to their knowledge of relevant tactics on the battlefield.

Despite the new technologies and availability of long-range weapons, land-centric warfare remains people-centric at its core. In one of the interviews, Gen. Zaluznyi explained the reason for the Ukrainian survival and endurance through the nine years of war – ordinary Ukrainian people. In this context, discussing the matter of different ways of warfighting between Ukrainians and Russians, he stated that it is about perception and value of human life. The Russian political and military leadership are more accepting of casualties among their military, which was evident in the use of cannon-fodder tactics and high rates of blue-on-blue fire among the Russian forces. The Ukrainian leadership, in contrast, has been consciously more virtuous, focusing on defending the people and reducing casualties among the UAF as much as possible. From the perspective of total defence, as Zaluznyi said, 'the war starts with professional military and ends with teachers and engineers'[48] meaning that it consumes the professional military first, while it eventually requires civilian reserves to step up into the warfighting. While the exact numbers of the Ukrainian

losses are not made public and only some general numeric comparisons with more significant Russian losses were made, this land-centric and human-centric war showed significant demand for constant mobilisations and systematic training of the reserves during the ongoing warfighting. Hence, one year into the full-scale invasion and nine years into the war – there were more engineers and teachers in the UAF, while additional reserves were being trained abroad and in Ukraine in order to build up sufficient skilled and equipped manpower for the Ukrainian summer counteroffensive.

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6

THE AIR DOMAIN

This chapter is devoted to exploring air power and the aerial domain of the war in Ukraine. It addresses why air superiority was not gained and how a parity of mutual air denial was established instead. It explains the initial chronology of the events, various ways of employing air power and the limitations of the Russian long-range missile attack campaign. It illustrates how the Ukrainian layered approach to air defence and the employment of dispersal denied the military advantage of Russian numerical and technological superiority in the aerial domain. It also shows the importance of interservice and cross-domain integration in achieving the desired effects. Furthermore, attention is paid to the skills and training of the Ukrainian pilots compared to that of the Russians, illustrating the extent that adaptability and dispersal were acquired by the UkrAF during the first eight years of war.

Stages of the air war

Four distinctive stages in the Russian air war over Ukraine can be defined during the first year of the full-scale invasion. The first stage, February–March 2022 was characterised by the preliminary engagement of air forces gradually being substituted by the establishment of air defences and anti-access and area denial capabilities (A2AD) in their respective controlled areas. The initial targeting focused on military objectives. One of the tactical adjustments was changing from day to night-time flights. The second stage of March–August 2022 can be considered as an interim period, with testing of various Russian tactics and approaches in targeting and Ukrainian responses. During this period, targeting switched to bigger targets, including in civilian areas, intensification of bombing in June, focusing on storage facilities, railway infrastructure and refineries etc. The third period August–November 2022, corresponded to the Ukrainian

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counteroffensives and demonstrated Russian air and land assets being on the defensive.[1] On the other hand, the Russian long-range ballistic missile attack campaign continued throughout the year, intensifying punitive attacks on civilian areas and infrastructure on the occasions of Ukrainian victories on the ground, or when important foreign decisions and visits took place or on symbolic dates. The fourth stage of December 2022–March 2023 was characterised by the continuity of the previous combination of the long-range ballistic missile barraging with various extents of intensification, using bombers from the Russian and Belarusian air space to attack targets in Ukraine. Various Russian attempts within this recent period also saw Russian employment of gliding bombs, the inclusion of UAVs to support their critical mass in barraging campaigns and ISR tasks.

The employment of the aerial assets in the full-scale invasion was paramount for the surprise and paralysing effect and degrading of the Ukrainian air defences and air forces at their most vulnerable – when they were on the ground. The attacks included heavy cruise and ballistic missile barrages combined with the employment of bombers Su-34 and fighters Su-30 and Su-35, facilitated by electronic jamming of air defences. The main focus of the attacks were Ukrainian air defences, air bases and airfields, fixed radar and surface-to-air missile (SAM) sites, and ammunition storage facilities. Russian targeting lists were detailed due to the preliminary intel gathered from the multiple classified and human intelligence (HUMINT) sources, resulting in heavy fire; but allies informed the UAF about the actual attack and thus succeeded in preserving various aerial capabilities intact. Mobile air defence and personnel were moved from their preliminary positions known to the Russians, which meant that when Russian missiles reached those places, they were hitting empty locations. In addition, the rather obvious targeting of aircraft while it was the most vulnerable on the ground did not provide the desired effect of destroying the UkrAF since most of the fleet was either airborne or retracted to the peripheral airfields.

The intensity of the fire in the first days was significant, with between 200 and 140 sorties for fighters and bombers flying deep into Ukrainian territory. With some of the air defences moved and others jammed and supressed by means of electronic warfare, the UkrAF, using Mig-29 and Su-27 fighters, had to engage in the immediate defence of the country's air space in the first few days of the invasion. The evident tactical technological superiority of the Russian SU-30 and Su-35 in terms of radar and missile performance required the Ukrainian pilots to innovate with aggressive tactics and low flights taking advantage of the air littoral under the conditions of being significantly outnumbered. Accordingly, in the first few days of the invasion, many brave pilots of the UkrAF downed Russian fighters and bombers, often paying for the achievement with their own lives, such as the famous Ukrainian flying ace Col. Oleksandr Oksanchenko, who was often considered to be the legendary 'Ghost of Kyiv.' He died on 28 February 2022 when his Su-27 was shot down over Kyiv.[2] When the Ukrainian ground-based air defences (GBAD) restored their functionality, the issue of deconfliction arose, which was resolved by allocating different operational areas.

Antonov/Hostomel international cargo airport was a focal point in Russian invasion plans, located 30 km northwest of Kyiv. It was to be used as forward operating base for further Russian deployment into the area and advancement towards Kyiv. Control over other airports like Kyiv International Airport (Zhuliany) and Boryspil were also potentially considered for this purpose.[3] The Hostomel\ Antonov airfield was significant for the Russian airlift of troops and heavy cargo not only because of its immediate closeness to the capital, but also because of its distinctive infrastructure. The airfield was built for heavy transport use of the biggest transport aircraft in the world – An-225 Mriya, which meant very wide and well-strengthened airstrips. In capturing the area, Russians used primarily their Mi-8 transport helicopters to drop their paratroopers, and Mi-24 and Ka-52 combat helicopters supported by fighter jets to gain control of the airport. In the first instances a few hundreds of Ukrainian defenders had to fight against numerically superior enemy. Nevertheless, they managed to take down some of the Russian helicopters with MANPADS. Later on, Ukrainian paratroopers were deployed into the area. Although Russians eventually managed to get hold of the location, the infrastructure was degraded so that it could no longer be used for the intended heavy airlift purposes. Three Ukrainian airborne paratroopers commanded by a young paratrooper with a call sign 'Zeus' that were in the encirclement of the Russians in the area, successfully coordinated Ukrainian artillery and aviation fire on the Russian positions until their full withdrawal from Northern Ukraine.[4]

From the air power perspective, this battle was significant in many ways. Its crucial role in preventing further encirclement and advancement on Kyiv is unquestionable. It also illustrated the vulnerability of the Russian aerial assets in Ukraine to MANPADS. While Russians placed significant focus on their paratroopers and Army aviation, which they showcased in all of their wars, this battle illustrated that they were the most vulnerable. In the further months of war, in the count of destroyed Russian assets, transport and attack helicopters were the most numerous. From the perspective of forward operating bases, or logistical hub, the inability to control Antonov airport also illustrated that Crimea 2014 and Kyiv 2022 were very different operational environments.

What has been witnessed in the progressing months of war illustrates cross-domain and inter-unit efforts in achieving air denial to Russian attempts to establish air superiority in Ukrainian airspace. First, the inability to destroy mobile air defences like S-300 and Buk systems with their further deployment in the needed areas of operation was a huge disadvantage for the Russian Air and Space Forces (Vozdushno-kosmicheskiye sily VKS). Second, Russians did not manage to destroy UkrAF on the ground, and even their technological superiority did not destroy Ukrainian military aviation, not to mention that Ukrainian pilots proved more innovative and sophisticated in aerial manoeuvres. Third, since the medium altitudes from which Russians operated in their campaigns in Syria were limited due to the SAM systems, the Russian pilots moved to the lower altitudes and operated in air littoral which, in essence, was unknown to them. Just as

Ukrainian ground troops had the advantage of the terrain in land warfare, so did the UkrAF have the advantage of knowing the air littoral to outmanoeuvre the Russians. Furthermore, low altitudes became even more dangerous for the Russian fixed- and rotary-wing aircraft due to the availability of Stinger and Starstreak MANPADS. There were reports of anti-tank missiles being used against Russian helicopters flying low. Hence, UAF illustrated that 'defense in vertical depth is most effective when the defender exploits the interactions between the blue skies and the air littoral.'[5] Besides fixed-wing aircraft luring Russian counterparts into the air littoral, Bayraktar drones targeting approaching Russian convoys also were chased by the fighters and were lured to the lower altitudes. This worked until Russia deployed air defences, such as S-400 and Buk, to cover the battlefield. Mutual air denial over the battlefield occurred.[6] Furthermore, the effectiveness of Ukrainian air denial made Russian pilots of fixed- and rotary-wing aircraft afraid to enter Ukrainian airspace, which meant that they either operated at high altitudes or conducted strikes from the Russian airspace. These changes can also be perceived as operational adaptation, learning from one's enemy, and engagement, which once again required the defending side to develop additional innovations.

In essence, denying the Russians control of the air over Ukraine confirmed one of the air power dictums of Colin Gray, which is that 'control of the air is either essential or highly desirable but differs qualitatively from control on the ground,'[7] suggesting that it 'does not imply the immediate surrender of an adversary in the same way as control of the ground.'[8] Fluidity and changeability of both control of the air and air denial provide opportunities for changing the parity if new opportunities arise. A few factors conditioned the Ukrainian air denial. It required integration and deconfliction of various assets across domains in their support of air denial and employment of air power in the frontline. Dispersion of the aerial assets across the country; avoidance of concentration of force; and a high level of adaptability of pilots to taking off, landing, flying and enduring technological challenges under severe circumstances of field air bases or airfields contributed to employment of air denial. Combined effects from conventional aircraft, cheap drones and ground-based firepower established effective countermeasures against various targets in the air across various altitudes. International military assistance provided logistical support and spare parts supplies allowing Ukrainian engineers and Ukroboronprom to restore various aircraft and fix air defence systems and radars. Devoted ground troops were motivated as much as Ukrainian pilots to take Russian aviation off Ukrainian skies with all available means.

Effects, posed objectives, targeting and precision

When a mass approach is adopted for structuring and employing force, it might be tempting to assume that 'more' might mean more effective and that quantity would compensate for other deficiencies. As the air war illustrated, although critical mass is needed to sustain both air offensive and defensive, as with any military force, it

is about how the capabilities are being used – multiple hit targets or a huge number of dropped bombs do not equal the achievement of posed military objectives and desired strategic effects.

When the air raids against Ukrainian military infrastructure in the first few days proved far less successful than what was expected and Ukrainian GBAD were recovered, the VKS had to adjust the flights of their Su-25, Su-30 and Su-34 to fly at low altitudes during the first two weeks of the full-scale invasion. Low altitude and often flying in singles instead of in a significant formation resulted in rapid losses of aircraft from the MANPADs, at one point reaching eight hits within a week. Besides the danger, the low-altitude flying meant very little time for acquiring, manoeuvring and dropping weapons on the given target, not to mention lack of up-to-date maps and the challenges of attacking well-dug-in Ukrainian forces that used the same equipment as Russian troops. Hence, the Russians were flying sorties against preassigned targets rather than taking advantage of time-sensitive targets or targets of opportunity. Furthermore, daytime low-altitude flights were considered too dangerous by more experienced Russian pilots.[9]

The primary Russian adaptation during the early spring 2022 was shifting sorties from the day to the night-time. The primary advantage for Russians was that Ukrainian soldiers on the ground lacked thermal imagers or night-vision devices to shoot at Russian aircraft at lower altitudes. However, with more national and international crowdfunding aimed at this distinctive equipment, more night-vision goggles were provided for the ground troops in Ukraine. Hence, the mutual addition of tactics continued, but it took time to get this equipment. So, the Russians took advantage of the night-time for most of the spring 2022. From the targeting point of view, night sorties were not characterised by greater precision, which resulted in switching from the Ukrainian military objects that required more accurate intelligence and planning to the usual Russian indiscriminate bombing of besieged cities. While in Syria, the Russians had used TU-22M Backfire medium bombers to conduct 'carpet bombing' of Aleppo from medium altitudes,[10] in Ukraine, they bombed them from lower altitudes. It is no coincidence that the ruins of Aleppo look the same as the ruins of Mariupol. Choosing big targets of populated cities like Kharkiv, Summy, Chernihiv and Mariupol provided symbolic achievements for the VKS to report to the Kremlin at the time when Ukraine was winning the Battle of Kyiv.

Russian withdrawal from Northern Ukraine and relative stabilisation of the frontline impacted the employment of aerial assets in the months before the Kharkiv and Kherson counteroffensives. Russians could regroup and consolidate their air force. Besides continued fighter attacks, Russians began using Orlan drones to identify and jam Ukrainian SAMs. As a result, the Ukrainian SAM systems of Buk and Osa had to be moved away from the frontline to reduce their losses. This allowed the VKS to use medium and low altitudes close to the frontline. However, due to the high losses of SU-34 in the night raids, they were often used against fixed targets from a distance of 18–15 km and medium altitude.[11] With the beginning of

the Ukrainian counteroffensives in Kharkiv and Kherson, like the ground troops, the VKS also went onto the defensive. The availability of AGM-88 HARM missiles supplied to Ukraine by Western partners allowed Ukraine to exhaust and suppress Russian GBAD, which allowed Ukrainian Su-25 and Su-24 to conduct standoff rocket attacks and bomb Russian positions on the frontline. Besides GBAD suppression, another factor disadvantaging the VKS was the scarcity of tanker support, which was traditionally focused on supplying the bomber fleet. As a result, combat air patrols (CAPs) would have to be shorter and sorties more frequent in order to cover designated areas of the frontline during the daytime. On the other hand, the Russians started using long-range R-37M from Mig-31BMs at high altitudes, which provided them with the reach at a safer distance outside the Ukrainian defences[12] but reduced the precision and target recognition, especially on the constantly changing frontline of the Ukrainian counteroffensive.

As the damage done to the aircraft increased at the lower and medium altitudes, it was mainly used against fixed targets and following given coordinates. While in modern warfare, targeting indeed depends on the intelligence gathered and the significance of the target to the overall objective, the Russian cherry-picking of targets could potentially have had a surprise effect. However, the lack of continuity of sporadic attacks without follow-up raids to clear the areas or conduct effective battle damage assessment (BDA) undermined the very utility of the initial strikes. Accordingly,

> the very choice of targets at different stages was questionable and inconsistent with potential operational and strategic objectives or effects. Also, many time-sensitive targets and targets of opportunity were ignored. From one perspective, it could have looked like taking advantage of mass by concentrating it where it was needed at a given time. In reality, the extent of that necessity was doubtful. However, with the gradual establishment of the frontline, the focus shifted towards covering the frontline and nearby territory.[13]

Besides the symbolism and obvious necessity of showing progress in the aerial part of the campaign, this experience with targeting and mass use of ammunition showed another inherent Soviet deficiency of the VKS – even mass is exhaustible. Although much has been written about Russian aerial capabilities and their lack of involvement in Ukraine to the fullest capacity, the missing point is that, from an air cover perspective, the Russian aerial fleet is overstretched between covering national air space, making occasional moves into European national airspace and fighting the war in Ukraine. Furthermore, the ammunition stockpiles are also exhaustible and irreplaceable at the desired speed and rate, especially considering that various Russian missile manufacturing facilities have been sabotaged. Russia is dependent on the Western supply of spare parts, microchips and components for its various Russian-manufactured weapons, supply which was heavily restricted by sanctions.[14] Conflict Armament Research (CAR) investigates and physically

documents weapons and communication equipment used by Russia in the war against Ukraine. They identified 144 non-Russian manufacturers of more than 650 unique component models used in Russian military equipment in Ukraine.[15] The use of identical components across different military systems makes Russia dependent on them for sustaining mass capabilities production across different platforms. For instance, Russian 3M14 Kalibr, 9M544 Smerch, Kh-59 Ovod and Kh-101 missiles use the same satellite navigation signal receivers. Similarly, the same parts were used in on-board computers for Kh-101 missiles and Ka-52 helicopters.[16]

The UkrAF did not have the advantage of the same number of aerial capabilities and munition. Therefore, targets had to be well scrutinised before confirming and engaging. Furthermore, the scarcity of fixed-wing aircraft due to their first weeks of active engagement, and the necessity of repairs and spare parts, placed various firepower tasks on to ground artillery, UAVs and rotary-wing aircraft. Hence, the time was spent using the delivered spare parts for fixing Ukrainian fixed-wing aircraft.

Ukrainian Army Aviation and Close Air Support (CAS)

The primary source of CAS for the UAF would traditionally be Army Aviation, subordinate to the ground forces of Ukraine. Before the beginning of war in 2014, Ukrainian helicopter pilots were involved in various peacekeeping operations worldwide. Starting with 2014, the focus was on strengthening the materiel of the branch. The branch was involved in various activities of ATO. By mid-October 2014 helicopters had flown 8,000 sorties with a total flying time of 8,000 hours. In the interim years of the war, army aviation was involved in mobility tasks, combat missions against enemy forces at Donetsk airport and airlift to then-surrounded Kramatorsk airfield. After the full-scale invasion, army aviation flew missions to Azovstal in besieged Mariupol. They also played their part in the liberation of Snake Island, performing airlift, attack and rescue tasks.[17]

Fire support for the ground forces cannot be overestimated in inter-state warfare. Often not only the advancement but the very survival of the troops on the ground is dependent on the timeliness of the available air cover. In the case of the UAF, ground forces would often gain support from various sources of firepower: artillery, mortars, drones and different types of aircraft. The diversity of fire cover was conditioned by the scarcity of aerial assets in providing CAS across the extended frontline and the necessity of repairs and sustainment of the aerial capabilities before their engagement in the counteroffensives. Nevertheless, UkrAF and Army aviation were often called in to provide cover during spring and summer, with active involvement in CAS sorties supporting the offensives. The phenomenon of fire support provided by UAVs and remotely piloted vehicles (RPVs) in support of the tactical needs of the ground forces became of particular importance. However, the Ukrainian Army aviation is known to be the primary frontline support for the troops on the ground; as their motto says: ‘we are where we are needed.’

In the case of Russian air power and CAS missions, Su-25 were conducting more of a barrage effect support, while the Su-34 fleet potentially was more capable of multirole standoff tasks against constantly moving Ukrainian troops. However, during the Ukrainian counteroffensive, while the UkrAF was flying CAS missions, the same could not be said about the VKS. Several reasons can explain the lack of Russian air power in CAS. First, greater functionality and employment of Su-34 and Su-25 since the beginning of the invasion resulted in reducing the fleet and wearing out of the materiel and personnel. Second, in order to reduce fleet losses in CAS missions, the VKS began using Su-35 and Mig-31 high-altitude interceptors to target Ukrainian aircraft during their CAS missions in the frontlines, taking advantage of safe distances and preventing them from receiving return fire.[18]

Russian long-range missile attack campaign

Another manifestation of the Russian mass approach to the employment of air power was the ongoing heavy barrage of Ukrainian territory with cruise and ballistic missiles from day one of the invasion: 'Russia launched more than 1,100 missiles at Ukrainian targets over the first 21 days of the war and a total of 2,125 missiles over the first 68 days of the war.'[19] In the first few months of the war, Russian attacks focused on military infrastructure, logistics supply, fuel storage facilities, bridges and civilian targets. Besides the existing intel on the static infrastructure, military objects and logistics chains, there was data collected from HUMINT. The UAF used shoot-and-scoot tactics for various mobile air defences and mobile units, which significantly undermined the effectiveness of the bombardment. Consequently, the focus of targeting shifted to fuel supply chains, storage facilities and railway infrastructure, together with seemingly casual retaliatory missiles hitting civilian targets like shopping malls and railway stations in the middle of the cities, such as the Kramatorsk railway station attack on 8 April 2022 and the city centre shopping mall attack in Kremenchuk on 27 June 2022.

Autumn illustrated yet another change in the Russian bombing campaign – the Russian retreat in Kharkiv and Kherson resulted in a change in leadership over the Ukrainian campaign. On 9 October 2022, General Sergey Surovikin was appointed as the new commander of the Russian forces in Ukraine. He was known as 'General Armageddon,' the orchestrator of the indiscriminate Russian bombing of Syrian cities. As the saying goes, an old dog cannot be taught new tricks. The next day, a massive bombing of the entire territory of Ukraine took place, targeting civilian infrastructure and especially the electricity grid. On that day alone, 84 missiles and 24 loitering munitions (also publicly known as Shahed 'kamikaze drones') were launched.[20] In order to cause greater damage and casualties, the timing was chosen as early morning on Monday when people would be going to work and preparing to travel for their daily chores. From that day on, the bombing intensified, and the regular bombing of entire country continued, further targeting the electricity grid aimed at forcing the Ukrainian people into submission through deprivation of

electricity, heating and water supplies. After the Ukrainians regained Kherson on 11 November 2022,[21] bombardment intensified with a particularly severe attack on 15 November (around 100 missiles) and 23 November (70 missiles launched), resulting in severe blackouts due to disruptions of electricity production, transportation and distribution of electricity. Zaporizhzhya nuclear power plant, Europe's largest, had no external electricity supply and operated on diesel generators.

Despite the intensification of the Russian bombardment, the Ukrainian air defences were regrouped and readjusted to the variety of the attacks, with consequent improvement of the interception rates from 20–30% in March–April 2022 to 50–60% in June[22] and 70–80% in November. According to Commander-in-Chief of the Armed Forces of Ukraine, Gen. Valery Zaluzhny, the effectiveness of the Russian ballistic missile attacks was equivalent to the coefficient of 0.76, meaning that out of 100 launched missiles, 24 would get through.[23] The improved interception rate was significantly conditioned by the greater availability of air defence systems and ammunition provided by international partners. The Norwegian Advanced Surface-to-Air Missile System (NASAMS) was highly praised.

Overall, there are a few observations to be made about the Russian bombing campaign. First, indiscriminate use of mass without linking it to carefully chosen targeting lists with clear strategic effects would mainly empty stockpiles. Second, shifts between targeting priorities was an adjustment to the course of the war. However, it did not make the strikes more effective, especially with improving Ukrainian air defences. Third, targeting the civilian infrastructure most certainly had two intentions. From the military perspective, the dispersion of the attacks across the entire country was aimed at exhausting Ukrainian air defences and redirecting valuable ammunition for interception purposes – highly technological ammunitions that could be used against Russian aerial capabilities or at the frontline. From the psy-ops perspective, Russians assumed that they would gain success where the Nazis had failed before – reducing the people's morale to fight by indiscriminately bombing cities and civilian infrastructure. This war has shown that indiscriminate bombing of civilians only makes Ukrainians angrier and strengthens their will to fight.

On air defences

Military necessity gives birth to various innovations and unconventional solutions. The Ukrainian system of air defence is such a case. According to the spokesperson of the UkrAF, Yuriy Ignat, the Ukrainian air defence system was distinctive since it utilised assets from various sources and domains. It initially employed Soviet air defence systems combined with attack aircraft and MANPADS. People with MANPADS were then spread across the country and various observation posts were established.[24] Hence, different means provided varying range and more diversified cover of the key objects from the Russian missile and loitering munition attacks. However, the necessity for more advanced Western air defences arose because of

the diversity and intensification of the Russian long-range ballistic missile attacks since 10 October 2022. For instance, one of the challenges was shooting down Iskander missiles since they were flying very low and Kindzhal missiles travelling at high speed. Hence, more technologically sophisticated Western technologies like NASAMs, IRIS-T and Patriot systems were required to counter this faster and more sophisticated side of the Russian ballistic missile capabilities used in attacking Ukraine.

One of the obvious challenges of Ukrainian air defences was the complexity of integrating different capabilities with varying technological characteristics and logistics requirements into a single functional system, avoiding conflicts, fratricide and duplication of effort. Indeed, the UkrAF managed to get the most out of different air defence systems provided by international partners. The issues of deconfliction and integration of technologically different air defence equipment into a single system of national air defence was achieved by utilising diverse means ranging from attributing separate areas of responsibilities to different assets and combining a balanced approach in centralisation and mission command. Different air defence systems would also have dissimilar ranges and varying utility across the country and against specific threats. Hence, combining various assets allowed to cover some gaps and improve the success rate of the air defences.

One of the widely discussed themes in this segment of air war was the correlation between the numerical side and costs. The war of attrition with Russian long-range missile barrages and Ukrainian utilisation of the more sophisticated Western air defences would inevitably come to the question of who would have the most missiles to last the longest, along with the cost of the more sophisticated technologies that require more time for repairs and manufacturing in the quantities that the war demanded.[25] However, due to sanctions and disruption of supply chains, Russia could no longer manufacture its ballistic missiles at the same rate or quality as before. In the case of Ukraine, the solution to this challenge was combining cheaper air defences options against threats like Shahed kamikaze drones. For instance, if they were launched during the daytime, then large-calibre machine guns or other small arms could be effectively used to shoot them down.[26] The primary necessity with the Shahed drones was to have radars with suitable characteristics to identify their trajectory, while various cost-effective means were used to shoot them down. Hence, more sophisticated Western air defences like the Patriot system were crucial against more advanced Russian ballistic missiles like Kinzhal.

Drone warfare

Drones became the central part of the war in Ukraine. Fewer numbers of manned aircraft and their necessity for repairs after the first engagements and mutual air denial inevitably resulted in the gap in aerial capabilities across various roles of air power. Previous purchase of Turkish TB-2 Bayraktar drones, customisation of

the commercial drones and new production of Ukrainian innovations of drones suggested new trends in modern warfare and the place of UAVs, RPVs and loitering munitions in inter-state warfare.

From the very beginning of the full-scale invasion, Bayraktar drones were used for ISR and precision strikes on Russian convoys and C2 locations and places of force concentration since Russian air defences were focused on the cover of the frontline. Often, they were used as decoys to lure Russian aircraft to lower altitudes. However, having realised this vulnerability, Russians also focused on the cover of their logistics chains. As a result, Ukrainian TB-2 became used in more complex attacks under more favourable conditions, like in the case of Snake Island and air and naval combined drone attacks on the Russian Black Sea fleet in Sevastopol. The Russian equivalent to TB-2 was the Orion drone. Strictly military ISR UAVs like the Ukrainian SKIF and Russian Orlan-10 were relevant for each side since they could fly at medium altitudes and could provide substantial imagery for rapid fires.[27] Russia was frequently using Il-20M for gathering signal intelligence, on the tactical level. At the same time, Russian UAV 'Granat' of various modifications and Orlan-10 were aimed at collecting ISR for SOF and troops on the ground. Regarding the tactical ISR purposes of the Ukrainian SOF, the United Kingdom and Norway purchased for Ukraine Norwegian-produced micro-drones Black Hornet, which is the smallest ISR system in the world and is often used by the SOF for immediate tactical intelligence.

Another distinctive feature of the war is the increased use of commercial drones for numerous military purposes. First of all, simple and cheap drones were used for the tactical level ISR purposes of monitoring the movement of the Russian troops, spotting artillery pieces, inspecting buildings and documenting Russian war crimes on the ground[28] and even for dropping small munitions. Customisation of commercial drones and assembling of small drones started from the very beginning of the invasion. Various engineering faculties, like the Igor Sikorsky Kyiv Polytechnic Institute, started modifying and making small drones for custom requests of specific units of the UAF.[29] Often when the scale of these grassroots initiatives was expanding, Ukrainians living abroad would crowdfund purchases of materials or general drones for further customisation in Ukraine.

In one of his social media posts Gen. Zaluznyy wrote: 'In wars of such intensity and scale, technology plays an important role. Aerial reconnaissance increases the situational awareness of commanders on the battlefield.'[30] In that post, he specifically referred to the work of a widely known division of aerial reconnaissance in the UAF, known as 'Birds of Madyar' led by Robert Brovdi. The activity of his unit illustrated the fullest potential of the UAV in monitoring the frontline and delivering attacks on Russian positions across the frontline. At one point, their unit was based in the Bakhmut area.

This unit employed various civilian drones, such as the widely used DJI Mavic. They also used crowdfunding to purchase drones for night-time use. Furthermore, with the Ukrainian objective of crowdfunding the Army of Drones, and intensification of the warfighting, the demand for civilian and military drones did not subside.

Therefore, it could have been more cost-effective and timely to have the capacity to alter drones according to one's needs. While spare parts could have been a challenge, Robert Brovdi found an innovative solution: he bought 3D printers and used them to print the required elements for the civilian drones to carry munitions. These drones would then deliver munitions to bomb the Russian trenches.

Another development in the aerial drone side of the war was the improvement of previous test projects and the development of new drone technologies by the Ukrainian military industry. For instance, in 2021, Ukrainian Infozakhist Research and Production Center was already testing its Airborne Warning & Control System (AWACS) Gekata based on PD-2 drones, a system that is capable of reconnoitring targets within 450 km reach and could detect ground and air signals in real time.[31] Since the invasion, these drones and systems were widely used for UAF purposes. For instance, the Back and Alive Foundation purchased 20 drones and 10 ground stations for them.[32] Another response to the demands of ISR and fire coordination was Ukrspecsystems' development of reconnaissance and fire coordination drone, Shark for deep penetration of temporarily occupied territories. Punisher attack drones were used for a short range of 45 km to fly reconnaissance, attack and transport missions in support of the tactical needs of SOF.[33]

One of the most significant developments in Ukrainian military drone manufacturing became the long-distance strike drones. This topic received much attention and was characterised by some speculations. While various military developments during the war were classified and found well-protected, there were also trends in the development and testing of pilot projects prior to the beginning of the invasion. One such project was the long-range attack drone Falcon-300, which could operate at an altitude of 12 km and, depending on the engine, could have a flight range from 1,000 to 3,300 km.[34] Design bureau Luch also produces Skif or Stugna man-portable anti-tank guided missile systems and missiles for Ukrainian MLRS Vilkha. It was equipped with another Ukraine-manufactured equipment – an optical aiming station 'OPSN' produced by Izyum Instrument-Making Plant. This example illustrates a few very important features of the Ukrainian military aviation industry. First of all, as the cradle of manufacturing for the Soviet military, Ukraine preserved its military industry on a smaller scale but still effective and functional despite the three tumultuous post-Cold War decades. Second, the knowledge base and skills for developing innovative projects and production were still there. Third, during war, the necessity for the final product within a short time frame dictated a reduction in red tape and any other restrictions that would often prevent various projects from going forward. Finally, this means that Ukraine's new drones and long-range striking capabilities are the result of many years of work. The achievements of these efforts became vital during the full-scale invasion.

Despite the apparent advantages of the drones, the enemy forces identified and took advantage of their vulnerabilities. The early use of drones and their success was gradually overruled by strengthening Russian electronic warfare assets (such as the Shipovnik-Aero) at the established frontlines and the concentration of

effort in Donbas. This resulted in significant disruption of navigation and directed artillery against Ukrainian aerial assets. Despite the stated advantages of the UAVs, their survivability was not very high. Some 90% of the UAVs used by the UAF in the first stages of war were destroyed, with the durability of quadcopters being three flights, while that for fixed-wing UAVs was around six flights. The number of flights could be improved: 'skilled crews who properly pre-programmed the flight path of their UAVs to approach targets shielded by terrain and other features could extend the life of their platforms.'[35] However, the short lifespan of drones primarily demonstrated the need for their continued supply and the necessity of them being cheap, produced on continuous basis, have a simple delivery, deployment and use.[36]

Regarding Ukrainian electronic warfare (EW) assets, from the first days of invasion, mobile EW and electronic intelligence units were spread across the country to detect, identify and localise threats through their distinctive radiated electromagnetic energy. The gathered formation is then sent to the field commanders. The UAF operates varied anti-UAS systems: complexes include "Bukovel-AD" (UA), "Nota" (UA), "Enclave" (UA), "Mandat" and R-330KV1M (UA), "Polonaise" (UA), VAMPIRE (USA), Blighter Surveillance Systems A422 (UK); portable anti-drone systems (anti-drone guns) include Antidron KVSG-6 (UA), RG-7 (UA. Soon to enter service), EDM4S Sky wipers (LT), Nightfighter (UK) and Drone Defender (USA). Furthermore, Ukrainian engineers developed small 'trench' EW devices for the frontline.[37]

One of the initiatives reflecting the demands of the battlefield was the idea of developing high-speed kamikaze quadcopters to be used against tanks, penetrate enemy dugouts, catch relatively slow Shahed loitering munitions, and detonate them in the air. The primary challenge of the project was not the manufacturing technical side, but finding highly skilled drone pilots. The quadcopter pilot school aimed to develop pilots with relevant skills in using quadcopters to their full potential against various targets and in many tasks. The focus was also placed on the role of drones in urban warfare, specifically in using small, light quadcopters to check buildings for the presence of enemy forces or explosives. In January–March, the centre aimed to prepare 100 pilots and 100 copters to support the UAF.[38]

Personnel, training and skills of Ukrainian military aviation

The air war over Ukraine illustrated that the time of heroic air battles, dog fights and human potential in aerial war is far from being over. The examples of the heroism of Ukrainian pilots fighting for the freedom of Ukrainian skies while outnumbered by Russian aircraft will become part of the history of modern warfare. One such example was the pilot of the 40th tactical aviation brigade, Oleksandr Brinjala, who, with his wingman, fought against 12 Russian, more-modern attack aircraft. This resulted in taking down three Russian aircraft at the cost of his life.

The spokesperson of the UkrAF, Yuriy Ignat, was convinced that despite the technological advantages on the Russian side, Ukraine could redress the balance and

achieve positive outcomes in close combat primarily thanks to the highly trained skills, professionalism and motivation of the Ukrainian pilots.[39] Despite their numerical and technological advantages, the Russians failed to gain air superiority and became afraid of entering Ukrainian airspace because of the skilled and highly trained Ukrainian aviation, among other reasons. The UkrAF proved itself combat-ready already in 2014, but the next interim years of war were used effectively in preparing the service for the inevitable fighting of the known enemy. Accordingly, Ukrainian aviators focused on training to adjust to various potential scenarios. During the flights, they trained aviation to exit from under attack, to operate from the operational (dispersed) airfields, to dogfight in air battles, to learn how to shoot down cruise missiles by training on the Soviet Tu-143 Reys (unmanned reconnaissance aircraft); how to drop bombs; to restore aircraft damaged in the battle in the quickest way; and how to conduct search-and-rescue missions for downed pilots.[40] Furthermore, pilots were trained to land and take off from almost any relatively suitable surface. One of the training processes included 'touch and go' landing on temporary airstrips, usually highways, which in essence meant that once the chassis touched the ground, the pilot had to move to the take-off phase immediately.

These skills were essential for the survival of Ukrainian military aviation in the first days of the full-scale invasion. According to the Commander of UkrAF, Lieutenant General Mykola Oleschuk:

> Thanks to these skills, the enemy did not manage to destroy our aviation at the base airfields. Instead, the Ukrainian pilots came out from under the attacks and immediately began to destroy the enemy in the air… On the first day, Ukrainian Su-27 pilots destroyed two state-of-the-art Russian Su-30SM in dogfights. On the critical route near Gostomel, Su-24M bombers, Su-24MR scouts, and Su-25 attack aircraft regularly launched powerful rocket-bomb attacks against the Russian landing force, which was trying to hold the strategic bridgehead.[41]

In the interview, Commander of the 831st Tactical Aviation Brigade of the UkrAF, Colonel Oleksandr Mostoviy commented on the events of the first hours of the full-scale invasion and taking aircraft out of the airfield in complete darkness*:*

> There was a warning that the runway might be damaged. That is, there was no certainty that the takeoff would be successfully completed. Turned on the headlight, took off, the strip was partially damaged, and after that, one by one, all the planes took off.[42]

Regarding the Anti-Aircraft Defense Missile Artillery Forces within the UkrAF, they have gained combat mission operational experience since 2014, primarily focusing on the East of Ukraine, with occasional shooting down of Russian reconnaissance UAVs. Their skills were further honed during annual exercises at the Yahorlyk training ground, focusing on anti-aircraft combat, manoeuvring,

autonomous performance, joined actions with aviation and repelling a massive air attack as part of a group. In the battlespace of the full-scale invasion, these skills were further tested with 'the constant necessity of changing positions, entailing the need for rapid deployment, withdrawal, the establishment of communication and logistics, choosing positions so that enemy pilots did not even guess where the missiles would fly at them from…'[43]

One segment of the UkrAF that suffered the most during the first few days of the full-scale invasion were the radio engineering units, since, due to the nature of their work, the radio stations were less mobile. According to Lt. Gen. Oleschuk:

> A functioning radar is the No. 1 target for anti-radar missiles. It is like a person with a flashlight in the dark. If you turn it off, you become invisible. But without them, our defense forces and aviation cannot fully function. Every locator knows this well. And despite everything, these brave warriors tried to conduct reconnaissance of the airspace continuously.[44]

They were targeted by Russian elite SOF and airborne troops, and missiles were sent against them, but despite being injured and losing their brothers in arms, they continued to provide critical information about the airspace. Radio-engineering units located closer to the Russian border, also had to be engaged in the ground fighting to defend their positions. Furthermore, after the initial numbers of the Russian aerial assault were reduced, Russians adapted and began using gained knowledge of the terrain flying along the riverbed, hiding behind the terrains and hills, and widening the use of electronic warfare. However, in its turn, the UkrAF adapted its air defences by placing radars in the most favourable locations, creating mobile fire groups, and employing some tactical tricks which allowed to detect Russian aircraft, missiles and loitering munitions.[45]

Regarding the formal military education of the Ukrainian pilots, during the eight years of war, the focus in training was placed on improving flying skills and upgrading pilots' qualifications to pilot of the 3rd class in the Kharkiv National University of the UkrAF named after Ivan Kozhedub. Graduates of this university would join their respective brigades already with 200 hours of flying time, a few months later they would be put on combat duty of the National Air Defences. Both air force and army aviation pilots would participate in various annual exercises locally (including strategic command and staff exercises) and with international partners. During these exercises, one frequently practised tactical technique was getting out or escaping a missile attack on an airfield.[46]

Russian pilots training and experience

Regarding the Russian operational experience and training, various gaps were revealed in their performance in Ukraine. From the beginning, their sorties illustrated great self-confidence and assumption that no obstacles would be faced. The effective

opposition of the UkrAF from the first days in the Battle of Kyiv shocked Russian pilots. Even greater shock was the inconsistency between their pre-planned and indoctrinated flight patterns compared to the more sophisticated manoeuvrability and skills of Ukrainian aviation. Even the further stages of mutual learning and adaptations illustrated that the VKS was adapting slower, and technological and numerical superiority did not provide the desired advantage in the air.

Although the high expectations of the VKS were heralded across the world, emphasising their operational experience in Syria, Crimea and Georgia, the sporadic attempts at air–land integration were not at that scale and the missions flown by the VKS were not of the same complexity, depth and in a such contested environment as in Ukraine in 2022. Accordingly, their primary tasks in those operations were primarily air-to-ground with limited engagement with aerial assets of the defending sides or strong air defences.

From the perspective of training, the VKS demonstrated a reduction in flying hours, with the annual 100–120 flight hours for a fighter pilot, 120–140 for military-transport pilots, 100 hours for long-range and army aviation pilots.[47] This is below the NATO standard of around 200 hours. The quality of the training remains unknown. Although various exercises of the VKS focused on the usual training of low and high-altitude flying, night-time and bad weather conditions, their primary limitation and consequent disadvantage in the actual warfighting was the lack of integration with larger formations. Furthermore, although Russians employed precision-guided munitions (PGMs) in Syria, that did not necessarily reflect changes in their training.[48]

Furthermore, the quality of flying would also differ between generations of pilots: Soviet old-school ones would normally have far more flying hours and experience. On the other hand, their involvement in the war in Ukraine illustrated that they did not have much better adaptability but showed the indoctrinated Soviet style of flying according to directives rather than taking advantage of the opportunities arising. Furthermore, going by the book made Russian flying predictable for the Ukrainian pilots, since they knew that book very well and could take advantage of that knowledge.

Another important aspect to consider is that the experience accumulated by the Russian pilots in the previous wars has significantly declined with their losses of pilots in the downed aircraft in Ukraine. Although Russians focused on educating, training new pilots and retraining the pilots from civilian aviation, they did not have the same experience of fighting complex sorties and manoeuvres in the Ukrainian air littoral as Ukrainian pilots. For that very reason, they are hiding in the safety of their airspace. Skills-wise, Russian pilots are no match to Ukrainian ones, illustrated in tactics, employment of dispersal and taking full advantage of air littoral, and integration with the ground forces and GBAD. The primary advantage of the Russians was technological superiority. That is why the primary theme of this year of the full-scale invasion was the necessity of providing the UkrAF with Western combat aircraft. Combined with the skills of Ukrainian pilots, they would

have already changed the course of war. Ukrainian pilots and the UAF have proven their skills more than once. They have learnt and adapted and made the most of the available technologies.[49]

Points for consideration

The air domain of the war in Ukraine illustrated some enduring features that extended across domains, together with more distinctive and applicable ones specifically for the air. These observations and characteristics of this war provide a fruitful field for exploring what constitutes modern, effective and resilient air power and which tools enable greater readiness and effective performance in the modern battlespace.

First, doctrine, training and exercises are aimed not only at teaching how to fly a certain number of hours but how to gain relevant skills per modern standards. The VKS illustrated the hazard of indoctrination of the rigid flying practice for decades, without training the full spectrum of skills required for innovative thinking and adaptability under the conditions of diverse fighting environments. On the other hand, UkrAF used Soviet doctrine as a toolkit to unravel the enemy's behaviour and prepare relevant skills and manoeuvres to outmatch the enemy's technological and numerical advantage. Furthermore, the conceptual component can provide so much, but it cannot be a substitution for the practice of flying different missions in all weather and joint exercises. The UkrAF combined the best of both worlds – knowledge of the enemy's Soviet school of doctrine and training and having access to the Western military education and joint exercises, taking full advantage of the eight years of war in developing multi-faceted skill set and the inherent Ukrainian will to learn practical skills and learn fast. Hence, this case shows not only that the preparation of the pilots requires systematic approach across doctrine, training and exercises, but also a suitable organisation and strategic culture for the innovative and adaptable skills to be developed and practised in the battlespace. Historically, the Ukrainian side had been known to be innovative and adaptable, while the Russian side did not manage to break away from the Soviet past and practice.

Second, in discussing mass and cutting-edge technology dichotomy, the air war over Ukraine illustrated that numerical superiority does not guarantee victory or even air superiority. Once again, purely numeric and mass approach to structuring the VKS revealed more shortfalls than provided anticipated overwhelming superiority. Although large numbers of available aircraft would suggest mass supremacy, not having the experience of complex multi-aircraft operations, and consequent simultaneous and for that matter continuous use of multiple aerial assets in a single area of operation inevitably revealed logistical shortfalls, such as lack of sufficient air-to-air refuelling, repairing and wearing out of those assets, further complicated by blue-on-blue fire.

Furthermore, the complexity of war in Ukraine and the use of the full vertical depth and the necessity of various missions to be flown in support of the ground

troops, illustrated that despite the total mass numbers of the overall fleet, the primary functionality and demand was for multi-role aircraft for multiple purposes. In its turn, it placed greater pressure on the scarcer cutting-edge side of the Russian aerial fleet, not only in terms of more frequent use and wearing out of the materiel but also the gradual increase of the losses of the more frequently used assets. Personnel-wise, despite the number of available aircraft for flying, soon the primary scarcity of the VKS became skilled pilots. This scarcity became conditioned by the high losses of downed aircraft in Ukraine and the lack of sufficient planning for teaching and training pilots for wartime requirements.

From the perspective of long-range ballistic missiles, the mass approach was also beginning to prove counterproductive. Although Russia could sustain continual ballistic missile attack campaigns almost throughout the entire war and damage a lot of Ukrainian civilian infrastructure and obliterate cities, as in Syria, the stockpiles even of the Russian mass-structured arsenals proved to be far from non-exhaustible without the availability of Western microchips and spare parts used in manufacturing and putting navigation on their ballistic missiles. As a result, Russia had to get cheap Iranian drones to sustain its mass attacks, as well as buying more missiles from the other 'allies' it still had left.

Regarding air denial, the UkrAF in fact utilised assets from multiple domains in projecting power into aerial one posing challenges to the enemy across different altitudes. This illustrated even greater cross-domain dependency and hence the necessity of cross-domain deconfliction and integration of the military assets. Finally, by extension from the previous points, there should also be a balance in the preparation of pilots for both manned and unmanned aerial assets. While UkrAF had a program for the preparation of the pilots for manned aircraft, additional effort and initiatives were launched already during the full-scale invasion to prepare drone pilots for anti-tank warfare. One of the current Western debates is whether to provide all services with UAVs and RPVs and to what extent, which of course will increase demand for RPV-piloting skills and their training.

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7

THE MARITIME DOMAIN

Unlike the aerial and land domains covered in the previous two chapters, events in the maritime environment were more sporadic due to various factors, starting with the primary disparity between the Ukrainian and Russian Navies and the consequent destruction of the Ukrainian naval assets in the early stage of the war. Nevertheless, this chapter addresses the maritime domain, focusing on capabilities and the employment of naval assets in the war, identifying various gaps in the available resources and warfighting requirements, and the implications of these experiences for sea power.

Unlike the two previous domains, events occurring in the maritime domain are less covered in the public sphere. This is partially conditioned by a certain sea-blindness, in a more abstract use of the phrase. Since the outreach for these events and their consequences might be more difficult to register, in contrast to those in the air and land domains, the sea clashes and their implications tend to be less well covered in the newsfeeds or discussed in detail within the evaluation of developments in this war. Accurate situational awareness in the sea requires military-grade equipment and capabilities across various domains. While it can be attained by the fighting sides and NATO, it is far more difficult to obtain accurate and cross-verified information on the events in the sea domain compared with those on land and in the air. Nevertheless, this chapter looks at the most significant events in the maritime segment of the war and various trends within it.

The context

As with any national military service, historical and cultural contexts are essential in understanding the rationale for various decisions in procuring specific capabilities and their place in the overall intention and strategy of fighting a war with a distinctive

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opponent. The Russian Navy was no exception, and it is important to consider the Cold War design legacies that defined the Russian approach to their naval capabilities and their employment. Although Stalin had great hopes for the huge Soviet Navy to counter British and American mass and technological advantages, the experience of World War II reduced these hopes to a more modest approach of focusing on asymmetric capabilities in countering NATO's advantages in the domain. Hence, the focus was placed on building small vessels, naval aviation and submarines, while the primary strength of the Russian war machine was in a strategic nuclear deterrent and massive ground forces. Various organisational and cultural changes are often driven by visionary individuals, which for the Russian Navy, was Admiral Sergey Gorshkov, who focused on revamping the fleet for blue water operations and developing what he called a 'balanced fleet.'[1] This meant refocusing on cutting-edge technology, carrier killer missiles, a much more extensive and capable submarine fleet and heavier naval aviation. He highlighted the strategic role of the Soviet Navy as protecting the strategic missile submarine fleet, which inevitably brought the service out from under the shadow of the land-centric thinking of warfare and the role of various domain-specific capabilities and services.

This historical context and the design legacy decisions of the 1970s and 1980s impacted the modern Russian fleet and its distinctive approach to warfighting. While the Western approach to navies focused on protecting their aircraft carriers as the means of destroying adversaries' fleets through massive air attacks, the Soviet fleet focused on the supreme concept of firepower and gaining the advantage in long-rage fire exchanges. The primary implication of this focus was reflected in the design decision to place more long-range missile systems on the decks, using all possible space for the heavier equipment in support of firepower while reducing the convenience of maintenance and access for personnel. The combination of heavier weaponry, ammunition loads and jet fuel on the decks also meant that such ships were much more explosive in and of themselves due to the threat that ammunition would ignite.[2] The next stage in Russian naval development was its decline during the 1990s due to the collapse of the Soviet Union and the breakup of the service structures, maintenance services and military industry. During Putin's time, the Navy was revamped with an additional focus on placing more of the long-range Kalibr cruise missiles on Russian ships, which became known as the Kalibrization of the Russian fleet.[3] This feature will become particularly palpable with regard to the Ukrainian infrastructure during Russian long-range cruise missile strikes.

Preparation

Since the annexation of Crimea, the Russian Black Sea fleet has doubled in size. Before the full-scale invasion, the Russian Black Sea fleet consisted of 6 submarines (Kilo class), 6 surface combatants (the flagship cruiser *Moskva* and 5 frigates), 36 patrol and coastal combatants, 10 vessels devoted to mine warfare

and 10 amphibious assault ships and landing crafts. Using the pretext of exercises in 2021, the fleet was further strengthened by six amphibious ships from the Baltic Sea and Northern Fleets, including their personnel and equipment.[4]

Among the national armed forces, Ukrainian maritime capabilities were the least prepared for country's defence. At the start of the full-scale invasion, the Ukrainian Navy had one frigate, twelve patrol and coastal craft (including one corvette), one mine warfare vessel, one amphibious landing ship, one amphibious landing craft and eight logistics and support vessels.[5] After the Ukrainian frigate *Hetman Sahaydachniy* (U130) was stationed for maintenance in the port of Mykolaiv, it was then scuttled in early March 2022 so that the Russians could not take it.

Russian numerical and technological superiority was greatly felt in this domain, primarily because Russia prioritised naval assets in its modernisation campaign long before the invasion. This modernisation was influenced by the power projections its naval capabilities allowed in various regions, most importantly in controlling the Black Sea area and sustaining Russian claims in the Arctic region.[6] In contrast, after 2014, Ukraine had to start almost from scratch because the Ukrainian Navy lost 75% of its personnel and 70% of its ships and critical infrastructure after the annexation of Crimea.[7] Thus, for the first eight years of the war, the naval capabilities had to be restructured, modernised and increased in numbers. While some effort was made during this time, the systematic approach identifying a clear naval force design and its capabilities for the Ukrainian Navy 2035 was developed only in 2019 and contained in the Strategy of the Naval forces.[8] The strategy identified the main capabilities and three stages of their acquisition and the expansion of the area of control and influence. The first stage (2018–2025) was to focus on maintaining maritime domain awareness in the coastal area (40 nautical miles [NM]) by developing ISR capabilities. Second, sea denial assets, such as mine-barrier installation, electronic warfare and employment of coastal defence capabilities to protect the littoral, were to be acquired. The third priority in this stage was to establish sea control by 'build-up of ranger, convoy and patrol boat capabilities to ensure navigation in the littoral zone and in the estuaries, establish an effective system of port infrastructure protection through development of counter mining, counter sabotage, search and rescue capabilities.'[9] The next stage (2025–2030) was to build on the developed capabilities and extend sea control to Ukraine's exclusive economic zone (EEZ) to the area of 200 NM in the Black Sea and the Sea of Azov. An increase in long-range precision antiship systems was to be emphasised. The last stage in 2030–2035 was to develop a sufficient contribution of the Ukrainian Navy to the blue water missions undertaken by allies in Europe, NATO and the UN.[10]

This strategy did not see its full implementation due to factors beyond the full-scale invasion, but some modernisation and strengthening of the Ukrainian naval capabilities did take place. First, to strengthen the ISR on the surface, Ukraine purchased the multifunctional radar complex 'Mineral-U.' This system allowed the detection of active and passive modes and the identification of surface targets at

the 500–600 km range. It was supposed to work with the coastal mobile antiship missile complex Neptune, designed by the bureau 'Luch.' The Neptune's range is 280 km with a sea-skimming feature,[11] meaning that the missile is flying at a very low altitude, decreasing the chance of radar detection by its target in the sea. The first battalion of Neptunes was to be deployed in April 2022. Although the full-scale invasion speeded up the transfer of these systems, their full readiness required more time and a more significant number of missiles for these complexes. The issue with this capability was soon resolved when Ukraine was provided with the Harpoon antiship missile system with a similar use to that of the Ukrainian Neptunes. The Neptune system became famous for sinking the Russian cruiser *Moskva* on 13 April 2022. Other aspects of improving coastal defence included strengthening coastal artillery, mine-blocking activities and radio-electronic warfare.

Objectives and actions

Russian objectives in the land and aerial domains were very straightforward, with the land domain more dependent on the physical characteristics of the terrain, while in the case of the aerial domain, more flexibility and freedom for manoeuvring were allowed by the vertical depth. In the case of the maritime domain, geographical specifics played a significant role similar to the more fixed characteristics of the land domain. During the eight years of war, the Russians had become more accustomed to using the Sea of Azov as their internal lake, suppressing the freedom of Ukrainian naval traffic and access to its ports. Russia's first objective was to gain command of the Sea of Azov to blockade the Ukrainian ports in this sea, such as the ports of Berdiansk and Mariupol. This was to facilitate naval support of the Russian movement on the ground and the building of the Crimean bridge to establish a land connection between Russia and Crimea. This support was conducted as firepower, amphibious landing and supply reinforcement. The significance of the city of Mariupol was twofold – it was a seaport in the Sea of Azov and a focal point in gaining land access to Crimea.

Russian fixation on a land path to Crimea was conditioned by the unchanged importance of the Sevastopol base for control of the Northern Black Sea and its inherent vulnerability to interruptions in supply. Logistics were dictated by the distinctive geography of the Crimean Peninsula, which was open on all three sides for sea assault and linked by a narrow strip to Ukraine. If Russia had not taken two-thirds of the Ukrainian fleet in 2014, the Russian positions in the Black Sea and their control of Crimea would have been much more contested.

The next natural objective was to gain control of the Black Sea and suppress Ukrainian naval assets in the ports. The far-reaching objective was to cut Ukraine off from coastline access by controlling various ports and conducting amphibious landings to enable further progress by the ground troops. Russia would factually blockade Ukraine, denying it additional maritime routes to support its economy, and providing additional tools in its hunger tactics to pressure Ukraine and the

international community. The achievement of the enabling role of maritime power – command of the sea – provided Russia with opportunities to project power in support of its ground campaign. The role of the Black Sea fleet was primarily to blockade the Ukrainian coastline and conduct a long-range attack campaign deep into the country's territory using Kalibr cruise missiles.

In Russian planning for the invasion, amphibious forces had their role. Two amphibious task groups were created to be used in landing along with the ground advancement of the Russian troops in the southern direction towards Kherson, Mykolaiv and Odesa. They were to be employed after the initial invasion but before the ground troops arrived in the area. Their tasks included seizing main intersections and chokepoints to facilitate further movement of the ground troops in the Mykolaiv area.[12]

Although Russia obviously had complete numerical superiority in the maritime domain and soon was able to achieve most of its objectives in that domain, the immediate limitation that would prove significant in the further development of the war was that Turkey, on 28 February 2022, exercised its right under the Montreux Convention to close the Dardanelles and Bosporus Strait to the entry of combatant ships during the conflict. This meant Russia could not reinforce its Black Sea fleet from its bigger fleets in the Baltics and High North. Since Ukraine did not have naval assets equivalent to the Russian Black Sea fleet, naval specialists indicated that the primary means of counter action would be ground-based coastal sea denial fires, mine warfare and the use of small craft.[13] However, as the war progressed, Ukraine's unconventional approach to tactics and the employment of innovative equipment illustrated new ways of degrading the enemy's maritime assets –using unmanned sea vehicles (USVs) combined with other assets.

From the first days of the invasion, the Russian fleet suppressed Ukrainian vessels in the ports and quickly began blockading the country by closing the Kerch Strait connecting the Sea of Azov to the Black Sea. Blockading Ukrainian ports in the Black Sea and closing transportation routes to the Sea of Azov meant the complete denial of any chance of transportation and resupply of the Ukrainian troops in the east via the sea.[14] Although the argument of the convenience and speed of the sea route in providing supplies for various port cities like Berdiansk and Mariupol could be considered sound in peacetime, the route into the Sea of Azov was dangerous even before the invasion due to Russian *de facto* control of the strait and the sea. Even if the Russian fleet was engaged elsewhere, this still would have made any vessel trying to get through an easy target for the coastal artillery from both sides of the strait: Crimea and Russia. Hence, the optimal land route for allied supplies and equipment was to go from Poland to the frontline.

With control over the Sea of Azov, the Russians prepared to launch their amphibious landing in Mariupol. To avoid any potential resistance, the landing was conducted approximately 48 km from Mariupol, closer to Crimea and within reach of various sources of firepower if the need arose. Soon they were engaged in fighting in Mariupol. Although the employment of amphibious assaults was

also expected in the port city of Berdyansk, the city was occupied by Russian ground forces, and only then were amphibious vessels stationed in its port. The vulnerabilities of amphibious ships became evident when the UAF sank the *Saratov* as the ship was offloading at the pier in late March 2022. The lack of helicopter support for the amphibious landing, which is common in Western Navies, made Russian amphibious pier-side supply of the ground forces vulnerable to light antitank weapons, Tochka-U, drone strikes or even the 9M113 Konkurs antitank missiles if they were in the right hands. Despite these vulnerabilities and the exercise of greater caution by the Russians, amphibious reinforcement on the coastline continued.[15]

Traditionally, amphibious operations require the element of surprise and, ideally, some fire coverage from the aerial domain when the landing takes place. Thus, it had a greater chance of success earlier in a war when land defences were not at full strength. One of the much-discussed topics of the sea war in Ukraine is the lack of a Russian amphibious landing in Odesa. As previously stated, Odesa was one of the objectives to provide support for ground troops. The closest Russians came to landing in Odesa was on 15 March 2022, although there had been some indications of preparations to facilitate an amphibious landing. In the pre-landing phase, the Russian Naval and Air Force conducted missile strikes around Odesa, with 90 missiles used to weaken ground-based resistance to the landing. The indications of landing operations included landmine sweepers leading the way, followed by amphibious ships and the formation of the supporting ships were reported. Ukraine was making ground preparations for the defence, including fighting readiness of tanks and artillery located on the coast against potential landing. On that occasion, landing did not occur and was categorised by some analysts as an 'amphibious demonstration,' which is a show of force.[16] Although in peacetime, a show of force can act as intimidation or a deterrent, in wartime, it looks more like hesitation. It indicates the significant vulnerability of amphibious assaults to ground-based fire, especially when there is no close air support (CAS). In this instance, air bombardment served as air interdiction or sweeping of the area before the insertion of the amphibious task group, which without CAS in the event of landing would still be vulnerable to the Ukrainian ground defences.

One of the most prominent occurrences of spring was the sinking of the Russian flagship cruiser *Moskva*. Ukrainian Neptune antiship missiles hit the ship and it sank on 14 April 2022 while it was being towed to a port. The sinking of the *Moskva* raised numerous discussions in professional military circles about how this was possible, the factors that enabled the ship to be sunk and the actual state of the Russian fleet. While there were various theories of how this was accomplished, the official version is that two Neptune missiles launched by Ukraine sank the ship. Two anti-cruise missiles hit the ship on 13 April 2022, resulting in its sinking on 14 April 2022 due to continued fire and flooding while under tow.[17] The primary discussion did not focus as much on the fact that the Neptunes managed to hit their chosen target, but rather on additional factors after the attacks that might

have contributed to the eventual sinking of the ship. Two of the widely discussed issues were the reasons the air defences and the ship's radar did not alert the crew of the incoming missiles and the ineffective handling of the damage caused by the two missiles. According to Chris Carlson, this was due to several factors. Some of these factors were the outdated technological characteristics of the Slava class design cruisers, partial automation of consoles, overreliance on manual servicing of various capabilities, including air defences and a lack of sufficient training for the military personnel and safety protocols.[18] As with materiel in other domains of warfare, one of the arguments is that the Russians focused on the amount of equipment, in this case, equipment located on the ship's deck, rather than investing in the human capital to support all of it. Carlson further elaborated on the personnel issues of the Russian navy. Instead of employing an entirely professional military, Russia used conscripts to man its vessels. The overall length of conscription for all its armed forces was reduced to one year in 2021. Previously, conscription varied between the services and was two years for the Army and three years for the Navy.[19] Although the exact details of the sinking of the cruiser will require an end to the war and an examination of the ship to confirm the factors, the same trend in the Russian approach to fighting power is as evident in the maritime domain as it is in the ground and in the air – economy on personnel skills and training following the Soviet assumption that no one is irreplaceable and the numbers of poorly trained reserves and conscripts can cover the gaps. However, each domain of warfare has illustrated that technological and even basic sophistication and improvements require sufficient skills and training of the personnel and servicing crews. These skills are the ones that need time to build up and be maintained, and they are often missing in the conscripts.

Although this event did not have a game-changing impact on the course of the war, it would have resulted in the loss of a communication infrastructure and anti-ship and air missiles it could have provided for the Russian fleet. This event, of course, had symbolic importance, especially during the tough April fighting. It showed that the Russian Black Sea fleet is far from being invulnerable and would need to approach the Ukrainian coastline at a different distance. The reach of the Neptune missiles is approximately 300 km. This also illustrated that any amphibious ambitions could be very costly over the Black Sea coastline controlled by Ukraine.[20]

Early summer also brought the wider use of TB2 Bayraktar drones near Snake Island. The most important discovery was that Russian Tor and Pantsir air defence systems could not fend them off, and Bayraktar drones managed to take down enemy assault boats and air defences: 'Their biggest coup was hitting a landing craft just as it attempted to disembark a Tor missile system. The sunken landing craft blocked access to the island until it could be salvaged.'[21] Harpoon missiles provided by Denmark further strengthened Ukrainian defences. Their impact was already felt in June when on 17 June, two of them were used to eliminate the support vessel *Vasiliy Bekh*. Tor systems strapped to its deck did not help its

survivability. Harpoons were also successfully used against Russian-controlled gas platforms employed by Russia for surveillance purposes. The use of these combined capabilities against the Russians based on Snake Island and the targeting of their resupply soon resulted in the Russians leaving the island on 30 June 2022. Their further movements were more cautious in August, with assault activities limited to submarines launching long-range cruise missiles against Ukrainian territory, while the Admiral Grigorovich-class frigates were kept at a further distance from the Ukrainian coastline.[22] Additional concerns about Ukrainian anti-ship missiles and long-range attacks caused by further Ukrainian counteroffensives in Kherson, which were evident in long-range attacks on the Russian fleet's HQ and its main naval aviation airfield, resulted in Russian kilo-class submarines being moved from the Sevastopol base in Crimea to Novorossiysk port in Krasnodar Krai, southern Russia.

Unmanned sea vessels (USVs)

On 29 October 2022, the Russian sense of invulnerability and supremacy at sea was also damaged by the Ukrainian assault on Sevastopol Naval Base that targeted ships, including the new flagship frigate *General Makarov* and a minesweeper, using maritime drones or USVs and UAVs. These drones were equipped with explosives that used semi-swarm tactics in attacking enemy ships. Although the damage to the ships did not result in their sinking as in the case of the cruiser *Moskva* and the *Saratov*, it had important implications for the standing of the Russian Black Sea fleet in the region. First, it was once again shown that the fleet was not invincible, even in its own harbour of the Sevastopol Naval Base. Second, USVs and potentially UAVs managed to get through the naval and aerial defences of the well-established Russian military base. Third, it challenged Russian dominance in the Northern Black Sea, and this supported Ukrainian progress on the ground during the counteroffensives and showed that Crimea was far from as secure as Russia wanted to believe. Fourth, the Russian Navy's sense of superiority and security, and their morale were significantly damaged. This was further illustrated in their relocation behind the safety of the Crimean Peninsula and their involvement in long-range cruise missile attacks at even greater lengths from the Ukrainian coastline. Hence, 'a country with no operational navy has overwhelmed a superior enemy at its home base.'[23]

From a materiel perspective, this attack illustrates the overarching theme of this war in various domains – the effective use of Ukrainian innovative asymmetric solutions that undermine Russian numeric and technological superiority. Flagships, frigates and mine sweepers are far more expensive and time-consuming to produce. At the same time, the Ukrainian USVs, despite their relevant modern technological edge, can still be put together in rather undemanding and multifunctional facilities at significantly lower cost and with a shorter time required than manufacturing a cruiser. From the perspective of functions and innovative technologies, many navies

worldwide were developing USVs for purposes other than kamikaze missions, including surveillance, countermining activities and defence purposes.[24] Since Ukraine no longer had a multifaceted fleet, the direct necessities of war dictated innovations and the use of new technologies. In essence, this attack also showed the utility of drone swarms in the maritime domain of warfare. It was certainly a starting point (although not the first time USVs were used in such a role), but as the extent of damage illustrated, greater numbers or more explosives to inflict critical damage would be required to achieve a successful result. Alternatively, a combination of UAVs and USVs could provide the desired effect.

The Sevastopol attack illustrated some relevant considerations for modern warfare. The attack demonstrated the combination of unmanned assets from various domains in achieving the desired effect of reaching the target. The significance of the attacks is not just in employing drones from another domain. In 2017, Houthi rebels used drone boats against a Saudi frigate operating off the Yemeni coast.[25] USVs are much cheaper than their targets, providing the full advantage from asymmetry. They carry more explosives than mines or torpedoes. The primary importance of the current employment of USVs is that the defences focus on countering UAVs. Hence, the focus is on a different domain.[26] The employment of both UAVs and USVs in the attacks illustrates the relevance of distracting attention with the use of UAVs, while the USVs provide the desired kinetic effect or vice versa. Placing this discussion into the multidomain warfare context, each unmanned platform has its characteristics and the advantages and disadvantages of the domain from which it originates. While domain-specific solutions might be viable, drone threats from other domains can overcome even integrated defence systems focused on a single type of unmanned threat originating in a single domain. Thus, with the current focus on UAVs, USVs can pose a more significant threat to naval fleets and coastline targets. For instance, after the success of the Sevastopol attack, USVs were effectively used to attack Russian oil at the Sheskharis oil terminal in Novorossiysk in mid-November 2022.[27] Besides the strategic importance of the fuel storage facilities, the message was very clear – this naval base was within reach of Ukrainian firepower. It is worth remembering that Novorossiysk is the naval base where Russian Black Sea fleet submarines are often hidden as their safest harbour in the entire Black Sea and the Sea of Azov.

While physical restraints are less problematic for the UAVs, they could be more effective in creating barriers to the free movement of the USVs. Accordingly, after the Ukrainian attacks, Russia strengthened its defences of both Sevastopol and Novorossiysk Naval Bases with layers of floating booms. However, unlike ships, oil infrastructure is more difficult to protect.[28] Another important consideration in the defences against drones originating in different domains is their detection:

> Current best practices for detecting and countering UAVs emphasize defence in depth using different types of sensors attuned to different signatures, given

> range differences and detection trade-offs. Although nonaerial drones may give similar types of signatures, the details will be different. For example, acoustic detectors may pick up the unique sound of a UAV engine or whirring rotors, but the engine of a ground or surface vehicle may sound quite different. Plus, how do detection measures hold up when groups of drones attack from multiple angles across multiple domains at once? Only once the drone is detected can defenders respond.[29]

In terms of countermeasures, various tools from jamming to physical barriers might be useful, but their effectiveness would largely depend on the sophistication and technological characteristics of the nonaerial drones, especially in the case of unmanned undersea vehicles (UUVs).[30] Hence, in this new segment of naval and multidomain warfare, adaptations and countermeasures will develop hand in hand with the situational characteristics of the two sides fighting. Another important aspect of this discussion would be establishing the critical mass required to conduct a systematic assault on a military base to achieve damage beyond immediate repair. While swarm tactics across various domains could provide the desired kinetic effect, the issue would be how to preserve a more numeric assault undetected. Aerial assets provide greater reach and access to the desired targets but might be more detectible in the mass swarm, while USVs would have certain limitations of the physical barriers and some naval bases and strategic targets would be more vulnerable to their strikes than others, partially due to their maritime geography and access.

Russian blockading of seaports and hunger tactics

One of the distinctive features of the sea segment was the enabling contribution of the blockading of the ports to the employment of other tactics and the leveraging of influence for the war. Most of the Ukrainian Black Sea ports were used for loading huge quantities of grain and shipments of grain to various countries worldwide. Ukraine is one of the world's major producers of wheat, and it contributed almost 40% of the World Food Program's wheat supplies.[31] The blockade of shipments from the Ukrainian ports, including grain, allowed the Kremlin additional leverage in placing pressure on the Western countries and the global community by blackmailing them with food shortages due to the blockade. Although hunger tactics are not new in Russian practice, the blockade enabled it on a new scale. Russia aimed to use this leverage to reduce sanctions imposed on it and its oligarchs. On 24 July 2022, the UN and Turkey brokered a deal and the 'Black Sea Grain Initiative' was achieved, allowing ships with Ukrainian grain free passage, while another part of the deal allowed the export of Russian food and fertilisers.[32] The next day, Russians bombed Odesa with Kaliber cruise missiles, hitting port infrastructure.[33] Despite the constant dangers of the Russian strikes, grain routes continued until October when Russians

suspended the grain deal after the attacks on Sevastopol naval base. Despite this, grain convoys continued to leave the port of Odesa and deliver food worldwide. Since the deal was brokered, 17.8 million tonnes were delivered to countries in need. According to the UN,

> the critical food supplies, mostly from farms in Ukraine heavily disrupted by the continued fighting in the wake of Russia's full-scale invasion last year, have reached 43 countries since August – more than 40 per cent of them low and middle-income nations, the initiative's Joint Coordination Centre (JCC) said in a Note to Correspondents on Wednesday. In December, exports through Ukraine's Black Sea ports rose to 3.7 million metric tonnes, up from 2.6 million in November, and in just the last two weeks, nearly 1.2 million metric tonnes have left port.[34]

From the fighting power perspective, this case demonstrates the strategic implications of the availability of firepower and hardware in the maritime domain to block civilian traffic on the maritime routes. This caused economic damage to Ukraine and provided certain leverage for the Russians to project power over the global community. Although Russia did not achieve its proposed objective of lifting sanctions, the case still illustrated the significance of a relatively numerical naval fleet with firepower in blockading traffic in the maritime domain.

On mines

Another technological relic of the past resurfacing in this war was the old Soviet sea mines. While their use in the maritime domain has been considered as another illustration of asymmetric response to the numeric advantage of an enemy, they were also used as a means of denial of freedom of movement by restricting traffic for civilian vessels in the Russian attempt to hijack the export of grain from Ukraine and project Russian control over wider areas of the Black Sea region. As a result, the spreading of the loose sea mines that have been detected in various parts of the Black Sea, including Turkish, Romanian and Bulgarian national waters, has raised various questions regarding the borders of the war and its immediate implications on the region and sea traffic through the strait of Bosporus and Dardanelles. Since the invasion, Turkey, Romania, Bulgaria and Ukraine have destroyed around 40 sea mines in the western Black Sea area.[35] However, strictly from the sea warfare perspective, 'old-fashioned sea mines are still effective enough to slow or deter amphibious assault, complicate logistics, and curtail maritime trade.'[36] While traditionally the threat of sea mines was often handled by mine sweeper vessels, in the case of Ukraine, its divers and relevant naval personnel were trained on how to handle the threat of the sea mines by employing uncrewed drones. The Royal Navy's Diving and Threat Explosion group and the US Navy's 6th Fleet personnel taught a six-week course to Ukrainian personnel on how to operate drones for searching the seabed for

mines and unexploded ordnance. The United Kingdom provided six drones, so Ukraine could learn to use them and then employ them in clearing the Ukrainian coastline of mines upon their return home.[37] Previously, Ukrainian divers would have had to conduct searches of the seabed area around the Odesa coastline in person, jeopardising their lives each time.[38] The drone initiative and training was one of the British contributions in countering Russian threats to the safety of the grain exports from Ukraine and employing Russian hunger tactics to achieve concessions on the sanctions imposed on it. Addressing the matter, the then UK Defence Secretary Ben Wallace stated:

> Russia's cynical attempts to hold the world's food supply to ransom must not be allowed to succeed. This vital equipment and training will help Ukraine make their waters safe, helping to smooth the flow of grain to the rest of the world and supporting the Armed Forces of Ukraine as they look to defend their coastline and ports.[39]

On the future of the Ukrainian naval fleet

Despite the actual lack of big ships in the Ukrainian naval fleet, making of the future Ukrainian Navy continued even during the war. On 16 October 2020, an agreement for cooperation in the field of security and defence was signed between Ukraine and Turkey:

> The memorandum enshrines the desire of Ukraine and Turkey to develop their defence-industrial programs and strengthen defense capabilities, as well as to establish mutually beneficial long-term cooperation based on mutual respect and consideration of each other's interests. The document outlines the intentions of the parties to launch and implement joint projects for the construction of warships, UAVs and all types of turbine engines.[40]

The outcome of this agreement was a Ukrainian order for two corvettes to be built by Turkey's RMK Marine Shipyard, with the construction of the first one beginning in 2021. It was to be finished and fully equipped in 2023 for further tests to follow. This plan was made before the war started. However, despite the situation, on 2 October 2022, the first Ada-class anti-submarine corvette, *Hetman Ivan Mazepa*, was launched in Istanbul.[41] It was intended to become the flagship of the newly restored Ukrainian Navy.

Another addition to the Ukrainian Navy came from one of its closest allies – the UK. As part of the British defence review in 2021, 'Defence in Competitive Age,' the United Kingdom was to retire the Sandown- and Hunt-class vessels and refocus on unscrewed minehunters within its £184 million Maritime Mine Counter Measures (MMCM) programme. As a result, two Sandown-class mine hunters were gifted to Ukraine. The extent of UK–Ukraine collaboration established in

2021 regarding the maritime domain was to the extent of acquiring more vessels and building naval bases:

> in addition, eight missile boats will be built according to the requirements of the Ukrainian Navy, the first two of which will be built directly in the United Kingdom, and the other will be built already in Ukraine. The assistance of the United Kingdom in the construction of naval bases on the Azov and the Black Sea is also planned.[42]

The two ships were renamed the Chernihiv and the Cherkasy and sailed under the Ukrainian flag for the first time in January 2023, being based in Rosyth, Scotland, for further modifications.[43]

One of the equipment additions to the Ukrainian capabilities related to the maritime domain was the Royal Navy providing Ukraine with Sea King helicopters. This initiative and the training of ten Ukrainian pilots to operate them was announced on 26 November 2022, with the first helicopters sighted in Ukraine in January 2023. Despite their varied use in the Royal Navy, the exact technical specifications of the three helicopters were not specified:

> in Royal Navy service, the Sea King performed shipborne anti-submarine warfare (ASW), search and rescue (SAR), airborne early warning (AEW), and utility transport. Variants also served in a SAR role with the Royal Air Force. The precise version, or versions, supplied to Ukraine have not been revealed.[44]

In any case, these are additional airborne capabilities for employment in the Ukrainian coastal area.

Points for consideration

Overall, the maritime domain of the Russia–Ukraine war illustrated a less intense and decisive impact of the events on the overall course of war, but it provided a lot of points for discussion in terms of modern warfare and construction of fighting/sea power in this domain. Some trends remain transferable from other domains of warfare already discussed, while others have more domain-specific characteristics. First, as in two other traditional physical domains of warfare, Russian numeric superiority was challenged by asymmetric solutions originating from various domains. Although from the first days of the invasion, Russia could claim that it gained control of the Sea of Azov and the Black Sea by capturing the rest of the Ukrainian vessels and blockading various ports; this control was soon challenged by land-based antiship cruise missiles and even long-range artillery against closer targets in the near-coastal areas. This asymmetry feature illustrates that cutting-edge and precise firepower originating from another domain can significantly undermine more costly and capable equipment in the maritime domain. In this

regard, the sinking of the *Moskva* made the development and manufacturing of Neptunes justified, cost-effective and timely and confirmed the vital necessity of ground-based defences against threats originating in other domains. Hence, to some extent, capabilities from other domains can compensate for the shortfalls in a domain with fewer available materiel, which in this case was the maritime domain.

Nevertheless, control of the sea requires control on the surface, under and above the sea. While coastal defences damaged Russian naval capabilities, they did not fully deny the Russian fleet control of the sea. Domain-specific capabilities exist for a reason – they provide greater freedom of action and power projection in their respective domain. Firepower and power projection from other domains can to a certain extent compensate and provide an asymmetric response, but they cannot fully compensate for the lack of an actual naval fleet and its greater distance in power projection. The loss of the Ukrainian naval fleet, due to treason and defection to the Russian navy during the annexation of Crimea, was felt during the full-scale invasion. All modern technologies require substantial time for development, but this is even more true for naval capabilities on a large scale, like cruisers and corvettes.

The sinking of the *Moskva* exemplified the enduring challenge in the Russian military machine and significant lessons for the construction of viable fighting power in the future – materiel needs to be designed with survivability in mind and not just firepower. Personnel require sufficient training and skill development. The enduring issue for the Russian military is its lack of investment in people in terms of skill development and time devoted to their training. While in land warfare, less-trained personnel can be used for secondary tasks, limiting interaction with high-tech equipment, in more technology-centric domains, such as maritime and aerial domains, lack of training and skills become evident quickly and have devastating results.

As in other domains, the maritime domain observes a combination of old and new assets in power projection and the denial of freedom of action. From one perspective, sea mines are as usable and effective today as they were during World War II; although the scale and numbers might vary, they still deny access to amphibious landing, restrain sea traffic and threaten military ships. This matter also poses the legal question of the boundaries of war in the sea when mines travel to the national waters of other countries, causing damage to civilian vessels owned by third parties. From another perspective, the introduction of wider employment of USVs in combination with UAVs and on their own illustrates further development of military technology and tactics in which the combination of assets from various domains can overcome the limitations of assets within a single domain. Moreover, from the perspective of innovation and adaptation, the focus of the current defences on the threats primarily from UAVs provides more opportunities for the effective use of USVs and/or UUVs taking advantage of the blind spots in the Russian defence of its fleet, naval bases and supporting infrastructure.

Another reflection of the old and new dichotomy is the question of legacy materiel and new trends in the changing character of war. The Soviet legacy of the Russian fleet design reflects far more than just the idea of continuity and supremacy of the firepower projected from the maritime domain, which in essence can be argued as confirmation of the primary utility of naval assets as no more than naval artillery in support of the Russian land advancement and the long-range cruise missile terror campaign against the entire territory of Ukraine. The main question is not so much about the reason the Soviet fleet was designed around the concept of offensive firepower but more about if it is still fit for purpose and, of course, the question: What is the purpose? There most certainly was no sea battle like in the old days (this does not mean that we will not witness this in the future but probably not in the Russia–Ukraine war) and combined firepower was primarily used against the land targets, which made the Russian Black Sea Fleet serve as naval artillery and a means to resupply the ground forces. The question is whether the Russian Soviet legacy of fleet design and its approach to structuring and manning its fleet are suitable for the new reality of combined UAV, USV and UUV attacks. While Russia has been quoted to have gained operational experience with its use of long-range cruise missile attacks in Syria and then further application in Ukraine, a few enabling factors facilitated it. In Syria, Russian actions were unrestrained due to the attacks on anti-Assad and civilian populations. In the case of Ukraine, besides the threat of drones from different domains, the Russian fleet remained relatively safe, since Ukrainian aviation was not enough to be pulled away from the support of Ukrainian needs in the land and air domains. If Ukrainian military aviation had not been weakened and almost extinct after three decades of Russian interference in Ukrainian internal affairs, the Russian Black Sea Fleet would not have favoured the extent of control of the sea that it did, not to mention if two-thirds of the Ukrainian naval fleet had not defected to Russia in 2014. Context remains a key to understanding the given case.

The lack of amphibious landings also raised some relevant discussions about this maritime activity. The historical evidence[45] confirmed that opposed amphibious landing was a very dangerous endeavour, especially if the landing force is not protected by firepower before and during the landing. Furthermore, surprise was hard to achieve considering the obvious strategic areas to capture, meaning seaports and chokepoints, which, in turn, were strengthened by the UAF with heavy artillery, tanks and ground forces. From the perspective of amphibious landing in modern and future warfare, this case illustrates the importance of relevant skills and a more flexible concept of amphibious landing suitable for modern realities and the situational specifics of a distinctive enemy.

Notes

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8

INFORMATION AND CYBER ASPECTS OF THE WAR

This chapter is devoted to the non-physical domain of warfare, paying attention to the information warfare and cyber domain segments of the war. Accordingly, the first part of the chapter looks into the Ukrainian and Russian approaches to the information aspect of the war, various conditions and tools that enabled different achievements within this segment of war. Attention is also paid to the international community and the widespread phenomenon of North Atlantic Fellas Organization (NAFO). Strictly from the military perspective of the changing character of war and greater openness of the battlespace, the question of open-source intelligence (OSINT) is addressed. Finally, the cyber domain of the war is explored, followed by a discussion of various points for consideration within the information and cyber segments of the war.

Information segment of the war

The principles of information warfare, deception and disinformation are not new to warfare. However, the means have changed, and the extent of informatisation and digitisation of human life has also changed. Inevitably, information technologies affected certain aspects of conducting warfare and the impact of warfare on societies. The CNN effect, the mediagenic effect of air power, the dichotomy of immediate remoteness and closeness of the conflict affect how one perceives and experiences warfare in the modern information age. However, this war brought new experiences in the interaction between the battlespace and information space.

The use of information space and media platforms for disinformation, propaganda and military purposes is also not new. The research on fake news and the Russian propaganda in support of its favoured candidates in various Western elections extensively covers the topic.[1] The phenomenon of using social media platforms, such as Twitter (now 'X'), Facebook and others, for sharing information

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on the events on the ground during various uprisings and conflicts has already gained attention in the academic research.[2] However, in the case of this war, information space became an integral front of the war, in which different narratives and claims had to be refuted, if not in real time, then immediately after in order not to allow the enemy the advantage on this segment of war.

Before discussing the approaches of the two sides to the information front of the war, it is essential to establish a few distinctive features of the information space in the context of this war. First, conventional means of communication like smartphones managed to dissolve the fog of war to a greater extent than in previous wars. Soldiers at the frontline could take videos of the events and provide evidence to prove or refute different claims. The videos of trench warfare, use of artillery, CAS conducted by the Army Aviation and evidence of the enemy's dead bodies soon flooded the social media platforms, with only one difference – the extent of censorship of the content characteristic of a certain social media platform. Second, available data posed a security risk and could be used to identify a person's location and coordinate fire. Thus, behaviour in the information space had to be adjusted in order to prevent such instances. Third, it might seem that both sides can manipulate visual and audio data from the battlespace. However, the practice of further verification illustrated that the authentic videos do not require time for adjustment and are streamed much faster than are altered, fake videos. The high tempo of the war and the constant movement of the frontline favoured the spreading of authentic videos rather than fake ones, especially since the fake ones would have several flaws and would quickly be taken apart by the audience more skilled in information technologies.

Fourth, Russian soldiers' use of ordinary mobile phones to call home provided a lot of data for the Ukrainian intelligence to use in achieving kinetic and information objectives of the war. Sharing the recordings of the Russian soldiers talking to their families provided a new layer and means of fighting the war on the information front. Historically, such data could primarily be obtained from the letters collected after the end of war. It was important to gain the upper hand on the information front for several reasons. The global outreach provided opportunities to engage audiences from different countries and gain their support. It became another means of boosting the morale of the Ukrainian people and their partners, while degrading the enemy's morale. It provided opportunities to address the enemy's audience through platforms that were not fully controlled by Russian censorship. It allowed people from across the world to contribute to the fight against Russian aggression through the means available to them in their everyday lives. The best example would be the NAFO social media movement and its place in the information war to suppress the Russian disinformation campaign.

The Ukrainian approach

Like many things in war, the Ukrainian approach to fighting on the information front evolved and crystallised with various systematic practices as the actual war

progressed and as a response to the behaviour and changing tactics of the enemy. In general, the Ukrainian approach can be characterised as systematic and multifaceted, taking advantage of every available opportunity and platform involving different actors to create and sustain resilience in the information space. This discussion focuses on the following actors/fighters on the information front: ordinary people, political figures, the UAF (both as institutions and individual soldiers) and organised international movements.

From the perspective of the ordinary people of Ukraine, from the first days of the full-scale invasion, information space became the means of sharing data regarding Russian movement on the ground, identifying which areas were hit by shelling, various crowdfunding initiatives and supporting each other across regions. In the beginning, mistakes were made, such as sharing open-source data on the details of hit targets. However, soon ordinary people, educated by each other or negative experiences, understood what data could be shared online and what should remain undisclosed. Human intelligence (HUMINT) on suspicious behaviour in various areas of the rear prevented different sabotage attempts and fire coordination. The principle of reporting suspicious behaviour in the rear in real time also evidenced significant progress in threat identification and detention. After this initial learning experience with fire coordination through social media, another milestone in public information activity and transformation of the Ukrainian public from ordinary users to information front fighters was the promulgation of visual evidence of Russian atrocities in Bucha and Irpin via online platforms. The trigger for change was the immediate attempts of the Russian propaganda machine to distort the reality of these atrocities and to manipulate the existing evidence to their own advantage. The outrage with this disinformation triggered a more proactive involvement of ordinary people in spreading accurate information via various information platforms. This proactive approach was further strengthened by the questions from the Western public and media who would often be confused about whom to trust and which evidence to believe. Soon any Russian attempt to spread false allegations would be refuted by multiple pieces of evidence and rapid sharing of accurate data from ordinary Ukrainian people, especially those who could not be on the frontline.

As the experience with media usage illustrates, different countries and conflicts have been characterised by the employment of various platforms in each case. In Ukraine, the public would use Facebook and YouTube to share personal news, but Twitter and Telegram gained prominence in the information front of war. Twitter proved effective in reaching both local and international audiences and degrading Russian bot accounts, while Telegram allowed more detailed footage from the frontline to be shared due to its lower censorship restrictions. The most complex to use was YouTube due to its stricter content regulations. UkrTwi or Ukrainian Twitter became a phenomenon of its own – people would share their feelings and support each other, as well as post fundraising for the immediate tactical needs of various units, evidence of purchase and use and sharing of different types

of information. Of course, at various focal points of the war, great uncertainty required official sources to sustain the balance in the information space, which the formal accounts of the UAF and Ukrainian political leadership would often provide.

One of the most prominent figures in the information battlespace was President Zelenskyy himself. He was always present in the information space, reaching various segments of the audience with different tools. For the national audience, he recorded short daily video reports of the situation and his activities, paralleled with written data spread on his other media channels. From the perspective of the international audience, he conducted an unprecedented information campaign to raise awareness and support for Ukraine worldwide. This included online speeches to national governments and parliaments, international organisations, various field-specific fora and conferences worldwide. As the situation stabilised and he could leave the country, he conducted in-person visits to strategic partners of Ukraine, strengthening ties and support of partner nations for Ukraine. He also applied a very holistic and pragmatic approach to the information front of the war – he invited leaders of foreign governments not only to visit Ukraine to experience the environment of the war but also to witness the evidence of Russian atrocities for themselves. Hence, foreign leaders visiting the country would be brought to Bucha and Irpin to see for themselves what was done to the Ukrainian people. Overall, Mick Ryan laconically concluded that Ukraine rapidly adapted to the information age requirements and employed 'a highly effective international influence campaign' led by President Zelenskyy starting with his famous phrase 'I need ammunition, not a ride.'[3] This campaign not only allowed Ukraine to have the upper hand in refuting Russian disinformation but also provided Ukraine with 'significant levels of military, humanitarian, economic and intelligence support.'[4] But President Zelenskyy didn't just appeal to Western audiences; he also managed to address the Russian population. Various pro-Ukrainian hacker groups facilitated broadcasting his speeches on Russian and Crimean TV, disrupting the normal news broadcasts.

As in many spheres of Ukrainian life, various initiatives combine grassroots and top-down approaches that often have the same objective but employ means and advantages related to their respective actors and their situations. The military's role in the information front of war is no exception. From an individual and grassroots perspective, Ukrainian soldiers started from the very beginning to record and share two types of videos. The first type would be videos from the frontline showing their lifestyle and achievements. Of course, the content of these videos would be unclassified and approved by immediate leadership for public release. The second type would be more entertaining videos of soldiers dancing, singing or performing various tricks. These videos would often be distributed via various platforms, but their short nature made them particularly suitable for the TikTok and Twitter platforms, which encouraged many people to start using TikTok in the first place. For instance, one paramedic to let his relatives know he was alive posts a picture

with a coffee cup each day, wishing everyone 'good morning, have a nice day, we are one more day closer to victory.'[5] Both types of videos would boost the morale of people on the frontline and the rear, both nationally and internationally. As the war progressed, videos also became the means to show various shortfalls of resources distributed across the frontline, which attracted attention to different areas of concern. In February 2023, videos from Bakhmut were the most frequent because too many manipulations and attempts to discredit the UAF and their efforts in holding the area were attempted by Russian propagandists. For example, the air reconnaissance group commander with the call sign 'Madyar,' Robert Brovdi, was going online with daily updates on the situation in Bakhmut and Soledar. He was changing location within the Bakhmut area each time he recorded videos and uploaded them into the Internet to provide a timely update on the situation in the area. Such regular video updates had to follow strict rules of non-disclosure of sensitive information. Also, repeated appearances of the same officer would add to the source's credibility and increase its consequent value for informing the audience and boosting morale. This type of video was often aimed at the local population or Ukraine-speaking audience.

From the institutional perspective, the Ukrainian leadership also initiated a more formal format of video interviews and video projects to access fundraising, international support and to boost morale. Some of these initiatives would be interviews with commanders discussing their distinctive units or past battles in more detail as participants in the fighting, like the story of the Ukrainian counteroffensive in Kharkiv told by Colonel Ihor Skybiuk, the brigade commander of the 80th separate amphibious assault brigade.[6] Other initiatives would focus on distinctive capabilities and their employment in different battles. For example, one of the initiatives of President Zelenskyy, United 24, the official fundraising platform for Ukraine, would often have various projects and fundraising led by distinctive global figures. For instance, *Star Wars* actor Mark Hamill was an ambassador for fundraising of the RQ-35 Heidrun reconnaissance drones. Canadian actress Katheryn Winnick became a fundraiser ambassador for the building restoration project on this platform as of 1 March 2023. Another project would focus on artillery and would provide detailed examples of the role of artillery in various battles.[7]

NAFO phenomenon

Another distinctive phenomenon in the information space is that of the NAFO, which operates under the hashtag #NAFO on Twitter. It is

> an organic online group of pro-Ukraine supporters that have gained the attention of policymakers and global leaders for their creative use of digital media to take on key sources of Russian disinformation and raise support for the war effort in Ukraine.[8]

One of the co-founders is Matt Moores. Like many movements and phenomena in the modern information space, this one started with a random occurrence and became a trend and a worldwide phenomenon. It started as a fundraiser. According to Matt Moores, the activity of a group of people started by using memes with the cartoon Shiba Inu dog images as a way to caricature various elements of Russian propaganda, and people began paying money to get their own Shiba avatar to support the cause. The fundraiser gathered $300,000. The initiative of targeting Russian bots and propaganda elements started with mocking the Twitter posts of the Russian Ambassador to international organisations in Vienna, Mikhail Ulyanov.[9] Unlike the formal refutations of various claims, the NAFO community employed more mainstream information space behaviour, which became extremely difficult to counter for the Russian propagandists; NAFO fellas were mocking and ridiculing pro-Russian authors of the tweets and their content. The immediate confirmation of the effectiveness of this approach was Ulyanov's engagement with the mocking tweets and his growing infuriation and then his gradual taking of breaks from the social media platforms. This was a learning point for the community, which shifted its activity towards identifying, tracing and reporting Russian propaganda accounts across various social media platforms. The Ukrainian officials also favourably greeted the initiative, with some officials gaining their own Shiba Inu avatars on their Twitter profiles. This phenomenon illustrated a few important aspects of warfare in the information age. The battlespace has most certainly shifted into the information space, taking the form of fake news and propaganda elements. While the governmental means of countering such threats would be partial and costly, the solution found itself in the information space and in the online behaviour of ordinary users. Ordinary people can get involved in resisting propaganda and disinformation without needing any additional skills or specific military or cybersecurity training. By identifying the disinformation accounts and Russian bots and reporting them to the admins of the social media platforms, they achieve a well-felt effect on countering propaganda in the information space. It does not mean that these efforts are the only means, but combined with other formal and grassroots initiatives, they contribute to systematic dealing with the threat. Mockery is very difficult to confront because it does not use a rational argument or negative emotions like anger; instead, it uses humour. Any attempts to counter this mockery with more propaganda, fake evidence or rational arguments simply drain more effort and resources from the propaganda channels.

Another observation of this phenomenon is that warfare is no longer a localised matter, and different effects in the information space can be achieved from anywhere. Hence, anyone can get involved in the movement. The NAFO example illustrated that grassroots initiatives might start by focusing on a certain activity, but the opportunities the information space and online engagement provide allow rapid evolution of these initiatives into more formalised, global and effective entities. This initiative also shows further blurring between the traditional civil and military divides and the effects that activities of non-military individuals might have on

war-related matters, especially when audiences from the countries not involved in the war are getting more involved in resisting propaganda and disinformation of the aggressor.

Russian propaganda

The Russian propaganda machine is not a new phenomenon in international relations. It has been used to distort reality for decades both inside Russia and globally. Regarding the war in Ukraine, Russia followed some of its traditions of manipulation with information, people's perceptions and the promotion of pro-Russian views and narratives. It followed the same pattern as it did in 2014 and constructed its own *casus belli*. In the 2014 invasion and annexation of Crimea, Russia distorted the principles of international law and created the narrative of Russian protection of the Russian-speaking population. The next eight years of war were used to strengthen the narratives.[10] A February 2023 report by the Atlantic Council on the narrative warfare of Russia provided an analysis of the 350 fact checks of pro-Kremlin disinformation during the eight interim years of 2014–2021. They collected more than 10,000 articles of false and misleading narratives published by 14 pro-Russian outlets in 70 days when propaganda intensified (16 December 2021–24 February 2022) before the full-scale invasion. The main pro-Russian narratives included:

- Russia is seeking peace (2,201 articles);
- Russia has a moral obligation to do something about security in the region (2,086 articles);
- Ukraine is aggressive (1,888 articles);
- the West is creating tensions in the region (1,729 articles); and
- Ukraine is a puppet of the West (182 articles).[11]

One of the distinctive features of the Russian approach to propaganda and the construction of narratives is taking an event out of context and substituting the original context with the Russia-favourable one. This approach is often more successful in the long run, when it is layered with new fake evidence or 'bogus eyewitnesses.' A distinction can be made between Russian propaganda for the foreign audience and their home audience. Articles written for the international audience tend to be embedded in national specifics and manipulation of the existing political power struggles in the countries. For instance, many pro-Russian fake news outlets find support, and some far-right and left-wing elements in liberal democracies across the world spread their content. Also, some national media outlets tend to employ and host pro-Russian individuals. One of the academic research projects on Russian propaganda targeting the US population discovered a positive correlation between the Russian media outlet Sputnik and some American media outlets.[12] Accordingly, narratives related to the war tend to be tweaked to

the concerns of these groups and manipulate them to support a pro-Russian stance that is closer to their views. In contrast, in targeting their population, Russian propaganda has used the symbiosis of famous propagandists and TV figures appearing on national television and online platforms. In this regard, narratives of Russian imperial supremacy over former Soviet countries, especially over Ukraine, were used to boost Russian support for the war and strengthen Russian hatred of Ukrainians based on the old myths embedded in Russian imperial, totalitarian, expansionist history:[13]

> For audiences within Russia, changes in legislation and the regulatory environment effectively criminalized media independence and public dissent against the war, while the Kremlin and its media proxies embraced jingoistic messaging that could be reduced to symbols like the letter Z. The Kremlin also weaponized fact-checking tropes, exploiting increasingly popular Telegram channels such as War on Fakes to amplify disinformation via media outlets and diplomatic social media accounts.[14]

While it was much easier for Russia to continue disinformation among its population after the decades of the Soviet rule of propaganda and obedience, the full-scale invasion illustrated the need for a different approach due to the high tempo of events and increased presence of the Ukrainian counter-propaganda efforts. According to Andy Carvin,

> changing people's minds and positions is much harder than simply sowing doubt or fear. It's one of the reasons why Kremlin information operations focus so much on essentially generating chaos, causing contagion, causing a loss of morale, or just getting people simply confused about what's true and what's not.[15]

From the first days of the full-scale invasion, Russians intensified their disinformation campaigns, starting with a poorly made deep-fake video of President Zelenskyy appealing to the Ukrainian nation to surrender. In the first weeks of the invasion, 35 new Russian disinformation narratives occurred per day. Their primary objective shifted to undermine the credibility of Ukraine and its Armed Forces in the international arena and make international audiences doubt Ukrainian evidence of Russian atrocities in Ukraine. Some of the Russian activities included using fake accounts and bots, altering imagery to create deepfakes, forging documents (to discredit Ukrainian officials and international military support for Ukraine) and creating and posting fake news videos on behalf of reputable news agencies like the BBC.[16]

Customisation of the Russian disinformation campaign since the full-scale invasion became evident in using different national cultural and historical narratives to undermine the credibility of Ukraine. For instance, in the case of Poland,

pro-Russian hackers took control over social media accounts. They used them to spread forged documents claiming that Ukrainian officials have anti-Polish views. Another predominant narrative was in painting Ukrainian refugees as a burden on the Polish economy, exploiting the generosity of the Polish people. Another attempt was aimed at appealing to the historical context of territorial belonging. Accordingly, in September 2022, forged ballot papers allegedly produced by the Polish Electoral Commission appeared that aimed to conduct a referendum for the western Ukrainian city of Lviv to join Poland. Another attempt speculating on the same subject was conducted in November 2022, using a Telegram channel spreading a questionnaire allegedly prepared by the Polish embassy asking Ukrainians whether they wanted to live under the Polish 'protectorate.'[17] Such rudimental attempts illustrate poor Russian understanding of the mentality of the two nations and the primary objective of fighting off Russian invasion once and for all. This also shows that they did not realise the extent of modern digital literacy of people and the additional means of data cross-verification available in the modern information age. France was targeted with a focus on their military support and false claims that the French Caesar howitzer gifted to Ukraine ended up in the Russians' hands. The extreme case of the pro-Russian propaganda was the Georgian government repeating Russian narratives.

From a global perspective, while a greater pushback from most Western audiences to the Russian disinformation campaign took place, its message might have resonated better with some of the local audiences of the Global South. Russia's focus on Africa in terms of economic and military interests within its 'Return to Africa' policy was only strengthened by its disinformation campaign. Russia continued using its channels RT and Sputnik, if they were not banned, and diplomatic media channels as an alternative if they were banned. Furthermore, on 4 March 2022, pro-Russian accounts launched a social media campaign in Africa supporting Putin and his invasion of Ukraine. The distinctive hashtag resulted in over 300,000 mentions by around 106,000 user accounts.[18] In Latin America, to overcome the loss of restricted propaganda TV channels RT and Sputnik, Russia used its diplomatic media channel and YouTube channels to spread its messages.[19]

Regarding narratives, Russia focused on employing the anti-Western and anti-imperialist attitudes present in various countries of the Global South,

> portraying itself as a 'victim of NATO' and as an alternative to the imperialist West … Russia also manipulates the narrative of the alleged racism of Ukrainians and Westerners. For example, it exploits tensions over more favorable treatment for Ukrainian refugees compared to those coming from Africa, the Middle East, or Latin America.[20]

These narratives are well entwined with Russian promises to establish mutually beneficial relations in the diplomacy and trade spheres, which are attractive for various developing countries. From the Russian perspective, it is essential to

provide some evidence that it is not entirely isolated from the world and that it still has friends.[21]

Despite the scale and sophistication of the Russian propaganda and disinformation campaign, various factors contribute to it being less effective and successful compared to the pre-war and interim eight years of the war period. First, Russians' experience significant resistance and resilience from audiences worldwide to their disinformation campaign. The full-scale invasion, bloodshed, territorial occupation and the constant shelling of civilian areas made the war the main topic of the news for a year. It became more difficult for Russians to hide what was happening on the ground, since many independent journalist investigations and live reporting were widely spread.

Third, despite the immediate outreach of information technologies and the instantaneous digital spreading of news, the high tempo of the war and constantly evolving frontline were counterproductive for the Russian disinformation campaign. Russians tend to use specific events, layering them with lies and invented contexts. As stated by Emily Harding, a senior fellow and deputy director of the International Security Program:

> So, like, for – a lot of their election propaganda, for example, you could see them find a kernel of truth and then do the whole, you know, just-asking-questions thing that they can then insert into certain discussion forums or some, like, fringe journalism outlets. But then they create enough buzz around it that it moves very slowly into mainstream, and mainstream feels like they have to report on it because people are talking about it in these other forums.[22]

For such schemes to fully effect, layering and 'the backstory' require time to be settled in the audience's perception. For the fake evidence to be credible, they need time to be created with details and good editing skills. However, what was observed with Russian disinformation videos and forged documents was that many of them were prepared in a hurry, of poor quality, and could easily be torn down by ordinary users identifying distinctive features of the location or posting the original videos used for the fake ones. Meanwhile, on the Ukrainian side, it is easier to share original and immediately taken videos from the frontline to refute Russian disinformation since Ukrainians are sharing what is happening on the frontline.

Another challenge for Russian disinformation is the volume of information generated by people covering the war and sharing information from the frontline. While previously Russian bots would have had the upper hand in spreading disinformation, now there are too many sources. As Ukraine adopted a multifaceted and systematic approach to fighting the information war, Russians shifted their focus to the Telegram platform[23] due to less strict content restrictions. There, they would create accounts pretending to be Ukrainians and would spread their disinformation. On the one hand, official information can be verified through different official sources available on such platforms, such as official websites and web accounts on

Facebook, Twitter and other platforms. On the other hand, Russians have greater outreach with Telegram channels; as of June 2022, 700 million active users were on Telegram. For comparison purposes, it is worth mentioning that Twitter has only around 368 million monthly active users,[24] while Facebook's outreach is almost 2.96 billion monthly active users (but it has more restrictive rules for content upload and sharing).[25]

Open-source intelligence (OSINT)

In discussing the information front of the war, Emily Harding identified another important feature of the war and the information space: 'the West is experiencing its first real open-source war.'[26] Another phrase used to describe the war was 'the first digital war'; this means the digital space has been more dynamically used in this war than in any previous one. In essence, OSINT in this war refers to the multitude of data relevant to the military that could be obtained from non-classified, accessible, public – and hence open – sources of information. The multitude of technological means and their sophistication varied in the data availability and access to it, but it was not classified. The more high-end spectrum of data on the OSINT was collected from satellites. For instance, Google Maps traffic data showed coordinates of the movement of the Russian troops near the Ukrainian border. Similarly, NASA satellite imagery from space-based synthetic aperture radar sensors allowed to monitor Russian preparation and restocking efforts.[27]

The behaviour of the Russian soldiers on social media exposing sensitive information which the UAF could then use falls on the less technologically complex side of the spectrum. For instance, Russian soldiers would frequently upload their pictures, tag their fellow unit members and geolocations on their Telegram and VK (VKontakte – the Russian equivalent of Facebook) profiles. In turn, this information would allow the UAF to trace Russian movement and coordinate fire. These pictures were also used to identify specific units' locations where the Russian soldiers committed atrocities, like in Bucha and Irpin. This was one of the examples proving the maxim of modern life and warfare – it is almost impossible to hide from the cameras and leave no trace in the information space. Similarly, when Russians made and uploaded to TikTok videos of their travelling on the convoy trucks, it allowed to identify the route, the exact equipment, the brigade and its formation. In addition, since the majority of Ukrainian citizens have smartphones, they possess sensors that act as a force multiplier for the UAF, widening the area of cover.[28] OSINT was also used for reporting BDA, confirmation of attacks on air bases and other strategic targets.[29]

The implications of the OSINT for intelligence proved significant in this war, changing not only the situational awareness per se, but also the means of data collection, processing and employment. General Sir Jim Hockenhull, Commander of UK Strategic Command, identified and systematically discussed these implications.[30] First, OSINT reinforces anticipatory intelligence, meaning that

additional intelligence strengthens the understanding of the adversary's posture and deployment. Besides the obvious utility for the military, it provides relevant insights into the given situation for the wider audience to interpret. Second, this war had an impact on public confidence. The audiences in Ukraine and the West were constantly in the loop of the events and cross-verification of data through OSINT. Hence, the perception of the war, its conduct and the inconsistency between formal Russian claims and reality became evident to audiences worldwide.

Third, OSINT was essential in undermining the Russian disinformation campaign and false flag narratives. The Russian disinformation campaign was losing on more grounds because truthful footage and accurate coverage of the events were widely spread across the world through multiple media outlets and social media. Fourth,

> open source has proved to be a force multiplier, and we've been able to move to an approach which militaries around the world have sought to do for some time. Through open source every platform and every service person is able to act as a sensor. Citizen involvement has meant that practically every citizen and every phone has become a sensor. There are some challenges around the ethical and moral position of this, but in the context of a war of national survival the Ukrainian public are incredibly committed to playing their part and providing the advantage to their decision makers.[31]

Fifth, crowdsourcing and employment of standardised chatbots to report the location of the Russian troops by Ukrainian civilians also provided a variety of perspectives and viewpoints on the information. This is important since it gave more perspectives on the events and allowed for additional insights. Finally, OSINT managed to a greater degree to lift the fog of war. It can be compared to the jigsaw puzzle of collecting information pieces to see the full picture. Instead of being the lid of the puzzle box, OSINT provides endless versions of the pieces of the puzzle, and an infinite number of pictures can be put together with those pieces. Furthermore,

> it also introduces a challenge in terms of discretion around the information, and we must filter with a view to being able to refine. This is where the combination of open-source intelligence and secret sources of intelligence becomes invaluable in being able to see whether we can define greater understanding as a consequence.[32]

These implications identified at the highest professional military level make OSINT an integral element for the war in Ukraine and future warfare in general. However, it also demonstrated the previously identified challenge of the information age – the availability of an overwhelming amount of data and the necessity for timely processing. The war provided various experiences with this matter. For instance, on one occasion, the UAF identified and coordinated fire on the Chechen

unit 40 minutes after they uploaded videos to TikTok; on other occasions, the image had to be widely circulated for one to three days to be geolocated. Another significant implication is the accumulation of footage. According to Mathew Ford, the video footage produced from wars is significantly increasing. For instance, such footage was up to 40 years of running time during the Syrian war, while in the first 80 days of the full-scale invasion of Ukraine, some 10 years of running time had already been produced.[33]

Some of the challenges related to OSINT became evident across various stages of this studied year of the war. After the first few weeks, Ukrainian people learned that they should not post pictures and discuss the extent of damage in various areas after the Russian bombing. While some learned naturally, others were shunned by peer pressure in the information space. However, with various technologies becoming available in Ukraine and increasing hype for flashy images and videos, normative actions had to be taken to prevent spreading of some information in the media. The most prominent of the examples was the posting of photos and videos of the work of Ukrainian air defences (including US Patriot systems) in Kyiv during Russian ballistic and drone attacks. This information resulted in the sequential Russian strike on that location and partial damage to the Patriot system.[34] People who posted information were identified and given official warnings with clear normative implications of such actions being identified. Video recordings with their apologies (but not showing their actual faces) were then used to clarify that filming work of air defences has damaging effects on national defence. It goes without saying that those who coordinate Russian fire inside Ukraine are prosecuted according to the criminal code of Ukraine.

Another case is related to the hype and elevated agitation in the Western and local media regarding the timing, direction and details of the Ukrainian spring 2023 counteroffensive. Journalists, academics and think-tank analysts tried their best to discover the details, to the point that the Ukrainian president had to say that the counteroffensive is not a movie. In early June 2023, the Ukrainian Ministry of Defence posted a video encouraging everyone to remain silent and not post or share any information related to the plans and actions of the UAF. The 24/7 media attention to the war and the constant demand for information have created obstacles in the operating environment of this war.

The cyber aspect

The cyber domain has become an inseparable domain of modern warfare, and the war in Ukraine is no exception. However, like with various aspects of this war, analysts' predictions were only partially fulfilled. Although the grand-scale cyber war and complete cyber dominance of one side over another was not achieved, the cyber aspect illustrated various trends to consider in national security and defence.

Russian cyberattacks on Ukraine did not start on 24 February 2022 but when the war started in 2014. For years, Ukraine served as a testing ground for various

Russian GRU cyber unit hacks. In March 2014, a distributed denial-of-service (DDoS) attack targeted Ukrainian computer networks and communication systems, aiming to distract attention from the occupation of Crimea. Two months later, pro-Russian hackers tried to manipulate votes in Ukrainian presidential elections, and removal of malware delayed the vote count. More attacks occurred in the years to come, but the most significant and internationally well-known was the June 2017 NotPetya malware which disrupted the work of various governmental, financial, communication and transport services and businesses. This attack also disrupted the work of the Chornobyl nuclear power plant and spread globally, affecting 65 countries and around 50,000 systems, resulting in an overall loss of $10 billion.[35]

Various attacks continued up to the full-scale invasion, with a greater intensification in January–February 2022. The primary targets of the attacks were Ukrainian governmental websites, communication services and the banking system. On 23 February, the FoxBlade wiper malware attacks focused on the financial, IT and aviation sectors. On 24 February 2022, in the facilitation of the invasion, Russia launched a major cyberattack against Viasat, a satellite communication network, used by the UAF for C2, communication and intelligence. This attack also disrupted communication across Europe. Since the full-scale invasion, cyberattacks have become a part of the war with various distinctive features in changes of tactics and targeting.

According to the State Service of Special Communications and Information Protection of Ukraine (SSSCIP), although Russian cyberattacks can be traced in various spheres, they have continued since February 2022 to prioritise governmental, civil and energy infrastructure, media and communication. A shift in targeting from the military and governmental entities to the civilian population and infrastructure was observed as in other domains of warfare. The recent annual report on cyber incidents provided more detailed information on the intensification of cyberattacks in 2022. Compared to 2021, 2.8 times more cyber incidents were recorded in 2022: malicious codes increased by 18.3 and phishing attempts by 2.2 times; moreover, an increase of 26% in critical events originating from Russian IP addresses took place.[36] Some of the more detailed statistics are as follows:

- 58 bil of processed events (received by the means of monitoring, analysis and transferring of telemetry information about cyber incidents and cyberattacks);
- 181 mln of suspicious information security events (during primary analysis);
- 179,000 of critical IS events (potential cyber incidents identified after suspicious IS events filtering and secondary analysis completion);
- 415 registered cyber incidents (critical IS events identified and processed directly by security analysts).[37]

At first glance, it may seem that the increase in Russian cyber activity demonstrated their readiness for various scenarios of event development, at least in this domain. However, trends in this domain illustrate some similarities with

the traditional domains of warfare. Although NotPetya, FoxBlade and Viasat cases showed more sophisticated and complex cyberattacks on their targets and a greater scale of impact, experts have characterised the additional attacks during this year of full-scale invasion as more intense and less complex or 'fast, dirty and relentless.'[38] Accordingly, the Russian GRU military intelligence agency shifted their tactics from phishing attacks that were previously aimed at obtaining one's credentials or planting backdoors on an institution's working computers, they refocused on targeting devices providing immediate access, such as firewalls, routers and email servers. This change in tactics provided Russians with the following advantages:

> It's allowed the Russian military hackers to have far faster, more immediate effects, sometimes penetrating a target network, spreading their access to other machines on the network, and deploying data-destroying wiper malware just weeks later, compared to months in earlier operations.[39]

According to Viktor Zhora, a senior official of SSSCIP, the tempo and intensity of Russian cyberattacks had indeed increased, and there is division in tactics and targeting between the Russian GRU and the FSB. While GRU refocused on edge devices, the FSB still used phishing emails as their usual method. However, repeated wiping of the same organisation in a rapid sequence was rare.[40] Although the tempo of attacks has increased and intensity became evident, the complexity of these attacks and, to some extent, their scale were reduced.

Another feature of the Russian cyber war in Ukraine is that it is not limited to Ukrainian cyberspace. On various occasions, foreign governments in support of Ukraine were also targeted. For instance, on 11 April 2022, three German wind-energy companies were targeted, shutting thousands of turbines. This was not the first time wind-energy companies had been attacked. On 31 March, Nordex, a wind turbine maker, had to shut down its IT system due to an attack, responsibility for which was claimed by 'Russia-based ransomware group Conti which was sympathetic to Russia and meant to disrupt the European efforts of less reliance on Russian oil and gas.'[41] Another example was that in the week commencing 2 May 2022, Russian hackers attacked Czech Railways, some regional airports, the Czech civil service server and state resources in Estonia, Moldova and Romania. After the Estonian government decided to remove six Soviet military monuments in Narva on 16 August, Russian hackers launched a cyberattack on 18 August that was the most extensive attack in the country since 2007.[42]

Overall, Russian cyberattacks can be characterised as follows. As in other domains, Russian integration of cyber and conventional physical domains of warfare is far from multifaceted efficiency and the necessity of war. Although it can be argued that the increased tempo of the war in general and its reflection in the cyber domain illustrate that the Russian GRU cyber unit can keep up with the increasing demands, the simplification of methods for attacks, their limited scale (compared to the Viasat) and increased number of mistakes which undermined

various attacks suggest burning out of the personnel and/or a lack of new skilled recruits in support of the more established personnel of the Russian GRU.[43] While the exact situation with the Russian hackers remains unknown, the pure logic of over-committed activity remains undeniable. In this regard, while intensified attacks in Ukrainian cyberspace require constant attention and efforts, Russian retaliatory actions against EU and NATO members most certainly distracted them from the Ukrainian area of their cyberattacks.

Furthermore, despite the intensity and diversity of cyberattacks, they are far from being the decisive or the primary domain of war in Ukraine. Although cyber aspects contribute to the overall warfighting of the Russians, like many other Russian agencies, cyber units can achieve some of the tasks they are given, but their inter-agency integration and layering of effects are limited. This is partially because no planning for the prolonged war was in place and, thus, no thoughts were placed into the need for, let's say, cyber and ground forces advancement. Even one year after the full-scale invasion, cyberattacks were often used as a decoy to distract attention from various activities in other domains or geographical parts of the country rather than as integrated, well-planned actions to layer effects using tools from various domains.

Regarding the Ukrainian counteractions to the Russian cyberattack, Ukraine was assisted by both governmental and private stakeholders. The extent the US government collaborates with Ukraine in this sphere remains unknown. However, assistance from companies like Google and Microsoft was invaluable. One of the pre-emptive measures taken by the Ukrainian government before the full-scale invasion was changing its data protection laws, allowing more data to be moved into the cloud:

> Before this change, Ukrainian public-sector digital infrastructure was run on servers within Ukraine – leaving the physical servers vulnerable to destruction by Russian missile attacks. Three days after Russian forces began their invasion of Ukraine, Amazon had delivered Snowball devices to Ukraine; these hardened devices were used to securely transfer Ukrainian government data to the cloud. According to Microsoft, within 10 weeks of the beginning of the war, many of the government's most important digital operations and assets had been moved to the cloud – and out of the war zone.[44]

The increasing civil–military collaboration in the cyber domain was also illustrated in the fast tackling of the FoxBlade since the Microsoft Threat Intelligence Centre wrote a code to stop the attack. The code was then shared with the Ukrainian authorities to eliminate the threat. Civil–military collaboration also expanded. Microsoft contacted Ann Neuberger, US deputy national adviser for cyber and emerging technology, and was advised to share the code with European governments to prevent it from spreading in the region.[45] This development is of great significance, as it provides another example of incorporating the private/commercial sector into

the war, yet in a different domain. Strictly from the perspective of the cyber domain, cybersecurity has been demanding closer collaboration between commercial and governmental entities because to be effectively treated various threats operating in the grey zones would require expertise and tools available from both parties.

Another significant development of the war regarding the grey area of the cyber domain that will have long-term implications for the domain and future warfare in general refers to the legal categorisation of some Russian cyberattacks as war crimes. The primary argument is that Russian cyberattacks are conducted in conjunction with physical attacks on civilian infrastructure, resulting in civilian deaths. According to Ukraine's chief digital transformation officer, Victor Zhora:

> When we observe the situation in cyberspace we notice some coordination between kinetic strikes and cyberattacks, and since the majority of kinetic attacks are organized against civilians – being a direct act of war crime – supportive actions in cyber can be considered as war crimes. We are discussing completely new terms and ideas on how to classify these attacks, which happened during the war, which have never happened before.[46]

One of the most prominent examples is Russia's simultaneous cyber and physical attacks (shelling of the thermal power plant) on the DTEK company, Ukraine's largest private energy investor. The case is being presented to the International Criminal Court in the Hague. Although the Geneva Convention does not include such attacks, much has changed since 1949, and the war in Ukraine may result in many changes to previously established norms since the character of war has evolved.

Points for consideration

Traditionally, the fastest way to lose war was to lose it at home. Different warring sides have used this principle in conflicts across the entire history of warfare. However, in the war in Ukraine, this principle was at an entirely different scale and the tempo of information warfare significantly increased. From the conceptual perspective, the element of information warfare is already embedded in the military doctrines across domains and levels of warfare. However, the current war illustrates different considerations. It shows the necessity of preparing manuals on the correct military and individual behaviour in the information space during peace and war times. Although military personnel know about restrictions on what is allowed and what is not, the greater integration of the information space into the battlefield and the presence of smartphones as a network of sensors requires more detailed tactical-level manuals addressing this type of challenge.

Since the line between civilian and military personnel is becoming more blurred, especially in the sphere of the information space, more attention should be paid to strengthening the resilience of the civilian population and their behaviour

online under the conditions of warfare or severe crises. The Ukrainian population learned during the war what information can be shared, when and how it can be shared and its potential use by the adversary. From the perspective of strengthening national resilience against various activities in the information age and the relative dissolving of the fog of war over the battlefield, it is essential to prepare the population for the new requirements of operating under the conditions of warfare. Another consideration in this context refers to the pre-emptive measures in countering disinformation. The resilience of the population and its strengthening of information support for the military on the battlefield would largely depend on their ability to distinguish truthful information from fake information. Systematic courses in information security aimed at identifying truth from fake could contribute to strengthening the information front of war. In the case of Ukraine, a lot of effort was placed into pulling resources and people into the information segment of the war to prevent the wider spread of Russian disinformation. The learning point for liberal democracies is to invest in pre-emptive means of strengthening national resilience before any potential crises or conflicts. The general public is more exposed to the events of war, especially of this type, than ever before, and these features of the information segment of war are likely to continue in the future, and hence should be addressed sooner than later.

In terms of the physical component of the information space, while some capabilities might be more expensive to acquire and use in warfare, the case of Ukraine illustrates that relatively cheap but functional technologies can provide a significant difference. Stable communication and updated smartphones helped communicate between various units, coordinate fire and conduct battle damage assessments, and provide means for information warfare in the format of videos from the trenches and frontlines. Although smartphones could pose a threat in the frontline, they provide additional advantages and greater engagement with relatives and the wider public in the information space if used in the right locations. As the Russian experience with using the smartphones of the local population illustrated, a lack of basic knowledge and training in utilising smartphones can endanger survival of the unit.

Information warfare is most certainly no longer just a governmental effort. The war has illustrated that successful opposition to the disinformation campaign requires a systematic approach, engaging various national agencies, the local public and international stakeholders along with finding ways to address the population of the enemy. The Ukrainian approach to information warfare illustrates how its multifaceted nature undermined Russian propaganda and disinformation across various platforms and agendas.

From the morale perspective, the information space became the source of mutual support between Ukrainian soldiers on the frontline and their relatives and wider community in the rear, both nationally and internationally. The opportunity of communicating with soldiers on the battlefield or within a certain distance (when it was allowed and possible) strengthened morale on both sides – civil and

military. The civilian population knew why they were enduring limitations in terms of the disrupted infrastructure and deteriorated living conditions, while the soldiers on the battlefield knew the purpose for which they were fighting. In past wars, this connection was more remote and detached, but the information space of this war connected many people in an unprecedented way. This does not mean that communication in real time was constant or that there was always communication with the soldiers on the frontline; but when they could be online, there was an opportunity to reconnect with relatives and the strangers following them on social media, not only in Ukraine but worldwide.

Regarding the cyber domain, it most certainly did not illustrate the substitution of conventional means of warfare with cyber warfare. The extent of the Russian integration of cyberattacks with the physical attacks in other domains was not fully implemented, demonstrating the issues in Russian cross-domain integration and the lack of preparation for the war of attrition across domains. Unlike the physical domains of warfare, Russian cyberattacks provide sufficient resources to adjust to the requirements of the war. However, constant distractions to target governmental and private entities outside Ukraine showed that the Russian GRU and the FSB had to compromise the sophistication and scale of the attacks to more simplistic and frequent ones. In placing the discussion of the mass approach into the cyber domain, it is worth mentioning that attrition warfare necessities illustrated the need for that critical mass to sustain the intensity of the war.

Since the boundaries between civil and military, between private and governmental spaces and activities, were significantly blurred by the effects of cyberattacks and espionage, it is unsurprising that civil–military collaboration in counter-cyber warfare actions has moved to a new stage. In this regard, the cyber domain is probably on the frontline of the increasing role of the private sector in modern wars. The format and extent of civil–military engagement remain hard to predict but would largely depend on the role to be played by the cyber domain and information warfare in future wars.

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9

THE RESILIENCE OF THE UKRAINIAN PEOPLE

The Russian war against the Ukrainian nation has had a direct impact on the lives of ordinary people in Ukraine, resulting in displacement, injuries, killing, kidnapping of Ukrainian children, destruction of homes and families, and distortion of normal lives. Despite the Russian attempts, the Ukrainian people have illustrated incredible resilience and creativity in facing and coping with the most complex challenges posed to civilians in this war. This chapter focuses on the case of Ukrainian resilience which lies at the heart of the Ukrainian approach to the total/comprehensive defence, illustrated through different examples of the resilience of the Ukrainian people and various initiatives in support of the military on the battlefield. The chapter finishes with a discussion of the factors that enabled the Ukrainian total defence and the resilience of the Ukrainian nation.

Ukrainian approach to resilience

The legal framework to regulate the Ukrainian approach to resilience was adopted in September 2021 – 'Concept for ensuring the national system of resilience.'[1] This document outlined key definitions and the approach to achieving national resilience under hybrid threats and crises. Resilience was defined as 'the ability of the state and society to effectively resist threats of any origin and nature, to adapt to changes in the security environment, to maintain stable functioning, to recover to the desired balance after crisis situations quickly.'[2] The primary focus was on inter-agency (agencies included state authorities, local self-government bodies, enterprises, institutions, organisations and civil society institutes) and collaboration aimed at sustaining the functionality of the society across various spheres. The main elements of resilience included effective functioning of the governmental bodies; security of the critical infrastructure, specifically the supply of water, food,

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energy and heating; resilient functioning of the transport systems, cyber security and communication services; securing of law and order; support for the healthcare system in enduring greater pressure under the increased workload and restrained resources; effective functioning of the civil protection services; effective responses to the uncontrolled mass movement of people; social resistance, especially to the information warfare and propaganda; and financial and economic stability achieved through sustainment of the main business processes.[3]

This framework and consequent policy were established only in autumn 2021, and would be tested during the full-scale invasion. Despite the initial confusion and some of the members of Parliament (MPs) fleeing the country prior to the invasion in early February, those that stayed continued uninterrupted the work of this important legislative and diplomatic body. Inspired by the resilience of the president, the constitutional majority of 300 MPs continued to conduct plenary sessions in person, even when Russians were 20 km from the capital and the bombardment of the city and blackouts continued through autumn 2022.[4] The work of the Parliament also became more productive and effective. For instance, regarding the plenary time for the laws adopted in the first reading, half of all bills were passed in less than 41 seconds, and 90% of bills were passed in less than 2 minutes. Prior to this, only international agreements and ratifications were considered in such a turbo-mode.[5] Other governmental institutions, like law enforcement, social welfare and the tax office, continued working as well.

Regarding transport infrastructure, Russia caused severe damage and disrupted normal transportation flows through the air and naval routes. Due to the war and destruction of the civilian airports, civilian aviation could not operate in the Ukrainian air space, while transportation via Ukrainian ports proved to be complicated due to the Russian blockade of the ports, which affected the 70% of Ukrainian exports that were transported by sea. Oleksandr Kubrakov, the Ukrainian minister of infrastructure, reported in May 2022 that 7 airports, 144,000 km of roads, 1,242 bridges and almost 6,300 km of railways had been destroyed, which corresponded to 30% of the entire transport infrastructure of the country and was estimated to be worth €92.6 billion.[6] Due to this damage, the bulk of transportation for people, equipment and goods heavily fell on ground transportation.

While huge vehicles could deliver so much through the block-posted roads across the country, the Ukrainian Railways became the symbol of resilience in the transport sector. In terms of passenger transportation, railways were the fastest way to evacuate people from the more dangerous areas into safer parts of the country and abroad. According to the official statement of Ukrainian Railways in 2022, the railways transported 1.4 million passengers into the EU countries, which was the biggest figure in the previous ten years. On top of that, 600,000 people were transported as evacuees to the EU. The total of its performance for 2022 was '16.9 million passengers transported in long-distance connections, another 4 million passengers were evacuated.'[7] According to the end-of-year estimates, despite everything, Ukrainian Railways still transported 150,582,000 tonnes of

cargo in 2022, 52.1% less than in 2021. While all cargo transportation was reduced, one type of cargo reduced the least: grain. In 2022, Ukrainian Railways transported 28,871,300 tonnes of grain, which is only 14.2% less than in 2021.[8]

Another example of Ukrainian resilience is the endurance of Ukrainian farmers in continuing their work despite the full-scale invasion. The impact of the war on agriculture has been devastating. The Russian bombing campaign against Ukrainian civilian infrastructure also targeted various segments of agriculture, including farms and fields. While some farming fields will have to be cleared from the remnants of the explosions, other agricultural areas must be cleared because Russia mined them during their retreat. According to Oleksandr Dvoretskyi, the head of demining in the Kherson region, in this region alone, 300,000 hectares have to be demined to be again usable for agriculture purposes.[9] This was before the destruction of the Nova Kakhovka dam on 6 June 2023, resulting in the flooding of the Kherson region and ecocide on an unprecedented scale.[10]

From the first days of the invasion, the immediate effect was disruption of the normal agricultural cycles and industrial supply chains for various types of agriculture. This meant not only that various territories were occupied and could not be used for sawing but also that those areas that could be used had to be sawn under the dangerous conditions of the threats of constant Russian bombing campaigns and the stealing of farm equipment from Ukrainian farmers. Nevertheless, Ukrainian farmers sawed, fertilised and harvested crops despite falling bombs, poor weather conditions and other disruptions. They found solutions and arrangements to disseminate storage and facilitate delivery to where it was possible for small-scale farming. While people can compensate for various limitations of the existing circumstances even in terms of overcoming dangerous situations or the initial scarcity of some resources, such as fertilisers, pesticides and even tractor fuel, they cannot easily overcome such issues as heavily mined territories or lack of transportation flow for the harvested or stored grain, which might become stale and unusable. Further financial assistance to Ukrainian farmers was provided within United States Agency for International Development (USAID), the Agriculture Resilience Initiative (AGRI)–Ukraine; $100 million was aimed at supporting uninterrupted production of agricultural products, focusing on the provision of financial support as well as supplies of fuel, fertilisers, pesticides, personal protective equipment (PPE), seeds and other types of equipment. To support the harvest of 2022, this assistance was provided to 23% of the registered farmers, which is an estimated 12,800 Ukrainian farmers.[11] The initiative also addressed enduring challenges, such as widening the capabilities of Ukrainian entrepreneurs in drying, temporary storage and processing different agricultural products.[12] This was particularly important since damp weather and the urgency of harvesting crops when possible resulted in corn containing 30% moisture, which was not ideal for harvesting and required drying.

The best illustration of the resilience of Ukrainian farmers is the harvest of 2022. According to the Ministry of Agrarian Policy and Food of Ukraine, as of 26

January 2023, Ukraine had threshed 52.6 million tonnes of grain from 11.1 million hectares (96%). In this regard, wheat, barley, peas, soybeans, rapeseed and sugar beets were harvested from 100% of the areas. Other agricultural crops were almost completely harvested – corn (90%), buckwheat (98%), millet (99%) and sunflower seeds (99%).[13] Furthermore, although the area for sowing the main spring crops for the 2023 harvest in Ukrainian-controlled territory decreased by 206.5 thousand hectares to an estimated 5,700 thousand hectares compared to 2022, the Odesa region had already started sowing, and more than 16 thousand hectares were sowed in March 2023.[14]

Although the destruction of different meat, dairy and poultry farms significantly reduced the livestock, those farms that remained kept going despite the dangers. The owner of the 2,000-cow dairy and crop farm commented on the resilience of his employees in the situation:

> The creamery, the processing factory, they never skipped one day in picking up the milk. They never skipped a day in paying. We gave them some milk for free and they processed it for free and they gave these products to refugees and to the army. And a lot of people, a lot of farmers did similar things.[15]

In the modern digital- and electricity-dependent age, electricity shortages and blackouts challenge the logistics of societal survivability and individual resilience. Russian attacks on the Ukrainian electricity grid and civilian infrastructure were aimed at destroying normal life, depriving the Ukrainian people of the means to prepare food, get water and obtain heat during the coldest times of the year. However, the Ukrainian experience during this time illustrates the reverse of the Russian desired objectives. It again illustrated the successful integration of grassroots and more centralised top-down initiatives. When blackouts became an ordinary occurrence, regional administrations developed schedules for power cuts in order to economise electricity available for distinctive regions. This often depended on the extent of the Russian bombing, the speed of recovery of the electricity grid by the local services, restoration of electricity supply to the newly de-occupied areas and industry consumption. Furthermore, alternative, independent power generators and other electrical equipment soon satisfied the immediate demand for electricity. The supply of these devices was provided through different channels. Foreign governmental aid for big power generators was sent from all over the world, while some were purchased by the Ukrainian government, individual businesses and ordinary people for personal use at home.

While large businesses had to reorient their activities according to the availability of the big power generators, small businesses did not give up. For instance, various artesian coffee shops continued to work during power shortages using electricity generators, allowing people to charge their devices or get additional assistance. In essence, doing business as usual was another manifestation of the Ukrainian defiance against all odds. Many people learned to adjust their activities to the times

when electricity was available and use personal power banks, or publicly available support points. The Points of Invincibility/Unbreakability became essential support for the people in those severe times. They also became crucial pillars in sustaining total defence during prolonged public service disruptions. Accordingly, in the event of prolonged emergency power outages, points of invincibility were meant to provide electricity, Internet, water, heating and rest areas for people free of charge on a 24/7 basis.[16] The initiative was announced at the end of November 2022, with 4,000 points already prepared at that time and more to become available. For convenience search of their locations, a dedicated website with an interactive map including a description of the services and places available was launched.[17] In addition to the governmental points, some businesses would provide the basic services free of charge, while others would require payment. Such participating businesses in each city would also be listed on the same website. This initiative was implemented very fast. The primary distinction between various points was the relatively different availability of additional services, like medical support or childcare, which varied between regions and depended on the funds available in each regional administration.

One of the prominent examples of Ukrainian resilience is its ability to sustain and restore the power grid damaged by Russian attacks. According to US data, before the beginning of direct targeting of the electricity grid in November 2022, only 5% of the grid was damaged, but after the attacks were focused specifically on the grid, 30% was damaged.[18] As a result, in order to restore various segments of the grid, Ukrainian repair teams were working around the clock and even under further rounds of Russian bombing. The electricity team has been on full alert with a 24/7 working schedule since midnight on 24 February 2022. Four hours before the invasion, a test disconnection of Ukraine from the Russian power grid was conducted to check its compliance with requirements of the European Network of Transmission System Operators for Electricity. It was to last for three days. According to Mariia Tsaturian of Ukrenergo, during the first days of the invasion, electrical engineers had to conduct synchronisation of the national system with the European one, and a project that would normally require 1.5 years was finished within 3 weeks.[19] Despite Russian targeting of the same places after their repair, Ukrenergo teams continued working and fixing damage. In autumn, they also had to work on fixing connections between the newly de-occupied territories of Kherson and the rest of the national power grid.

Volunteering movement

In the early chapters, Maidan and the roots of the Ukrainian volunteering movement were discussed. The full-scale invasion illustrated that the volunteering movement became more consolidated and spread to more spheres, products and services provision, than before. As a result, it became a strong pillar in strengthening total national defence and the link between the rear and frontline at the crucial tactical

level. The multitude of initiatives and volunteering frameworks would require a book of its own; thus, only some of the most prominent examples with their distinctive specialisations are discussed here. Army SOS is known for purchasing military equipment to meet the demands of different units in the UAF. It also developed the 'Kropyva' tablet software used for artillery targeting. A similar military direction of equipment development and provision was adopted by 'Aerorozvidka,' which focused on developing and employing network-centric and robotic military capabilities in the Ukrainian defence. This team developed their own R18 drone – a vertical take-off and landing octoper with eight lifting screws that can carry a payload of a few kilograms.

The Hospitallers medical battalion was created in 2014 by medical volunteer Yana Zinkevych, and it continued its work into the full-scale war. The primary purpose of this volunteering paramedic initiative was to provide first aid to the wounded on the battlefield, evacuation to the closest hospital, help with rehabilitation processes and transfer the deceased to their burial sites across Ukraine. In addition to actual involvement in medical support on the frontline, the unit has also conducted numerous training programmes to teach different volunteers and military personnel how to save lives. It has conducted various fundraising activities to purchase medical and transportation equipment supporting different units. One of the most important and lifesaving means constantly in need on the frontline remains a good medical turnstile and practical knowledge of its correct use.[20] The unit's cause was further supported by abroad fundraising initiatives, such as Hospitallers Ukraine Aid from the UK, which focused on fundraising to provide fully equipped and medically supplied ambulances to Ukraine.[21]

An example of how the volunteer initiative 2014 developed into a fund that systematically addresses needs on the frontline is the 'Come Back Alive' foundation. It is the first charity organisation in Ukraine licenced to buy and import military and dual-purpose goods. Among its purchases are Bayraktar TB2 drones and supporting equipment, thermal imaging optics, quadcopters, cars and intelligence systems. It also facilitates various training programmes for demining activities, drone operators, artillerymen, snipers and pre-medical aid on the battlefield. It provides more niche training for the needs of the SOF. Since 2014, it has raised over UAH 6.6 billion ($175 million).[22] One of their projects 'Long Arms of Territorial Defence' was aimed at strengthening the Territorial defence units with 'reconnaissance and strike complexes with a unified system of providing means of reconnaissance, fire damage, communication, mobility and specialized training by the instructors of the Foundation.'[23] The total sum of UAH 333 million was divided on a regional basis following the way TDF was formed. Another project was to establish a cyber centre in one of the units. Another project was fundraising in support of the tactical needs of the 10th Naval Aviation Brigade.[24]

Another large-scale foundation that was established later than 2014 is the Prytula Foundation, which became prominent in its ability to purchase satellite access when $16 million gathered for drones was not required because the Turkish manufacturer

Baykar gifted Ukraine three Bayraktar drones. Besides various military projects, this foundation also launched projects to help the civilian population affected by Russian aggression. This included aid to medical institutions, urgent humanitarian aid to people living close to the frontline or to recently de-occupied territories, provision of heating and connection equipment, and the NEST temporary housing initiative.[25]

These few examples of volunteering go hand-in-hand with another important phenomenon of the war – crowdfunding. According to Chatham House research, despite the ongoing war, 72% of Ukrainians were donating money to support the UAF: 'on the day of an Iranian drone attack on the centre of Kyiv in October 2022, people donated more than £5.6 million to buy kamikaze drones for the Ukrainian army.'[26] From the Ukrainian perspective, there is nothing new in supporting different military units with equipment and personally purchased items. While it may seem that the experience dates back to the beginning of the war when the UAF were under-resourced during the pro-Russian regime of Yanukovych, the experience dates back to both revolutions (the Orange Revolution and the Revolution of Dignity) when people would send support to those standing on the main square. Various initiatives and practices were crystallised in the examples mentioned in this section. Crowdfunding was indeed one of the Ukrainian adaptations to the requirements of the war.[27] From one perspective, it provided additional means to support the UAF that were customised to the needs of the tactical levels of specific units. Often customised orders could be sent sooner than any centralised requests, not to mention that centralised purchases could then prioritise more strategic and operational objectives. Once again, the two approaches – grassroots and top-down – complemented each other, which was especially significant under the conditions of the high tempo of war on dynamic frontlines.

From another perspective, namely the societal one, people had an opportunity to directly support the UAF in their fight against Russian aggression. This was an important factor in strengthening the connection between the rear and the frontline and, hence, boosting mutual morale. The civilian population that could not fight felt more engaged and motivated because they could at least help the UAF financially. Soldiers on the frontline felt the support of not only the Ukrainian government and the chain of command but also the Ukrainian nation and society in general, which reduced the feeling of alienation and blurred the idea of a greater divide between the relatively peaceful rear and the warfighting on the frontline. These initiatives widened support for the UAF from that of Ukraine and the region to the global scale since ordinary people worldwide could donate money in support of the UAF. This meant that the very concept of the rear and social support in the total defence had significantly transcended any limitations of the conceptual frameworks and illustrated not only the global support for the UAF in this war but also that the Ukrainian war for its independence and integrity resonated with the core humane values across the world. It indeed became a global war.

Besides the big crowdfunding projects, there have been smaller individual initiatives by people known and trusted by various groups in society. These ties are based on knowing people personally or through trusted sources. One of the examples is Yana Suporovska,[28] a talented journalist, public activist and founder of the Cultural Tribunal podcast. This project is about prominent Ukrainian names in culture, art and science and the world-class collections that for centuries were appropriated by the Russian Empire.[29] In addition to being active in the cultural and information segments of the Ukrainian struggle against Russian aggression, she is an active participant in the UkrTwi community. In terms of crowdfunding, she would often post smaller crowdfunding initiatives for various units' very specific tactical needs. The importance of these projects was that they would provide needed means in terms of funding, purchasing and delivering the exact items within the shortest time. The effectiveness of such initiatives is based on trust, posting evidence of the purchases and their deliveries, and further confirmation from the people on the ground. This is also conditioned by the directive feature of the Ukrainian society of preserving the social aspects of data verification, meaning that under the conditions of the post-Cold War transitional stage of instability, one of the sources for cross-verification of data would be HUMINT or to know people who were involved in one event or another. For the same reasons, people tend to trust individuals more than institutions. In the context of this war, it would often mean confirmation of the information by people on the ground. Hence, greater transparency of even civilian or civil–military collaboration has been observed in this war.

Another example of precise, customised crowdfunding is conducted by the well-known commander of the air reconnaissance group 'Birds of Madyar,' Robert Brovdi (call sign 'Madyar'). In March 2023, he announced crowdfunding for Mavic thermal drones to boost the night-time activities of various units of the UAF. The most surprising part of this effort was not the request or purpose or who initiated the call but the fact that instead of the needed UAH 10 million, UAH 15 million were crowdfunded within five hours after the call for funding was announced on social media platforms.[30] Such examples illustrate the core of Ukrainian strength in this war – unity and standing together despite differences.

Besides the big projects or well-known initiatives, some ordinary people were often hidden by the shadows of the grand scale of the war but they made a huge difference for Ukrainian warriors on the frontline. From the first days, ordinary people gathered supplies and manufactured Molotov cocktails, women and children knitted camouflage nets for the ground forces and SOF, and restaurant owners opened their doors to feed people. There were grandmothers in their eighties baking bread in half-destroyed stoves to feed UAF warriors on their way to the frontline. Children were playing instruments or chess on the streets of Ukrainian cities to crowdfund for the UAF; some were giving away their personal savings to help the UAF in defending their homeland. Other people were eager to deliver anything or anyone to and from the frontline. On one occasion, I came across social media exchanges between the soldiers on the frontline asking someone from

the surrounding area to pick up a puppy because it could not be taken with the relocating unit and would starve to death or be killed by Russians if they came into the area. People would help each other like never before.

Sources of Ukrainian resilience and total defence

The aforementioned examples and segments of Ukrainian resilience and approaches to total defence are the result of characteristic features of Ukrainian society, the historical context and various experiences of the last few decades. From the historical perspective, because of a long history of occupation and domination, Ukraine has a long tradition of resistance, independence and sovereignty movements. Hence, from the political perspective of organising the country, a rigid hierarchy would never work. It would mainly result in diversification of local practice in the regions beyond what centralised directives envisaged. Inconsistency between people's will and centralised attempts to suppress it was manifested in the two revolutions in Ukraine. Since the driving force of change was coming from the people and ground initiatives, it gave rise to a strong civil society that started from simple assistance provided to people from one's region during the Orange Revolution and the Revolution of Dignity and developed into a strong rear consisting of volunteers, businesses, NGOs and ordinary people supporting the UAF during the full-scale invasion. In essence, through these tumultuous years of revolutions and constant transition, various civil society initiatives developed from ordinary ideas into large-scale projects providing systematic support to various segments of the UAF and parts of Ukrainian society.

The proactive nature and effectiveness of Ukrainian civil society was driven by necessity – the necessity of living in a transitional period, helping revolutionaries on Maidan and helping the military on the frontline. Although societal trends varied during the first eight years of war, one year of full-scale invasion illustrated that know-how developed in the last ten years had improved the readiness of the civil society to financially, physically and morally support the UAF. The argument that the strong front depends on the strong rear became sound during this year of the war like never before.

Another important factor in the adaptability and flexibility of Ukrainian society across spheres was the combination of advanced digital services and know-how with traditional and close-to-the-ground practices. Ukraine combined the benefits of digitisation of various spheres of life with preserving some more traditional ways of providing services for the categories of society that preferred to use more traditional tools. For instance, although most of the banking system would function on mobile and Internet banking, the importance of cash transactions was not ruled out as much as it has been in many Western countries over the last decade. Hence, under the crisis conditions, more people would have cash for transactions at the local outdoor markets, which proved to be an important adaptability during the blackouts. When supermarkets could not be open due to the lack of electricity

before power generators were available, people could purchase almost anything at the outdoor markets. Of course, from the perspective of adaptability and alternative sources of product supply, more urbanised areas were more vulnerable to the disruptions of supply chains, while the less urbanised areas closer to the sources of the food supply would feel the shortages differently.

Another factor in sustaining Ukrainian resilience and self-sufficiency is that Ukraine is an agrarian country. Most food and clothes products were or could be produced in the country. Despite the war and Russian targeting of fields, crop storage facilities and delivery routes, Ukraine supported itself with food necessities and exported grain abroad. Furthermore, although the country's industrial potential declined in the post-Cold War decades, the remaining industries could reorient to product and service provision in support of both the front and rear. One example is the most famous Ukrainian brand of military tactical clothes and equipment M-Tac, which is worn by the Ukrainian political and military leadership and is supplied to military and civilians for tactical-level needs.[31] Other large light-industry factories are reoriented to the governmental orders for different needs of the UAF.

One of the important factors in the survivability of various sectors of the national industry was the ease of mobility of various factories. In other words, when the full-scale invasion started, many factories with movable equipment migrated to the safer parts of the country – primarily central and western Ukraine. The availability of big facilities into which the factories could move was not a problem, since many big factory buildings remained unused after the decline of industrial production in the post-Cold War decades. Thus, the capacity to house these factories was there. In turn, these factories brought jobs into the areas. Furthermore, many small and medium-sized enterprises reoriented towards societal needs in participating in various governmental programmes and producing time-specific products and providing relevant services based on the changed demand and priorities in consumer behaviour. In this regard, people plan purchases more in advance and focus on Ukrainian brands and those that provide additional support to the UAF.[32]

From the governance perspective, one of the factors stimulating Ukrainian resilience and effective decision-making across regions is the previous reforms aimed at decentralisation and reinforcement of regional and municipal governance. The direct result of these reforms was that regions and municipalities would have greater freedom in decision-making and could focus on the regional development according to the local specifics and requirements. This set of reforms was conditioned by Ukrainian orientation towards EU membership and was initiated after 2014. Besides various refurbishing and reconstruction projects run since 2014, 'decentralisation reforms had a positive effect on the administrative, human resource and fiscal capacities of municipalities, as well as on service quality.'[33] Regarding the challenges posed by the full-scale invasion, following the overarching direction outlined by Kyiv, these reforms allowed local authorities to craft their response packages and activities based on the available local resources and infrastructure. For instance, the governor of the Truskavets' health resort was

working around the clock to facilitate incoming, internally displaced persons arriving from the temporarily occupied and heavily bombed areas. Different cities would face varied challenges since some would be on the main train routes and would take in more people.

In terms of resilience to air attacks, a few aspects need to be considered. On the plus side, the Soviet system of bomb shelters in the old buildings was very important for saving lives and providing people with much-needed shelter. From the perspective of the air raid sirens, the infrastructure for spreading the alerts was in place but various locations required repairs, which were undertaken fairly quickly across the country. As with many other activities, duplication of notifications and air raid alerts were conducted also digitally via smartphone apps, indicating the beginning of the air raid siren, the extent of the danger and the consequent end of the siren. Hence, the data were collected and transmitted symmetrically. Often attacks were coming from Crimea and the Black Sea in the direction of Kyiv, and people would be given the approximate time of the incoming attacks. One of the challenges with the bomb shelters was that in the new buildings, people would use basements for this purpose, which, in essence, meant that these were not designated bunker-type bomb shelters. Still, this was better than nothing. In contrast, some Soviet-era bunkers in the old school and municipal buildings, especially in the regions, were not immediately suitable and would often require repairs. These challenges would be prioritised, and during this first year of the full-scale invasion, many bomb shelters were repaired using local and central funding opportunities.

From the perspective of resilience, presence of the relevant infrastructure and the use of alternative places like the Kyiv underground for bomb shelter proved to be lifesaving and allowed focusing on other immediate challenges, especially during the first months of the war. However, for the infrastructure to be used to its fullest potential, it needs to be checked and fixed regularly so that it is ready when it is most needed. The argument that a certain threat might not be feasible proved wrong. The refurbishment of many bomb shelters made them functional again, but the capacity issue remained pressing, with many people using basements or car parks as shelters. Many people staying in their houses would protect themselves following the rule of two walls. Even in the case of bomb shelters, the Ukrainian volunteering spirit and creativity went hand in hand, with various solutions coming from local people. For instance, in the spring 2022, local volunteers in Odesa began clearing old 20-meter-deep catacombs to transform them into bomb shelter.[34]

On innovations

When discussing one of the Ukrainian adaptations in the war, Air Marshal Johnny Stringer (Royal Air Force), stated that Ukraine achieved ‘focused innovation,’ combining various platforms from small, medium and big technologies to create app-based ISR and C2.[35] The phrase ‘focused innovation’ can be extended to characterise the Ukrainian approach to resilience. On the basis of talent and hard

work, many Ukrainians achieved a lot in foreign countries where they would find more favourable conditions for their development – Ukrainian artists, inventors, businessmen and public activists can be found across different countries throughout the nation's history. During the Soviet era, many achievements of the Ukrainian people were appropriated by the state, which called them 'Soviet.' Some examples of this appropriation of Ukrainian artists are the famous film director Oleksandr Dovzhenko, and the avant-garde artists Kazymyr Malevych and Oleksandra Ekster.[36]

During the eight years of war, various innovations have been created across different spheres of Ukrainian life: from volunteering mechanisms, high-quality textile products, IT services to drone test projects and innovations in the military sphere. While the protracted war stimulated some innovations and allowed them to gradually develop, the full-scale invasion and the severe threat to the very survival of the Ukrainian nation refocused people and their skills on the single purpose of fighting and resisting the enemy in all domains and fronts of war. This vital necessity draws people's innovation in a single direction – to the rear to sustain the front and to the front to fight. Regarding the supportive environment for various initiatives and innovative suggestions, previously existing red tape and corruptive, restrictive layers were lifted (at least to a greater extent), allowing people to implement their ideas in life. Furthermore, the pressing necessity dictated immediate solutions without the usual doubts. People were just doing what they could, whether it be the Cultural Tribunal recovering Ukrainian cultural heritage from centuries of Russian thefts, or new drones developed for the UAF, or a Ukrainian boy inventing a demining drone to clear his land from the Russian explosive footprints, or various apps in support of both civil and military needs. Ukrainian foreign minister Dmytro Kuleba summarised the case of Ukraine as follows: 'Historically, Ukraine was unfairly under-appreciated, and I regret it took bloodshed and a devastating war for the world to realise how cool we are.'[37]

One of the crucial factors for the relevance of the innovations and their consequent implementation is that the vast majority of them are driven by tactical-level needs and are resolved by the grassroots, ground-level people who manage to create things under conditions of limited resources, disrupted supply chains, and a lack of electricity and sleep. From the military perspective, this was a crucial targeted innovation, because it addressed essential challenges faced by Ukrainian warriors in their day-to-day activities. People would remember how to do trench candles and how to improve them. This war illustrated the importance of being practice-oriented in problem-solving and innovation. The Ukrainian principle of 'get the most with what we have' prevailed in every aspect of life in times of war.

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10

INTERNATIONAL MILITARY ASSISTANCE

One of the distinctive features of this year of the full-scale invasion was an increased support of Ukraine by various international partners. This support has varied depending on Ukrainian needs and available assets as well as the political environment in the partner countries towards aiding Ukraine and the types of assistance possible at a given time. This chapter explores the importance of foreign military assistance to Ukraine to reinforce the capabilities of the UAF. In essence, the chapter looks at the significance of wider supply chains, supply chain continuity and the uninterrupted nature of supply chains to sustain modern full-scale inter-state warfare. The role of industrial capacities in support of the demands of high-intensity warfare is also discussed.

The various Russian sabotages before the full-scale invasion resulted in the preliminary degrading of Ukrainian stockpiles, and it was only a matter of time before the question of scarcity and lack of ammunition for the existing materiel was raised, which was illustrated by the challenges across domains. Sooner or later, more ammunition and equipment would be crucial for Ukraine to sustain its defence over a longer time and for the very survivability of the troops and holding of the lines. As further developments across the year showed, each stage of Ukrainian counteractions and counteroffensives was characterised by gathering all available and delivered assets to strengthen the firepower of the UAF and limit the extent of casualties through the use of precision weapons and ammunitions in as cost-effective a manner as possible since even with the foreign military aid, the issue of scarce resources overshadowed Ukrainian decision-making each step of the way.

While Chapter 9 illustrated the resilience of the Ukrainian people and their support in sustaining the fighting power with their available skills and activities within the country, the foreign military assistance provided another layer in sustainment of the Ukrainian capabilities with more specific and targeted military

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equipment, training and financial support crafted to Ukrainian needs on a larger scale and according to the demands of a particular stage of the war. In essence, the physical component of Ukrainian fighting power was strengthened by Western military equipment of various characteristics and different requirements for training. While some types of equipment required more training than others, partner nations showed an eagerness to develop and provide training courses on the shortest notice, matched only by Ukrainians' eagerness to learn relevant skills to defend their country. While some initiatives required more preparations from the partner nations, others were immediately established as demand increased and the situational characteristics deteriorated. One of the most prominent examples was the provision of power generators to Ukraine during Russian targeting of the electricity grid in autumn–winter 2022.

From the systematic perspective of logistics and supply chains, the case of Ukraine once again illustrates a symbiosis of different levels in satisfying the constantly increasing requirements of inter-state warfare. Some tactical-level demands in the form of basic and specialised equipment and commercial UAVs could be satisfied by Ukrainian civil society through crowdfunding and other initiatives, but on the macro level (strategic and operational), other assistance was essential. While some equipment could be developed and produced by the Ukrainian military industry, a significant number of military technologies was provided by Western partners, with the scale gradually expanding as the war progressed and demanded more equipment and greater firepower aimed not only for defence and degrading enemy forces but also for more kinetic counteroffensive activities.

The case of a no-fly zone (NFZ) over Ukraine that never was

Before discussing the extent of Western military assistance to Ukraine, it is essential to examine the idea that dominated the discussion of the war in the spring 2022, which was the debate on the potential of Western full or partial closing of the skies over Ukraine. This issue is discussed here, since it is primarily a decision and capabilities commitment of the Western countries, which can be categorised as an option of support that never occurred. Hence, it needs to be explained before discussing the variety and increasing intensification of international military assistance to Ukraine.

The concept of NFZ can be described as

> a physical area of a nation that is patrolled using airpower of another sovereign state or coalition. The legitimacy of such patrols of sovereign territory is derived from the fact that the no-fly zones are typically implemented within the context of international PSO coalitions, as was the case in Iraq and Bosnia.[1]

As a result of the post-Cold War operational experiences, three types of NFZs have been identified based on the distinctive purposes for their establishment.

Air cover NFZs are aimed at providing aerial support for the troops in hostile situations. Air deterrent NFZs are aimed at preventing invasion and aggression between two countries. Air occupation NFZs are an alternative to troops on the ground.[2] While NFZs originated in the conventional warfare of the First Gulf War, they are primarily used in peace-support frameworks or segments of counterinsurgencies. There are a few complexities with this type of missions. While from the contributing countries perspective, these missions might seem like a more feasible means of addressing a problem at hand, the elimination of a ground footprint still requires significant aerial assets, logistics and commitment, the extent of which would depend on the type of the NFZ, situational features of a given conflict and the scale of the aerial coverage. As a result, the effectiveness of the mission would depend on the density of aerial coverage, the extent of hostile activities and counteractions, and the distinctive rules of engagements conditioned by unique situational characteristics of an operation. Furthermore, despite the immediate flexibility that aerial assets can provide policymakers, there is a greater necessity for coordinating actions with the troops on the ground, which becomes even more complex when those troops are from other nations and operate within different national military systems.[3] In essence, establishing an NFZ means achieving a certain degree of control of the air by denying the enemy its use. This is accomplished not only by the mere presence of aircraft in the air but also by their actual kinetic employment in destroying any aerial or ground-based violation of the NFZ status. It is thus a combat mission with all of the accompanying legal and political consequences.

Some of the above points become even more prominent in the context of the discussion of the NFZ in Ukraine, with some new arguments arising. The primary consideration is that the Ukrainian case did not fit into any of the aforementioned types of NFZs. This would not be air cover for the troops on the ground since no allied troops would be on the ground, and any Western air cover or close air support to the Ukrainian troops in warfighting would mean active direct involvement in the warfighting. It could not be an air deterrent NFZ because the warfighting was already taking place, with the full-scale Russian invasion and during the previous eight years of war. The very preventative nature of this type of NFZ was absent from the start. Finally, the air occupation type was highly unlikely due to its employment in Libya and the consequent backfiring of this decision from the long-term political perspective.[4]

Another consideration on the subject of an NFZ is its cost. Even though it is a seemingly favourable alternative to the traditional troops on the ground, an NFZ is far from cheap. For instance:

> The USA's simultaneous involvement in two NFZs over Iraq cost $12 billion, not to mention the uncalculated cost of the rapid ageing of aircraft and overworking of the USAF personnel. This figure is not surprising, considering that in the first five years of Southern Watch, 86,000 sorties were flown. On each rotation, an

average operation was supported by 5,000 US personnel; however, in crisis that number was as high as 15,000.[5]

In Ukraine, even if there could be a shorter timespan for establishing an NFZ, it would not mean that cost would be lessened considering the employment of more expensive cutting-edge technologies in Western military and the need for more advanced logistical support in some cases. Of course, another aspect to consider is the scale. As compared to Iraq, the territory of Ukraine is 1.4 times bigger and would require an even greater commitment of aerial assets and consequent logistics.

Probably the most crucial argument against the NFZ over Ukraine was conditioned by the very nature of the mission – it would be a combat mission entailing the potential of actual warfighting, at least over the covered territory. Even within the relatively limited framework of the NFZs, taking part in warfighting 'would bring Russia into direct conflict with NATO forces.'[6] In early March 2022, Jens Stoltenberg, NATO's Secretary General, summarised the situation as follows: 'We understand the desperation but we also believe that if we did that (establishing a no-fly zone) we would end up with something that could lead to a full-fledged war in Europe, involving much more countries.'[7]

The other discussions regarding partial NFZs over Western Ukraine were primarily based on political considerations of the Western countries rather than the military thinking of their sufficiency and effectiveness. Hence, there was very little surprise that NFZs in any shape or form were ruled out.

The overall international military assistance to Ukraine

The question of international military assistance to Ukraine became evident from the beginning of the full-scale invasion. Various institutions had to change their policies in order to provide needed assistance, while some countries required shifts in their political environments to adjust assistance packages to Ukrainian needs. Since NATO was not going to get directly involved in the war and possessed no capabilities of its own, NATO member states had to make their assistance on a bilateral basis. However, there was a need for coordination of international support. Accordingly, the United Kingdom (UK), Poland and the United States led the coordination of international military assistance.

The United Kingdom arranged and hosted two donor conferences in February and March 2022, involving 35 countries from the European Union (EU) and NATO. In April 2022, the International Donor Coordination Centre (IDCC) was established in the US European Command Headquarters in Stuttgart, to provide military assistance in the most organised and effective way. This initiative was then supported by creating the Ukraine Defence Contact Group (UDCG) on 26 April 2022, which took place on the Ramstein Airbase and became known as the Ramstein format. Its aim is to discuss the partner commitments and their review according to the evolving military needs of the UAF in further intensification of

war and changing situational characteristics in the battlespace. It also became a platform for discussions of various matters at the top level. The ninth meeting of the UDCG took place on 14 February 2023, with 50 participating countries. Within this framework, countries jointly committed to provide Ukraine with military assistance worth £40 billion.[8] The International Fund for Ukraine (IFU) was another initiative to coordinate buying and transporting military equipment from third countries or enterprises to Ukraine. It was established in April 2022 under UK leadership.[9]

The war also triggered a shift in the Common Foreign and Security Policy (CFSP) and its relatively new tool of the European Peace Facility (EPF). It was founded on 22 March 2021 as a substitution for other instruments in this field, meaning the Athena Mechanism and the African Peace Facility. In essence, the EPF is 'an off-budget instrument aimed at enhancing the EU's ability to prevent conflicts, build peace, strengthen international security.'[10] Its initial financial ceiling for 2021–2027 was €5.692 billion.

On 27 February 2022, the EU High Representative for Foreign Affairs and Security Policy, Josep Borrell, announced that the EPF framework was to be used to satisfy two emergency assistance needs of Ukraine 'to finance the supply of lethal material to the Ukrainian army, as well as urgently needed fuel, protective equipment and emergency medical supplies.'[11] This was a significant decision not only because this tool was employed for the provision of the military equipment and logistics assistance to a country fighting the war against aggression but also because 'a "taboo has fallen", and that this will be the first time in history that the EU will be providing lethal equipment to a third country.'[12] Militarily neutral countries of the EU could opt out from provision of the lethal weapons. The scale of assistance within this framework in six sequential tranches was around €3.6 billion. Since 60% of the EFP budget was devoted to helping Ukrainian needs in the war, the ceiling of the fund had to be increased by two more billion.[13]

As previously mentioned, besides common centralised and institutionalised frameworks, individual nation members or non-members of the EU and NATO conducted their contributions on a bilateral basis. It is crucial to look into assistance from some individual countries to understand the scale of Western military support to Ukraine. It will not be possible to include the details of all the countries in this chapter, but some aspects and examples should be identified for a better understanding of the wider foreign military assistance and supply chains.

American military assistance to Ukraine has a long history. During the initial eight years of the war, primarily non-lethal weapons were provided, with a gradual shift towards lethal weapons during the Trump administration. Hence, some equipment was made available before the full-scale invasion. From 2014 until 27 February 2023, the United States committed about $34 billion in security assistance for Ukraine to defend itself. Of this sum, the commitment of the Biden administration since the start of the full-scale invasion was estimated at more than $31.7 billion.[14] Since 2018, Ukraine has procured less-advanced weapons, such

as Javelin anti-armour missiles and Mark VI patrol boats, along with various non-lethal equipment like helmets and body armour. Since 2022, the United States has provided more advanced defensive equipment and increased the quantity of previously sent types of military supplies and equipment. Some of the most prominent advanced weapons provided since 2022 include ground-based air defences such as HIMARS, NASAMS and Patriot; M1 Abrams and T-72B tanks and Bradley infantry fighting vehicles; APCs; Stinger anti-aircraft systems; Javelin and other anti-armour systems; Phoenix Ghost and Switchblade Tactical UAS and artillery; mortar systems; Remote Anti-Armor Mine (RAAM) Systems; Tube-Launched, Optically Tracked, Wire-Guided (TOW) missiles, high-speed anti-radiation missiles (HARMs), and laser-guided rocket systems; grenade launchers and small arms; communications, radar and intelligence equipment; and training and maintenance services.[15]

In addition to the direct assistance, the Unites States has also authorised delivery of equipment to Ukraine that originated in the United States but was in the arsenals of the 14 NATO and partner countries. The United States has also facilitated allies to supply Ukraine with air defence systems from their national inventories, and it announced '$682 million in Foreign Military Financing to incentivise and backfill donations of military equipment to Ukraine by its allies and partners.'[16]

The United Kingdom was the second biggest contributor to Ukraine in military assistance after the US. Preliminary help started a few months prior to the invasion in December 2021. As of February 2023, the United Kingdom had provided military assistance worth £2.3 billion within a year, of which £250 million was given to the IFU. The current British government of Rishi Sunak has committed to match the same sum for 2023–2024. Besides the non-lethal assistance, such as body armour, helmets, night vision devices, medical supplies and winter clothes, the country also provided a significant number of lethal weapons, including NLAW anti-tank missiles, Starstreak air defence systems, AFVs, M270 MLRS and anti-structure ammunitions among many other pieces of equipment. As was previously mentioned, the United Kingdom was one of the few countries that provided Ukraine with aerial assets in the form of Sea King helicopters.[17] With the intensification of the war in autumn and winter, some more sophisticated technologies were sent to Ukraine; among them were Advanced Medium-Range Air-to-Air Missile (AMRAAM) to be used in NASAMS. The characteristic feature of these missiles is that they are capable of shooting down cruise missiles. Following preparations for the Ukrainian spring offensive and widening the discussion among partner nations regarding the provision to Ukraine of a significant number of tanks and various armoured vehicles, the United Kingdom committed to provide 14 Challenger II tanks with additional ammunitions for various platforms. The United Kingdom was the first country to provide Ukraine with long-range missiles – Storm Shadow – which were in use by the UAF already in spring 2023.

As one of the key countries coordinating international support for Ukraine, the United Kingdom facilitated transportation from the NATO and third-country

partners. The Royal Air Force C-17 Globemaster transport aircraft from the Air Mobility Force delivered thousands of tonnes of military assistance to Ukraine from various allied and international donors throughout 2022. In the case of NATO and EU Member States, deliveries were conducted within the ATARES programme, which is aimed at mutual support through the exchange of national air transport services.[18]

Poland is the country that is beyond praise in its constant support of Ukraine's requirements at each stage of the war. It has hosted millions of Ukrainian refugees and became the primary logistical hub for the military assistance being sent to Ukraine from around the world through various routes and means of delivery, transferring it to Ukraine and spreading it in accordance with the needs of the UAF. Poland was already supplying Ukraine with lethal weapons at the end of January 2022; through the year of the full-scale invasion, it was one of the main suppliers of heavy weaponry to Ukraine, ranging from Polish AHS Krab howitzer artillery, IFVs and T-72 tanks to grenades, ammunition, mortars, anti-aircraft missiles and reconnaissance drones.[19] With German permission, it resupplied German-manufactured Leopard II tanks to Ukraine and successfully received permission to redeploy five Cold War MiG-29 fighter aircraft from German inventory.[20] Since Poland has given away a lot of its military equipment, the United Kingdom and the United States were discussing frameworks to backfill some of these capabilities.

The geostrategic location of Poland made its role in Ukrainian logistics even greater since it allowed an equipment repair workshop to open in an undisclosed location in Poland. The state-owned Polish Armaments Group conducts repairs of Polish-manufactured Krab howitzers that were damaged in Ukraine.[21] The Polish engineers' remote realtime technical support of these howitzers used by Ukrainian artillerymen on the frontline received much praise. During the visit of President Zelenskyy to Poland on 5 April 2023, the partnership between the two countries was further tightened with Ukraine procuring Polish weapons, such as Rosomak APCs, Rak self-propelled gun mortars and ammunition for the Piorun air defence systems. Furthermore, the two heads of state discussed various opportunities for establishing joint commercial enterprises in manufacturing of weapons and ammunition.[22]

Together with the US, Turkey was one of the few countries to sell Ukraine lethal weapons before the Russian full-scale invasion. The primary items for procurement were Bayraktar drones manufactured in Turkey. However, the arrangement and its continuation through the year was primarily advertised as a deal between the manufacturer Baykar Technology and Ukraine. Since then, various sources have discussed the extent of Turkish assistance to Ukraine,[23] but the two countries have officially acknowledged few details.

Germany has been in the middle of the debates regarding provision of Ukraine with various types of weapons at each stage of the full-scale war. Despite the complex debates on providing Ukraine with weapons and blocking the provision of German-produced weapons to Ukraine by other countries, such as Estonia, as

well as blocking artillery or anti-drone rifles and anti-sniper systems via NATO procurement means, and despite the debates regarding provision of Leopard 2 tanks and recently MiG-29, and despite all its shortcomings, Germany provided support to Ukraine across various segments.[24] The total sum of German military assistance to Ukraine as of February 2023 was €2.36 billion.[25] Due to various funding schemes, different capabilities either facilitated Ukraine to buy directly from the German manufacturer or were provided from the German military arsenals, and some of these funds were devoted to Germany's increased contribution to EPF.[26] The situation significantly changed one year later. Germany stepped in with even more significant military assistance to Ukraine of €2.7 billion pledged in May 2023, focusing on heavy weaponry like tanks and air defences.

French military support to Ukraine was present across all rounds of the Western supplies from howitzers in spring–summer, air defences during autumn and tanks and armoured vehicles in winter. Spain provided Hawk air defence systems, artillery ammunitions and winter uniforms. Following the allied decision to send tanks, Spain joined the initiative with Leopard II tanks they had in storage. Italy agreed to send Ukraine lethal weaponry, including Stingers, mortars and anti-tank weaponry. Further packages included heavier weapons and air defences. From the earlier stages of the war, Portugal provided both non-lethal and lethal weapons and offered to contribute to the European training courses. The majority of equipment sent by Portugal remains classified.[27] Romania provided both lethal and non-lethal weapons and allowed military equipment and other supplies to transition across its territory. Bulgaria provided logistical support; it agreed to supply some pieces of its Soviet-era equipment only in December 2022 in exchange for NATO assistance in modernising its capabilities.[28]

The Netherlands already began providing Ukraine with military assistance a week prior to the Russian invasion. As of December 2022, the total sum of the assistance through 2022 was €987 million.[29] As in many other cases, it evolved from the more basic ammunition to the more complex equipment, including howitzers, air defences (including Patriot systems), combat vehicles, different sensors, bridges, individual weapons and ammunition. Furthermore, they provided different transport vehicles, minehunter vessels and a variety of equipment for demining as well as logistics equipment.[30] The country also cooperates with the United States to sponsor refurbishing of Czech T-72 tanks.

Ukraine's neighbouring Eastern European countries also provided constant support. From the first days of the invasion, the Czech Republic committed to deliver pistols, assault rifles, machine guns, sniper rifles and one million cartridges as well as Czech Dana howitzers and RM-70 Vampir MLRS. In spring 2022, it became the first country to provide Ukraine with Soviet-era tanks T-72 and combat helicopters.[31] It also collaborates with NATO allies to modernise Soviet tanks in its inventory. As a signatory of the Tallinn Pledge on 19 January 2023, the Czech Republic committed to further supporting Ukraine by boosting its mass production of ammunitions and maintaining the already deployed equipment.[32] Slovakia

followed the same path of immediate assistance in February 2022, focusing on 120 artillery ammunitions and fuel, later followed by S-300 air defences, mortars and Zuzana self-propelled gun-howitzers. Slovakia was also repairing various Ukrainian and Russian vehicles used by the UAF. On 19 March 2023, Slovakia announced it would deliver its 13 MiG-29 aircraft to Ukraine. It was the second NATO country to pledge fixed-wing aircraft delivery.[33] The first four were already delivered on 23 March 2023.

The Baltic countries were among the European countries that were well aware of what the Russian threat was really like. Hence, their support of Ukraine was incredible despite their smaller military budgets and available capabilities. Latvia already began delivering Stingers, individual equipment and dry food supplies to Ukraine in January–February 2022, followed by more supplies of these items with UAVs, helicopters and M109 howitzers. In May 2022, Lithuania was among the top 15 Ukrainian donors with immediate deliveries of Stingers, anti-tank weapons, UAVs and radars, followed by heavier ground forces transportation requirements, such as M113 armoured personnel carriers, military trucks and all-terrain mine clearance vehicles. The recent commitments include Mi-8 helicopters. Estonia already began providing Ukraine with smaller portions of firearms in 2020, starting with 2,400 Makarov semi-automatic pistols, then with weapons with more firepower when there was a renewal of Russian military build-up in 2021. In January 2022, Estonia sent Javelins after receiving US approval, while it took longer for Germany and Finland to approve licences for more Javelins and howitzers, which nevertheless were sent later. The latest package focused on armoured vehicles and air defences. The overall package of military assistance from Estonia was around €340 million.[34]

Another group of significant contributors of military assistance to Ukraine were the Nordic countries. The revival of the Russian threat resulted in a shift in regional security and Sweden's and Finland's NATO applications and a greater focus on military, financial and humanitarian support of Ukraine's fight for its independence and integrity. Norway changed its principle of not supplying weapons to war zones. During this year, it delivered M72 light anti-tank weapons (LAW), M109 howitzers and armoured vehicles. Norway also took part in various bilateral and trilateral initiatives, such as investments with Denmark and Germany in the production of howitzers in Slovakia. With the UK, it collaborates on provision of MLRS and Black Hornet micro-drones for the needs of special operation forces.[35]

Despite having a long tradition of military non-alignment, Sweden has a prominent military industry producing various equipment from Gripen fighter aircraft to land warfare Archer artillery systems. Regarding its military assistance to Ukraine, it was announced on 27 February 2022 that it was committing to supply field ratios, helmets, body armour and anti-tank weapons along with €47 million of financial help to Ukraine. Further tranches included anti-ship missile systems, air defences, small arms and protective equipment. The content of some packages of military assistance has not been disclosed. In the recent (January 2023) and

the largest tranche so far, worth SEK 4.3 billion, Sweden included CV-90 IFVs, anti-tank missiles and the Archer artillery systems.[36] Finland also announced immediate assistance to Ukraine, which very soon evolved from defensive to lethal weapons supply, with nine tranches as of December 2022, although very few details have been shared due to security reasons. Denmark contributed 600 million through different initiatives starting with non-lethal weapons and ending with the recent promise of providing 19 Caesar artillery systems. With Germany and the Netherlands, Denmark established a Leopard 1A5 initiative to supply Ukraine with 100 Leopard 1 tanks, additional spare parts and ammunition.[37] Furthermore, Nordic countries are also in the heart of the fighter jet coalition that agreed to train Ukrainian pilots and engineers to employ fourth-generation fighter aircraft like the F-16 and Jas 39 Gripen. The nine countries – the UK, the Netherlands, Poland, Denmark, Sweden, Belgium, Portugal, France and the US – also agreed to join the coalition.[38] Discussions held with some coalition members focused on sending F-16s to Ukraine, while other members committed primarily to pilot training programmes.

Countries from other regions also supplied Ukraine with military assistance. Australia provided AUD 475 million in various protected armoured vehicles and demining equipment. One of the most unique types of equipment was provision of cardboard drones – the 'Corvo Precision Payload Delivery System' drones – manufactured by the private Australian company SYPAQ Systems.[39] New Zealand sent packages of non-lethal weapons. Canadian military support for Ukraine also transitioned from non-lethal to lethal weapons, initially focusing on individual weapons and ammunitions, then heavier ones like howitzers, heavy armoured vehicles; it recently announced purchases of NASAMS from the United States to be sent to Ukraine. The estimated sum of Canadian military support since February 2022 has been estimated at $1 billion.[40] Japan sent various types of non-lethal support equipment and humanitarian aid. As of early spring 2023, it remains restricted in its freedom to send lethal weapons due to Japan's prohibitive legislation the revision of which was to be discussed in spring 2023.[41] Japan also promised to increase its initial support for Ukraine from more than $1 billion to $5.6 billion in financial aid.[42] Taiwan was assisting Ukraine with hundreds of tonnes of humanitarian aid, financial support and $56 million in assistance for rebuilding the country. The country also suggested various training opportunities for Ukrainian personnel.[43]

Overall, Western military assistance to Ukraine illustrates many initiatives on various levels from institutional, bilateral, group and project-based activities. In addition to constant dialogue within the Ramstein format, various countries have re-emphasised their commitments to support Ukraine each step of the way. One of the recent initiatives was the Tallinn Pledge – a joint statement of the defence ministers of Estonia, the UK, Poland, Latvia, Lithuania and representatives of Denmark, the Czech Republic, the Netherlands and Slovakia – which was announced on 19 January 2023. The purpose of the statement was 'to reaffirm our continued determination and resolve to supporting Ukraine in their heroic resistance against

the illegal and unprovoked Russian aggression.'[44] It then proceeded with detailed individual commitments of the participating parties. This statement was made the day before the next Ramstein meeting on 20 January 2023.

Training courses

Besides materiel provision, Western partners also assisted the UAF with various personnel training programmes. The United Kingdom has conducted training initiatives in Ukraine since 2015. Earlier that year, operation Orbital was launched. It aimed at non-lethal training and capacity building. The initial focus was on non-combat military personnel providing basic training in medical, logistics and intelligence capacity development. As various gaps were identified, the operation was extended to 100 military personnel focusing on 'additional medical, infantry and survival skills training, countering improvised explosive devices; training for defensive operations in an urban environment; operational planning; engineering; countering attacks from snipers, armoured vehicles and mortars.'[45] The primary approach of the operation was to 'train the trainers' in order for the Ukrainian personnel to spread their skills across the relevant branches and units. Starting in 2015 up until the full-scale invasion, the United Kingdom had trained 22,000 Ukrainian personnel within this operation and the Maritime Training Initiative.[46]

Just like the UK, Canada also conducted training and capacity-building activities in Ukraine since 2015 under the umbrella term of Operation Unifier, aimed at training

> 36,000 Ukrainian military and security personnel in battlefield tactics and advanced military skills. As the mission progressed, much of the direct training undertaken by CAF members transitioned to members of the Armed Forces of Ukraine, with Canadians acting as advisors and mentors as well as assisting in the development of courses.[47]

Operation Orbital provided a functional framework for establishing a training programme crafted for the new requirements of the full-scale war. As a result, the United Kingdom launched a long-term training programme under Operation Interflex, aimed at training at least 10,000 Ukrainian soldiers every 120 days. Unlike its predecessor, this operation has been taking place in the UK, while some other medical and engineering training initiatives are held in Ukraine.[48] This training received further support from various international partners. The Netherlands was one of the first to offer personnel to participate in the training. Canada agreed to send its people to the United Kingdom to strengthen the joint effort as it had extended the duration of its Operation Unifier until March 2025. The Nordic countries also agreed to contribute: Sweden (120 instructors), Finland (20), Denmark (130) and Norway, though they did not specify the exact number. Denmark has experience collaborating with the United Kingdom and Canada since

it was part of the previous operation Orbital and Unifier. Lithuania, New Zealand and Australia also sent their personnel. The next stage of expanding this programme is to include training of Ukrainian pilots.[49]

Another initiative within this framework was the establishment of training programmes within the EU frameworks. Accordingly, the European Union Military Assistance Mission Ukraine (EUMAM) was launched on 15 November 2022. The programme is set to run for two years and already involves 24 EU Member States, and it should initially train 15,000 Ukrainian personnel. This framework is aimed to complement existing training arrangements within British, Canadian and other bilateral initiatives.[50]

Besides this systematic training programme, various equipment exploitation and maintenance courses have been given to Ukrainian military personnel in partner countries. For instance, the United States trained the Ukrainian military to use the Patriot air defence systems.[51] The United States had previously trained 3,100 Ukrainian military personnel to use and maintain other types of equipment, such as HIMARS, howitzers and armoured vehicles. The recent American initiative of training Ukrainian forces in combined arms training in Germany is aimed at sharpening relevant skills for the counteroffensive.[52]

In addition to participating in Operation Interflex, Sweden expanded collaboration with the Ukrainian military across a few more points. In April–May 2023, Sweden launched the largest defence exercise in the last 25 years – Aurora 23: 'an exercise in which all service branches and other armed forces will participate, and which will reinforce the collected capability to counter an armed attack on Sweden.'[53] The exercise involved 26,000 personnel from various partner countries, including Ukraine.

The Swedish Defence University conducted another collaboration initiative through a range of bilateral visits and meetings of the university military and civilian leadership with Ukrainian counterparts from the National Defence University of Ukraine and Ukrainian Ministry of Defence. During the April visit of the Ukrainian delegation, some of the discussed topics included

> a Strategic Leadership Programme exclusively for leaders in Ukraine, with the support of NATO's Defence Education Enhancement Programme (DEEP). The project is run by the Swedish Defence University's Centre for Societal Security (CTSS) which has offered this leadership programme since 2021 as part of Sweden's involvement in NATO's Partnership for Peace (PfP).[54]

The visit also touched upon the Swedish officers training programme's curriculum and various bilateral cooperation opportunities.

As part of Norway's commitment to participate in Nordic training initiatives for the UAF, the country began training 100 Ukrainian personnel at Vaernes on 24 April 2023. The four-week course was aimed at training skills in military medicine, sharpshooting and team leadership. This was the first course of its kind in Norway. The Norwegian Home Guard supervised it.[55]

Points for consideration

The wider international military assistance to Ukraine confirmed some of the significant observations about inter-state warfare, and to a certain degree, adjusted some other views on modern and future warfare. Despite the tendency for limited wars of choice, full-scale inter-state warfare requires continuous and increasing support both in terms of skilled personnel and the supply of materiel of various characteristics depending on the tasks at hand in the battlespace. The Ukrainian requirements in firepower across domains were identified early in the last year of the full-scale war, with different stages of intensification and the necessity for varying capabilities. While some immediate needs could be satisfied by domestic supply chains and logistics in the rear, the wider international community served as a support hub of the UAF in terms of the provision of cutting-edge technologies to strengthen Ukrainian fighting power in defending the country. The scale of the war and partner military not only identified the necessity of long-term sustainment of fighting power in a protracted war or war of attrition but also illustrated various challenges in the current strategic environment and military readiness across various stages of its achievement.

Time and timeliness

The primary consideration evident in this war is the matter of time and timeliness of decision-making, delivery and employment of various equipment across the battlespace. The matter of time in warfare is probably even more essential today than ever due to the high tempo of war and the speed of information transfer worldwide. Robert Leonhard identified four time-related factors for defining and limiting political and military power: duration, frequency, sequence and opportunity.[56] Mick Ryan explained that in the post-Cold War era, Western countries aimed for conflicts of more limited duration. This 'desire for shorter wars is driven by the level of interests involved as well as the need to sustain political and public support for military actions.'[57] In the case of Ukraine, this Western tendency had a few manifestations in terms of military assistance to Ukraine. While some countries provided immediate military assistance to Ukraine in the spring 2022 or even earlier, various Western countries initially found it difficult to gain and sustain political and public support for the provision of military assistance or the gradual shift from sending non-lethal weapons to lethal and then heavier lethal weapons to Ukraine.

Although eventually political and public support for military assistance to Ukraine was achieved in various Western countries, challenges in timely decision-making and delivery of weapons remained. Since each round of partners' discussions of the military assistance was stimulated by the deteriorating situation in Ukraine and the vital Ukrainian needs for survival at a given time, the decision-making was reactive rather than proactive. In its turn, this approach had direct implications on

the timelines of formal processing of decisions, the establishment of time frames of commitments and the actual delivery of equipment. This tendency was evident in national debates over air defences, Leopard tanks and fighter aircraft. From the foreign partners' perspective, this is a natural mode of action in assisting within the peacetime framework and procedures. However, from the perspective of full-scale inter-state warfare, the question is posed differently – long-term planning, building up of capabilities and earlier availability of resources to arrange kinetic aspects of counteroffensives and the regaining of Russia-occupied territory require a pro-active approach in supply contribution to enable a further gaining of military advantage and its full employment in the battlespace.

The important shift in the dynamics of the war is that there is a big difference between having the capabilities to contain one's enemy within a given frontline and having accumulated needed capabilities to advance and take back territory. In other words, while the first nine–ten months of this intensive segment of war were characterised by the responsiveness of international partners in providing the UAF with the means to survive and defend the country within the established frontlines, the winter preparation for the Ukrainian counteroffensive illustrated a gradually changing mindset – a move towards gathering strengths for the shifting of the relatively established military balance in Ukrainian favour. On 20 April 2023, Oleksiy Danilov, secretary of the National Security and Defense Council of Ukraine, commented on this topic, stating: 'The next necessary stage in our relations with allies and partners is the transition from ensuring the military balance on the battlefield to the level of achieving Ukraine's military superiority over Muscovy's occupation army.'[58]

The intensification of the war, its move towards the war of attrition and wider Russian targeting of the civilian population across Ukraine affected the partners' mindset and perception of the war. Initially, it was a matter of underestimating the UAF and considering how long the country would last. Then it was about developing systematic provisions of lethal weapons across various demanded time frames. In the recent stage in preparation for the counteroffensive or, as Danilov said, gaining Ukrainian military superiority or military advantage, the focus is on reshaping the existing Ukrainian fighting power towards the heavier and more technologically advanced side of the spectrum and also improving the logistics of these technologies with various maintenance and payload supply arrangements. However, time and timeliness were crucial factors in providing military assistance across various stages of the intensification of war – whether that was artillery and tanks for counteroffensives, air defences or aerial capabilities.

Mass

In the case of the war in Ukraine, the question of mass and building up critical mass became essential in achieving both military balance and military advantage on the battlefield. The warfighting experience in Ukraine is called for good reasons the

war between Russian capabilities as characterised by the structuring of the mass approach against Western NATO military equipment used by the UAF. Indeed, employing more cutting-edge technologies provided by the Western partners allowed degrading Russian numeric superiority across various segments of the battlespace and domains. This, in essence, confirmed the effectiveness of the more advanced technologies in full-scale inter-state warfare.

However, there are some reservations and limitations to such a simplistic conclusion. First, the scale of the war with relatively open terrains requires a certain concentration of forces to hold the line, which entails the need for wider coverage and employment of cutting-edge technologies. Although they can provide the effect of force multiplication, their impact would largely depend on spreading of the frontline and the intensity of the warfighting. For instance, some advanced technologies would not be prepared for non-stop use under the conditions of constant warfighting. Others would be very few and scarce to be committed to more mundane tasks. Thus, any distinctive equipment must be available in sufficient numbers and/or combined with an ordinary mass of less sophisticated technologies to reach full functionality and maximum effect.

Second, while many Western technologies proved invaluable in different stages of the war, the Soviet weapons and older Western equipment proved to be essential in the survival of the UAF, especially in spring 2022, and the consequent conduct of the war. From the mass approach perspective, this experience demonstrates that the critical mass, meaning the sufficient number of capabilities aimed to achieve the desired effect, was built by combining relative numerical availability of the older equipment with the cutting-edge technologies. While some equipment could not be as precise or long-range as desired, it could still be used in dangerous places where more valuable assets could not be committed. This mixture of more advanced and older Soviet-era military technologies provided by the partners helped to come closer to the establishment of the critical mass needed not only to defend territories and hold the lines but also for the counteroffensives and regaining Russian-occupied territories. However, this realisation of the building up of relative numeric mass for immediate and further actions and the high consumption of ammunition required time and a lot of partner negotiations to develop common decisions and more systematic solutions.

Third, another aspect of the mass in the war and partner military assistance that was revealed refers to logistics. The intensity of constant employment of new and old equipment raised the question of increased necessity of ammunition. While the immediate challenge of having different calibre used in Soviet and NATO equipment was obvious, there were issues with providing sufficient numbers of ammunition across both modern and old segments. In the case of the old technologies' ammunition, the solution and challenge were to gather Soviet-era ammunition from the countries worldwide, which, of course, required time for negotiations, gathering and meeting transportation requirements. In the case of ammunition for Western equipment, the challenge at first was to commit partner

nations to provide ammunition from their stocks, but then the issue became the need for production of new ammunition when stock supplies drained. While technically, production of new munitions for cutting-edge technologies should not be an issue, the current demand for military equipment and munitions illustrated numerous challenges. While using the same calibre ammunition across different equipment and platforms corresponds to standardisation and interoperability of the allied forces, from the industrial perspective, it creates large-scale demand that requires immediate provision. The core of the problem is that most of the military industries worldwide were tuned to produce equipment and ammunition for the demands of peacetime, following scheduled national procurement plans. The war in Ukraine significantly boosted demand. On the one hand, demand increased for advanced technologies in support of Ukraine. On the other hand, allied countries required procurement of more materiel for their own national defence, especially if these technologies were already tested in the ongoing war. In essence, a certain bottleneck effect in production occurred, requiring the rewiring of the military-industrial production for wartime demands. Adjustments to this reality began taking place across NATO countries producing this military equipment.

Nevertheless, industries require time to adjust, while the war continues and demands military equipment and ammunition, if not yesterday, then today. This realisation was reflected in the partners refocusing on shortening the logistical path by stimulating the refurbishing of the Soviet-era equipment in the Eastern European NATO members and establishing manufacturing of the ammunition there. In addition to the obvious increase of capacities in satisfying increased demand, these solutions also reduce transportation costs and make the arrangements more cost-effective from both immediate and long-term perspectives. However, time and timeliness remain merciless factors in this war.

On 20 March 2023, in response to this vital demand, one of the common European initiatives established during the Swedish Presidency of the Council of the EU was launched, a three-track approach to delivery and joint procurement of ammunition to Ukraine. Its aim is to 'speed up the delivery and joint procurement aiming at one million rounds of artillery ammunition for Ukraine.'[59] This 12-month framework resulted from the informal meeting of ministers of defence in Stockholm a month prior, where the decision was made to devote two billion to boost ammunition production and consequent delivery to Ukraine.[60]

Interoperability of military equipment and relevant skills

One of the widely discussed challenges of foreign military assistance was the issue of the multitude of different equipment produced by various manufacturers, raising a few questions in terms of their interoperability with each other and consequent integration into Ukrainian defences. Besides the equipment's actual characteristics and functionality, improving the UAF skills in their employment and maintenance became paramount. Various solutions were identified to meet these challenges.

The problem of interoperability or using the same single platform across the entire domain and/or battlespace is a luxury that Ukraine did not have. While the idea of a network of networks and communication between various assets across domains is one of the solutions that modern cutting-edge technologies can provide, the most important thing for Ukraine was to have firepower where it was needed and to secure deconfliction capabilities from various domains. The Ukrainian solution was the tactical fire coordination centers that could coordinate fire from artillery, RPVs to helicopters and fighter aircraft. For various air defences, different types were in different areas and can be perceived as functioning as their distinctive bubbles. From the perspective of people who are to use different equipment with more sophisticated features, they need to acquire skills primarily for this type of technology. On the other hand, regarding the MANPADS of different manufacturers, after some training with instructors on some equipment, they would adjust their skills to use different versions manufactured by other Western partners.

As previously mentioned, training with various types of equipment, like artillery and air defences, was often conducted within a short course provided in the countries that were sending that type of equipment. Usually, empirical training courses require more time, but the Ukrainian military showed fast learning capacity and acquiring relevant skills within the shortest time frames. Partner nations often praised the UAF soldiers for their motivation, eagerness to learn and ability to grasp relevant information and improve desired skills faster than the usual military personnel.[61] The Ukrainian military were not just talented, considering their diverse backgrounds or motivated, considering the pressing requirements of returning to war; there was also the enduring factor of the culture-specific transitional nature of life in Ukraine. This factor entails that people often need to have varied skills quite different from their initial degree or first career. It was also common for people to change to other careers and quickly acquire new skill sets. In terms of training, this often meant that the initial skill set brought by the Ukrainian soldiers was already multifaceted.

Another question related to the diversity of military equipment refers to maintenance and repairs. In the initial stages of the war with the provision of smaller arms, such issues were secondary in various discussions and commitments, but with the provision of wider and heavier military assistance, more attention was paid to establishment of maintenance facilities in various neighbouring countries, which was particularly emphasised in the Tallinn Pledge. Countries also took responsibility for providing repairs and spare parts for equipment they previously sent. From the military perspective, the availability of such hubs in the safe areas of other countries can provide the desired logistical support for the more complex technologies, but this will also take time, which once again poses additional challenges in sustainment of the critical mass and fighting power at a given stage. On the other hand, the Soviet-time equipment requires spare parts for more substantial repairs.

Although the diversification of equipment poses multiple challenges in its sustainment and employment, this diversity can also be viewed as an advantage since some equipment can be fixed at home or even in the nearby maintenance hubs not far from the frontline by Ukrainian soldiers themselves, while other equipment needs to be repaired in the national rear or in the wider maintenance locations abroad, such as the Polish Crab artillery repair workshop. From the perspective of vulnerabilities of the logistical chains, even if some locations are targeted, others will perform as required. The same is true with the multitude of assets; while some might be damaged and require longer repair times, others can be made available immediately. The functionality of these substitutions largely depends on the wider availability of military equipment, the extent of freedom in its circulation across the battlespace, and the path to the rear and repair facilities and back. Furthermore, in the crucial locations of grinding Russian troops (likeBakhmut) availability and resupply of equipment and ammunitions is vital to the very preservation of the lives of the UAF and their ability to hold the territory and to continue opposing waves of Russian assaults.

To an extent, it can be argued that people remain the glue sticking together the different systems and military assets. The ability of the Ukrainian military to find solutions even to the most complex situations, combined with various elements of Western training, resulted in remarkable adaptability from the human part of the nation's fighting power and its consequent resilience. Technologies can be adjusted to the desired specifications, but they cannot overcome their physical capabilities; on the contrary, people can adjust to the most difficult situations and come up with the most innovative solutions – or 'smart innovation.'

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11

FINAL CONSIDERATIONS

Modern warfare and resilient fighting power

Previous chapters have looked at various aspects of the war: its context, combatants, doctrines, different experiences across domains, the role of the wider national society and the assistance of international partners in supporting the UAF. This chapter combines various considerations on this war within the framework of the themes and concept of the resilient fighter power. Distilled lessons are important for learning purposes of the military and political entities. In addition, some lessons 'learned' six months after the full-scale invasion will differ from lessons identified after a year or what might be stated in years to come. Accordingly, this chapter does not claim to be the most exhaustive or detailed list of lessons learned. Instead, it highlights the points for consideration and consequent discussion within the previously identified themes in modern warfare. It pulls together the experiences of the war to understand the factors that contributed to the resilience of the Ukrainian fighting power against Russian aggression. This also illustrates the shortfalls of the Russian fighting power in the context of this war and large-scale inter-state warfare in general.

Land-centric warfare, asymmetry and innovation

This war showed the revival of high-intensity land-centric warfare in times of cutting-edge technologies, nuclear weapons, UAVs and AI. Despite technological developments, the core of land warfare remains defined by the characteristics of the terrain and the advantage it provides to the defending side in using asymmetry against a numerically superior enemy. The primary source of asymmetric advantage was the Ukrainian people, adaptable and innovative according to the war requirements.

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Nothing makes people innovate as much as the necessity to survive and the consequent demands of war. In the case of the UAF, various innovations were conditioned by the necessity of tactics and Ukraine's very cohesive civil society. However, such developments do not occur overnight. Many of them were crystallised during the first eight years of the war, with full-scale invasion pushing them forward for their systematic employment. The urgent need for solutions also reduced any other setbacks and limitations. Ukrainian 'smart innovation' showed once again that new, cheaper civilian and military technologies supported with customised software could become more functional. Traditionally, the sources of innovation that could be used in the military sphere often originated in the private sector. In the war in Ukraine, a new source, which corresponds to the modern trend of grassroots initiatives, originated in civil society and volunteers. This tendency is conditioned by reducing the gap in the civil–military divide and the greater tradition of the involvement of Ukrainian civilians in supporting the military on the tactical level over the nine years of war.

Another interesting consideration in boosting the Ukrainian innovations evident in the war is the conceptual component and diversity of warfighting elements with diverse types of training. While the traditional military single-service doctrine is aimed to achieve unified performance, the variety of units involved on the Ukrainian side received different training with different doctrines or concepts as part of the learning process. The immediate necessities of war dictated that practical skills be trained with some conceptual basis while taking advantage of individuals' background knowledge and previous skills. This illustrates that tactical-level experiences and adjustments to the enemy behaviour determined solutions and tactical innovations. Various examples in the training courses developed in Ukraine showcase the significant role of sharing the accumulated knowledge and experience of NCOs or the equivalent. However, this knowledge and experience must be systematically incorporated into the training system for wider outreach. There is still a need in many fields to establish modern officer development and training courses.

In the case of the Russian troops, unification was conducted through the traditions of the Soviet doctrines with a consequent inconsistency between the available technologies and manpower to sustain and employ those technologies to their fullest potential. From the perspective of adaptability and innovations, more experienced military personnel and conscripts were characterised by rigid decision-making, but for slightly different reasons. Conscripts were provided with basic training, if any, with limited understanding of the tasks and the reality of warfare. In contrast, more experienced military personnel faced the challenges of a rigid Soviet-style chain of command and the time required for decision-making. The later stages of 2022 showed Russian tactical adaptations in terms of the use of artillery, CAS and the Wagner PMC tactic of using cannon fodder in waves in Bakhmut, which shifted towards scorched-earth tactics. This choice of tactics was, to a greater extent, conditioned by the lack of sufficient Russian experience

and training in urban warfare. One year on, the Russians began learning from the Ukrainian innovations replicating them according to their available resources. However, from the perspective of civil society support, a very different dynamic was observed in the case of Russia, in which most of its specialists left the country out of fear of being mobilised. The brain-drain and significant citizens' migration from Russia also intensified when Putin's regime came to power, because it would not allow for smaller businesses and grassroots initiatives to flourish under his regime of strengthening central control.[1] Hence, a source of innovation originating from civil society was absent in Russia.

There is nothing new in what, in fact, enables adaptability and innovation – besides the actual creative thinking aspect of the process, there should also be a susceptible environment encouraging or at least not prohibiting creativity and innovative thinking. The necessity of survival dictates innovative thinking, which can be encouraged by organisational culture but is ultimately conditioned by an individual's skills and adaptability and the nature of the enemy faced on the battlefield.

From the perspective of organisational change, much has been discussed on the significance of investing in people as an important part of capabilities building. This was evident in various reorganisation initiatives introduced during the first eight years of the war and foreign partners' training courses provided to the UAF. Although various systematic plans for military reform and professionalisation of the UAF were finalised and had already been announced in 2019 with the adoption of various NATO standards and practices, the actual organisational transformation and modernisation was primarily personality-driven. Understanding of the need to use Western practice and standards to correspond to the requirements of modern warfighting originated within the innovative progressive leaders such as Col. Gen. Vorobyov, who taught and shaped different leading officers of the UAF, including the current Commander-in-Chief General Valery Zaluzhny. This does not mean that the entire Ukrainian Army was transformed, but the top-down initiative was met with the eagerness of younger generation soldiers who had been fighting for eight years to adopt more effective ways of warfighting instead of following the outdated Soviet methods of a rigid chain of command. As Zaluzhnyi once commented, Soviet army methods would not work with the young, modern 30-year-old officers in the UAF.

The Ukrainian personality and progressive youth-driven approach to transformation and reorganisation towards Western standards of professional Armed Forces were in striking contrast with the Russian attempts at numeric reforms of their military, which provided results only on the paper of the senior leadership's reports. While corruption is often blamed for the failures of the Russian military reform, it is also a matter of rigid thinking from the top to the middle-level officers, the traditions of the hazing (*dedovschina*) system and many other relics of the past. Innovation and reforms are not possible without critical thinking and open-mindedness to innovations.

The learning point for any innovation is that it requires a few factors for its fruition: an encouraging environment, personal leadership initiatives and support from the innovative groups from within the service. While all three factors might be present at a given time, the availability of at least two can compensate for the lack of the third one. However, all three were missing in the case of the Russian Armed Forces.

Jointness or interservice integration: how to proceed and not to proceed

Interservice or interdomain integration is not a new phenomenon and has gone through various stages of reconceptualisation in various debates on modern warfare. In the case of this war, much attention was devoted to how the rigid Russian top-down approach to jointness and employment of air power and sea power as artillery extensions of the ground forces undermined their effectiveness in the war.[2] Achievement of the desired joint effect depends on a fragile balance between interservice integration on different levels of warfare and the distinctive strategic role and functionality of single services in different strategic settings. Supremacy of single services or complete elimination of distinctive services is a lesson already. Although land-centric warfare revived various discussions on the utility of distinctive services and capabilities, the most significant takeaway is the extent of jointness and interservice integration observed in the UAF and its approach to its implementation.

Although not all services were present in the war to the same extent in their own domains, primarily due to the varied assets available at the beginning of the full-scale invasion and the immediate losses in the first few weeks, the existing units from different services were integrated into the overall warfighting mechanism of the war. Just as in many other activities, the distinctive feature of the Ukrainian military practice was that it combined initiatives from both the grassroots tactical level and the top-down approach. Although changes to military institutions tend to be more complex due to many bureaucratic processes, and the Ukrainian military still have many spheres to clean up from the Soviet practice; interservice and cross-domain integration allowed to coordinate fires originating from different domains hitting Russian units in trenches, their logistics and ammunition storage facilities across the frontline and deep in their rear.

To a greater extent, tactical-level jointness was conditioned not by the idea of a tactical manifestation of the previously established policy of jointness and cross-domain integration outlined in the national strategy document. The vital need drove effectiveness. The scarcity of resources and capabilities across domains, including the maritime and aerial assets, required a more effective use of the available means in conjunction with the land component. Ultimately, cross-domain effects were observed by using ground-based air defences against Russian aviation, Ukrainian aviation in CAS and air interdiction missions, helicopters and drones in various ISR and kinetic roles, coastal defences against the Russian fleet, marines in urban warfare and demining activities in the Black Sea. The best description of the

Ukrainian strategic culture and fighting spirit evident in this war is the analogy of a beehive – once someone attacks its home, the hive does not require distinctive plans of action, only a direction to attack the enemy and defend the home until the end. This analogy illustrates Ukrainian strategic culture's inherent feature – decentralisation as a precondition for the joint actions and achievement of joint effects across domains. In this regard, a dual approach to command and control was essential in adjusting the complexity of a long frontline and the distinctive, unique challenges for different segments of it.

Mission command should not be viewed as a panacea for all situations and types of war, but in the earlier stages of the full-scale invasion, its employment provided a significant advantage for the UAF. Under the conditions of the wide spreading of the Russian troops without a yet well-established frontline, mission command allowed Ukraine flexibility in responding to the enemy actions in the best Ukrainian traditions of partisan warfare. Under those conditions of uncertainty on the ground, Russian troops suffered from confusion, a disrupted chain of command and a lack of military experience in this type of war. Although there are many current discussions about the reconceptualisation of mission command, it remains a viable skill in sustaining agility and freedom of action on the ground. Its learning requires more training and exercises characterised by close-to-war settings. The rigid Russian command structure would also never allow for flexibility and initiative decision-making.

Placing this discussion once again into the joint or interservice context, the provision of objectives or direction was sufficient for the UAF to approach the task at hand with what was available and could provide desired effect within the closest time frame and with minimum use of ammunition, which is always crucial in high-intensity warfare. In essence, Ukrainian interservice and cross-unit integration and collaboration was another innovation and adaptation of the UAF since it was a tactical-level solution to the problem of scarce resources and the necessity of achieving layered effects using capabilities across different domains.[3] Although different analysts might be tempted to emphasise the significance of one service or another or outline the decisive role of one type of military power over another, in reality, the war has been conducted using all of the available services and their assets towards a single goal – defending Ukraine and repelling the enemy from the Ukrainian territories. It could be assumed that the war would have looked very differently if more numeric and technologically advanced aerial and naval capabilities were in the Ukrainian inventory, there had been greater and more prolonged control of the air and there had been more aerial assets to make the work of the ground forces easier and reduce pressure on the artillery and infantry, but it was not attainable after the post-Cold War disarmament of the UAF.

Mass, cutting-edge technologies and force multiplication

The land-centric nature of this large-scale inter-state war once again raised the question of the importance of sufficient critical mass in modern warfare. Unlike

the conflicts of the last three decades, this war was primarily characterised by the invading side having both mass and technological advantages, at least from the onset of the war. It soon shifted towards Ukraine utilising Western technologies against the Russian mass approach using Soviet and relatively modern military equipment. Hence, the dichotomy of mass and modern cutting-edge technologies could be traced in this war in a more traditional sense to achieving artificial mass by employing cutting-edge technologies. However, the high tempo, scale and Russian ignorance of their own casualties and losses suggested that although new, more advanced Western technologies across domains illustrated the much-desired force multiplication to the traditional characteristics of precision, improved targeting, electronic warfare capabilities and ISR capacities, their numeric availability and logistics should be present in sufficient numbers to cover the long frontline and the vast territory of Ukraine. The discussion in Chapter 10 on international military assistance illustrated that there is a difference between layering defences across domains in support of achieving desired mass and joint effects and accumulation of capabilities for more enduring effects of the counteroffensives and holding those de-occupied territories.

Following Deptula and Penney's emphasis on the more numerical force due to the three challenges, the following can be identified in the context of Ukraine. The most evident in Ukraine is the first challenge of effectively covering given territory with both tempo and mass. The need for a more balanced mass – critical mass – in Ukraine was conditioned by the long frontline, the constant intensity of Russian assets across various segments of that frontline and the continuous assaults on the entire territory of the country within the long-range bombing campaign using Russian aerial and naval capabilities. It became evident that while holding the frontlines could be achieved with some assets of artificial mass and by taking advantage of the terrain, defending civilian infrastructure from the long-range bombing required significant numbers of ground defences and ammunition in order to protect most of the country. One year on, not all missiles can be shot down. However, according to UkrAF commander Mykola Oleshchuk, Patriot air defences proved able to shoot down Russian Kinzhal missiles.[4]

Looking at the matter from the Western conceptualisation and the employment of mass in the last three decades, it seems clear that out-of-area operations, while posing their own logistical challenges in sustaining firepower and its enduring effect, are a very different experience to defending your country from invasion. From this point of view, the task is to defend the country on the frontline and over the entire territory instead of being concentrated across the focal point in gradually achieving various objectives in a given overseas operation. This entails that the sufficient numbers of various capabilities should be spread across a rather large battlespace.

The second challenge with structuring the armed forces and consequent capabilities is posing a challenge to an adversary with 'sufficient system complexity to complicate their targeting and operational strategy.'[5] The idea of the system can

be discussed as the overall system of Ukrainian defence and the UAF in general. In the case of Ukraine, from the first days of war, the advantage taken from the mobility of various defences is the principle of dispersal. In the later stages, once the UAF had adjusted to the warfighting, various tactical and operational level adaptations were aimed to achieve this objective of system complexity. Although in the context of Western cutting-edge technology, system complexity can be viewed in terms of networks of more sophisticated capabilities, in the case of Ukraine, this meant achieving system complexity through the combination of various military technologies across different segments of the frontline. In the aerial domain, it was layering the system of defences across different altitudes by employing both ground and air capabilities. The system complexity was achieved through diverse characteristics of different technologies with consequent layering effects. The system complexity principle was also evident in the supply chain and logistics, with different solutions creating opportunities for the uninterrupted provision of supply and maintenance services in the closer and wider rear.

The third challenge of 'withstanding attrition in contested environments' is an significant aspect of the war in Ukraine. During this year of the war, the UAF took full advantage of Western technologies in precision fires even under the scarcity of these technologies and relevant ammunitions. This was achieved by targeting fuel supply chains or force concentration and taking advantage of the bottlenecks and other favourable terrains. While the Russians would be losing more men and equipment during the war, the significant aspect for the UAF was the question of reinforcement and rotation of the more experienced serving officers. While most had very few recovery days within this year of war, the strengthening of the personnel side of the fighting power was attributed to the diversification of Ukrainian combatants and paths to the warfighting. This diversification allowed for facilitating different stages of mobilisation and training across the year as well as speeding up reinforcements across various segments of the frontlines. However, this also posed an issue of the varied levels of training and preparation of different units within the territorial defence in different regions before their actual deployment to the frontline.

In the case of Bakhmut and the grinding of Russian cannon fodder in the form of recruited prisoners, the newly mobilised and Wagner mercenaries, withstanding the attrition by Ukrainian forces was primarily dependent on the constant availability of the firearms and ammunition, since the waves of assaults were continuous and were aimed at achieving a breakthrough by constant sacrifices of massed waves. Such a contested environment illustrates the immediate existential significance of the numbers of available ammunition, with the focus primarily on numbers and their ability to operate round the clock rather than the characteristics of precision per se, since the problem was not in hitting the target, but to be able to destroy continuous waves of numerous targets approaching.

Inevitably, the factor of time is at the heart of this discussion. Effective technologies must be available not only in more numbers, but also supplied

sufficiently and continuously. This feature of continuity is essential in the high tempo of a more prolonged attrition land-centric war. In this regard, besides the traditional technical specifications of the technologies, their effectiveness becomes evaluated in terms of the timeliness of their availability in combination with skilled and trained personnel. The war experience illustrated that, to have greater flexibility and adaptability in the battlespace, the critical mass should be at the heart of force design with relevant interconnectedness between peace and war times. This would require a contingency plan for the industrial adjustments for the war requirements, but these plans should already be in place during peacetime.[6]

The follow-up aspect within this segment of discussion refers to the ways of building the critical mass. As was illustrated on various occasions across domains and the supply and military assistance chapters, achieving sufficient numbers in cutting-edge technologies and consequent artificial mass or force multiplication requires time and the significant restructuring of ammo productions of the military industries. However, in the case of Ukraine, the opportunity to build critical mass consisted of several initiatives. Western technologies provided by the international partners were used with Soviet-era equipment from the Ukrainian inventory and the trophy equipment captured from Russian troops. Another segment in strengthening the required critical mass was, of course, the Ukrainian military industry. Once it was cleared of pro-Russian elements, it produced required technologies based on prior test projects and new initiatives. In recent months, the focus has also been placed on strengthening joint enterprise initiatives in the production of military equipment between Ukraine and Poland and between Ukraine and the Czech Republic. While all of these channels for strengthening critical mass to match high-intensity warfare illustrate systematic solutions, they all require significant time, and many of them were gaining tempo only one year after the beginning of the full-scale invasion.

This war illustrated another source for providing force multiplication and firepower per the immediate tactical demands of the war. This refers to the use of cheap, unmanned platforms across various tasks. While military-grade drones proved essential in the first months of this year of war, cheap civilian drones with Ukrainian modifications became the highlight of force multiplication under the high tempo of the war. The example of commercial drones for military purposes showed cheaper options in establishing and sustaining critical mass using military and civilian initiatives in their funding, delivery and repairs are needed.[7]

Another important factor in using drones to satisfy some aspects of critical mass and force multiplication is that due to their cheapness, their uninterrupted supply is attainable. However, the ability to have a continuous flow of cheap drones should not be taken for granted because it also depends on such factors as the extent of the public ability to crowdfund constant funding requests and even continuity of drone manufacturing by commercial entities. Furthermore, countries manufacturing cheap drones might reconsider their policies regarding selling them to war zones or even third parties on the market. Hence, an important contribution to sustaining

this part of the capabilities was establishing local repair services to reduce costs spent on purchasing new drones and as a means of significantly improving the resilience of such devices and the timeliness of their availability.[8]

While, to a certain extent, technologies can provide force multiplication, there is always a human side of the critical mass that requires more significant efforts and time to prepare and develop the required skills. The human segment and time became entwined in this war. While technologies can provide artificial mass at a given time and some desired effects, the lack of critical mass in terms of technologies and firepower is often compensated by the people fighting across domains, often costing the blood and lives of the best.

People

While the primary challenges with technologies were, first, their immediate availability, second, their accumulation and, third, the logistics of their continuous supply and sustainment under the conditions of high-intensity war, the question of people was related to the crucial elements of establishing and building up sufficient capabilities in conjunction with the available technologies and often as compensation for the lack of required equipment. The experiences of the two fighting sides were very different. In the case of Russia, although there were exaggerated expectations of its numerical superiority and the military reforms in the previous two decades under Putin's regime, they illustrated significant flaws in having a capable people component. Their mass approach to structuring their armed forces focused on the advantages of more advanced technologies, with insufficient personnel to sufficiently service this equipment or employ it to the fullest potential in the battlespace.[9] The focus on conscription and partial modernisation of the Russian Army were futile since they were conducted in Soviet pro-forma style. Modernisation attempts did not commit to the actual skills development, nor did they encourage innovations. Hence, Russian numerical superiority was not found in the skilled personnel in support of the available, relatively modern equipment; as always, Russia had a higher headcount without any sufficient connection with the skills required for the equipment they had.

In the case of Ukraine, the prior eight years of war focused on fighting a single, well-known enemy and the support of the Foreign Legion soldiers who fought Russia in other wars of the post-Cold War era significantly prepared the people's side of the Ukrainian capabilities and the physical component of the fighting power. While the immediate hits were taken by the more experienced and trained military personnel and better-trained sections of the territorial defence units, various waves of mobilisation prepared more personnel to sustain the fighting power across the battlespace through the year. The national experience of warfighting in the first eight years combined with some international training courses allowed the strengthening of the skill set of the UAF. Furthermore, like on various other occasions, the diversification of paths and training frameworks provided additional advantages,

with SOF having greater flexibility in focusing on developing specifically required skills for the given operating environment while training recently mobilised aiming for formalised solutions. Unlike the Russian headcount approach to building critical mass, the UAF as a general rule had a greater focus on strengthening the skill set of the personnel utilising both national and international training opportunities. The availability of reserves and various training initiatives for the civilian population within the concept of total/comprehensive defence stimulated the development of the relevant skills within a shorter time, allowing for greater adaptability, especially in the first days of the full-scale invasion.

In this context, the important means of force multiplication for the UAF was the inherent Ukrainian adaptability, creativity in problem-solving and innovative thinking. Various immediate tactical solutions multiplied giving advantages across the battlespace. This was conditioned by a greater degree of living in transitional times for the last three decades and the consequent strengthening of Ukrainian psychological capabilities and adaptability. Shannon Houck makes a good case for the psychological capabilities in support of resilience, exploring the development of resilience in Ukrainian society.[10] The rationale can be extended to a wider context of living in uncertainty and its impact on preparing people to adapt or perish in a storm of events. While in the initial stage, uncertainty and inability to accept the given reality have a paralysing effect on an individual, the constant presence of uncertainty results in an adjustment to it and greater adaptability and unconventional thinking, which became evident in various experiences of the UAF:

> 'Similar to how we adapt to the stress of a physical workout by increasing the strength of our muscle fibers, building mitochondria, or producing more red blood cells, our brains adapt to the stress of uncertainty, by adjusting our stress response, establishing and reinforcing memory connections, and being better equipped to handle that formerly uncertain situation.' With exposure to uncertainty comes more psychological preparedness, not necessarily for specific incidents, but for the discomfort that unanticipated incidents may bring.[11]

One of the aspects or sub-themes of the mass approach and the structuring of the armed forces is the question of casualties and military/political attitude to casualties in war and the likelihood of the decision resulting in mass casualties among the military personnel. Russia has a long tradition of accepting casualties, with individual life seemingly becoming even cheaper in Putin's Russia. Soviet losses in the war in Afghanistan were enough to undermine the stability of the Soviet power, resulting in its withdrawal. However, Russian losses in Ukraine are much larger than in the ten years in Afghanistan, which to a greater degree illustrated the reduced value of life in Putin's Russia.[12] This observation is then strengthened by the traditional Russian tactics of using their personnel as cannon fodder – the lower the ranks, the more likely they are to be utilised in waves of attacks. The same was

illustrated in the Wagner tactic of sending recruited prisoners in waves at gunpoint in Bakhmut.

The number of Ukrainian fallen and of injured soldiers remains classified for the good reason of preventing a decline in high morale, although people in Ukrainian cities see how many soldiers are dying, and funerals have become an integral part of Ukrainian life just as have constant air raid sirens. Ukrainian soldiers know whom they are losing and the cost of 'Bakhmut Holds'. Ukrainians have a strong morale and fighting spirit because after this year of war, they also live and fight for their fallen comrades. The fighting ethos dates back to the old warrior code of honour, for this is the patriotic war for the liberation of the homeland and the survival of the Ukrainian nation.[13]

For the UAF, it is not a war of choice because there is no choice but to fight. Since at various stages of this year of the war, military equipment or ammunition was scarce, or various segments of the frontline had a greater intensification of the enemy assaults or employment of different tactics, holding certain territory came at a higher cost in human lives. Hence, the UAF leadership has a very realistic understanding of the cost of a mile in this war. This also refers to the counteroffensives. Despite the losses, the UAF illustrated high adaptability and speed in restructuring various tactical-level units under the conditions of attrition war. The agility of Ukrainian tactical units and the inherent tradition of mission command allowed faster and more effective unit readjustment under the conditions of losses compared to the Russian inability to make tactical-level reorganisation decisions without the involvement of orders from officers in decision-making.

Civil–military relations and total/comprehensive defence

Despite the clear-cut division between civil and military matters and the distinction between different sources in support of strengthening the fighting power, this total war illustrated the gradual merging of civil and military assets in support of the UAF. This merging was illustrated in various segments. First, from the perspective of Ukrainian society, the total character of the war, the nation's survival and the preservation of the country's territorial integrity resulted in the war being at the heart of people's lives in Ukraine. This manifested in various contributions by ordinary people and businesses to sustain the armed forces, including crowdfunding, individual assistance and volunteering activities to the initiatives in repairs and innovations in support of the physical component of the fighting power. From the perspective of resilience, the toughness and flexibility of the Ukrainian society contributed in many ways as a supportive means of reinforcing the resilience of the military fighting power, addressing both moral and physical components.

In terms of the concept of total/comprehensive defence and its application in Ukraine, although various initiatives to improve the readiness of the country for the next stage of war were taking place in 2021 following the national strategy document, many adjustments were conditioned by both experience and ad hoc

solutions. Some activities in societal readiness for the war were determined by the first eight years of the war. However, the scale and intensity of disrupting Ukrainian normal life and statehood were lower than post-February 2022. Accordingly, the experiences of volunteering, crowdfunding and various grassroots initiatives were crystalised based on lessons learned from the previous years of war. Many other responses were evolving ad hoc in accordance with the situation – the previous examples of the civilian population preparing Molotov cocktails and establishing drone harbours and repair hubs come to mind. Once again, the adaptability and innovative thinking of Ukrainian society were conditioned by the high psychological resilience of the people living in times of uncertainty and transition for a few decades, combined with cognitive readiness and determination to fight a patriotic war for the survival of their nation and territorial integrity:

> Preparing individuals and populations for invasion requires cognitive readiness. Determination. Motivation to get in and stay in the fight. Psychologically resilient individuals feel a sense of connection and belonging to their social circles and community environment. They trust their local forces and civilian services. They are knowledgeable about enemy influence attempts. They believe in their country's narratives and purpose and feel a sense of national identity and pride.[14]

The sustainment of this resilience was also based on the clear-cut common objectives of the war for both the military and society – territorial integrity of the country and survival of the Ukrainian nation – to live as free people. The goal resonated with local and foreign people on so many levels that it gave them the strength to withstand the most complex challenges, from the making of 'Bandera smoothies' (Molotov cocktails) to enduring blackouts and constant Russian bombardment.

From the perspective of learning lessons in total/comprehensive defence and strengthening civil–military relations, nations adopting this concept would ideally not face the same existential threat as Ukraine did during the Russian aggression; the preparation of a society for total defence requires clarity of objectives, and realistic training and consequent realisation of what war is about, and that it requires defence of the homeland. Ukraine once again illustrated how important it is to allow grassroots initiatives to flourish in support of both political and military objectives. It suggests focusing on improving better civil–military understanding of modern warfare and the roles of the respective participants in total/comprehensive defence with various opportunities for innovation and tactical-level contributions by the civil society.

Towards resilient fighting power

Although a full operational analysis of the war and its full-scale segment will have to wait until the war is over, the experience of the studied year of this war provides

insights into relevant factors shaping resilient fighting power in modern inter-state warfare. These various characteristics are derived from the experiences of the war within the themes previously discussed in this chapter. From the perspective of the *conceptual component* of the fighting power and the thought process behind the warfighting, it can be argued that although both Armed Forces shared the same Soviet doctrinal past, their post-Cold War adjustment and development of the conceptual component and respective reforming of the Armed Forces went very differently. Despite the shortfalls in conducting systematic military reforms in Ukraine due to the political ups and downs with various pro-Russian governments in power, Ukraine managed to take advantage of relevant conceptual lessons from the Soviet doctrine, Western best practice and consequent NATO standardisation of the military for the requirements of the modern warfare. In contrast, despite announcing various new doctrinal concepts like a hybrid or new age of warfare, the core of the Russian conceptual component and strategic thinking remain Soviet in their essence and practice. The experiment with SOF–air integration in Syria was focused only on a fraction of the Russian Armed Forces and, hence, did not represent the actual state of their thinking and warfighting, especially on the inter-state level of the Ukrainian scale. From the perspective of adaptation and innovative thinking on warfighting, Ukraine illustrated thinking outside the Soviet conceptual box, adopting some aspects of the Western doctrines and best practice derived from the eight years of experience fighting war in Ukraine. Although the Western-style doctrines were not systematically adopted and did not serve the same purpose as in the allied countries, the Western conceptual component was gradually incorporated into Ukrainian military culture and thinking through the NATO standardisation processes, training and exercises and individual initiatives. This was facilitated mainly by individual initiatives of the progressive military officers and the gradual modernisation of the Ukrainian organisational culture, which reduced the red tape and the Soviet bureaucratic footprint, hence reviving the long-term pre-Soviet strategic culture of bottom-up integration and mission command.

In contrast, Russian (read Soviet) organisational culture, its rigid top-down joint, centralised command and control and the superficial nature of its modernisation trends resulted in the conceptual component and military thinking bouncing within the same box, not often realising the extent of their predictability in warfighting for someone who knew that box from the inside yet went beyond it. It can even be assumed that many so-called innovative Russian doctrines were often written for Western audiences rather than for the Russian armed forces as a serious means of reforming their thinking and improving readiness.

From the perspective of resilient fighting power, although the Russians illustrated various adjustments of their tactics across domains in response to the Ukrainian tactical developments and various modernisations, initially this required the involvement of high-rank officers and significant losses of Kadyrov Chechens and Wagner PMC cannon fodder. Nevertheless, Russian performance across domains remained focused on mass fire with little attention to precision or discrimination

in targeting. The usual feature of the Russian wars – targeting civilians – remained evident in this war. For the conceptual component to contribute to resilience, it has to be present in military education and training, and then be further altered as the situational characteristics require. Ukraine managed to do so by taking advantage of the tactical solutions to the issues of interservice integration, fire coordination and combined arms in strengthening layered effects. As much as military organisations aim to formalise and unify their personnel, this war has shown that the most innovative and adaptable side can achieve resilience and endurance even in the midst of such a high-intensity inter-state war.

Physical component: people and equipment

This war has illustrated that people remain the driving force to achieve posed objectives. They have the relevant skills to operate the equipment directly or remotely. They compensate for various technological limitations or limited availability. The force that is the most adaptable and innovative is the force that can bounce back to operational readiness sooner and achieve the desired effect through various means in a more productive manner. The UAF is an example of a modern, flexible, highly trained force with unique operational experience that is capable of employing varied types of equipment in fighting the enemy across domains. Psychological capabilities and readiness conditioned by long decades of transition and uncertainty stimulated creativity and innovative thinking focused on distinctive tactical-level objectives. The learning point is that warfighting does not take place in ideal circumstances, and the force that is the most resilient in the worst-case scenarios can achieve the highest level of combat readiness and sustain it over time. Various discussions of the war in Ukraine have illustrated the necessity of strengthening the combat readiness and agility of the military during peacetime with close-to-real war military exercises that are focused on developing exact survival and fighting skills across domains.

The Russians illustrated the endurance of their Soviet heritage with significant negligence in investing in regular personnel. The fear of military coups against Putin's clique resulted in investments in SOF and mercenary groups like Wagner PMC. While the use of mercenaries and proxy forces is not new, they are not a sufficient alternative to a strong national military. Hence, the majority of the Russian military personnel were poorly or insufficiently trained and their numbers were not enough to achieve the required objectives. Despite the constant focus on the mass approach to structuring their armed forces, Russians illustrated that they did not have sufficient numbers to sustain that mass both in terms of army soldiers and human assets in the information space. The widely known Russian exercises involving various services and significant numbers were often aimed at giving a show of force, and a numerical one, instead of providing opportunities for effective cross-service integration and improving the military skills of personnel and the effective use of equipment.

For military personnel to be resilient, they should not be afraid to take the initiative and find their solutions. The versatile skill set of the Ukrainian military, with their diverse backgrounds, allowed them to contribute to various tactical solutions. The UAF also proved to be fast learners. This can be explained by many factors, including the imminent presence of war requirements, but it is also because most of the Ukrainian soldiers would have higher education and a profession in their civilian life in one field or another. Newly mobilised Russian conscripts or even experienced officers did not match the skill set the Ukrainian people already had before joining the UAF. The focus on giving children higher education has traditionally been part of Ukrainian culture. It aimed at providing the next generation with a wider overview of life and developing critical and independent thinking. It is not accidental that students and youth stood their ground in the two Ukrainian revolutions. In the current context, it also contributed to the survivability of the nation. European statistics showed the following:

> In Ukraine 97.5% of women and 97.1% of men aged 20–24 years had completed at least an upper secondary level of education in 2021. This was an improvement on the situation in 2011, when the levels were 95.7% and 94.2% respectively … the proportion of 30–34-year-olds in 2021 who had completed a tertiary level of education – Ukraine had the highest overall proportion of tertiary qualification holders among ENP-East countries, with 2021 figures of 51.4% of men and 64.8% of women, in total 58.0%. In comparison, in the EU 41.0% of young people aged 30–34 years had completed tertiary education in 2021; this corresponded to 46.1% among women and 36.0% among men.[15]

From the perspective of sustainment of the qualified skills of the military personnel prior to and during the war, the focal points remain the reserves and various waves of mobilisation. The extent of their effectiveness and contribution to the fighting power largely depended not only on the individual experiences and mobilised or volunteer route to warfighting but also on the type of training they were given and the extent of the warfighting skills acquired.

Materiel

Regarding the materiel segment of the physical component, the discussions across themes and chapters on different domains illustrated that the operational advantage in high-intensity inter-state warfare is achieved not by the traditional Soviet approach to massing both soldiers and equipment but in attaining a balance between effective employment of the combined arms with the use of more advanced technologies and the built-up mass of the Soviet-era technologies. In this case, Ukraine achieved desired objectives with what was available and provided at the given time; however, more kinetic and wider-scale advancement required the accumulation of versatile assets to project power and achieve layered combined

effects across domains. At various stages, a decrease in available equipment and ammunition was compensated with human creativity, yet the price of time was the lives of the UAF. From the perspective of resilience of fighting power and revival of its military effectiveness, military equipment needs to be available at a given time and in constant resupply with sufficient ammunition, especially for this type of war. Logistics and sustainment have always been crucial factors in warfighting. In the case of Ukraine, equipment diversification allowed for various sources of supplies and support, ranging from national, civil and military initiatives to international military assistance from the partner nations and their societies.

From the perspective of sufficiency and effectiveness of the military equipment under high-intensity inter-state warfare, at least partial national self-sufficiency is required to satisfy the immediate needs of warfighting. The discussion after the one-year high-intensity segment of the war in Ukraine is focused on returning to the traditional approach to military arsenals, fully stocking them and keeping ammunition and equipment in repaired and functional condition. Although there is nothing new in this way of thinking in terms of sustainment and readiness of the fighting power for various types of threats and conflicts, under the prolonged thinking of the peace dividend and a lack of direct threats, the focus was on other matters while stocking arsenals for various threats and scenarios was considered a relic of the past. The war in Ukraine illustrated the endurance of the principle 'si vis pacem, para bellum' (if you want peace, prepare for war). In the context of the high-intensity warfare, the crucial triangle of equipment availability, its endurance and a constant flow of ammunition illustrated that it was crucial to survival and achieving military advantage. While many Ukrainian arsenals with Soviet-era ammunition were destroyed by various sabotages during the first eight years of war, the sustainment of the Ukrainian military equipment was partially satisfied through a range of initiatives – manufacturing capacities of the Ukrainian UkrOboronprom, the assistance of the partner nations in bringing in Soviet-era supplies and recent initiatives for joint ventures and manufacturing of ammunitions in the neighbouring countries.

From a wider perspective of the supply of Western equipment and its sustainment in Ukraine, it showed that the wider international community strengthened and sustained the physical component of the Ukrainian fighting power. However, the primary challenges of Western military industry and the consequent challenges for the future of strengthening fighting power across the alliance are that decades of out-of-area operations and wars of choice resulted in the military industry functioning under peacetimes, meaning individual contracts between manufacturers and distinctive nations. During the short period of relative peace, such arrangements allow the scheduling and planning of various procurement programmes, but under the conditions of total war, they pose vulnerability in themselves, especially if there is little diversification in terms of platforms, ammunition and equipment. While the interoperability of ammunition is essential for the systematic functionality

in joint cooperation and unification of the logistics and sustainment, building up critical mass for the national and allied defences requires time and increased production capacities, which many global manufacturers in the military industry are working on. Despite the new advanced technologies with the AI component and system of systems marvels; manufacturing capacities, speed, logistics, endurance and sustainment remain significant in assessing the effectiveness of the military equipment. Just as at any other time in the last two millennia of warfare, weapons baptised in the fire of war are the ones to prove themselves and are likely to be procured for the next war. Furthermore, the equipment's resilience, besides its systematic sustainment, largely depends on the adaptability and knowledge of the personnel that utilises it and flexibility in finding solutions to fix it.

In the case of Russian military equipment, although their stocks were not sabotaged prior to the invasion, their use of indiscriminate bombing and artillery shelling and the overall approach to warfighting illustrated that even their stockpiles are exhaustible and not prepared for a protracted attrition war on such a scale. The Russian war machine was also significantly damaged by international sanctions, limiting access to foreign technologies like microchips in ammunition manufacturing. Although Russia still managed to sustain its equipment manufacturing and the production of various ammunitions, the restraints were conditioned by the speed of manufacturing, which was significantly crippled by numerous sabotage activities against Russian military apparatus throughout the entire year of the full-scale invasion with greater intensification in spring 2023. Disruption of the functionality of the military industry, its delivery capacity and overreliance on the cheap railway system for the equipment delivery to Ukraine illustrated significant shortfalls in the Russian ability to sustain its physical component of the fighting power. The Russian choice of cheaper Iranian Shahed 'kamikaze drones' (loitering munitions) was a good illustration of the need for fast restocking of their capacities in order to sustain continuous, indiscriminate bombing campaigns. From the perspective of technological parity, in preparation for the Ukrainian counteroffensive by combining various sources to fully stock military equipment and ammunition, Ukraine was beginning to gain the upper hand in firepower, precision, range and establishment of the critical mass compared to the Russian military apparatus. In essence, the resilience of equipment and a build-up of a critical mass is about the smart use of weapons because they are never inexhaustible. The UAF started with scarcity and coped with it through various stages of this year, while Russia started with numerical superiority and its mass employment without consideration of the sustainment and endurance of the firepower and fighting power in general and was left with scarcity and insufficient supply compared to their demands. Inter-state war is not a sprint, it is a marathon, and the physical component of the fighting power needs to be sustained to endure, instead of hoping for immediate results without any contingency planning for other potential developments in the war.

The moral component

In commenting on the war in Ukraine, US Army General (Ret.) David Petraeus said that 'about as clear a right-versus-wrong as we've seen in our lifetime.'[16] This recognition of clear-cut right and wrong is directly related to the moral component of the fighting power and resilience of the UAF compared to the enemy.

The simple source of the high morale and what kept the Ukrainian people going was that this is a patriotic war for their homeland's independence and territorial integrity. For the UAF and all the people fighting on the Ukrainian side, it is a war for liberal values, freedom and human lives. As President Zelenskyy said in his speech to Canadian students, 'we are fighting for our future, our freedom, our land and the opportunity to build a new Ukraine.'[17]

It is based on human values, comradeship and a strong fighting spirit that not only brought people from around the world but also helped to sustain the high morale and survival of the UAF in the most difficult situations. Although some professionals avoid discussing the warrior ethos, in this war it was indeed the warrior ethos that was established through interpersonal ties and the facing of hardships together.

The behaviour of the combatants on the Russian side included looting, raping, killing of civilians, a lack of discrimination between combatants and non-combatants, the long-range bombing of Ukrainian cities and the kidnapping of Ukrainian children. These actions violated the law of armed conflict.[18] Russian combatants that had more fighting experience and high rank often avoided combat until they were forced to do so. The newly mobilised were unprepared, while Wagner PMC used recruited prisoners as an additional source of cannon fodder. Such a mass of a fighting force could not be characterised by the high morale or traditional fighting spirit. The instances of Russians leaving their wounded and not helping them were recorded many times. Lack of a legitimate cause of war cannot provide one's combatants with a strong will to fight; even fear tactics have their limitations. As the preparations for the Ukrainian summer 2023 offensive illustrated, more and more Russian combatants were surrendering right away in order not to die in Eastern Ukraine. The side with no motivation to fight, but with fear, is vulnerable, especially in a more prolonged war. The problem is that, in the Russian tradition, they often have to fight at gunpoint. However, the Wagner experience illustrated that if there were enough recruited prisoners to turn around and overpower their commander, they could survive by surrendering to the UAF. It indeed had led some to posit that human life had become cheap in Russia.[19]

The moral resilience of the fighting personnel comes from within. It can be strengthened through training and military service and belonging to distinctive units, but the core of it lies in a far more existential belonging to humankind fighting for the right cause – human life, freedom, your homeland, families, friends and humane virtues.

Finally, the extent of the collective performance of the two sides of the war must be stressed. The case of the UAF illustrated not only the significant integration across services and units but also cohesion across units with different backgrounds and paths to warfighting. In this regard, cohesion was conditioned by the tactical-level demands, the polishing of previously gained skills and the strengthening of newly acquired ones during this intensive year of war. Furthermore, even when units had to be reorganised due to losses and other reasons, this was done according to the immediate situational requirements.

In contrast, the Russian collective performance from the first days of the war was undermined by a lack of cohesion due to the diversification of units and their consequent ethnocultural, regional and status conflicts. This significantly undermined inter-unit cooperation on the ground, and on various occasions resulted in internal fights between various factions and engaging with other groups in the first waves of warfighting. This lack of integration often resulted in fratricide and/or duplication of effort.

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CONCLUSION

The war was continuing as this book was being finalised (summer 2023). The UAF was in the middle of the counteroffensives, while Prigozhin's one-day coup illustrated significant flaws in Putin's regime in Russia. While more Russian soldiers surrendered to the UAF in the spring 2023, the price of each liberated mile of Ukrainian land is still very high. However, the Ukrainian nation and all those fighting and supporting Ukraine demonstrated remarkable resilience and strong fighting spirit.

This book has illustrated that the resilience of Ukrainian fighting power during this one year of full-scale invasion was determined by multiple factors. Unlike in 2014, when the UAF was starved of resources and investment, the issue with training and availability of basic supplies, in 2022, the war was going on for eight years. These eight years strengthened the Ukrainian military and provided them with the relevant operational experiences and time to prepare for the inevitable full-scale Russian invasion. It was inevitable since bully-states and dictatorships understand only strength. The entire nine years, and this last year more specifically, showed that the primary assets in the resilience of the fighting power remain to be people. These are people who are fighting on the frontline, volunteers to crowdfund and support the tactical needs of the units, and the wider public that donates funds and items in support of the UAF. These are also people who train and provide military assistance to the UAF; the Ukrainian military and political leadership that inspired various reforms and changes in the Armed Forces.

Having the right people in the right places also requires enduring motivation and sustaining morale and fighting spirit. For the UAF, and those fighting and supporting them in many ways, this is a clear-cut division between right and wrong. The UAF is fighting for the survival of the Ukrainian nation and the liberation of the Ukrainian territory from the aggressor. This is the war of liberation, for human values and

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freedom. These values kept people going through this year, sustaining high morale on the frontline and rear. The dynamic between the frontline and rear is very much like a smile – it is contagious. So, when the UAF shared their achievements and even funny videos on media platforms, the wider society would rejoice with them. Similarly, when the rear withstood various Russian attacks and kept going and supporting the UAF, this would only strengthen morale on the frontline.

The technological side of the Ukrainian resilient fighting power illustrated that diversity provides a significant advantage in countering numerically superior enemy. The critical mass developed by the UAF took full advantage of the numerical side of the available and more dated Soviet equipment and more advanced Western cutting-edge technologies in building layered defences across domains. In this regard, the necessity of war required tactical solutions and rapid decisions, which incorporated many assets in support of the UAF objectives across the frontline. Once again, precision proved to be more cost-effective and useful in achieving specific objectives than the mass barraging and carpet bombing inherent in the Russian military tradition.

Although more advanced technologies illustrated the greater significance of precision, taking advantage of unmanned assets across domains, it also showed that in high-intensity warfare, a continuous flow of ammunition is crucial for the sustainment of the fighting power and its actual survival in various segments of the frontline. Timely availability of technologies and ammunition is essential for effective adaptation in the battlespace. On the contrary, their absence or a delay in one domain puts additional pressure on another, and even greater pressure on the people fighting across those domains. The UAF survived and consolidated its capabilities because it had motivated people with multiple skills and talents. Future reports and books will reveal how many lives the freedom of Ukraine cost. The sacrifices of the fallen are likely to live long in the memory of Ukrainians. Many make reference to the 'golden generation' that have died on the frontlines.[1]

The combination of the human will, innovative thinking and war necessities resulted in many adjustments and developments that made the Ukrainian fighting power resilient in this war. The adjustment during the first eight years was that most of the training and exercises were focused on actual warfighting against a well-known enemy. Hence, much of the UAF training across services was conducted in close-to-war settings or approached as operational rehearsals, which only tuned relevant skills for adaptation in the first few days and weeks of the full-scale invasion. The experience of the 2014–2015 warfighting also showed the necessity of a more empirical education within the NCO framework, with various incentives fruition during 2022. The urgency of war stimulated Ukrainian warriors to acquire relevant skills in warfighting and in operating Western equipment within the shortest time, finding the most effective employment in Ukrainian settings.

On the contrary, Russians were fighting a war of invasion and aggression. Propaganda and a focus on the numerical structuring of the armed forces and firepower, and the indiscriminate barraging of civilian areas, can get the aggressor

only so far. The Russian traditions of using fear and firing squads in warfighting had not evolved much since World War II, nor had its organisational culture of rigid hierarchy and complete centralisation, killing any initiative and unconventional thinking. The armies of mercenaries, recruited prisoners and Kadyrovites also did not provide sufficient mass or skills to sustain the fighting power over a prolonged period of time in a war on the Ukrainian scale. The lesson already learned in warfare is that the side that does not evolve and adapt to the operating environment or the wider strategic environment is doomed to lose; it is only a question of time.

From a broader perspective, this war illustrated that peace cannot be taken for granted and that the absence of war today does not mean it cannot happen tomorrow. This does not mean living in fear, but instead, the reality requires preparing for warfighting during peacetime, considering the trends in the strategic environment. Already, the Ukrainian experience with resilient fighting power and total defence is being discussed and influences the conceptualisation and organisation of national security and militaries across the world. The important aspect is ensuring these lessons are not to be neglected and forgotten when this war is over and when another era of peace arrives in international relations. The price of ignoring the existence and likelihood of war in the foreseeable future might be too high to pay.

Note

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