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Introduction

"We have really realized many months ago that this is a war of attrition, meaning a battle of logistics," stated former NATO Secretary General Jens Stoltenberg (as cited in NATO Allied Command Transformation, 2023, para. 3). Stoltenberg's words suggest the renewed prominence of military logistics in discussions on security and strategic planning (Dowd et al., 2023). They also reflect a heightened awareness across the Alliance's higher echelons of the pivotal role of supplying military operations—a stark difference from the strategic, operational, and tactical aspects of the wars waged by Western powers in the aftermath of the attacks of September 11th, 2001 (Erbel & Kinsey, 2015). Erbel and Kinsey (2015) argue that since the end of the Cold War, NATO has steadily marginalised the relevance of military logistics and sustainment in large-scale military operations from the core of the post-Cold-War security environment. However, with Russia's full-scale invasion of Ukraine, supply, logistics, and sustainment must be addressed by NATO and the Member States as a critical component of the new realities of armed confrontation (NATO, 2023).

Logistics and sustainment remain the centrepiece of any effective military strategy and the key to its successful implementation, relying heavily on strategic and operational planning (Antai et al., 2023). This is evident in the Russian military failures in Ukraine (Ti & Kinsey, 2023; Erbel & Kinsey, 2015). Ti and Kinsey (2023) also highlight how logistical deficiencies hindered the Russian advance and revealed flaws in their pre-war logistical planning. These strategic failings underscore the complex interrelationship between military strategy and sustainment operations, emphasising the critical importance of logistics as a foundational component of strategy.

This paper builds on the contextual understanding of logistics and strategy to examine NATO's sustainment capabilities and logistical vulnerabilities in supplying large-scale combat operations, drawing insights from the war in Ukraine. The full-scale Russian aggression in Ukraine has exposed critical challenges for the Alliance in supporting its warfighting capabilities. The first section assesses the evolving battlefield, the emerging threats, and the challenges of resupplying forces within modern combat at the tactical level, using examples from the Russo-Ukrainian conflict. The subsequent section analyses NATO's logistical structure and capabilities.

1. The Evolution of the Contemporary Battlefield and Logistics: The Case Study of the 2022 Russian Invasion of Ukraine

Historically, supply lines have been crucial in organised large-scale military operations (Watling & Horne, 2024). Logistics, sustainment, and frontline support troops have

historically governed the scale, scope, pace, tempo, manoeuvrability, lethality, and resilience of field armies in combat (Skoglund et al., 2022; Watling & Horne, 2024). Despite considerable changes to the conduct and means of war since ancient times, military logistics has remained a fundamental factor for success at all levels of warfare (Ti & Kinsey, 2023). However, emerging threats, including the availability of cruise missile technology and long-range one-way attack munitions, combined with increasing battle transparency, are rapidly transforming the modern battlefield, reshaping the tactical landscape for sustainment operations, including force protection, personnel and weapons resupply, and support equipment (Watling & Horne, 2024; Ti & Kinsey, 2023). This shift calls for renewed attention to sustainment and logistics, which have long since suffered from a relative oversight in Western military doctrines and strategic planning.

At its most fundamental theoretical level, tactical logistics operates as a two-sided process: the upward flow of equipment and troops to resupply frontline forces and the rearward evacuation of casualties and materiel (Watling & Horne, 2024; Skoglund et al., 2022). This paper will largely focus on the sustainment and resupply of forces in the field due to the limited scope of this piece, as a comprehensive discussion of all aspects of military logistics is beyond its scope. Thus, the tactical (re)supply of modern armed forces exemplifies these emerging challenges, as observed from the case-study of the Russian invasion of Ukraine. These functions are adapted to the tactical landscape to mitigate supply operations vulnerability, following three well-known military principles: convoys, deception, and dispersal (Watling & Horne, 2024; Skoglund et al., 2022).

Accounting for the realities of tactical resupply for land troops reveals the first significant discrepancy between the ‘absolute form of war’ and the actuality of land warfare—namely, the sheer volume of resources and equipment required to sustain large military formations (Foss, 2014; Martin et al., 2023). This dynamic creates a mutually dependent effect: First, large-scale commercial infrastructure is essential for sustaining an army; Second, logistics for frontline troops becomes increasingly vulnerable as supplies enter the battlefield through large, fixed targets such as ports, terminals, and rail infrastructure (Watling & Horne, 2024).

Against this backdrop, traditional military doctrine’s emphasis on dispersion is not entirely feasible in environments where land forces are engaged in high-intensity combat (Watling & Horne, 2024). In such scenarios, resupply lines become scarce and concentrated around a few easily identifiable sustainment nodes, making them vulnerable to enemy fire and, in turn, jeopardising the combat effectiveness of frontline troops (Dalsjö et al., 2022). This vulnerability became particularly evident in the early summer of 2022 on the battlefields in eastern Ukraine (Dalsjö et al., 2022). Until June 2022, Russian forces had accumulated an overwhelming advantage in artillery firepower and successfully shaped the battlefield by

saturating the electromagnetic spectrum. This saturation hindered the Ukrainian armed forces from locating their targets, preventing them from disrupting Russia's rate of fire and reducing heavy attrition (Zabrodskyi et al., 2022; Dalsjö et al., 2022). Yet, at the beginning of June 2022, Ukrainian precision artillery and rocket fires, mainly GMLRS (Guided Multiple Launch Rocket Systems) started to successfully target Russian command-and-control (C2) and logistical hubs (Watling & Reynolds, 2023). The destruction of key sustainment nodes, such as munitions depots, led to a sharp decline in Russia's volume of fire. As a result, Kremlin troops were forced to relocate C2 centres beyond the range of HIMARS (High Mobility Artillery Rocket System), exposing Russian electronic warfare platforms to Ukrainian strikes (Watling & Reynolds, 2023). By pushing stockpiles and C2 beyond the range of Kyiv's precision munitions, a requirement for battlefield adaptation, Russia lost its fire supremacy which is critical for its planned doctrine of warfare (Watling & Reynolds, 2023).

The fighting in Ukraine serves as the perfect case study, highlighting two relevant developments that increased the vulnerability of critical logistical infrastructure: the growing transparency of the modern battlefield and the widespread availability of long-range precision munitions (Dalsjö et al., 2022; Martin et al., 2023). Advancements in cruise missile technology and the proliferation of inexpensive, expendable UAVs have enabled deep-range strikes on theatre-wide logistical hubs, posing unprecedented challenges to sustainment operations. Historically, the relative scarcity and high costs of long-range precision-guided munitions constrained the ability to target critical logistics nodes (Watling & Horne, 2024). On the contrary, nowadays, key infrastructural nodes are under threat, as demonstrated by Ukraine's targeting of the Kerch bridge—a vital resupply route through Russian-occupied Crimea (Watling & Horne, 2024).

Consequently, modern high-intensity warfare, as witnessed during Russia's full-scale invasion of Ukraine, has given rise to unique logistical challenges (Martin et al., 2023). While static, large-scale logistics infrastructure is essential for sustaining military operations, its design prioritises commercial efficiency, limiting the ability to disperse supplies (Watling & Horne, 2024). At the same time, the widespread availability of inexpensive long-range munitions has increased the vulnerability of critical logistics hubs, necessitating a higher degree of logistical expansion by moving depots and sustainment nodes further rearward to decrease the likelihood of enemy targeting (Watling & Reynolds, 2023). In turn, the combat needs of forces heavily constrain the dispersion of sustainment operations. As resupply routes and logistical lines extend, military forces lose warfighting capacity, as combat elements must be diverted from the frontlines to support sustainment efforts (Connable et al., 2020; Dalsjö et al., 2022).

Indeed, as the planned swift multi-front invasion failed in the first weeks of the 2022 invasion, the Kremlin increasingly relied on extended ground transportation for supply and

support to continue the war (Caron, 2023; Dalsjö et al., 2022). However, Russian sustainment operations were consistently exposed to Ukrainian interdiction by drones and mortar fire, leading to significant failures on the battlefield and a distinct inability to sustain its campaign effectively (Martin et al., 2023; Connable et al., 2020). A notable example is the infamous convoy consisting of an MTS brigade and a mechanised battalion for force protection, which stalled on route to Kyiv—an early demonstration of Russia's logistical challenges at the onset of the war (Dalsjö et al., 2022; Caron, 2023; Skoglund et al., 2022). In other words, Russia's withdrawal from the Kyiv front largely stems from its failure to supply forward-deployed troops in Hostomel, as any road-based sustainment convoy remained highly vulnerable to attack (Skoglund et al., 2022; Caron, 2023).

The secondary role assigned to logistics in Russian operational planning significantly hampered their military capabilities from the early stages of the invasion. This was apparent in their failure to meet the surging demands for materiel and transportation across overstretched supply lines (Skoglund et al., 2022; Vershinin, 2021; Hugos et al., 2022). Nevertheless, beyond Russia's inability to adequately execute a large-scale ground offensive far from static logistics infrastructure, the growing threats to sustainment nodes and the complexities of the modern battlefield pose critical enquiries for Allied armed forces. These forces could potentially engage in conflicts where adversaries actively challenge the logistics environment (Vershinin, 2021; Hugos et al., 2022).

2. NATO Logistics and Lessons Learned

The increasing battle transparency and long-range capabilities observed in the Russo-Ukrainian war require a closer analysis of the new pressures on the operational and tactical sustainment of NATO land forces. The emerging challenges to logistics are not solely limited to the armed forces of the Russian Federation; in high-intensity, large-scale conflicts, the ability to strike resupply infrastructure is widely available, exposing vulnerabilities in Western logistical planning (Watling & Horne, 2024). For instance, Allied logistics focus on building concentration capacity within the theatre (Ti, 2022a), reflecting the previous combat experiences of Western forces, which have primarily operated in conflicts with mostly uncontested logistics environments, such as Afghanistan (Erbel & Kinsey, 2015; Watling & Horne, 2024). In other words, Western logistics relies on its ability to concentrate supplies in predetermined key sustainment hubs in order to enable the battlefield with forces and equipment to the frontlines (Waitling & Horne, 2024).

While logistics for NATO operations is partly framed as a collective responsibility "to provide timely, continuous, adequate and reliable logistics support of forces" (NATO, 2025, Key principles and functions), each Member State remains largely responsible for supporting its

own national contingent. As a result, Allied logistics remain subordinate to the sustainment capabilities of individual nations, despite the vital role logistics play in the success of any large-scale NATO deployment (Oppelaar, 2023). Since national members are responsible for resupplying their forces, NATO planners face significant obstacles in simultaneously managing operational execution and the logistical planning required by NATO Doctrine AJP-5 (Oppelaar, 2023).

Nonetheless, officials have taken some steps in response to Russia's renewed aggressive posture. Following the Kremlin's annexation of Crimea in 2014, NATO established the Joint Support and Enablement Command (JSEC) in Ulm, Germany, whose area of responsibility (AOR) covers the reinforcement, support, and sustainment of NATO forces in wartime (Hooker Jr, 2024; Knappe & Boeke, 2021). While JSEC benefits from its central geographical location in Europe—considering the proximity to prepositioned storage sites in Belgium and the Netherlands—the headquarters remains outside NATO's command structure (Hooker Jr, 2024; Knappe & Boeke, 2021).

Although JSEC has yet to achieve full operational capability, given its relatively recent establishment in 2018, modern sustainment operations involve a substantially different approach from Cold War-era deployments of full-strength divisions (Knappe & Boeke, 2021). A key shift has been the increasing privatisation of critical infrastructure, with commercial and civilian entities playing an important role in military logistics, particularly in military transport (Knappe & Boeke, 2021). This reliance on civilian logistics partners adds additional challenges in the tactical reinforcement of NATO forces in theatre (Koster, 2018). However, several notable differences exist between Russian and Western military logistics systems. Russian support, sustainment, and logistics force structures are proportionally smaller relative to those of comparably sized NATO forces (Ti & Kinsey, 2023; Vershinin, 2021). This shortfall becomes particularly evident in Russia's overreliance on fixed infrastructure (Caron, 2023; Vershinin, 2021). For instance, Russian logistics support includes a substantial number of personnel dedicated to static resupply lines, including rail transport and pipelines (Caron, 2023; Ti & Kinsey, 2023). On the contrary, NATO formations possess a markedly higher ratio of combat vehicles and logistic trucks (Ti & Kinsey, 2023; Vershinin, 2021), allowing a more flexible and scalable logistics system compared to the more rigid requirements of Russian combined arms units.

Thus, the logistical problems and vulnerabilities faced by the Russian army during its initial assault on Ukraine highlight the need for sustainment and reinforcement in order to support a campaign (Sollfrank & Boeke, 2024). With NATO's recent pivot to collective territorial defence, logistics will have to be incorporated into Allied plans and command structures as a collective responsibility and effort (Sollfrank & Boeke, 2024). The enablement landscape

in Europe has dramatically changed since the Cold War:The accession of several new Member States has increased the length of the supply lines to the frontlines on the Eastern Flank, and advancements in precision deep-strike missile and drone technology has opened vulnerabilities in the rear area of the theatre (Sollfrank & Boeke, 2024). Without improved logistical capacity and infrastructure by NATO JSEC, Allied forces are rendered unable to sustain large-scale operations as reinforcements will have to "[fight] to get to the fight" (Dowd et al., 2023; Van Herck & Van Ovost, 2022, para. 4).

Conclusion

This article has aimed to provide a brief examination of the challenges facing the sustainment of NATO land forces, drawing relevant lessons from the logistical failures and developments observed since Russia's full-scale invasion of Ukraine in 2022 (Hurt, 2022). The battlefields of Ukraine have revealed a transformed logistical landscape, where the proliferation of cruise missile technology and long-range precision munitions—such as inexpensive, one-way attack drones—has radically heightened the traditional threats to fixed, large-scale sustainment infrastructure (Watling & Horne, 2024). In response, Russian forces have been forced to seek greater dispersion and relocate concentrated logistics hubs rearward, further away from the theatre (Ti, 2022b).

Similarly, NATO's ability to reinforce Allies in a high-intensity, high-threat, large-scale combat environment must address critical vulnerabilities. Most notably, the absence of a fully established sustainment command with operational control over collective logistics requires national Members to improve their reinforcement capabilities (Koster, 2018). Nonetheless, in contrast to the case study of the 2022 Russian invasion, NATO's force structure offers inherent advantages that mitigate some of the resupply breakdowns widely observed in the Russian military (Vershinin, 2021).

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