



Russian Military Logistics in the Ukraine War

RECENT REFORMS AND WARTIME OPERATIONS

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Abstract

This paper examines the Russian military logistics system since 2010 with emphasis on its performance in Ukraine. It includes a detailed assessment of Russia's military logistics system based on major reforms introduced in 2010, highlighted by the merger of the Technical and Logistics Services to form a unified material-technical services (MTO). Over the next decade, Russia's logistics system underwent further reforms including changes in structure, order of battle, command and control, and transportation and storage systems, to improve performance and better align logistics with the new brigade structure introduced after the Georgia War. Next, the paper examines the performance of Russian military logistics during the 2022 Ukraine campaign. Russia's MTO forces performed poorly during the initial invasion in part due to deficiencies in force design and doctrine and in part to the immense challenges presented by the initial invasion plan. Russian logistics fared better once the campaign refocused on the Donbas, which greatly simplified the logistics task. MTO operations had to adjust further after introduction of US HIMARS, which necessitated moving key logistics nodes further to the rear, and during mobilization, to accommodate the mass influx of new personnel. Despite many setbacks, Russian logistics has been generally successful in sustaining combat operations in Ukraine, while MTO leaders are now using lessons learned to inform future reform efforts.

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9/29/2023

This work was created in the performance of Federal Government Contract Number N00014-22-D-7001.

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September 2023

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Executive Summary

Russia's February 2022 invasion of Ukraine and its combat operations there have highlighted the challenges and adaptability of the Russian military's logistical and combat service support system. This paper examines Russian military logistics during operations in Ukraine in 2022. It begins with an overview of the logistical system, highlighting its history, approaches, structure, and ongoing reform efforts that have been underway since 2010. The second part of the paper focuses on the system's performance during the war in Ukraine, viewing military operations in several discrete phases. The final part of the paper focuses on how leadership and authoritative thinkers in the Russian military logistics community are discussing lessons learned from recent operations while highlighting evolutionary priorities for the logistical system, given Russia's enduring adversarial relationship with the West.

The following is a summary of our key findings.

- Even before the war in Ukraine, the Russian logistics and combat service support system was in a state of continuous adaptation, dealing with a wide range of organizational, capacity, and technical challenges. The structure of Russia's current logistics system has its origins in the major reform efforts launched in 2010. The highlight of these reforms was the merger of Russian logistics and technical services to form a unified material-technical services (MTO) organization. Formation of a unified MTO was part of the "New Look" reforms launched after the Georgia War and were undertaken to better align logistics with the new brigade structure and other military reforms implemented at that time.
- Other key highlights of the "New Look" MTO reforms include the following:
 - Creation of MTO bases and brigades within combined-arms armies (CAAs) in military districts
 - Efforts to modernize and reduce the number of types of logistics vehicles
 - Transformation of the Railway Troops to improve their performance and technological base, culminating in 10 brigades connected to military districts
 - Outsourcing of certain support functions (e.g., catering, depot maintenance) to Oboronservis, a state-run corporation, which was later reversed because of inefficiencies and a major corruption scandal

- Reforms and restructuring of the logistics education system, which, when combined with a shortage of noncommissioned officers, contributed to a shortage of qualified logistics personnel
- Since the initial “New Look” reforms, Russia’s military logistics system has continued to evolve based on a series of additional reform efforts to optimize the new logistics system, albeit with mixed results. At the national level, the divisions and directorates within the MTO headquarters (MTO HQ) have taken a range of measures to better link the national production base with divisions and brigades in the field, but they have continued to struggle with the magnitude of the task. In addition, MTO leadership has been constantly tinkering with the three-tier MTO structure in a bid to improve command and control and optimize linkages between MTO HQ, military districts, and individual combat units in the field, with mixed results. MTO HQ has also continued to make changes to the MTO force structure based on lessons learned during recent conflicts and exercises.
- Despite such efforts, Russian MTO forces lacked the overall capacity to meet logistical demands during the initial phases of the 2022 war in Ukraine, largely because of continuing shortfalls in staffing and equipment in comparison with their logistics counterparts in advanced Western militaries. Lack of sufficient motor transport capacity was particularly problematic for Russian logistics operations in Ukraine during the initial phases, especially for units operating at significant distances from railways.
- Yet despite highly publicized failures of the system during the initial phases of the war, Russian logistics has proven to be remarkably adaptive. Much of the blame for Russian MTO performance problems during the initial phases of the campaign can be attributed to the sheer complexity and scale of the initial campaign plan, which involved a multi-axis advance across multiple fronts that severely taxed the ability of Russian logistics to keep pace and at times overwhelmed them. As a result, Russian combat units found themselves facing severe shortages of food, fuel, ammunition, and other resources and often had to forage for supplies.
- Over time, however, Russian MTO commanders made several adjustments to the logistics distribution system, including streamlining supply chains and relocating depots closer to the front. As a result, delivery of resources steadily improved, especially after Russian forces were withdrawn from Kyiv and reconcentrated in the Donbas, which greatly simplified logistics support. The ability to deliver ammunition sufficient to sustain Russian artillery fires was a major advantage for Russian forces during the second phase of the campaign running through mid-2022.
- Russian logistics faced new challenges during later phases of the campaign. The introduction of long-range US High Mobility Artillery Rocket System (HIMARS)

capable of striking supply depots deep in Russian rear areas was initially a major problem for Russian logistics. MTO forces eventually overcame the HIMARS challenge by moving depots farther to the rear and dispersing MTO operations closer to the front. The new approach impeded resupply efforts, however, so Russian forces lost much of their former advantage in firepower. Likewise, the two successful Ukrainian counteroffensives at Kharkiv and Kherson forced major adjustments to the MTO footprint to accommodate the evolving situation at the front. Similarly, Russian MTO forces struggled initially to absorb, train, and equip the nearly 300,000 new troops added during mobilization, but after some early struggles, they eventually adjusted to meet this challenge as well.

- Since then, the process of interaction has continued to unfold, with Ukrainian forces finding new ways to challenge Russian logistics and Russian MTO forces finding additional ways to respond. Overall, despite a problematic start during the initial phases of the campaign, Russian logistics has proven reasonably resilient and generally sufficient for the task of sustaining Russian military operations in Ukraine, although certain capability and capacity problems have endured.
- The lessons learned from Russian logistics operations in Ukraine have not been lost on Russian commanders. Drawing on these lessons and those taken from other recent high-profile military operations and exercises, Russian MTO leaders have recently embarked on another cycle of adaptation. Recent reform measures include reestablishing dedicated logistics support for Russian airborne forces; expanding equipment maintenance, repair, and operations facilities to increase capacity; and improving logistics mobility. Russian MTO force planners are also looking anew at roboticization and increased reliance on pre-positioned stocks to support future operations. Whether these new reforms will be sufficient to address underlying challenges remains to be seen.

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Introduction

Russia's February 2022 invasion of Ukraine and its subsequent combat operations there have highlighted the challenges of the Russian military's logistical and combat service support system. The system's performance has been mixed when it comes to the Russian military's ability to refuel, rearm, resupply, and revive its troops, repair equipment, and transport them across the battlespace. Ukraine's armed forces have also successfully degraded Russia's logistical capability.

The Russian military's logistical and combat service support system, MTO, is an integrated capability that facilitates the combat readiness and logistical needs of the Russian armed forces.¹ Its functions include transporting people and cargo; providing military equipment, fuel, maintenance, and repairs; feeding, equipping, and housing troops; repairing road and rail infrastructure; and assisting with the mitigation of disasters. Specially trained MTO troops are present in every Russian military district (MD), service, and fleet, and MTO capabilities are tested every year in minor and major military exercises. MTO is central to Russia's strategic mobility and ability to engage in operations outside of its territory.

Analyses to date have differed in their explanations of the challenges of Russian logistics during the war in Ukraine. Some have attributed them primarily to failing operational plans, especially early in the invasion.² Others have focused on the limits of the Russian reliance on the railway system.³ Still others have pointed out the inflexibility of the Russian push (versus the Western pull) logistical system and the inadequate numbers of logistical support personnel (tooth-to-tail ratio).⁴

¹ Referenced in Russian as “материально-техническое обеспечение” (MTO) or material-technical support.

² Per Skoglund, Tore Listou, and Thomas Ekström, “Russian Logistics in the Ukrainian War: Can Operational Failures Be Attributed to Logistics?,” *Scandinavian Journal of Military Studies* 5, no. 1 (2022), pp. 99–110, doi: <https://doi.org/10.31374/sjms.158>.

³ Maria Engqvist, *A Railhead Too Far: The Strategic Role of Railroads During Russia's Invasion of Ukraine*, Swedish Defense Research Agency, Oct. 2022, <https://www.foi.se/rest-api/report/FOI%20Memo%207954>; Emily Ferris, “Russia's Military Has a Railroad Problem,” *Foreign Policy*, Apr. 21, 2022, <https://foreignpolicy.com/2022/04/21/russias-military-has-a-railroad-problem/>.

⁴ Ronald Ti, *Russian Military Logistics*, International Center for Defence and Security, June 2022, https://icds.ee/wp-content/uploads/dlm_uploads/2022/06/ICDS_Brief_Russias_War_in_Ukraine_No3_Ronald_Ti_June_2022.pdf.

This paper seeks to add to the literature by providing (i) detailed background information on the Russian logistical and combat service support system as it has evolved since 2010 under the influence of various reform efforts, (ii) findings and analysis on how Russian logistics has performed during the ongoing conflict in Ukraine, and (iii) preliminary conclusions on the future direction of Russian logistics over the near term based on lessons learned in Ukraine and other recent exercises and deployments. In the process, the paper seeks to highlight and explain the gaps between expectations and performance in the following three periods:

1. Baseline: before the war in Ukraine
2. Present: during the war in Ukraine
3. Future: further evolution of Russian logistics as MTO leadership incorporates the lessons learned in Ukraine to shed light on its future direction during the ongoing war in Ukraine and/or a potential future regional war with US/North Atlantic Treaty Organization (NATO) allies

This paper provides a brief background on the MTO and describes the performance of this system in Russian military operations in Ukraine throughout 2022. It begins with an overview of the logistical system, highlighting its history, approaches, structure, and reforms beginning in 2010. This section draws on Western analyses, authoritative Russian military journals, interviews with organization leadership in Russian military publications, and previous CNA analysis of Russian exercises incorporating logistics capability in recent years. The second part of the paper focuses on the system's performance during the war in Ukraine, depicting Russian military operations in several discrete phases. This section draws on daily reporting and assessments on the war in Ukraine by entities such as the Institute for the Study of War; weekly English-language newsletters tracking the war, such as reports by Rochan Consulting; and other English- and Russian-language reporting. The third part of the paper focuses on how leadership and influential thinkers in the Russian military logistics community discuss lessons learned from recent operations and highlight evolutionary priorities for the logistical system. The sourcing for this section is drawn primarily from recognized and respected Russian military publications. The final section covers our findings and conclusions.

The Russian Military Logistics and Combat Service Support System

For centuries, the Russian armed forces have recognized the “rear” as essential to victory in armed conflicts. Russian military leadership has reformed the logistical and combat service support system in response to lessons learned from military engagements and in line with perceived shifts in the character of war. This section provides a brief history of the Russian logistical and combat service support system, discusses recent reforms, and provides a primer on the system’s operations.

Historical background

Russian military sources trace the formalized creation of combat service support to February 18, 1700, immediately ahead of the 1700–1721 Great Northern War between Russia and the Swedish Empire. On that day, Peter the Great signed edicts creating the *Proviantskiy Prikaz*, a body responsible for supplying foodstuffs to the armed forces, and the *Osobyi Prikaz*, a body responsible for disbursing funds for armaments, horses, and clothing to the military.⁵ The *Artilleriy Prikaz* was responsible for the manufacture, repair, and distribution of artillery.⁶ Over the centuries that followed, the system underwent numerous changes.⁷

As the nature of war evolved with the emergence of firearms, motorization, and aviation, so did the demands on the combat service support system, which now also had to provide ammunition and fuel as well as technical support for an ever-expanding number of military systems.⁸ Mass mobilization engendered the need to equip, feed, and sustain a significant

⁵ Andrey Kalii, “It All Began with Warehouses of Provisions” (А начиналось с провиантских складов), *Krasnaya Zvezda*, July 31, 2020.

⁶ A.P. Vachugov and A.A. Komarov, “On the Issue of Historical Experience of Building and Development of the RF Armed Forces Material-Technical Support System” (К вопросу об историческом опыте строительства и развития системы материально-технического обеспечения вооруженных сил Российской Федерации), *Nauchnye problem material'no-tehnicheskogo obespecheniya vooruzhennyh sil Rossiiskoi Federatsii* 3, no. 13 (2019).

⁷ Kalii, “It All Began with Warehouses of Provisions.”

⁸ To use one example, “In the largest battle of Waterloo (1815), both sides spent 9 thousand artillery rounds with a total weight of 37 tons, and in the Berlin operation (1945), the Soviet Army used up 30 thousand tons of artillery ammunition (i.e. 810 times more).” Dmitry V. Bulgakov, “The System of Material Provision for Forces: Directions for Improvement” (Система материального обеспечения войск направления совершенствования), *Voennaya Mysl*, July 2000.

number of troops during a potentially protracted conflict. The Railway Troops, created in 1851, began to play a prominent role in logistics.⁹ Growth in the maneuverability of combat further challenged the ability to deliver supplies without interruption, and the logistical system vacillated between differing degrees of centralization.

The most significant 20th century milestone for the Russian armed forces, the Great Patriotic War, was central to the development of the present-day Russian logistics and combat service support system. The Red Army entered the war with a complex organization of responsibility for the rear across the staffs and headquarters that was disconnected from the actual delivery of supplies and services.¹⁰ Worse, because many of the stocks of armament, fuel, clothing, and medicines were warehoused close to the Russian border, they were lost in the first several months of the war to the German military or to destruction by retreating Soviet forces.¹¹

The shift toward a unified structure began with the issuance of an August 1, 1941, edict elevating the Headquarters of the Rear into a central monitoring and coordinating role and the appointment of a chief, Gen. Lt. A. V. Khrulyov of the quartermaster service.¹² Khrulyov is heralded as a strategic thinker and an important leader of Russian combat support services—so much so that the Russian military logistics academy carries his name. During the war, he created effective command service support staffs at the front; at the army, corps, and division levels; and in the air force, navy, and MDs.¹³ And, in 1942, when railroad operations were significantly disrupted, fundamentally challenging delivery of supplies to the front, Khrulyov also served as the People’s Commissar of Railways.¹⁴ The lessons of the war for the logistical system—many of them potentially important today—have been summarized as follows:

The need to create rear service groupings in the areas of military operations and to ensure the greatest autonomy of groupings of troops in the rear area; the importance of creating and maintaining permanent availability in a sufficient number of reserves in the rear echelon of forces and assets; and the

⁹ Emily Ferris, *Russia’s Railway Troops: The Backbone Sustaining Russian Military Force Posture*, CNA, IOP-2023-U-035262-Final, Apr. 2023, <https://www.cna.org/reports/2023/04/russias-railway-troops>.

¹⁰ Dmitry V. Bulgakov, “The System of Commanding the Rear of the Armed Forces: Stages and Potential for Development” (Система управления тылом вооруженных сил: этапы и перспективы развития), *Военная Мысль*, Sept. 2001.

¹¹ A.V. Sadovodov and M.V. Martynov, “Rear Support of the Red Army in the Initial Period of the Great Patriotic War” (Тыловое обеспечение Красной Армии в начальном периоде Великой Отечественной войны), *МТО Vooruzhennykh Sil Rossiiskoi Federatsii*, July 2021.

¹² Bulgakov, “The System of Commanding the Rear of the Armed Forces.”

¹³ L. Hairemdinov, “The Forge of Quartermaster Manpower—the Rear—МТО” (Кузница кадров интендантства – Тыла – МТО), *Krasnaya Zvezda*, July 31, 2020; Bulgakov, “The System of Commanding the Rear of the Armed Forces.”

¹⁴ Sadovodov and Martynov, “Rear Support of the Red Army in the Initial Period of the Great Patriotic War.”

need to create a stable system of all-round protection of the rear from enemy strikes, both ground and air.¹⁵

During the Cold War, important stocks were warehoused close to the potential front lines in Warsaw Pact countries where high-readiness units were based. Western parts of the Soviet Union were major reserve areas at the time, whereas Russia largely garrisoned fourth-echelon forces and provided the mobilization base. The Soviet Union kept much of its equipment assigned to units in three types of divisions, depending on their degree of permanent manning versus the mobilized component. However, after the collapse of the Soviet Union, much of the logistical infrastructure was left outside of Russia, including the garrisons of forward-deployed units.¹⁶ The remaining stocks inside the Russian Federation were concentrated within 200 kilometers of the border region and close to large cities, necessitating alternatives to meet the military requirements of deep echelonment of logistical means.¹⁷ Much like the rest of the Russian military, the logistical system spent the 1990s in a state of decay.

The system continued to struggle after the end of the Cold War. During the Chechen Wars, it was unable to provide basic necessities and foodstuffs to soldiers. The rear had insufficient personal equipment, it had inadequate military equipment, and it even lacked the ability to offer effective identification and mortuary services.¹⁸ The 2008 war in Georgia also saw its share of logistical challenges, including malfunctioning military equipment, unreliable refueling vehicles, inadequate equipment for basic hygiene, insufficiently trained personnel, and the absence of effective communications means across the rear divisions.¹⁹ The Russian military also suffered from a diversity of platforms in similar roles across the ground force and, ironically, across the maintenance and sustainment components of the force as well. This diversity meant in practice that the Russian military had to maintain extensive stores of spare parts and equipment for numerous different types of vehicles, including those in the logistical components. Russia inherited these inefficiencies as a Soviet legacy, along with the Soviet Union's tendency to store vast amounts of obsolete equipment. For example, in 2008, the Russian military maintained multiple variants of four main battle tank types in the force: T-72A/B1/BA/B3 (and T-90A), T-80U, T-64BV, and T-62M. These issues set the stage for the main period of military reforms following 2008.

¹⁵ Vachugov and Komarov, "On the Issue of Historical Experience."

¹⁶ Bulgakov, "The System of Material Provision for Forces."

¹⁷ V.V. Vinogradov, "Developed Infrastructure of the Rear of the Russian Federation Armed Forces—Guarantee of High Autonomy of the Forces" (Развитая инфраструктура тыла Вооруженных сил Российской Федерации - гарантия высокой автономности войск), *Voennaya Mysl*, Mar. 1996.

¹⁸ Vachugov and Komarov, "On the Issue of Historical Experience."

¹⁹ Ibid.

Creation of the MTO

Russian military reforms that began in 2008 under then Minister of Defense Anatoly Serdyukov sought to create a smaller, more mobile, and better equipped military—a significant contrast to the mass mobilization military of the 19th and 20th centuries. Such a military would require smaller, yet much more responsive and flexible, logistics.

The New Look reform efforts, as they touched the military logistics and combat service support system, included the following:²⁰

- Creation of one unified structure—MTO²¹—intended to streamline the system, merging rear services and combat service support while simplifying command structures.
- Creation of MTO bases and brigades within combined-arms armies (CAAs) in MDs.
- Transformation of and cuts to the Railway Troops, particularly their officer corps, and efforts to improve the state of their technological base. Their structure culminated in 10 brigades and several battalions connected to MDs.²²
- Transfer of some support functions to a state-run commercial firm, Oboronservis (now, after a corruption scandal, AO Garnizon), for provision of some depot maintenance services.
- Reforms and restructuring of the logistics education system. Combined with an overall shortage of noncommissioned officers, this restructuring has contributed to a shortage of qualified logistics personnel.
- Efforts to modernize and reduce the number of types of logistics vehicles.

This new combined MTO system had an ambitious set of goals, as detailed in Appendix A. However, Russian military leaders have continued to face many structural challenges since the 2010 creation of the MTO. This section offers a primer on the system as it existed before the 2022 war in Ukraine.

²⁰ Roger McDermott, *Russia's Strategic Mobility: Supporting "Hard Power" to 2020?*, Swedish Defense Research Agency, Apr. 2013, <https://www.foi.se/rest-api/report/FOI-R--3587--SE>.

²¹ Referenced in Russian as “материально-техническое обеспечение” (MTO) or material-technical support.

²² Lester Grau and Charles Bartles, *The Russian Way of War*, US Army Foreign Military Studies Office, 2016, p. 327, <https://www.armyupress.army.mil/portals/7/hot%20spots/documents/russia/2017-07-the-russian-way-of-war-grau-bartles.pdf>.

MTO organization

Russian logistics is a complex undertaking involving a wide range of military and non-military organizations. Although the MTO plays a leading role in managing, coordinating, and carrying out logistics activities, several other military organizations, government agencies, and private and state-owned corporations participate in this effort as well.

The combined public-private nature of Russian logistics support is most apparent at the strategic level, at which effective logistics requires coordinated efforts by the Ministry of Defense (MoD), the Russian armed forces, government agencies such as the Ministries of Industry and Transportation, and a range of commercial entities.

Logistics is administered at the national level by the Central Office of the MTO, which falls under the Russian MoD. (See Appendix B for MTO structure.) The task of logistics is further subdivided into separate MTO departments and directorates, each of which is responsible for a particular logistics area.²³ The Logistics Headquarters is primarily responsible for planning and organizing the military-economic supply of the armed forces, essentially serving as a link between the economic system of the state and the Russian military during both peacetime and wartime.²⁴

The Department of Transport Support is responsible for arranging transportation through common carriers to support the movement of troops, equipment, and supplies over Russia's transportation networks. The Department of Resource Support is responsible for stockpiling supplies and resources and overseeing their delivery to Russian field units. These departments were formerly part of the Rear Services, which were merged during the formation of the MTO in 2010. Other lead MTO agencies include the Main Armored Directorate, which is responsible for acquiring, distributing, and maintaining Russian combat vehicles for Russian maneuver units. The Main Rocket and Artillery Directorate plays a similar role with respect to artillery, multiple-launch rocket systems (MLRS), and tactical missile systems. The Main Directorate of Railway Troops oversees the activities of the 10 Railway Troop brigades that this force

²³ Dmitry V. Bulgakov, "Current State and Development Prospects of the Material and Technical Support System of the Armed Forces of the Russian Federation" (Современное Состояние И Перспективы Развития Системы Материально-Технического Обеспечения Вооруженных Сил Российской Федерации), Russian Ministry of Defense, Jan. 16, 2020, <https://mto.ric.mil.ru/Stati/item/239399/>.

²⁴ Vladimir Trishunkin, "Headquarters Logistics Support of the Armed Forces of the Russian Federation – 80 Years" (начальник Штабаматериально-технического обеспечения Вооруженных Сил Российской Федерации, генерал-лейтенант), *Material'no-tehnicheskoe obespechenie Vooruzhennyh Sil Rossiiskoi Federatsii* 7, July 31, 2021.

comprises.²⁵ These directorates were formerly part of the Technical Services, which were likewise incorporated into the MTO during the 2010 merger.²⁶

Since its formation in 2010, the MTO has served reasonably effectively as a unified command responsible for managing and overseeing an integrated Russian military logistics system. Yet MTO leaders have continued to grapple with structural and organizational challenges since the merger. They are still struggling to create effective mechanisms for interfacing with a wide range of federal agencies and private enterprises to coordinate national logistics support for the military.²⁷ This task has fallen largely on the MoD's MTO Logistics Headquarters (MTO HQ), which has had problems managing the vast array of logistics agencies, programs, and activities under the MTO's command.²⁸ In response, MTO commanders are working to improve the system of logistics by adopting modern methods of management and automated systems and by conducting ongoing interagency exercises. A wide array of government agencies and state-owned corporations have participated in such exercises.²⁹ MTO HQ staff are likewise making continuous efforts to optimize linkages between industry and the military to realize the MTO's vision of an uninterrupted logistics supply chain linking Russia's economic base to the troops in the field.³⁰

MTO order of battle

The MTO forces currently have a three-level vertical structure. The MTO Central Office and its supporting departments and directorates (as described above) stand at the pinnacle of this vertical command structure and are responsible for managing MTO at the national level. Departments and directorates under the MTO Central Office command are responsible for administering specific MTO lines of effort as described above.

Each MD also has its own separate MTO apparatus, including independent MTO and Railway brigades, pipeline troops, and MTO support. At the MD level, MTO's primary responsibility is to support Russian maneuver brigades (and divisions) as well as the combat support brigades and formations attached to respective MDs. Each MD has a deputy commander for logistics who is responsible for the four MTO directorates under their command, each of which manages

²⁵ "Central Office of the MTO," Russian Ministry of Defense, accessed Feb. 1, 2023, <https://function.mil.ru/function/mto/info.htm>.

²⁶ See Appendix B for a more detailed breakdown of the organization of the MTO.

²⁷ Bulgakov, "Material and Technical Support System."

²⁸ Trishunkin, "Headquarters Logistics Support of the Armed Forces."

²⁹ Trishunkin, "Headquarters Logistics Support of the Armed Forces."

³⁰ *Ibid.*

a particular logistics area (MTO planning and coordination, logistic support, technical support, and Railway Troops).

MTO brigades attached to MDs are nominally independent. During military operations, however, MTO brigade subunits are attached to support the various combat and combat support brigades in the MD. There is considerable variation between MTO brigades, although there is a growing convergence in their force structure.

Typically, each MTO brigade now has a “command and control” element, two motor transport battalions, a maintenance battalion, a pipeline battalion, a field refueling company, and other logistics units. During combat operations, these units or portions thereof are typically attached to a maneuver brigade (or division) to provide logistics support as needed.³¹

Each MD also has one or more Railway Troop brigades. Russia maintains 10 Railway brigades in total, enough to assign 2 brigades to each MD. There are also several independent Railway battalions throughout the country, each of which is operationally attached to an MD.³² In addition, the General Staff operates several independent railway units that are directly subordinate to its control.³³ These units support military operations by maintaining the railway system, repairing tracks and rolling stock, building bridges, and using concealment to enhance security.³⁴ The addition of railway brigades increases the capacity of the existing MTO brigades, although reliance on dedicated railway units also tends to tie significant logistics capacity to the existing railway network.³⁵

The third and lowest level on the MTO vertical hierarchy includes the MTO battalions attached to combat brigades and organic logistics personnel that support lower level combat formations. All ground force maneuver brigades (and divisions) currently have their own MTO battalions.³⁶ Each MTO battalion has a dedicated cadre of logistics personnel and motor transport vehicles, including separate units dedicated to equipment maintenance, repair, and operations (MRO); food and fuel services; motor transport; and other functions.³⁷ During

³¹ Grau and Bartles, *The Russian Way of War*, p. 332.

³² *Ibid.*, p. 327.

³³ “Railroad Troops of Russia” (Железнодорожные Войска России), *Voенно-istoricheskii zhurnal* 8, Aug. 31, 2021.

³⁴ Grau and Bartles, *The Russian Way of War*, p. 327.

³⁵ Alex Vershinin, “Feeding the Bear: A Closer Look at Russian Army Logistics and the Fait Accompli,” *War on the Rocks*, Nov. 3, 2021, <https://warontherocks.com/2021/11/feeding-the-bear-a-closer-look-at-russian-army-logistics/>.

³⁶ Grau and Bartles, *The Russian Way of War*, p. 322.

³⁷ Tatiana Smirnova, “There Is No Victory Without the Rear!” (Без Тыла Нет Победы!), *Strazh Baltiki*, July 29, 2020.

combat operations, MTO battalions provide both logistics and maintenance support for the brigade's maneuver units.

Recent reform efforts have focused on improving the efficiency and reliability of MTO operations through additional changes to force structure. For example, the MTO formed new bridge battalions, which have been added to MTO brigades in each MD. At the same time, companies of multi-axle heavy-wheeled tractors were expanded into battalions. As a result, the capacity to restore bridge crossings to support both tracked and wheeled combat vehicles has increased (see Figure 1).³⁸

Figure 1. Bridge repair during training



Source: Vladimir Trishunkin, Anton Bychkov, Pavel Foryshev, and Oleg Knyazev, "Process of Improvement, Part 1" (Процесс совершенствования), МТО VS RF, Sept. 2022.

Capacity shortages

Despite recent reforms, MTO leaders are still contending with issues of capacity. In 2020, MTO Chief Bulgakov claimed that the MTO had a total staff of 305,000, including 160,000 uniformed

³⁸ Bulgakov, "Material and Technical Support System."

personnel and 145,000 civilians, which he said equated to a 5-to-1 ratio of logistics personnel to armed combatants. He claimed that this ratio met the standard maintained by most other advanced militaries.³⁹ However, in the US Army, the ratio of logistics to combat personnel is reportedly closer to 10 to 1.⁴⁰

Moreover, Russian MTO forces appear to lack the force size and capacity needed to meet MTO requirements to support a protracted, large-scale ground campaign. For example, Russian sustainment units organic to combat formations below the brigade level are an order of magnitude smaller than their US counterparts.⁴¹ Although Russian maneuver brigades have an equivalent logistics force, they lack the motor transport capability typically found in comparable US Army brigades. As a result, Russian ground forces have limited organic capability to operate more than 90 miles from their supply dumps and would likely have to double their organic capacity of trucks to materially extend their operational reach.⁴² Alternatively, with some limitations, MTO can sustain operations by impressing civilian motor transport capacity into service, although specialized mobile logistics equipment (e.g., custom-built refueling equipment) can be harder to replace using available commercial equipment.

Russian logistics units face greater demands in supporting Russian combat brigades, which have a larger complement of air defense and artillery than US Army brigades do.⁴³ Likewise, at the MD level, the Russian military does not have enough MTO brigades to support all the CAAs fielded by the Russian military. Russian standard practice is to have 1 MTO brigade for each CAA. Currently, however, Russia's 10 logistics brigades plus a specialized Airborne Forces (VDV) logistics battalion have to support 11 different CAAs, 1 tank army, 4 separate army corps, and 8 VDV divisions and brigades, well short of what is required to sustain major offensive ground operations.⁴⁴ The lack of an MTO force correspondingly large enough to support the 2 to 4 CAAs and other maneuver units in each MD is likely a reflection of Russian force planning decisions. Specifically, Russian planners appear to have built MTO capacity with the aim of supporting a more limited "active defense" strategy rather than a large-scale (blitzkrieg-style) war of maneuver.⁴⁵ However, Russian ground force, VDV, and naval infantry

³⁹ Bulgakov, "Material and Technical Support System."

⁴⁰ Ti, "Russian Military Logistics, p. 3.

⁴¹ Vershinin, "Feeding the Bear."

⁴² Ibid.

⁴³ Ibid.

⁴⁴ Vershinin, "Feeding the Bear;" Marta Carlsson, Johan Norberg, and Fredrik Westerlund, "The Military Capability of Russia's Armed Forces in 2013," in *Russian Military Capabilities in a Ten Year Perspective* (Swedish Defence Research Agency, 2013), p. 34.

⁴⁵ Vershinin, "Feeding the Bear."

divisions and brigades also have their own organic MTO battalions (or in the case of some brigades, MTO companies) to provide logistics support.⁴⁶

Command and control

The MTO chain of command follows the same three-level vertical structure running from the MTO Central Office. The MTO command chain, which was originally inherited from the Logistics Services and Technical Services, has undergone further reforms to align it more closely with the evolving brigade structures.⁴⁷ Currently, the chain of command starts at the top with the deputy minister of defense for material and technical support. It then runs through the various departments and directorates associated with the MTO Central Office. From there, the chain of command runs directly to the MDs.

At the MD level, the logistics system is headed by the deputy commander for logistics, who serves on the MD/Operational Strategic Command (OSK) staff. The deputy commander exercises authority through four MD-level directorates under their direct command. These include the directorates for planning and coordination, logistics support, technical support, and the Railway Troops.⁴⁸ Command and control of independent MTO brigades, MTO battalions, and lower level units at the MD level resides with the respective commanders of these formations. When such units (or their components) are attached to maneuver divisions and brigades, command and control shifts to the brigade or division commander. Within MTO brigades and battalions, material and technical support is organized by subordinate unit commanders, whereas in the combat brigades, command and control over logistics is exercised by the deputy commander for logistics and armaments.⁴⁹

Situational awareness

Ensuring the sufficiency of resupply efforts for combat formations requires continuous monitoring of both the evolving supply situation within frontline units and the existing inventories of fuel, ammunition, and supplies maintained by the MTO storage depots, refueling stations, resupply points, and other distribution nodes. At the HQ level, responsibility for

⁴⁶ Grau and Bartles, *The Russian Way of War*, p. 331.

⁴⁷ Bulgakov, "Material and Technical Support System."

⁴⁸ "MTO: Concentration of Power and Responsibility" (MTO: Концентрация Сил И Ответственности), *Voennyi Zheleznodorozhnik 2*, Jan. 10, 2011, <https://dlib.eastview.com/browse/doc/24212215>.

⁴⁹ Bulgakov, "Material and Technical Support System."

maintaining situational awareness of these matters resides in the Directorate for Monitoring the System of Material and Technical Support.⁵⁰

To support such efforts, the MTO Central Office and the Directorate for Monitoring have been actively working to equip the entire MTO hierarchy with automated control systems for managing MTO logistics and technical support, including automated accounting systems to track resource inventories using bar coding technology and radio-frequency identification (RFID) tags.⁵¹

However, efforts to equip the MTO with automated systems are still in the early stages and remain very much a work in progress. As a result, MTO forces lack the kind of real-time situational awareness necessary to calibrate delivery of the right resources to the right unit at the right time and place based on actual requirements. Therefore, Russian logistics continues to rely primarily on a push-based logistics model in which predetermined units of supply are pushed forward to the troops.⁵²

Integration of MTO into operational planning

On paper at least, Russian MTO commanders are well integrated into operational planning for pending military operations. At the MoD level, the deputy minister of defense for military-technical support reports directly to Russia's minister of defense, Sergei Shoigu, who until recently had been considered a member of Putin's inner circle. Likewise, the Logistics Headquarters of the Russian Armed Forces is designed to organize planning and coordination of logistics in the central bodies of military management, formations, and MTO units during both peacetime and wartime. Similarly, at the MD/OSK level, the deputy commander for logistics is an integral member of the MD/OSK commander's staff. During the lead up to military operations, the OSK commander is responsible for integrating logistics at the MD level, at least theoretically.

However, there are strong indications that MTO is not that well integrated into Russian operational planning, especially planning for a new conflict. For example, the MTO Central Office is subordinate to the MoD and does not report directly to the General Staff, which is responsible for planning and overseeing future military operations. Similarly, the Logistics Headquarters reports to the deputy minister of defense for material and technical support

⁵⁰ "Today Is the Day of the Logistics of the Armed Forces of the Russian Federation" (Сегодня празднуется День Тыла Вооруженных Сил Российской Федерации), Russian Ministry of Defense, <https://pda.mil.ru/pda/news/more.htm?id=12135746@egNews>.

⁵¹ Bulgakov, "Material and Technical Support System."

⁵² However, the Russian military can revert to a pull-based model in certain cases, such as during preparations for defensive operations before an anticipated enemy attack. See Grau and Bartles, *The Russian Way of War*, p. 344.

rather than the General Staff Main Operations Directorate, which plans military operations.⁵³ Although these MoD agencies would ordinarily be attached to the General Staff during wartime, their formal bureaucratic separation makes seamless coordination between the two staffs inevitably more difficult.

More important, there are indications that detailed logistics planning tends to occur only after the main outlines of a pending military operations have been developed. As noted in one recent article, “Logistics planning seems to take place after a course of action has been decided.”⁵⁴ This process is in keeping with Russia’s traditional top-down approach to operational planning, in which the commander selects the course of action (COA) and then allows subcommanders to plan accordingly.⁵⁵ This approach would limit MTO’s role to allocating and distributing resources based on the selected COA.⁵⁶ The chief of the country’s MTO Logistics Headquarters hinted at this tendency as well, noting that MTO’s role is to “implement (materialize)” leadership decisions.⁵⁷

Logistics delivery model

Guiding principles

Russia’s operational concept for logistics still relies heavily on the Soviet model, although it has undergone significant modification since the creation of the unified MTO in 2010.⁵⁸ As a result, MTO is still based to a certain extent on guiding principles dating back to the Soviet era, such as centralized management and control (versus a decentralized approach), reliance on a push-based delivery model, use of the echelon principle, and forward delivery by logistics units to troops at the front. At the same time, MTO leaders adopted several new principles during and after the New Look reforms, including those intended to simplify logistics based on the new brigade model, to improve strategic mobility (including through use of pre-positioned stocks), and to reduce storage requirements by relying more on rapid industry replenishment. These principles are covered in greater detail in this section. In managing the MTO reform process, Russian leaders aspire to adhere to these principles, although they are not always successful.

⁵³ “Logistics Headquarters of the Armed Forces of the Russian Federation,” Russian Ministry of Defense, accessed Feb. 9, 2023, https://structure.mil.ru/structure/ministry_of_defence/details.htm?id=9740@egOrganization.

⁵⁴ Skoglund, Listou, and Ekström, “Russian Logistics in the Ukrainian War,” p. 108.

⁵⁵ Ibid.

⁵⁶ Ibid., p. 105.

⁵⁷ Trishunkin, “Headquarters Logistics Support of the Armed Forces.”

⁵⁸ Skoglund, Listou, and Ekström, “Russian Logistics in the Ukrainian War,” p. 102.

Strategic mobility

Russian logistics is tied heavily to the objective of supporting strategic mobility, which was one of the primary goals of the New Look reforms. The elimination of the mass mobilization army, based on skeletal cadre divisions to be filled by conscripts and reservists during mobilization, gave way to a new force centered on permanent-ready combat brigades that are much smaller than former Soviet divisions.

The shift to brigades was undertaken because the conditions that supported the Soviet model were no longer present in post-Cold War Russia, given the high costs of maintaining a mass mobilization force predicated on mobilizing personnel and industry for wartime production while maintaining large stockpiles of equipment and supplies. These measures were deemed too costly for Russia's post-Cold War economy, and the country no longer had the manpower to support such a system.

The shift to lighter permanent-readiness brigades was based on the need to increase strategic mobility, in which maneuver brigades could be rapidly shifted to other theaters as required to meet emerging threats. To support the new model, MTO forces followed suit, establishing lighter, more mobile MTO brigades that also could be rapidly redeployed to other theaters to bolster their logistics capability. The shift to strategic mobility has been a key factor driving MTO force design ever since. At the same time, however, the MTO suffered deep cuts in its total force size because of the New Look reforms and the shift to brigades. These cuts were the result of trade-offs in force design, with Russian ground forces having a lower ratio of MTO support per combat unit. This design assumed that protracted ground campaigns were unlikely to be a major component of a large-scale local or regional war and that future wars would be shorter.

Ease of sustainment

In terms of logistics, the shift to a brigade structure also made the task of redeploying and sustaining the new combat brigades substantially easier than it was with the larger Soviet-style divisions. For example, the new brigades could be more easily transported via rail to locations throughout Russia. Once redeployed, the smaller brigades were also far easier to sustain because the average daily logistics requirements of these units decreased by an order of magnitude.⁵⁹ To hone their ability to transport and sustain Russian combat units, MTO forces participate regularly in strategic mobility exercises involving the redeployment of Russian brigade-sized forces to locations across the country.⁶⁰

⁵⁹ V. Ya. Serba and V. V. Grachev, "Problems and Directions for Improving the System of Logistics of the Armed Forces of the Russian Federation" (Проблемы И Направления Совершенствования Системы Материально-Технического Обеспечения Вооруженных Сил Российской Федерации), *Voennaya Mysl* 5, May 31, 2018, <https://dlib.eastview.com/search/pub/doc?pager.offset=4&id=51082223&hl=%D0%9C%D0%A2%D0%9E>.

⁶⁰ Grau and Bartles, *The Russian Way of War*, p. 32.

Pre-positioned stocks

The Russian military also makes extensive use of pre-positioned stocks of equipment and supplies to support strategic mobility. This practice was inherited from the Soviet logistics model but with some key differences. Whereas in the Soviet model local stockpiles were designed to outfit and equip local conscripts and reservists mobilized for conflict, in the current system, greater emphasis is placed on using such stockpiles to equip brigades that have been rapidly transported into theater without their heavy equipment. This ability has been frequently exercised over the past decade.⁶¹

In addition, in cases in which conflict has been imminent, Russia has arranged to leave forces and equipment in place after holding exercises in the affected theater. This approach was used following Kavkaz 2008, for example, when Russian leaders were preparing for a potential conflict with Georgia. Russian military leaders took a similar approach during ZAPAD 2021 and during the earlier spring exercises in preparation for the invasion of Ukraine.⁶²

Centralized management and control

Russian logistics, inherited from the Soviet system, is based on the concept of centralized management and control, in which most of the equipment, spare parts, and supplies are managed at the level of a CAA or higher. This approach allows MTO commanders to direct resources to where they are needed most. Moreover, centralized control allows Russian military commanders to rapidly redirect resources to deal with emerging contingencies. At the same time, this approach relieves frontline commanders of the need to plan and oversee the provision of logistics support.⁶³ The downside of this approach is that resupply efforts tend to be uneven: active units receive a larger share of resources, whereas units in quiet sectors are left to make do with fewer resources.⁶⁴

Push-based delivery model

Like its Soviet predecessor, the Russian military mainly uses a push-based logistics system for tactical logistics. Under this approach, MTO logistics units push forward supplies to their assigned combat units to meet operational requirements based on predetermined planning factors (i.e., resupply standards).

⁶¹ McDermott, *Russia's Strategic Mobility*, p. 33.

⁶² Skoglund, Listou, and Ekström, "Russian Logistics in the Ukrainian War," p. 104.

⁶³ Grau and Bartles, *The Russian Way of War*, p. 328; Constantine S. Vakas, "Soviet and U.S. Army Operational and Tactical Logistics," (Master's thesis, US Army Command and Staff College, 1990), pp. 45, 47, 49, 59, <https://apps.dtic.mil/sti/pdfs/>.

⁶⁴ Grau and Bartles, *The Russian Way of War*, p. 328.

Under the Russian system, frontline units are allocated specific quantities of fuel, ammunition, food, and other resources using standardized formulas developed during both peacetime exercises (based on observed consumption rates of combat units carrying out specific operations) and military exercises. Resources allocated for each unit are calculated in terms of daily sets of ammunition, food, spare parts, and refills of fuel.⁶⁵ Russian logistics uses different resupply rates for units in combat and those in heavy combat. In either case, Russian units usually receive their assigned allocations regardless of actual consumption levels, which can often lead to either undersupply or oversupply, depending on circumstances.

Russia's push-based logistics system contrasts with general NATO/Western practices, in which units tend to requisition supplies based on their actual requirements and receive the requested amounts from logistics units, although US forces also use push-based logistics in some cases.⁶⁶ Although the Russian approach eliminates the need for MTO commanders to closely monitor the actual supply situation within frontline units, it leaves them vulnerable to being undersupplied (or oversupplied) if consumption rates vary based on actual combat conditions. In the former case, if the situation is prolonged, combat units may be forced to forage for supplies among the local populace.⁶⁷

Echelon principle for restoring depleted combat units

During the Soviet era, military operations were conducted based on the echelon approach, in which frontline combat units were backed by one or more echelon units held in reserve. During high-intensity combat operations, as frontline units were depleted, they were withdrawn and replaced with reserve units from the second echelon. The withdrawn unit would typically be reorganized into smaller units, combined with other depleted units, and brought up to required levels through the addition of new personnel and equipment.⁶⁸

⁶⁵ Serba and Grachev, "Problems and Directions for Improving the System of Logistics;" Grau and Bartles, *The Russian Way of War*, p. 329.

⁶⁶ Grau and Bartles, *The Russian Way of War*, p. 329. See also McDermott, *Russia's Strategic Mobility*, p. 37. (Note: Modern conflicts demand that supplies be allocated to units based on their actual needs rather than having set amounts pushed to each unit.)

⁶⁷ Russian MTO units also operate at times using a supplemental pull-based approach, in which units pull supplies from higher echelon units, but this approach is used primarily when units are not engaged in heavy combat or when higher echelon units do not have sufficient motor transport to do the job. Grau and Bartles, *The Russian Way of War*, p. 344. In Ukraine, the Wagner Group has been observed using a pull-based approach in which it requisitions supplies using the same kind of set-based approach that underpins push-based logistics; however, Wagner's approach has also led at times to oversupply and undersupply.

⁶⁸ Skoglund, Listou, and Ekström, "Russian Logistics in the Ukrainian War," p. 102; Grau and Bartles, *The Russian Way of War*, p. 330.

The legacy of the Soviet echelon system still plays a role in Russia's current logistics model, albeit with some differences. Russian ground forces currently use a mixed force generation system. Although organized as brigades and divisions, Russian units are also arranged to force generate battalion tactical groups (BTGs) for local wars and short-notice contingencies. Within any maneuver formation at the brigade or regiment level, contract servicemembers are assigned to a BTG. These combined-arms units are thus modular in nature such that when one BTG becomes depleted another BTG can take its place. However, given the smaller force size, in some cases the Russian ground forces may be required to operate without a second echelon during large-scale conflicts.⁶⁹

Forward delivery

Army- and brigade-level logistics and technical support units are expected to be forward deployed to ensure that combat forces receive adequate logistics support. At the brigade level and below, MTO troops are embedded with their supported combat units and thus move with the force. Medical personnel and equipment recovery and repair elements are expected to operate closer to the front so that they can treat wounded personnel and recover and repair damaged combat vehicles. Likewise, logistics teams responsible for resupply of fuel, ammunition, food, and other resources are expected to set up resupply points, forward-based supply depots, refueling stations, and field kitchens reasonably close to frontline combat units.⁷⁰ Embedded logistics units maintain linkages with their counterparts farther to the rear to ensure continuous delivery of equipment and supplies to the front.⁷¹

Greater reliance on industry for replenishment

Since the New Look reforms, Russian MTO leaders have been seeking to reduce the amount of resources held in warehouses and military depots and to rely instead on rapid replenishment of supplies from defense industry partners. This practice was driven in part by budget constraints because smaller inventories are less costly to maintain and easier to manage. It was also driven by the desire to reduce the waste caused when articles in storage exceed their shelf life.⁷² With respect to ammunition, the elimination of aging stocks has also reduced the number of accidents and explosions.

By reducing the amount of resources in inventory, however, Russian logistics has become more dependent on industry to promptly produce new materials at levels needed to replenish depleted stocks quickly. This rapid production is not always possible, however, because of

⁶⁹ McDermott, *Russia's Strategic Mobility*, p. 32.

⁷⁰ Grau and Bartles, *The Russian Way of War*, p. 330.

⁷¹ Vakas, "Soviet and U.S. Army Operational and Tactical Logistics," p. 47.

⁷² Bulgakov, "Material and Technical Support System."

production limitations at many Russian defense enterprises. Moreover, before the Russia-Ukraine war, the defense industry's ability to replenish stocks had never been fully tested in a prolonged high-intensity conflict.

Outsourcing

During the New Look reforms, Russian military leaders adopted a new policy of outsourcing certain “noncritical” services, such as catering, fuel delivery, and equipment maintenance, to private industry. This measure was adopted both to relieve military personnel of this burden and to achieve greater efficiencies by engaging for-profit actors.⁷³ Outsourcing of these basic services also allowed top-ranking officials to disband certain logistics units and achieve additional cuts in force size.

Outsourcing was later expanded to include trucking services, refueling stations, maintenance of aviation equipment at air force bases, and other services.⁷⁴ To coordinate this effort, the MoD also formed Oboronservis, a state-owned corporation, which received contracts to provide a range of outsourced services.⁷⁵ Concurrently, the MoD transferred catering, fuel delivery, maintenance, and other noncritical operations to subsidiaries of Oboronservis. In turn, these subsidiaries were empowered to contract out these services to private contractors, although the only areas in which services were outsourced completely were catering and cleaning services.⁷⁶

However, the quality of services provided by Oboronservis declined precipitously following outsourcing, and the costs of such services increased sharply, leading to multiple complaints from the military. Oboronservis also profited directly from the sale of surplus military property and soon became a magnet for embezzlement and corruption. Then Minister of Defense Anatoly Serdyukov found himself caught up in the corruption scandals swirling around Oboronservis, which eventually led to his resignation.⁷⁷

Ultimately, the MoD's attempts at outsourcing were widely viewed as a failure, leading to numerous calls for its rollback. In 2014, Russian defense officials partly reversed course,

⁷³ Carlsson, Norberg, and Westerlund, “The Military Capability of Russia’s Armed Forces in 2013,” p. 41; S. Smirnov and Yu. Belousev, “Major General S. Istrakov: The Principally New Management System Changes the Requirements for Troop Training” (генерал-майор с. истраков: принципиально новая система управления меняет требования к подготовке войск), *Military Zheleznodorozhnik* 21 (May 2011), <https://dlib.eastview.com/search/simple/doc?pager.offset=14&id=24910644&hl=%D0%9C%D0%A2%D0%9E>.

⁷⁴ McDermott, *Russia’s Strategic Mobility*, p. 41.

⁷⁵ Carlsson, Norberg, and Westerlund, “The Military Capability of Russia’s Armed Forces in 2013,” p. 41.

⁷⁶ Dmitry Gorenburg, “The Future of Oboronservis,” PONARS Eurasia, Jan. 4, 2013, <https://www.ponarseurasia.org/the-future-of-oboronservis/>.

⁷⁷ Gorenburg, “The Future of Oboronservis.”

electing to return certain outsourced services to the military because of persistent performance problems with private service providers.⁷⁸ Military leaders were also concerned about relying on contractors to fulfill critical logistics functions on the battlefield.

As a result, Oboronservis was disbanded and replaced by a new company, AO Garnizon, which provides a more limited range of services. By that time, however, military logistics had already incurred significant damage because of the failed outsourcing effort, and it would take several years for the military to rebuild its internal capacity for services that had previously been outsourced. Yet the Russian military continues to rely on outsourcing in four areas: housing and construction, maintenance and repair, consumer services, and communication.⁷⁹ As an example, field repairs of malfunctioning or lightly damaged combat equipment are typically handled by uniformed servicemembers. By contrast, vehicles requiring more extensive servicing are typically sent to fixed field depots in the rear staffed by contract labor. When extensive overhauls are required, equipment is generally shipped back to the manufacturer for in-house repairs and refurbishment.⁸⁰

Logistics supply chains

The MTO has a detailed concept of operations for how logistics supply chains are expected to operate to support Russian combat forces during conflicts. The Russian military uses different supply chains for each major resource class. Although they all have certain characteristics in common, each supply chain also varies to some extent from the others based on the specific requirements of that resource class.

Before examining these supply chains in detail, it is important to recognize their interdependencies. Like their Soviet predecessors, Russians tend to adhere rigidly to a system of priorities when allocating resources for Russian combat units, especially when MTO motor transport is insufficient to move all the necessary supplies simultaneously. In such cases, delivery of ammunition and fuel receives the highest priority. Between the two, replenishing ammunition is ordinarily given top priority by allocating it the most weight and volume based on available MTO capacity; however, when Russian forces are advancing, the two priorities are reversed.

Resupplying food, medical supplies, and other resources (e.g., clothing, personnel amenities) receives lower priority. Thus, in the Russian logistics system, priority is placed on preserving

⁷⁸ Petr Altunin, "MTO: New Approaches," *Krasnaia Zvezda* 135 (2013), <https://dlib.eastview.com/search/simple/doc?pager.offset=24&id=35026598&hl=%D0%9C%D0%A2%D0%9E>.

⁷⁹ Alexander Tikhonov, "About Prospects of Outsourcing and Not Only Them," *Krasnaya Zvezda*, Aug. 20, 2014, p. 1.

⁸⁰ Grau and Bartles, *The Russian Way of War*, p. 326.

the mobility and combat power of Russian maneuver units, even if that exposes Russian troops to shortages of food, clothing, and other resources.⁸¹ To address this problem, Russian combat brigades typically maintain a “basic load” of supplies to operate independently for up to five days to cover such eventualities, but they will also resort to local foraging when necessary.⁸² By contrast, a BTG, which inherently has less transport capacity, is given sufficient supplies to sustain operations for only one to three days, according to one recent assessment.⁸³ This section focuses on four of the most important logistics supply chains used by the MTO—ammunition, fuel, food, and the recovery and repair of disabled combat equipment.

Ammunition

The Russian military places top priority on the resupply of ammunition given that Russia’s current military doctrine relies heavily on mass firepower, which requires large expenditures of ammunition. To meet this requirement, the MTO uses a tiered supply chain.

Ammunition is typically delivered by rail to fixed ammunition depots located near railheads in the rear areas of each MD. From there, MTO brigade elements rely mainly on motor transport to move ammunition to frontline combat units. When necessary, motor transport is supplemented by other means, including local rail, military airlift, and river barges. However, when Russian forces are advancing, MTO units may establish intermediate field depots at forward locations closer to the front.

From there, MTO brigade specialists typically deliver ammunition to mobile field depots situated in the rear of frontline combat brigades. According to Russian doctrine, such depots are to be located around 35 to 50 kilometers from the front lines, except during advances, when they may be located as close as 20 kilometers from the front. Next, local MTO troops push ammunition to frontline combat units, typically using their own cargo trucks.⁸⁴ In emergencies, MTO forces sometimes use Russian transport helicopters to speed delivery of ammunition to the front.⁸⁵

Although this approach appears sound in principle, Russian MTO units face a range of challenges affecting ammunition resupply operations. Because of improper storage,

⁸¹ Gilbert H. Edmondson, *Logistics: The Soviets’ Nemesis to Conventional War in Central Europe*, Air War College, 1989, p. 32, <https://apps.dtic.mil/sti/citations/ADA217257>.

⁸² Skoglund, Listou, and Ekström. “Russian Logistics in the Ukrainian War,” pp. 105, 106.

⁸³ Charles K. Bartles and Lester W. Grau, *Getting to Know the Russian Battalion Tactical Group*, Royal United Services Institute, Apr. 14, 2022, <https://rusi.org/explore-our-research/publications/commentary/getting-know-russian-battalion-tactical-group>.

⁸⁴ Grau and Bartles, *The Russian Way of War*, pp. 332, 336.

⁸⁵ Mikhail Malygin, “Field Features of MTO” (Полевые Особенности Мто), *Military Vestnik Iuga Rossii*, Apr. 14, 2020.

ammunition held in centralized storage depots is often unusable, reducing available supply. Likewise, because of a shortage of automated loading equipment, MTO personnel must spend an inordinate amount of time manually loading and unloading ammunition onto railroad cars and motor transport.⁸⁶

Ammunition resupply efforts are also hindered by lack of sufficient motor transport. According to one recent report, most of the motor vehicles used by the MTO have been in service for more than 30 years and are essentially obsolete. Moreover, for certain specialized equipment used by the MTO (e.g., field main pipeline support, fuel quality control equipment, motor pumps for rocket oxidizers), the original equipment manufacturer is no longer in business, which makes equipment overhaul more difficult.⁸⁷

MTO forces are taking steps to address such issues. For example, the MTO Central Office has begun building new ammunition storage facilities, eliminating older depots, and consolidating others. New storage sites are being equipped with modern safety and security systems and automated loading equipment.⁸⁸ However, the transition to new storage sites remains a work in progress. For now, MTO units still rely heavily on a network of aging and obsolescent ammunition storage facilities. Moreover, Russian field depots still lack sufficient automated loading equipment, further hindering resupply efforts by delaying the transfer of ammunition. Since the 2000s, the Russian military has been acquiring forklifts, carriages, and powered conveyers to enable the transfer of ammunition. However, these systems, which have been featured in displays, MTO articles, and exercises, have been a low procurement priority. Although the MTO Central Office is gradually recapitalizing the motor transport fleet, the percentage of modern equipment in the MTO (50 percent or less, depending on category) was still well below that of Russian combat units as of 2020.⁸⁹

⁸⁶ V.V. Korzo and A.M. Fedotov, "Improvement of Standard Schemes for Loading Ammunition on the Transport of Supply of Self-Propelled Artillery Divisions" (Совершенствование Типовых Схем (Вариантов) Загрузки Боеприпасов На Транспорт Подвоза Самоходных Артиллерийских Дивизионов), *Scientific Problems of Logistical Support of the Armed Forces of the Russian Federation* 2, no. 16 (2020), p. 117.

⁸⁷ Oleg Labutin and Yury Shestеров, "Current State of the Fleet of Technical Means of Material Support Services and Problems of Technical Equipment of the Logistics System" (Современное состояние парка технических средств служб материального обеспечения и проблемы технической оснащенности системы материально-технического обеспечения), *Scientific Problems of Logistical Support of the Armed Forces of the Russian Federation* 1, no. 15 (2020), pp. 116–119.

⁸⁸ Andrey Horban, "Bulgakov: The MTO System Should Meet the Rates of Development of the Troops" (Булгаков: Система МТО Должна Соответствовать Темпам Развития Войск), *Orientir* 5, May 31, 2017.

⁸⁹ Labutin and Shestеров, "Current State of the Fleet of Technical Means," pp. 116–119.

Petroleum, oil, and lubricants

The Russian military also places high priority on maintaining an uninterrupted supply of fuel and other petroleum, oil, and lubricants (POL) products for Russian combat and combat support units to sustain ongoing military operations. Resupply of fuel can be problematic, however, given continuing deficiencies in Russia's transportation networks, especially because POL products typically account for 50 percent of the total weight of all MTO resources delivered to Russian frontline units.⁹⁰ As with other resources, MTO relies heavily on the Russian rail system for delivery of POL products into each MD.

Figure 2. Tank refueling during exercises



Source: Russian Federation Ministry of Defense, mil.ru.

Upon arrival in the MD, fuel is transferred to centralized storage depots, which typically maintain a 12-day supply for troops in the field. Forward depots may also be established when the distance between central depots and advancing forces exceeds 100 kilometers. MTO motor transport companies use specialized tankers to haul fuel from these central storage depots to

⁹⁰ Moshe Kress, *Operational Logistics: The Art and Science of Sustaining Military Operations* (New York: Springer International Publishing, 2016), p. 11.

mobile refueling stations in the field (see Figure 2).⁹¹ These stations are typically set up anywhere from 20 to 40 kilometers behind the front lines.⁹² Fuel tankers at each station deliver fuel to visiting combat vehicles, with some of the latest Russian tankers able to refill up to 10 combat vehicles at a time.⁹³

Each MTO brigade also has an organic pipeline battalion and field refueling company.⁹⁴ During the initial stages of an advance, troops of the MTO fuel service usually must rely on motor transport to ferry fuel from central storage tanks to forward-based refueling stations. However, once a territory has been occupied for a few days, Russian pipeline troops can lay pipelines connecting back to rear storage facilities to ease fuel resupply operations.⁹⁵ Once these pipelines are in place, Russian forces in the areas served are less reliant on rail transport for fuel supply.

MTO fuel operations have been hindered at times by capacity limitations. During major combat operations, for example, Russia's railway system has insufficient capacity to deliver enough fuel to sustain large-scale military operations, potentially leading to deficits in supply.⁹⁶ To compensate for such deficiencies, the MTO will use supplemental means, including pipelines, ships, military airlift, and motor transport, to deliver fuel into the MD.⁹⁷

Food

The Russian military has detailed methods and procedures for distributing food to frontline combat units. MTO support personnel calculate food supply requirements based on predetermined consumption rates for personnel in the field. Delivery of food can be challenging at times because of the need to maintain food products at specific temperatures

⁹¹ Grau and Bartles, *The Russian Way of War*, pp. 328, 332; Vakas, "Soviet and U.S. Army Operational and Tactical Logistics:" V.V. Sereda, D.I. Melnykov, and D.A. Drozdov, "Organization of the Issuance of Fuel from the Main Oil Product Pipeline and Its Transportation Through the Field Main Pipeline in the Interests of the Armed Forces of the Russian Federation" (Организация Выдачи Горючего Из Магистрального Нефтепродуктопровода И Его Транспортирование По Полевому Магистральному Трубопроводу В Интерессах Вооруженных Сил Российской Федерации), *Voennaiia Mysl* 2, Feb. 28, 2019.

⁹² Grau and Bartles, *The Russian Way of War*, p. 336.

⁹³ McDermott, *Russia's Strategic Mobility*, p. 46; Mikhail Malygin, "МТО: Своя Специфика (МТО: Its Own Specificity)," *Military Vestnik Iuga Rossii*, Sept. 26, 2021, <https://dlib.eastview.com/search/simple/doc?pager.offset=11&id=70033406&hl=%D0%9C%D0%A2%D0%9E>.

⁹⁴ Grau and Bartles, *The Russian Way of War*, p. 332.

⁹⁵ Vakas, "Soviet and U.S. Army Operational and Tactical Logistics," p. 60; Sereda, Melnykov, and Drozdov, "Organization of the Issuance of Fuel;" Vershinin, "Feeding the Bear."

⁹⁶ Sereda, Melnykov, and Drozdov, "Organization of the Issuance of Fuel."

⁹⁷ Sereda, Melnykov, and Drozdov, "Organization of the Issuance of Fuel."

and conditions to prevent spoilage. The strict timelines involved in distributing perishable foods create additional challenges for Russian logistics.

The supply chain for food distribution begins at fixed logistical support centers in the MD's operational rear. These fixed storage depots have all the necessary climate controls to keep food well preserved, and each one can reportedly store enough food to support a CAA.⁹⁸ These centers are also equipped with automated equipment for loading food onto motor transport vehicles without exposure to the environment.⁹⁹

From there, food is transported to mobile field depots run by MTO brigades or MTO battalions (see Figure 3). As combat forces advance, field depots are often relocated every two to three days.¹⁰⁰ MTO units transport food supplies from mobile depots to forward-based field kitchens in the immediate rear of frontline units. Hot food is then prepared and issued to the troops at these locations, supplemented by bread prepared at mobile bakeries further to the rear, which is shipped to field kitchens by motor transport. Although three meals per day is the goal, every effort is made to deliver at least two per day. Troops also receive dry rations that they can eat between meals to help round out their diets.¹⁰¹

Figure 3. Wartime food preparation



Source: Vladimir Popov, "Bread Smells Like Gunfire" (Пахнет порохом хлеба), MTO VS RF, Dec. 2022.

⁹⁸ Anton Bychkov, Oleg Pyrkin, and Yegenyi Katun, *New Views on Storing Supplies in Field Conditions*, Russian Logistics Institute, July 1, 2021, <https://mto.ric.mil.ru/upload/site193/Bj6NPOhEsk.pdf>.

⁹⁹ Ibid.

¹⁰⁰ Ibid.

¹⁰¹ Grau and Bartles, *The Russian Way of War*, pp. 339, 342–343.

Russian military sources have readily admitted to problems in transporting and storing food supplies in the field because of inadequate storage equipment.¹⁰² Without proper care, food products are vulnerable to precipitation, which can lead to spoilage. Food supplies also require strict temperature and humidity control, although conditions in the field do not always allow this.¹⁰³

These problems are partly caused by aging and obsolescent food service equipment. The MTO Central Office has been slow to recapitalize existing equipment because of persistent budget constraints dating to the 1990s. The situation was further aggravated by the outsourcing of MRO to dedicated service providers, which deprived food service equipment manufacturers of another major revenue source. As a result, some of the leading Russian food equipment manufacturers were starved of capital and forced to cease operations.¹⁰⁴ Although efforts are underway to restore domestic capacity, much work remains to build an effective food service industry.

Combat equipment MRO

Russian military leaders place high priority on maintaining military equipment in a high state of combat readiness and on rapid recovery and repair of damaged equipment on the battlefield. The MTO has detailed procedures for repair of damaged or inoperable tanks, armored vehicles, and other equipment. Each maneuver or fire battalion has a dedicated MTO support platoon with maintenance personnel and motor transport that operate forward to make on-the-spot repairs to damaged or inoperable equipment. If that is not feasible, disabled vehicles are transported to assembly points in the immediate rear of frontline units for repairs. Combat vehicles requiring more extensive repairs are transported to centralized field maintenance depots located farther back in each MD.¹⁰⁵ Such depots are still run partly by civilian defense contractors under existing outsourcing arrangements. In some cases, equipment must be returned to the manufacturer to undergo extensive overhaul.

The Russian military's emphasis on rapid MRO of damaged equipment on the battlefield can be traced to its experience in prior conflicts. During World War II, Russian logistics units found that 25 percent of all Soviet tank losses were completely unrepairable, but they were reportedly able to place 80 to 90 percent of the remaining disabled tanks back into service

¹⁰² Bychkov, Pyrkin, and Katun, *New Views on Storing Supplies in Field Conditions*.

¹⁰³ Ibid.

¹⁰⁴ Oleg Labutin and Yuri Shesterov, "Analysis of the Capabilities of Industrial Enterprises for the Production and Repair of Technical Means of Logistics Services" (Анализ возможностей предприятий промышленности по производству и ремонту технических средств служб материального обеспечения), *Scientific Problems of Logistics Support of the Armed Forces of the Russian Federation* 2 (2020): 48–51.

¹⁰⁵ Grau and Bartles, *The Russian Way of War*, pp. 330, 343.

within 48 hours. However, the success of these efforts depended on Russian forces controlling the battlefield after a firefight so that damaged or disabled Russian combat vehicles could be recovered in the first place.¹⁰⁶

Russian MRO teams today are constrained by the low ratio of recovery vehicles to combat systems in the Russian armed forces, given that Russian leadership prioritized purchasing combat systems versus MTO equipment during the two most recent State Armament Programs.¹⁰⁷ MRO has also been hindered by obsolete recovery and repair equipment. Lack of spare parts is another recurring problem that has impeded maintenance and repair operations. During recent campaigns, Russian MRO units have been forced to cannibalize equipment from other units to keep combat equipment in operation.¹⁰⁸

Recently, such problems are being addressed. MTO units have begun to receive new equipment, such as the SEM-KL recovery vehicle, an all-terrain vehicle able to quickly evacuate damaged vehicles and haul them to a repair depot.¹⁰⁹ MTO repair teams have also started receiving new MT0-AM1 mobile maintenance workshops, each containing more than 20 kinds of special equipment for repairing military equipment in the field.¹¹⁰ However, delivery of new recovery and repair equipment is proceeding slowly.¹¹¹ As a result, many MRO units are forced to rely mainly on equipment that has been in service for 20 years or more.

Logistics infrastructure

Since 2014, Russia has invested heavily to develop, expand, and maintain its logistics infrastructure. Over this period, it has placed special emphasis on upgrading transportation networks and logistics storage facilities throughout the country. At the same time, Russian military leaders have taken measures to increase MTO motor transport capacity to support future combat operations at the theater level.

¹⁰⁶ Ibid., p. 336.

¹⁰⁷ Labutin and Shesterov, "Current State of the Fleet of Technical Means," p. 117.

¹⁰⁸ Mikhail Malygin, "The Strength of MTO Is in Uninterrupted Support" (Сила МТО - В Бесперебойном Обеспечении), *Military vestnik Iuga Rossii*, July 29, 2022, <https://dlib.eastview.com/search/simple/doc?pager.offset=29&id=79118718&hl=%D0%9C%D0%A2%D0%9E>.

¹⁰⁹ Malygin, "Field Features Of MTO."

¹¹⁰ Ibid.

¹¹¹ Ibid.

Transportation networks

Railways

Russian military logistics remains heavily dependent on the country's extensive rail system for both transporting forces into theater ahead of military operations and sustaining them once they are deployed. Russian railways are especially important for deploying and sustaining large-scale operations because neither the country's road transport systems nor its airlift and sealift systems have the capacity to move heavy equipment and forces at the scale needed to support such operations.¹¹²

In recognition of this dependence, Russian leaders have prioritized expanding Russia's railway systems, acquiring new rolling stock, modernizing critical railheads, and improving the loading and unloading of supplies. They have also taken steps to increase the quality of Russia's Railway Troops and to integrate JSC Russian Railways and other private entities into efforts to improve rail-based logistical support for Russia's armed forces.

Russia has invested significant funds to expand the country's rail systems. In 2018, the Ministry of Transportation adopted a new seven-year plan for the modernization and expansion of Russian rail infrastructure through 2024.¹¹³ At the same time, Russia allocated 1.25 billion rubles for railway upgrades, highlighting Russia's long-term reliance on the rail system.¹¹⁴ The plan also calls for increasing railway cargo capacity from 1,320 million tons in 2019 to 1,820 million tons by 2024. As a result, by early 2021, Russian railroads already had 66,000 working flat railcars at their disposal, enough to transport the entire stock of military equipment used by the Russian ground forces.¹¹⁵

Russian railway logistics require a high degree of cooperation between Russia's armed forces, especially the Railway Troops, and JSC Russian Railways, a state-owned corporation that holds a monopoly interest in Russia's railroad networks and associated rail transport services, although other Russian companies involved in rail transport tend to maintain their own rolling stock. Russian Railways is responsible for operating and maintaining Russia's railroad systems

¹¹² McDermott, *Russia's Strategic Mobility*, p. 16.

¹¹³ Russian Ministry of Transport, *Comprehensive Modernization and Expansion Plan for Rail Infrastructure for the Period 2018–2024* (Комплексный план модернизации и расширения магистральной инфраструктуры на период 2018–2024), 2018, <http://government.ru/docs/34297>.

¹¹⁴ Emily Ferris, *Problems of Geography*, RUSI, 2021, p. 27.

¹¹⁵ Konrad Muzyka, *Russia Goes to War: Exercises, Signaling, War Scares, and Military Confrontation*, Center for Strategic and International Studies, July 2021, p. 2, <https://www.jstor.org/stable/pdf/resrep33766.pdf>.

as a whole.¹¹⁶ The Railway Troops provide support for the construction, maintenance, operations, and security of Russian railway networks close to the front.¹¹⁷

Russian military leaders are also pursuing measures to upgrade the Railway Troops.¹¹⁸ After sustaining deep cuts in force size during the New Look reforms, the Railway Troops currently comprise 10 brigades, each attached to a particular CAA. Under the 2027 State Armament Program, modernization of equipment for the Railway Troops was given high priority, with the objective of increasing the share of modern equipment in the Railway Troops to 70 percent by 2021.¹¹⁹ However, officials recently admitted that just 50 percent of their equipment has been upgraded so far.¹²⁰

Despite these efforts, Russia's railroad networks face serious problems that continue to impede military logistics. According to one well-placed Russian source, the ability to perform loading and unloading operations at military depots has decreased because of a lack of modern facilities, which are currently in place only at fixed logistics centers attached to the MDs. During peacetime, Russian MTO brigades and battalions lack dedicated units for loading and unloading railway cargo.¹²¹

Russian forces also face problems with planning, scheduling, and managing rail-based logistics operations. Military train transports require careful planning that is complicated by the need to share lines with civilian rail traffic. Yet Russian bureaucratic procedures often hinder the orderly flow of railway traffic.¹²² These limitations were on display during ZAPAD 2021, when several formations were transported via rail from other MDs, leading to a serious shortage of railcars that disrupted commercial rail traffic in western parts of Russia.¹²³

Problems with railway maintenance have also hindered military logistics, as reflected by numerous breakdowns in the railway system and delays in the necessary repairs.¹²⁴ Lack of suitable maintenance equipment has delayed railway repairs in some cases. For example,

¹¹⁶ Engqvist, *A Railhead Too Far*, p. 1.

¹¹⁷ Ben Connable et al., *Russia's Limit of Advance: Analysis of Russian Ground Force Deployment Capabilities and Limitations* (Santa Monica, CA: RAND, 2020), p. 24; Engqvist, *A Railhead Too Far*, p. 2.

¹¹⁸ For more information on Russia's Railway Troops, see Ferris, *Russia's Railway Troops*.

¹¹⁹ Ferris, *Problems of Geography*, p. 19.

¹²⁰ *Ibid.*, p. 20.

¹²¹ Serba and Grachev, "Problems and Directions for Improving the System of Logistics."

¹²² Engqvist, *A Railhead Too Far*, p. 2.

¹²³ Muzyka, *Russia Goes to War*.

¹²⁴ Engqvist, *A Railhead Too Far*, p. 3.

Russian Railways maintenance equipment is sometimes too bulky for road transport and can be moved only by rail from certain designated train stations. However, if the station itself is down, that equipment is essentially sidelined.¹²⁵ To address this issue, the company is working to acquire new equipment that can be transported by road and by rail.¹²⁶

Despite such issues, Russian efforts to expand and improve rail-based logistics have been largely successful, with Russian military transport achieving notable gains in performance. In recent years, Russian ground forces have made extensive use of rail transport, with Russian brigades and their equipment frequently traveling great distances by rail to participate in military exercises.¹²⁷ In 2021, for example, Russia redeployed nearly 30,000 troops from various MDs in just two weeks to participate in a large-scale military exercise near the border with Ukraine. Such exercises have repeatedly demonstrated Russia's ability to rapidly redeploy forces via rail from bases across the country to support military operations in every strategic direction.¹²⁸

Motor transport

Russian military logistics also relies heavily on motor transport for deployment and sustainment of its forces. Russia maintains an extensive network of roads and highways, especially in the western parts of Russia. Yet there are vast portions of Russia where the road system remains woefully underdeveloped. The MTO forces also maintain an extensive inventory of motor transport vehicles to carry out logistics operations centered primarily on motor vehicle (automobile) battalions deployed in each MD.

Russia's motor transport capacity notably declined because of the New Look reforms, during which several automobile brigades at both the MD and HQ levels were eliminated. At the same time, the number of automobile battalions attached to formations (and navy fleets) was reduced as well.¹²⁹ As a result, motor vehicle capacity assigned to Russian maneuver units below the brigade level (e.g., BTGs) is substantially smaller than that of Western equivalents. According to one source, Russian formations reportedly have only three-quarters the number of motor transport vehicles as their US counterparts even though they must support three times as much artillery.¹³⁰

¹²⁵ Ferris, *Problems of Geography*, p. 21.

¹²⁶ *Ibid.*, p. 21.

¹²⁷ Grau and Bartles, *The Russian Way of War*, p. 32.

¹²⁸ Muzyka, *Russia Goes to War*, p. 1.

¹²⁹ Serba and Grachev, "Problems and Directions for Improving the System of Logistics."

¹³⁰ Vershinin, "Feeding the Bear."

Lack of sufficient motor transport capacity in Russian combat brigades has had a pernicious effect on Russian ground forces by limiting their ability to operate at significant distance from their supporting railheads. Moreover, as operational areas expand and as ground force units move farther and farther from their supporting railheads, especially during offensive operations, the ability of the MTO to resupply combat units using motor transport becomes correspondingly more difficult.¹³¹ Their effects vary, however, depending on the nature of ongoing ground operations, the availability of civilian motor transport, and the availability of workarounds.

The general reliance on railways has also driven the Russian military to maintain substantial numbers of railway and pipeline troops to support ground force operations.¹³² Insufficient motor transport, including a shortage of off-road logistics transport, also makes Russian lines of advance somewhat more predictable because MTO troops are better able to sustain large-scale operations when supported by railheads. Although MTO troops can also establish loading and unloading stations at various points along the railway, railheads and their existing road networks have a higher capacity and are more efficient at handling cargo. For the same reason, Russian forces are more dependent on capturing new railheads to support further advances.¹³³ Yet once captured, such railheads also make attractive targets for enemy strikes, which can further impede operations.¹³⁴

Logistics storage facilities

Russian military leaders have also taken steps to streamline and upgrade the network of storage facilities used by the MTO to support military logistics. As part of the New Look reforms, Russia launched a long-term program to substantially reduce the number of storage depots in use at the time and to consolidate them into larger storage facilities. Initial reform measures were centered on the establishment of eight centralized military logistics centers (CMTOs) distributed across the various MDs.

In a related measure, in 2012, the MoD announced plans to eliminate 570 separate ammunition depots by 2015 and replace them with 7 modern ammunition storage facilities equipped with

¹³¹ Skoglund, Listou, and Ekström, "Russian Logistics in the Ukrainian War," p. 107. See also Ryan T. Baker, "Logistics and Military Power: Tooth, Tail, and Territory in Conventional Military Conflict," (PhD diss., George Washington University, 2020), p. 9.

¹³² Ti, *Russian Military Logistics*, p. 2.

¹³³ Engqvist, *A Railhead Too Far*, p. 3.

¹³⁴ *Ibid.*, pp. 3, 4.

automated equipment.¹³⁵ Plans called for locating most of these facilities in the Central Military District to support operations in all strategic directions.¹³⁶ During the process, nearly 2 million tons of projectiles, bombs, and other forms of ammunition were relocated to new ammunition facilities, and nearly 8 million tons were destroyed.¹³⁷

The new CMTOs reportedly employ modern management methods, including warehouse automation and inventory tracking systems. The new ammunition centers use an automated registration system to track inventories using RFID technology. According to a defense industry source, the new RFID system will allow MTO officials to track each projectile and its remaining service life.¹³⁸ Collectively, between 2012 and 2016, these reforms led to a major reduction in the number of storage bases maintained by the Russian military.

In 2016, the MoD announced a new program to build 24 production and logistics centers (PLCs) across Russia, which would eventually replace the 330 legacy storage facilities still in service.¹³⁹ When completed, the new PLCs are expected to eliminate up to 50,000 jobs while reducing storage operating costs by more than 50 percent.¹⁴⁰ The first phases of the Nara facility, just outside of Moscow, were completed in 2017. When the project is fully completed, Nara will reportedly have the capacity to store 220,000 tons of material and 4,700 items of equipment. As a result, the MoD plans to discontinue use of 31 legacy facilities in the region.

In 2019, MTO Chief Bulgakov announced the signing of an agreement to develop a new PLC at Archangelsk. Later that year, the MoD announced plans to build another PLC near Novosibirsk in partnership with JSC Vis.¹⁴¹ Bulgakov also announced plans to build new PLCs at Sevastopol, Vladivostok, Khabarovsk, Novosibirsk, and Yekaterinburg, all to be completed by 2025.¹⁴² More recently, however, the PLC program appears to have slowed because of a shortage of funding.

¹³⁵ Darya Antoshko, "Defense Ministry Unites Arsenals into Bases," *Izvestiya*, May 2, 2012, <https://dlib.eastview.com/search/simple/doc?pager.offset=29&id=27104159&hl=depots>.

¹³⁶ Ibid.

¹³⁷ Ibid.

¹³⁸ Ibid.

¹³⁹ Ivan Safronov, "The Ministry of Defense Is Changing Warehouses to Complexes," *Kommersant*, Feb. 29, 2016, <https://www.kommersant.ru/doc/2926598>.

¹⁴⁰ Ibid.

¹⁴¹ "Logistic Center for Defense Ministry Will Be Built Near Novosibirsk," *Defense & Security* 1532, Dec. 23, 2019.

¹⁴² "Construction of a Production and Logistics Complex for the Ministry of Defense of the Russian Federation Began in the Arkhangelsk Region" (В Архангельской области началось строительство производственно-логистического комплекса для министерства обороны РФ), Russian Ministry of Defense, accessed Feb. 11, 2023, <https://pda.mil.ru/pda/news/more.htm?id=12236860@egNews>.

According to a 2019 report, completing all 24 PLCs will require \$1.04 billion in additional funding.¹⁴³ The MoD has been seeking private investors to fund the new PLCs in partnership with the MoD. Under this new approach, private investors will provide capital for construction of a new facility. Upon completion, the MoD will pay a service charge based on the total volume of materials stored at that facility.¹⁴⁴

For the time being, however, MTO forces must continue to rely on the numerous legacy facilities still in place to support military logistics. According to Russian sources, “Many of [these legacy facilities] are morally and physically obsolete, [and] most of them do not meet the requirements for operational and storage activities and fire safety.”¹⁴⁵

¹⁴³ A. A. Tselykovskikh, T. Kh. Kurbanov, and V. A. Plotnikov, “Risk Assessment of Public-Private Partnership for Logistics and Technical Support of the Armed Forces of the Russian Federation” (Оценка Рисков Государственно-Частного Партнерства Материально-Технического Обеспечения Вооруженных Сил Российской Федерации”), *Voennaia Mysl* 3, Mar. 31, 2019, p. 44.

¹⁴⁴ *Ibid.*, p. 44.

¹⁴⁵ Safronov, “The Ministry of Defense is Changing Warehouses to Complexes.”

MTO Performance in 2022

This section reviews Russia's military logistics performance during the first year of the Russia-Ukraine War. The section is organized chronologically, segmenting the war into roughly four stages, each tied to a specific period of logistics development: initial struggles (February–March), gradual adaptation (March–August), regrouping and leadership change (September–November), and preparing for a new Russian offensive in the Donbas (December). This organization highlights the challenges and struggles to effectively adapt Russian logistics from the war's onset through the winter of 2022–2023. These efforts enjoyed varying degrees of success: first, the initial failures to organize logistics to effectively support a quick decapitation strike against the Ukrainian political regime; then, the gradual but significant progress achieved in adjusting to the realities of a longer term warfighting effort; next, the notable successes in overcoming the threat to Russian logistics presented by the introduction of longer range, higher accuracy weaponry from Ukraine's Western partners; and finally, the general successes achieved in expanding logistics to accommodate the shock of mobilization on existing and still-evolving logistics networks.¹⁴⁶

In broad terms, evidence from the conduct of the war over the course of its first year points to a range of Russian logistics vulnerabilities. The most prominent of these include the following: Russia's continuing reliance on railroad networks as the principal means to sustain its forces; the insufficient supply of wheeled vehicles to provide secondary logistics support for Russian units operating at significant distances from railheads; and the persistent problems in striking an appropriate balance between using centralized rail-based supply depots and ammunition dumps, which are highly efficient but vulnerable to Ukrainian fires and sabotage, and using smaller, highly dispersed logistics nodes that are less efficient but more survivable. In general, these issues have been cited regularly in previous reporting on the state of Russian logistics in both foreign accounts and internal public discussions by Russian military researchers. Logistics problems observed during the campaign in Ukraine broadly match up with long-identified areas of concern on Russian military logistics.

¹⁴⁶ This section is intended to provide initial observations and insights on Russian logistics. It is necessarily preliminary in nature, given the limited degree of available data, reports, and impressions from the field and the restricted nature of the data released thus far by the Russian armed forces through both official and unofficial channels. Nevertheless, this initial sketch of Russia's logistics experience during the first year of war in Ukraine provides a relevant and useful picture, connecting conceptual and prewar MTO preparation with realities on the ground. This section should serve as a preliminary review to be used to support further research on Russian logistics as the war in Ukraine progresses.

Despite these problems, the Russian armed forces have largely been able to effectively sustain military operations in Ukraine with the logistics system as it has evolved over the course of the campaign. In the process, Russian MTO leadership has had to overcome various challenges. For example, the introduction of High Mobility Artillery Rocket System (HIMARS) and other long-range precision strike systems to the field led Russian MTO leaders to adjust logistics operations by moving field depots farther to the rear and modifying distribution methods, thereby avoiding permanent degradation and destruction. Mobilization was creaking in its implementation, but all evidence suggests that it was broadly successful over time at placing bodies in intended locations with the appropriate equipment and supplies necessary to meet battlefield requirements, albeit not always quickly or painlessly.

Initial struggles

The initial Russian campaign plan involved quick advances along three fronts: toward Kyiv from the north, bypassing Kharkiv in the northeast, and pushing up from Crimea across southern Ukraine. Russian forces on the Donbas contact line were initially given the more limited objective of probing along the front to fix Ukrainian units in place, with advances expected to follow the initial fixing effort. These operations required speed and decisiveness, with the goal of regime decapitation in the capital while setting conditions on the ground for a broad occupation aligned with a newly installed pro-Russian government.¹⁴⁷ This section reviews Russian logistics operations during the initial phase of the invasion, from February through March 2022.

Analysts continue to debate how plausible the initial plan was from an operational and strategic perspective, although these issues are beyond the scope of this paper.¹⁴⁸ Recent

¹⁴⁷ Skoglund, Listou, and Ekström, “Russian Logistics in the Ukrainian War,” p. 99–110; Mykhaylo Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine: February–July 2022*, Royal United Services Institute, Nov. 30, 2022, <https://rusi.org/explore-our-research/publications/special-resources/preliminary-lessons-conventional-warfighting-russias-invasion-ukraine-february-july-2022>; Julian G. Waller, “Intelligence Failures and Political Misjudgment in an Age of Ideological Change,” *The Strategy Bridge*, June 14, 2023, <https://thestrategybridge.org/the-bridge/2023/6/14/intelligence-failures-and-political-misjudgment-in-an-age-of-ideological-change>.

¹⁴⁸ Andrew S. Bowen, *Russia’s War in Ukraine: Military and Intelligence Aspects*, Congressional Research Service, No. R47068, Feb. 13, 2023, <https://crsreports.congress.gov/product/pdf/R/R47068>; Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*.

studies also diverge in their assessments of the role that logistics played in undermining the initial Russian offensive.¹⁴⁹

The Russian campaign plan found its greatest success along the southern axis, with Russian maneuver forces quickly overtaking Ukrainian forces and achieving significant territorial gains toward Kherson in the west and Mariupol in the east before their momentum was spent. By contrast, headline advances toward Kyiv from Gomel in the north and from Chernihiv along Ukraine's northeastern flank floundered more quickly, failing to achieve key operational objectives within their specified timetables and ultimately leading to serious reversals in the battle of Kyiv and elsewhere.¹⁵⁰ Although Russian forces successfully fixed Ukrainian units along the Donbas line of contact, they failed in pushing forward a parallel advance.¹⁵¹

Although Russian advance forces reached the outskirts of Kyiv and Kherson on February 25, sustainable levels of forces subsequently arrived only in the southern axis.¹⁵² These initial advances were supported by linear fires whose coordination and planning was not always coherent: there were strong divergences between performance in the south and that in the north and northeast, and poor assessment of battle damage led to insufficient awareness of the strength of opposition.¹⁵³

Logistical problems were readily observed within a few days of the offensive. By the time the invasion was launched, Russian forces, including supporting MTO systems, were staged in Belarus following the 2022 Joint Resolve exercise.¹⁵⁴ Yet these initial preparations did not prevent the early emergence of major logistics problems.

¹⁴⁹ Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*; Ti, *Russian Military Logistics*; Skoglund, Listou, and Ekström, "Russian Logistics in the Ukrainian War," pp. 99–110; Hlib Parfonov, "Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One)," *Eurasia Daily Monitor* 19, no. 125, Aug. 16, 2022, <https://jamestown.org/program/ukrainian-strikes-cause-moscow-to-re-think-munitions-supply-and-logistics-part-one/>.

¹⁵⁰ Bonnie Berkowitz and Artur Galocha, "Why the Russian Military Is Bugged Down by Logistics in Ukraine," *Washington Post*, Mar. 30, 2022, <https://www.washingtonpost.com/world/2022/03/30/russia-military-logistics-supply-chain/>.

¹⁵¹ Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, p. 28.

¹⁵² Mason Clark, George Barros, and Kateryna Stepanenko, *Russian Offensive Campaign Assessment, February 25, 2022*, Institute for the Study of War, Feb. 25, 2022, <https://www.understandingwar.org/backgrounder/russia-ukraine-warning-update-russian-offensive-campaign-assessment-february-25-2022>.

¹⁵³ Mason Clark, George Barros, and Kateryna Stepanenko, *Russian Offensive Campaign Assessment: February 27*, Institute for the Study of War, Feb. 27, 2022, <https://www.understandingwar.org/backgrounder/russia-ukraine-warning-update-russian-offensive-campaign-assessment-february-27>; Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, pp. 24–25.

¹⁵⁴ Andrew S. Bowen, *Russia's War in Ukraine*; Ferris, *Russia's Railway Troops*.

Only a week into the campaign, reports noted the tremendous difficulty of movement, a clear sign of Russia's growing logistics problems. For example, there were recurring reports of stalled Russian convoys and abandoned and broken-down tanks. On March 1, one report stated, "There is a large column of Russian troops and vehicles headed toward the city that has not made appreciable movement over the past day."¹⁵⁵ This widely publicized traffic jam on the approach to Kyiv stretched up to 40 miles long and was stuck almost 20 miles from the city's outskirts a week into the invasion.¹⁵⁶

Russian forces also struggled from the outset with deliveries of fuel, ammunition, food, and clothing for soldiers at the front.¹⁵⁷ Problems with fuel and food delivery were particularly prevalent, widely hindering Russian military operations throughout the initial phase of the campaign.¹⁵⁸ Early reports suggested that insufficient fuel and unexpected resistance had led to large numbers of Russian vehicles being abandoned.¹⁵⁹ Problems with maintenance and recovery operations likewise contributed to heavy equipment losses early.

To some extent, breakdowns and high loss rates for Russian combat systems were to be expected, given the high demands placed on them by the intensity of initial field operations.¹⁶⁰ Yet logistics problems also contributed to Russia's vehicle sustainment problems. Statements from the Ukrainian General Staff echoed this point very early in the conflict, noting that Russian forces were "experiencing an acute shortage of fuel" while relying on Belarusian logistical support to plug gaps.¹⁶¹ Russia's transportation problems were also attributable to insufficient road networks, poor road quality, and iterating failures resulting from traffic pileups and ambushes that were partly caused by the lack of sufficient combined-arms assault units to protect advancing column flanks.

¹⁵⁵ Jim Garamone, "Ukrainian Resistance, Logistics Nightmares Plague Russian Invaders," *DOD News*, Mar. 1, 2022, <https://www.defense.gov/News/News-Stories/Article/Article/2950915/ukrainian-resistance-logistics-nightmares-plague-russian-invaders/>.

¹⁵⁶ Luke McGee, "Here's What We Know About the 40-Mile-Long Russian Convoy Outside Ukraine's Capital," *CNN*, Mar. 3, 2022, <https://www.cnn.com/2022/03/03/europe/russian-convoy-stalled-outside-kyiv-intl/index.html>.

¹⁵⁷ Stephen Fidler and Thomas Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces," *Wall Street Journal*, Apr. 1, 2022.

¹⁵⁸ Fidler and Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces."

¹⁵⁹ Berkowitz and Galocha, "Why the Russian Military Is Bogged Down by Logistics in Ukraine."

¹⁶⁰ Trevor N. Dupuy et al., *Handbook on Ground Forces Attrition in Modern Warfare*, Historical Evaluation & Research Organization, Sept. 1986; DoD Manual 4140.01, Vol. 6, Mar. 8, 2017, *DoD Supply Chain Materiel Management Procedures: Materiel Returns, Retention, and Disposition*; Nancy Y. Moore et al., *Materiel Distribution: Improving Support to Army Operations in Peace and War*, RAND Arroyo Center, 1997.

¹⁶¹ Clark, Barros, and Stepanenko, *Russian Offensive Campaign Assessment, February 27*.

The same Ukrainian General Staff report also noted growing food shortages among Russian combat units.¹⁶² Similarly, other reporting in early March claimed that Russian soldiers were looting shops in newly captured Ukrainian territory to supplement their meager and insufficient food stocks.¹⁶³

To some extent, Russia's logistical problems can be attributed to shortcomings in the campaign planning process as well as systemic problems in the makeup of Russian forces. For example, Royal United Services Institute (RUSI) researchers wrote:

Orders were not distributed until 24 hours before the invasion to most units. As a result, Russian troops lacked ammunition, fuel, food, maps, properly established communications and, most critically, a clear understanding at the tactical level of how their actions fitted into the overall plan.¹⁶⁴

Moreover, the campaign plan, with its ambitious scale and overly tight timetables, bears much of the onus for Russia's logistics problems because it was simply too large and too geographically dispersed for Russian logistics forces to provide adequate support. Initial operations took place across multiple fronts involving as many as six or more axes of advance. The lightning push for Kyiv was particularly challenging because it outstripped the capabilities and expectations of available supply mechanisms. Russian MTO forces simply lacked sufficient logistics capability to support such far-flung military operations.¹⁶⁵ Consequently, each advance had to compete against the others for increasingly limited reinforcements, logistics, and air support.¹⁶⁶

More fundamentally, the ratio of Russian MTO forces to combat units was simply too low to support the kinds of large-scale operations undertaken during the initial phase. During the 2003 campaign in Iraq, the United States employed a comparable total force size of just under 200,000 troops, but it committed just 50 battalion-size tactical units, compared to the more than 100 BTGs employed by Russia in Ukraine. The difference between the two forces largely

¹⁶² Clark, Barros, and Stepanenko, *Russian Offensive Campaign Assessment, February 27*.

¹⁶³ "Hungry' Russian Soldiers Loot Ukrainian Shops," Radio Free Europe, Mar. 2, 2022, <https://www.rferl.org/a/russian-soldiers-loot-ukraine/31732450.html>.

¹⁶⁴ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, p. 26.

¹⁶⁵ Fidler and Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces."

¹⁶⁶ Bowen, *Russia's War in Ukraine*, p. 4 (citing John Paul Rathbone, Sam Jones, and Daniel Dombey, "Why Russia Is Deploying More Troops to Ukraine," *Financial Times*, Mar. 17, 2022; Andrew E. Kramer, "Ukraine's Troops Begin a Counteroffensive That Alters Shape of the Battle with Russia," *New York Times*, Mar. 24, 2022; Fidler and Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces").

reflects the substantially greater proportion of logistics forces employed by the US military in Iraq than that employed by the Russian military in Ukraine.¹⁶⁷

Moreover, the use of BTGs in Ukraine also contributed to Russia's logistical problems. The BTG concept of operation did not provide for extended field deployments without frequent resupply and logistics support. Rather, BTGs were designed to be self-sufficient for only a few days when operating under field combat conditions.¹⁶⁸ As a result, during initial operations, BTGs quickly outran their logistics support, which failed to keep pace with the advance. The nature of Russian combined-arms operations during the initial phase of the campaign also significantly hampered Russia's push-based logistics system, which was designed to support a slower moving front rather than the high-speed thunder runs that took place in Ukraine across multiple axes of advance.¹⁶⁹

At the same time, Russian forces on each major battle front faced their own unique logistical challenges. From the north, Russian ground units were initially ordered to move in administrative column, resulting in long delays caused by high traffic density on the existing road network, especially once irregular Ukrainian resistance began to emerge.¹⁷⁰ The lightning drive, or "thunder run," to Kyiv was mired in unforeseen problems due to traffic coordination failures and obstruction along the main highway points south from the initial break into Ukrainian territory.¹⁷¹

Advances in the northeastern axis were further hindered by the nature of the Russian intervention, which bypassed major urban areas. This choice led the forces to fail to capture railway connections in depth. With only limited access to Ukrainian railheads, Russian forces on the northeastern front were more dependent on Russian MTO motor transport units, which had to ferry fuel and supplies from distant railheads and field depots.¹⁷² One report from the Jamestown Foundation noted:

¹⁶⁷ Fidler and Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces."

¹⁶⁸ Bartles and Grau, *Getting to Know the Russian Battalion Tactical Group*; Nicolas J. Fiore, "Defeating the Russian Battalion Tactical Group," *Armor: Mounted Maneuver Journal* (2017): 9–17.

¹⁶⁹ Mike Nelson, "How Russia's Conquest of Ukraine Went Sideways," *New Lines Magazine*, Mar. 5, 2022, <https://newlinesmag.com/argument/how-russias-conquest-of-ukraine-went-sideways/>; Alex Horton, Karoun Demirjian, and Dan Lamothe, "Russia's Military Strategy in Ukraine Aimed at Key Cities, Decapitating Central Government," *Washington Post*, Feb. 24, 2022, <https://www.washingtonpost.com/national-security/2022/02/24/ukraine-russia-military-strategy/>.

¹⁷⁰ Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, pp. 26–27; Bowen, *Russia's War in Ukraine*.

¹⁷¹ Skoglund, Listou, and Ekström, "Russian Logistics in the Ukrainian War," pp. 99–110.

¹⁷² Fidler and Grove, "Behind the Front Lines, Russia's Military Struggles to Supply Its Forces;" Bowen, *Russia's War in Ukraine*.

With cities such as Nizhyn, Chernihiv and Sumy stubbornly defended by Ukrainian troops, the Russians had to set up truck supplies for their troops east of Kyiv—and failed miserably at this, as Russian troops could not advance further than 90–100 km from their supply warehouses.¹⁷³

Likewise, Russian MTO operations in the north and northeast came under considerable pressure from Ukrainian attacks on Russian logistics supply lines. Reports indicate that this pressure was part of a concerted effort by Ukrainian forces to attack the logistics network and undermine the Russian offensive. Such attacks were also facilitated by the many Ukrainian combat units that Russian forces had bypassed during the initial invasion, leaving them well situated to attack Russian lines of communication in the rear areas.¹⁷⁴ Russian units in the north also faced unique logistical challenges because of differences in their force posture. In one case, Russia's 12th and 13th tank regiments in the northeast had to abandon more than 40 T-80U tanks due to because of lack of fuel because Russia's fuel troops could not keep pace with high rates of consumption by these notorious gas guzzlers.¹⁷⁵

Advances in the southern axis were more successful, partly because they had sustained access to Ukrainian railheads, which allowed them to rely more heavily on railborne logistics for resupply. From Crimea, Russian forces had access to two main rail lines and sought to seize additional rail hubs quickly in Melitopol and Kherson. There they held a significant advantage in the correlation of forces, caught Ukrainian units relatively unprepared, and likely penetrated important elements of Ukraine's security services, all of which enabled a quick advance. Other factors also contributed to Russia's successes in the south, including inadequate Ukrainian defenses—Ukrainian forces were concentrated in other areas of the country, such as Kyiv and Kharkhiv, that were deemed to be of higher priority. However, one major hurdle for Russian forces in the south was to complete the “land bridge” between Crimea and the Donbas through Mariupol.¹⁷⁶ Although the bridge was seen as a key operational priority to open a new logistics corridor, it would take until May for the area to come fully under Russian control.¹⁷⁷ Why the

¹⁷³ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One).”

¹⁷⁴ Fidler and Grove, “Behind the Front Lines, Russia's Military Struggles to Supply Its Forces.”

¹⁷⁵ Ibid.

¹⁷⁶ Mason Clark, George Barros, and Kateryna Stepanenko, *Russian Offensive Campaign Assessment, March 3*, Institute for the Study of War, Mar. 3, 2022, <https://www.understandingwar.org/backgrounders/russian-offensive-campaign-assessment-march-3>; Mason Clark et al., *Russian Offensive Campaign Assessment, April 22*, Institute for the Study of War, Apr. 22, 2022, <https://www.understandingwar.org/backgrounders/russian-offensive-campaign-assessment-april-22>.

¹⁷⁷ “Mariupol: Key Moments in the Siege of the City,” BBC, May 17, 2022, <https://www.bbc.com/news/world-europe-61179093>.

land bridge was seen as particularly important from a logistics perspective remains unclear given that two major supply lines already fed forces in the theater from Crimea and Rostov.

Throughout the initial period, observers noted that Russia expended considerable efforts trying to sort through these logistical issues. Yet the high degree of logistical chaos that emerged would be only partly resolved by the end of March.¹⁷⁸

Within a week of the onset of hostilities, Russia began reorganizing logistics operations by moving away from the multilevel delivery and distribution system, which extended from the brigade level downward to companies and batteries.¹⁷⁹ Instead, division- and army-level logistics units began to play a greater role in providing logistics support at the brigade level because of the sheer volume of materiel that had to be transported.¹⁸⁰ For one, they reorganized the Russian ammunition supply system by shifting to a network of field artillery depots based on formerly civilian industrial infrastructure. Each node in this system was designed to supply ammunition across a 30- to 50-kilometer radius and was connected to the railway network as much as possible.¹⁸¹ However, these depots were reported to store “no more than two-three ammunition basic loads for an attached group of troops.”¹⁸²

In addition to establishing a depot system, individual units were encouraged to accumulate larger stockpiles of ammunition at the company and battery levels. Given ongoing traffic flow issues, this practice would allow them to disperse stocks as needed to units in the field,¹⁸³ which was necessary because the stretched supply lines after initial advances were at the edge of theoretical railhead resupply ranges, according to analysts. Both the advance to Kyiv (roughly 90 miles) and the advance to Kherson (roughly 120 miles) were at the longer extremes of standard resupply distances according to the most optimistic doctrinal limits.¹⁸⁴

¹⁷⁸ See, for example, Mason Clark, George Barros, and Kateryna Stepanenko, *Russian Offensive Campaign Assessment, March 21*, Institute for the Study of War, Mar. 21, 2022, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-march-21>.

¹⁷⁹ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, p. 42.

¹⁸⁰ Ibid.

¹⁸¹ Ibid.

¹⁸² Ibid.

¹⁸³ Ibid.

¹⁸⁴ Berkowitz and Galocha, "Why the Russian Military Is Bugged Down by Logistics in Ukraine."

Gradual adaptation in the spring and summer

The failure of the initial offensive to achieve its primary strategic objectives led to a belated Russian effort to reconstitute its forces and adjust the campaign to accommodate the reality of a sustained war.¹⁸⁵ By March it was clear that Russian units were taking significant losses and running short on supplies and were ill configured to sustain the war along multiple key axes. Senior officers were brought forward to establish sustained situational awareness given the failure to do so in the early weeks of the war. By some accounts, this effort was largely completed by the end of March, leading to additional reforms.¹⁸⁶ This section reviews Russian logistics adaptation during the late March to August time frame.

Although still operating under the rubric of a “special military operation,” the Russian military began to wake from the initial shock of its failed effort, albeit at this stage it had suffered significant losses among the best parts of the force. The need for major adjustments to support a longer-term military campaign was increasingly apparent. Preparing to support a sustained campaign would be an inherently difficult task, however, because Russian combat and logistics units were initially postured for a short-term conflict. As an example, Russian BTGs were intended to be self-sufficient for only around three days. Likewise, Russian estimates for ammunition, fuel, and food, as well as repair and recovery of vehicles, dubiously figured on no more than a few weeks for the main phase of combat operations. Thus, Russia’s military campaign as well as its logistics operations needed to be placed on a better footing to be more sustainable.

In late March, the Russian military undertook an orderly retreat from the Kyiv axis, which concluded on April 2.¹⁸⁷ On March 25, an announcement was made signaling major adjustments in the Russian campaign plan as forces sought to redeploy via Belarus back to Russia. The inability to supply sufficient artillery and ammunition was an important element

¹⁸⁵ Frederick W. Kagan, George Barros, and Kateryna Stepanenko, *Russian Offensive Campaign Assessment, March 19*, Institute for the Study of War, Mar. 19, 2022, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-march-19>; Clark, Barros, and Stepanenko, *Russian Offensive Campaign Assessment, March 21*.

¹⁸⁶ Frederick W. Kagan, George Barros, and Karolina Hird, *Russian Offensive Campaign Assessment, April 5*, Institute for the Study of War, Apr. 5, 2022, <https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-april-5>; Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*, p. 32.

¹⁸⁷ James Mackenzie, “In Villages Near Kyiv, How Ukraine Has Kept Russia’s Army at Bay,” Reuters, Mar. 30, 2022, <https://www.reuters.com/world/europe/villages-near-kyiv-how-ukraine-has-kept-russias-army-bay-2022-03-29/>; “Ukrainian Civilians and Soldiers Celebrate in the Streets as Russians Pull Back from Areas Around Kyiv,” ABC News, Apr. 3, 2022, <https://www.abc.net.au/news/2022-04-04/ukrainians-emerge-celebrate-as-russians-pull-back/100963856>.

of the decision to withdraw in the north because efforts to renew the advance around Kyiv without sufficient fire support caused Russian ground forces to take significant casualties.¹⁸⁸ The decision to leave Kyiv was also influenced by the failure of the supporting axis of advance from the north at Chernihiv and northeast from the direction of Sumy, both of which also bogged down after failing to make sufficient headway to support operations in Kyiv. However, by narrowing the front and refocusing operations on the Donbas—an area better served by Russia’s railway networks—Russia’s overall logistical challenges were significantly reduced.¹⁸⁹

Railways and motor transport

Russian forces also made efforts to place their ground-based logistics networks on a better footing to support long-term operations. The initial advance in several directions relied heavily on ground transportation for logistics support, including both railway networks and motor transport. During the initial multi-axis advance, Russian ground transportation resources were quickly overwhelmed and understaffed relative to actual logistical needs.

Railways played a critical role in Russian logistics operations during the initial phase of operations. By all accounts, efforts to integrate and coordinate Russian railways were more successful in the Donbas and along the southern axis in the Kherson and Zaporizhzhya regions than they were in the north and northeast because of Russia’s failure to seize control of Ukrainian rail networks in those areas.¹⁹⁰ In fact, Russia’s significant investment in railway logistics was most developed along the Donbas axis even though it was not the initial focus of the invasion plan. There, LDNR units (1st and 2nd Army Corps of the Donetsk and Luhansk “People’s Republics”) sought mainly to fix Ukrainian forces. Although Russian forces advanced quickly in Luhansk and in the south of Donetsk, these were secondary axes of attack. Given these narrower objectives, Russian rail-based logistics was more successful in sustaining Russian forces in the Donbas during the initial phase of the campaign.

Logistics networks within Russia proper were likewise essential for supporting ongoing military operations in Ukraine. However, these networks, which were primarily railway based, suffered from high demand for quick support to beleaguered and contested areas. This problem was exacerbated because connecting rail infrastructure in Ukraine was initially unavailable, although it would begin to be successfully utilized in occupied territories within

¹⁸⁸ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*, p. 32.

¹⁸⁹ During the initial phase of the invasion, Russian forces in the Donbas lacked the numerical superiority needed to make significant progress against heavily entrenched Ukrainian forces despite greater access to Russian railheads in the region.

¹⁹⁰ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One).”

three to four weeks of the invasion.¹⁹¹ Yet railway networks also suffered from accidents within Russia, including the reported derailment of a locomotive in the Bryansk region.¹⁹² Because Bryansk, Moscow, and Saint Petersburg are three of the most important rail hubs in western Russia and have some of the densest networks of railway junctions, incidents at those locations caused delays and breakdowns throughout the entire railway network.¹⁹³ Whether such incidents were due to network strain or acts of sabotage is still unclear.

Despite such problems, Russian MTO and Railway Troops continued to move large volumes of fuel and materiel over Russian-controlled railway networks during the second phase (see Figure 4). For example, RUSI researchers reported that during “1–19 April 2022, 228 railway cisterns with fuel and lubricants (more than 13,600 tonnes) were moved” to the railway station of Rovenki alone in the Luhansk region.¹⁹⁴ In general, Russian rail-based logistics was less constrained by a general shortage of supplies. Instead, logistics pressures at this time had more to do with the inability to deliver supplies (especially fuel) to the right location in the right time frame relevant to demand.

¹⁹¹ Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*, pp. 42.

¹⁹² Giulia Carbonaro, “Russian Train Derails After Railway Track Damaged, Photos Show,” *Newsweek*, Apr. 25, 2022, <https://www.newsweek.com/russia-bryansk-train-derails-railway-track-damaged-photos-1700512>.

¹⁹³ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One).”

¹⁹⁴ Zabrodskyi et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*, p. 42.

Figure 4. Refueling operations



Source: Russian Federation Ministry of Defense, mil.ru.

Yet the relative success of Russian rail-based logistics was in stark contrast to the wheeled vehicle logistical apparatus, which proved to be sorely unprepared for the volumes required. During the initial phase of the campaign, there was simply not enough motor transport to support resupply efforts for Russian forces in the field. As a result, starting in April, reports emerged that Russian forces in many locations had switched to commandeered civilian trucks as replacements and supplementary additions to the insufficient road-based convoy capacity.¹⁹⁵ Throughout forward areas, insufficient supply of spare parts was yet another common problem, with reports emerging in the summer about ongoing sustainment problems, including shortages of repair kits for wheeled and armored vehicles.¹⁹⁶ These problems put additional strain on motor transport capacity, further impressing Russian commanders with the need to focus on getting additional railway networks up and running as quickly as possible.

¹⁹⁵ Brad Lendon, "What Images of Russian Trucks Say About Its Military's Struggles in Ukraine," CNN, Apr. 14, 2022, <https://www.cnn.com/2022/04/14/europe/ukraine-war-russia-trucks-logistics-intl-hnk-ml/index.html>.

¹⁹⁶ Parfonov, "Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One)."

RUSI observers also reported that up until April, Russian forces continued to follow doctrinal suggestions to keep materiel and equipment within a 50-kilometer range of the line of contact, despite the increasingly decentralized and divergent nature of the multiple axes approach that Russian forces had pursued. Yet as Russian forces advanced, this practice left Russian logistics dumps increasingly vulnerable to rear area attacks:

As a result, [Russian logistics depots] became targets for damage [and] only at the end of April 2022 was the concentration of a significant part of [logistics] personnel, equipment and materiel moved beyond the 50-km (later 100-km) security zone, based on the maximum range of weapons used by the UAF.¹⁹⁷

Renewal of offensive operations in the Donbas

The Russian reaction to failure in the initial February–March period left a relative lull for April as reorganization and reassessment became the most important element of the task at hand.¹⁹⁸ By April, Russia had launched fresh offensives in the Donbas.¹⁹⁹

As the conflict shifted to a positional contest centered on the Donbas, the need to replenish Russian artillery units with fresh ammunition assumed growing importance. RUSI researchers report that “overall, during the offensive against the Donbas, Russian artillery were firing around 20,000 rounds per day, with their peak fire rate surpassing 32,000 rounds on some days.”²⁰⁰ Despite a structural shortage of available manpower, Russian forces began to advance because of a decisive artillery advantage that was fed by a logistical network capable of sustaining a rate of well over 500,000 artillery shells fired per month (not including other ammunition). At this stage of the war, the Russian military was able to attain a substantial advantage in artillery fire over the Ukrainian military, which was running low on ammunition.

Given the high volume and weight of artillery ammunition, the aggregate data imply that Russian forces were able to adapt sufficiently to the demands of the campaign in meeting demand for artillery ammunition. The actual record implies that early Russian logistical woes are not representative of the overall campaign because the MTO forces demonstrated steady improvement throughout the campaign.

¹⁹⁷ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, p. 42.

¹⁹⁸ Mason Clark et al., *Russian Offensive Campaign Assessment, April 18*, Institute for the Study of War, Apr. 18, 2022, <https://www.understandingwar.org/backgrounders/russian-offensive-campaign-assessment-april-18>; Frederick W. Kagan, Kateryna Stepanenko, and Karolina Hird, *Russian Offensive Campaign Assessment, April 19*, Institute for the Study of War, Apr. 19, 2022, <https://www.understandingwar.org/backgrounders/russian-offensive-campaign-assessment-april-19>.

¹⁹⁹ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine*, pp. 34–43.

²⁰⁰ *Ibid.*, p. 39.

Growing casualty rates created fresh logistics challenges, however, as Russian commanders began to withdraw the most heavily attrited BTGs from the line of contact. BTG subcomponents that were still largely intact were then assigned to other BTGs. Heavy casualties also led to changes in unit organization—primarily a reversion from general-purpose BTG units to mission- and task-specific company-sized units.

On the basis of interviews and reporting from the field, researchers at RUSI suggest that the formation of new BTGs from the remnants of other units led initially to “logistical and communications problems, as such units had to be integrated into a new chain of command, while also creating friction and compatibility problems,” which collectively complicated sustainment efforts.²⁰¹ By contrast, the shift to more specialized company-sized units simplified the replenishment of equipment losses because MTO units were able to concentrate on providing certain types of equipment, such as artillery, for each such unit. This shift also helped to alleviate delays and unevenness in resupplying general-purpose BTGs, which had a more diverse set of logistical requirements.²⁰²

By the end of the spring and into the summer, the Russian logistics network had stabilized and solved some of its initial problems, not least the failure to plan for a sustained warfighting period. The emergent approach ensured consistency throughout the Donbas offensive.²⁰³ Major problems that would remain through the rest of the period of observation include the continuing overreliance on railway networks, problems with the deployment of field depots at greater distances from rail hubs, and the requirement for units to carry significant ammunition (to mitigate the above problems), which left them less able to maneuver effectively.²⁰⁴

Concentrations of ammunition among units near the front to rectify initial delivery problems would set up another challenge later when Ukraine received HIMARS, which could target Russian ammunition dumps at distances of up to 80 kilometers behind the line of contact (with extensive Western support). Thus, ironically, Russian forces solved their initial logistical challenges in ways that made them more vulnerable to long-range precision fires in subsequent months, forcing them to adapt yet again after June 2022.

Major losses of equipment also led to new problems in the logistics network. In addition to supporting ongoing operations with ammunition, food, clothing, spare parts, medical supplies, and other materiel, the network increasingly had to deal with replacing equipment. Losses of

²⁰¹Ibid., p. 46.

²⁰² Ibid., p. 43.

²⁰³ Ibid., p. 35.

²⁰⁴ Ibid., p. 43.

equipment were already a sizable burden by the summer.²⁰⁵ Sourcing new items from storage competed with repairs and preparations to have new equipment cover losses; this problem required the stretched railways to find space to transport equipment to the front in addition to other supplies.

In addition, the period involved heavy “artillery dueling,” which led to a preoccupation with rapid target acquisition primarily through unmanned aerial vehicles and other air-based intelligence, surveillance, and reconnaissance (ISR) assets, even as such systems were highly subject to attrition because of low unit life expectancy.²⁰⁶ Replenishing these systems became a growing logistical challenge. Likewise, for the first time since the invasion, Russian forces set up a dense network of electronic warfare complexes across the front lines. This network disrupted Ukrainian navigation at times but also added another geospatial dimension to resupply efforts given that these systems were widely dispersed across the entire line of contact and had to be supported in an artillery-dominant battlespace.²⁰⁷ At the same time, the full restoration of the Ukrainian railway infrastructure became an important preoccupation as the rest of the rail-based MTO network came more fully online. Pontoon rail bridges, such as the one installed near the rail bridge in Kupyansk in May 2022, were put in place to quickly reconnect local lines to larger rail hubs (in this example, to the main railway for the Kupyansk-Vuzlovy-Vovchansk branch).²⁰⁸ Yet reliance on local railway infrastructure also led to problems of excess concentration and materiel density in easily targetable areas.

Other stresses on the logistics system also had to be dealt with more systematically at this time. For example, replacing lost military vehicles remained an issue for Russian forces, which turned increasingly to pulling equipment from storage and then transporting it to the front by rail (see Figure 5). One report from Rochan Consulting in mid-June noted that for “two weeks, we have seen videos showing Russian military trains carrying tanks and other military vehicles. Undoubtedly, Moscow is withdrawing equipment from its storage sites to replace losses in Ukraine.”²⁰⁹ Although the full scale of the replacement effort would remain obscure, it was a sizable and considerable logistics burden.

²⁰⁵ “Ukraine Conflict Monitor, Issue 87, 16-22 May 2022,” Rochan Consulting.

²⁰⁶ Zabrodskiy et al., *Preliminary Lessons in Conventional Warfighting from Russia’s Invasion of Ukraine*, p. 37.

²⁰⁷ *Ibid.*, p. 37.

²⁰⁸ *Ibid.*, p. 43.

²⁰⁹ “Ukraine Conflict Monitor, Issue 108, 13–19 June 2022,” Rochan Consulting.

Figure 5. Railway Troops train carrying military equipment



Source: Russian Federation Ministry of Defense, mil.ru.

Although by this point the railway network was now largely in place and operational, with considerable effort expended to rehabilitating damaged Ukrainian tracks, incidents still occurred. For example, one report noted that from June 24 to 25, “because of the derailment of a train with shells in the Pskov region, direct traffic between Velikie Luki–Kunya and Porkhov–Kunya was stopped for two days.”²¹⁰ Another report noted that Ukrainian strikes to railway tracks and power lines in August caused considerable disruption in the southern axis.²¹¹ The logistics lines from Kerch to Kherson were also heavily targeted in late summer, with reports

²¹⁰ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One).”

²¹¹ “Russians Blame ‘Sabotage’ for Blasts at Crimean Ammo Depot; Kyiv Hints at Role,” Radio Free Europe, Aug. 16, 2022, <https://www.rferl.org/a/ukraine-crimean-explosion-ammunition-depot-chubarov/31990544.html>; James Marson, Ann Simmons, and Matthew Luxmoore, “Explosions Hit Russian Ammunition Depot in Crimea,” *Wall Street Journal*, Aug. 16, 2022, <https://www.wsj.com/articles/explosions-hit-russian-ammunition-depot-in-crimea-11660635257>.

noting damage at Maiske and elsewhere; such damage was partially caused by strikes on ammunition dumps.²¹²

The sheer volume of transportation requirements also continued to put a heavy strain on logistics networks. One report suggested that just the “estimated consumption for the main categories of artillery ammunition and MLRS during the first five months of the war could be as much as 600,000 tons.”²¹³ Moreover, Western observers assessed that transportation volumes continued to increase, including daily usage rates of artillery, before peaking in June and July.

By August, supply problems were mitigated to some extent by growing reliance on materiel provided by Belarus. Indeed, by June there was evidence that Russian units were already receiving equipment and supplies from Belarus, although at first these may have been Russian pre-positioned stores. Russian deficits were particularly visible in growing shortages of 122mm artillery shells. Belarusian support proved critical in addressing enduring supply shortages as more than 30 storage facilities in Belarus were brought online. Even though only one-third of these facilities stored artillery and tank ammunition, Belarus also provided other elements, such as fuel, lubricants, food, and clothing.²¹⁴ One report noted:

In the first few days of August 2022, a train carrying ammunition (25 cars) was recorded arriving at the Bryansk-2 railway station; the stock was originally sent from the Orsha railway station in Belarus. Other trains carrying ammunition and storage infrastructure have been sent from the Gomel railway station in Belarus through Klinty (Bryansk Oblast) to Gukovo (Rostov Oblast).²¹⁵

Coping with the HIMARS threat

The introduction of US HIMARS into Ukraine’s arsenal in June signaled a new threat to Russian supply lines and ammunition depots, further complicating the logistics picture after a period of resettlement and reorganization. One of the earliest confirmed HIMARS strikes destroyed a

²¹² “Ukraine Conflict Monitor, Issue 150, 15–21 August 2022,” Rochan Consulting.

²¹³ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part One).”

²¹⁴ “Ukraine Conflict Monitor, Issue 114, 20–26 June 2022,” Rochan Consulting.

²¹⁵ Hlib Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part Two),” *Eurasia Daily Monitor* 19, no. 127, Aug. 18, 2022, <https://jamestown.org/program/ukrainian-strikes-cause-moscow-to-re-think-munitions-supply-and-logistics-part-two/>.

Russian ammunition depot on July 12.²¹⁶ This strike was followed by more—there were potentially as many as 50 strikes by late July.²¹⁷

HIMARS can strike up to 85 kilometers behind Russian lines (more practically the range is likely 70 to 75 kilometers). Thus, the introduction of HIMARS necessitated that Russia relocate logistics supply depots beyond the HIMARS strike range, which is also beyond the one-day round-trip supply range of wheeled vehicles used by Russian MTO resupply forces, according to some analysts.²¹⁸

The introduction of HIMARS also put greater pressure on MTO transportation chokepoints (such as bridges and river crossings) that had previously emerged as a major logistical problem during the spring reconsolidation effort. By the summer, problems with chokepoints had been made worse by the longer range HIMARS threat. In July, Ukrainian HIMARS strikes put the Antonovskiy bridge out of use, forcing Russia to set up a ferry service across the Dnipro River. This assault also damaged the rail bridge near Antonovskiy, which had immediate effects at the operational level, limiting crossings to rail and road bridges at the Nova Khakova dam.²¹⁹ The Antonovskiy bridge would be repeatedly brought back into service—it would be repaired and hit again and again in due course.²²⁰ In this manner, HIMARS strikes significantly impeded the flow of logistics. Still, the need for repeated strikes against the Antonovskiy bridge indicates that it took sustained HIMARS strikes to neutralize just one bridge because Russian forces were so adept at repairing the damage quickly. Russian forces also made other adaptations, such as using ferries or improvised barge bridges to sustain river crossings.

Russian forces were late in adapting to the presence of HIMARS, however. HIMARS was maximally effective over the first two months of its employment, striking logistics and command and control nodes throughout the theater. Yet after this two-month period of disarray, Russian forces adapted their practices to account for the HIMARS threat. Russian adaptation efforts included dispersing ammunition warehouses and hiding supply stocks, even though such practices led to delivery delays. Russian forces also began to employ mixed civilian

²¹⁶ “Ukraine Reports Striking Russian Ammunition Depot in South,” AP News, July 12, 2022, <https://apnews.com/article/russia-ukraine-social-media-black-sea-c9aefdc3cffbea91fc4f4395611900d3>.

²¹⁷ “Ukraine Conflict Monitor, Issue 128, 18-24 July 2022,” Rochan Consulting; Natalia Zinets, “Ukraine Says It Has Destroyed 50 Russian Ammunition Depots Using HIMARS,” Reuters, July 25, 2022, <https://www.reuters.com/world/europe/ukraine-says-it-has-destroyed-50-ammunition-depots-using-himars-war-with-russia-2022-07-25/>.

²¹⁸ Parfonov, “Ukrainian Strikes Cause Moscow to Re-Think Munitions Supply and Logistics (Part Two).”

²¹⁹ “Ukraine Conflict Monitor, Issue 134, 25-31 July 2022,” Rochan Consulting.

²²⁰ Ewan Palmer, “Satellite Image Appears to Show Key Bridge Damaged in Ukraine HIMARS Strike,” *Newsweek*, Aug. 27, 2022, <https://www.newsweek.com/satellite-images-antonovskiy-bridge-ukraine-himars-strike-kherson-1737547>.

and military convoys while using civilian logistics equipment to discourage Ukrainian targeting.²²¹ In addition, Russian forces set up decoys, hardened command nodes, and took other measures to reduce their exposure to long-range precision strike such that the effectiveness of HIMARS significantly decreased. Later, Russian forces began to employ electronic warfare and point defense more successfully to counter guided MLRS rockets fired by HIMARS or M270 MLRS systems. In sum, the Russian military's need for high-volume logistical throughput to sustain high rates of fire in April through July left it vulnerable to Ukrainian HIMARS strikes. Russian efforts to adapt to the HIMARS threat, such as moving depots farther to the rear and changing distribution methods, were largely successful in mitigating the threat. At the same time, such measures complicated Russian logistics support and appear to have reduced Russia's artillery advantage by leading to an overall reduction in the rate of fire.

Fall regrouping

By August, Russian forces had run out of momentum and largely ceded the initiative to the Ukrainian military. At this stage, the Russian military was stretched thin, suffering from a shortage of manpower, a deficit of replacements, and exhaustion due to the inability to rotate forces. In September, Ukrainian armed forces launched two consecutive counteroffensives along two fronts, at Kharkiv and Kherson. By this point, Russian sustainment problems were less acute, and the railway networks were in general fully operational. Russian forces had reacted to the introduction of HIMARS by pulling logistics points out of the system's range while dispersing and concealing likely targets. Yet the counteroffensives created new problems for Russian logistics. This section reviews Russian logistics operations during the September to November time frame.

Impact of Ukrainian counteroffensives

Ukrainian forces made rapid advances around Kharkiv, resulting in a shift in the line of contact well to the east within only two weeks. This offensive resulted in a Russian rout, during which retreating Russian forces abandoned equipment in large numbers, including at recovery and repair yards. For example, one report noted a substantial amount of abandoned equipment in the Izyum area at various repair bases. The abandoned equipment included several companies of T-80s MBTs belonging to the 4 Guards Tank Division.²²² Russian forces fought a delaying

²²¹ "Ukraine Conflict Monitor, Issue 140, 1-7 August 2022," Rochan Consulting; "Ukraine Conflict Monitor, Issue 145, 8-14 August 2022," Rochan Consulting.

²²² "Ukraine Conflict Monitor, Issue 165, 5-11 September," Rochan Consulting.

action at Lyman but were unable to hold the city; they later resettled on the Svatove-Kreminna line in Luhansk. At this stage, logistical bases that were previously believed to be safe and well placed—within a reasonable distance to the front—were now under threat.

In October 2022, in the midst of this counteroffensive, Ukrainian forces mounted a significant sabotage attack on the Kerch bridge, which was a major logistics corridor serving the southern theater. Using a massive truck bomb, the Ukrainian attack damaged both the road and one of the rail lines on the bridge, confining rail operations to a single track. Russian teams immediately began work to bring the bridge back into service, but throughout October there were reports of traffic pileups of cargo trucks at the reconstruction site.²²³ The rail bridge remained limited to single tracking for an extended time because of the damage. A Rochan Consulting memo noted:

Most logistics support to the southwestern part of the front (Crimea/Kherson) runs through the Kerch bridge, primarily through rails, as the fastest and the most cost-effective mode of transportation. Even if the road is operable, it will not be able to compensate for the loss of rail transport. A ferry does present an alternative, but the Russian ability to move supplies across will be more time-consuming, more expensive, and limited by the ferry capacity.²²⁴

The Kharkiv counteroffensive drove Putin to announce a partial mobilization. It also led to a shakeup of the strategic and operational commands, most notably the appointment of General Surovikin to lead efforts on the ground.²²⁵

In October 2022, Ukrainian forces launched a second counteroffensive near Kherson, eventually leading Russian forces to withdraw from the Kherson area starting later that month. Despite sustained HIMARS strikes, Russian units were able to withdraw in good order to new positions on the right side of the riverbank with their equipment intact. The bridge at the Nova Khakovka dam and a functioning ferry system proved sufficient for this purpose. Although the withdrawal from Kherson represented a tactical defeat for Russian forces, it had the beneficial effect of shortening the front lines and reducing Russian ground lines of communication. In short, it made the job of combat service support and logistics much easier.

²²³ “Russia’s Logistics Issues Intensify Following Kerch Bridge Attack - UK Intel,” *Jerusalem Post*, Oct. 19, 2022, <https://www.jpost.com/international/article-719998>.

²²⁴ “Ukraine Conflict Monitor, Issue 185, 3-9 October 2022,” Rochan Consulting.

²²⁵ “Surovikin: The Ruthless Face of Russia’s Campaign in Ukraine,” *France 24*, Oct. 20, 2022, <https://www.france24.com/en/live-news/20221020-surovikin-the-ruthless-face-of-russia-s-campaign-in-ukraine>.

MTO leadership changes

Over the same period, ongoing logistics problems caused MTO leadership to come under renewed criticism.²²⁶ This criticism appears to have finally driven the Kremlin to remove long-time Russian MTO Chief Deputy Minister for Logistics Dmitry Bulgakov, who was relieved of his duties in late September.²²⁷ For most of its existence, the MTO had been led by Bulgakov, who also held the rank of army general. In 2010, Bulgakov played a major role in the formation of the MTO, having formerly led the Logistics Service, one of its precursors, since 2008. Since the MTO's formation in 2010, Bulgakov had an outsize influence in shaping its direction, and he managed to steer the MTO through several challenges. First and foremost, he oversaw the complex task of integrating the logistics and technical services. He is also credited with successfully planning and overseeing Russian logistics operations during Moscow's successful intervention in Syria, including establishing the "Syrian Express," Russia's maritime resupply operation that ferried cargo from Russian Black Sea bases to ports in Syria.

Over the years, however, there had been recurring reports in Russian media regarding the improper steering of contracts for the purchase of supplies to favored companies at inflated costs. Such arrangements were also associated with delivery of defective goods, including expired dry rations, decayed meats, and poor-quality uniforms. Although Bulgakov was never accused of or tried for any of these incidents, they happened on his watch, and his name was mentioned in association with some of these incidents, thereby highlighting the continuing presence of corruption in MTO operations.²²⁸ Such issues may also help explain some of the logistics problems experienced by Russian servicemembers during the Ukraine conflict, including expired field rations, missing clothing, and defective medical kits.

Bulgakov was replaced by Colonel General Mikhail Mizintsev, who formerly served as the head of Russia's National Defense Management Center. Mizintsev had also participated in Russian military operations in Syria and Ukraine, where he acquired an unsavory reputation for operations that involved significant civilian casualty rates. By his own account, Mizintsev was not a trained logistician, and his experience came from engaging with the system during his service and leadership in the MoD.²²⁹ In the end, Mizintsev was caught up in the ongoing

²²⁶ Matt Murphy, "Dmitry Bulgakov: Putin Fires Deputy Defence Chief amid Supply Failures," BBC, Sept. 24, 2022, <https://www.bbc.com/news/world-europe-63021117>.

²²⁷ Ibid.

²²⁸ See, for example, Tsargard, "The General Who 'Ate' the Rations of the Russian Army" (Генерал, который "съел" пайки русской армии), e-vid.ru, Dec. 16, 2022, <https://e-vid.ru/biznes/161222/general-kotoryu-sel-payki-russkoy-armii>.

²²⁹ Alexander M. Smurov, "Military Economy - Logistic Support for the Troops (Force)" (Войсковое Хозяйство – Лицо Материально-Технического Обеспечения Войск (Сил)), MTO VS RF, Dec. 2022.

disputes between the Russian MoD and the Wagner Group and would subsequently be sacked himself.

In April 2023, Mizintsev was replaced by Col. Gen. Aleksey Kuz'menkov, who previously dealt with rear coordination issues as deputy director of Rosgvardia (see Figure 6). Kuz'menkov has an extensive logistics background as a graduate of the Volsky Military Institute of Material Support and the Khrulyov Military Academy of Logistical Support. He was also previously the chief of the logistics staff and the deputy commander of the forces of the Southern MD for material and technical supply.

Figure 6. New MTO chief, Col. Gen. Aleksey Kuz'menkov



Source: Russian Federation Ministry of Defense, mil.ru.

Preparing for the winter offensive

The consolidation of Russian lines to the Donbas line of contact and the Russian pullback from Kherson simplified issues for Russian logistics. The strike on the Kerch bridge had further encouraged Russian efforts to introduce greater redundancy into the system. Yet a Ukrainian campaign of sabotage unfolding behind Russian lines, and at times even deep inside Russia, created its own set of challenges for Russian logistics. These Ukrainian sabotage attacks affected the logistics system not only through direct action against specific logistics nodes but also by adding friction to the broader logistics network and additional security requirements. The specific impact of these attacks is difficult to assess in detail given the paucity of data. Yet these burdensome attacks clearly generated their own strain on the logistics system, ultimately leading to accidents, fires, and delays. There were even reports of railway problems deep in the Russian interior, where the Trans-Siberian and Baikal-Amur railways came under pressure because of the redirection of supplies

eastward, creating bottlenecks while reducing the supply from manufacturing centers in Russia to positions closer to the front.²³⁰

Continuing strains on Russian logistics

Over the course of the winter, Ukrainian forces continued their focus on obstructing Russian logistics. One example was a railway line that was destroyed by Ukrainian partisans near Shchastya.²³¹ Ammunition dumps continued to be targeted as well. In mid-December, for example, a local dump for the Russian military barracks at Kadiivka was destroyed, which highlighted that distributed ammunition storage sites were still in danger of being targeted despite Russian adaptation away from close-in centralized depots to lessen the threat from Ukrainian strikes.²³²

In December, Ukrainian officials emphasized that declining ammunition stocks remained a core problem for Russia, even after nearly a year of adjustments to fix the issue. At the end of the month, the chief of the Ukrainian Main Military Intelligence Directorate, Kyrylo Budanov, argued in a press conference that Russian forces were experiencing a significant degradation in available stocks and that problems would continue to exacerbate until March 2023. In seeking to address this issue, Russia had reportedly drawn down all remaining artillery ammunition from storage sites in Belarus.²³³ Nevertheless, evidence suggests that despite growing signs of a pending Russian ammunition shortage, Russian artillery units continued to muddle through, partly because of a more rigorous and well-thought-out effort to ration and rationalize the use of supply-sensitive fires.

Challenges in providing kit

Throughout the war, the Russian military struggled to repair and replace lost or damaged equipment by managing the cycle of recovery and repair and simultaneously pulling vehicles out of storage. Similarly, there were ongoing challenges with providing for the troops' basic needs because of problems in procuring sufficient individual kit, persistent quality control issues, and diversion of funding resulting from corruption. (Although corruption remained a

²³⁰ Hlib Parfonov, "Russia Struggles to Maintain Muniton Stocks (Part One)," *Eurasia Daily Monitor*, Dec. 5, 2022, <https://jamestown.org/program/russia-struggles-to-maintain-muniton-stocks-part-one/>.

²³¹ "Ukraine Conflict Monitor, Issue 240, 9-15 January 2023," Rochan Consulting.

²³² "Warehouse with Russian Ammunition Detonated in Kadiivka, Authorities Claim Explosion in Barracks," *Ukrainskaya Pravda*, Dec. 15, 2022, <https://www.yahoo.com/now/warehouse-russian-ammunition-detonated-kadiivka-083957860.html>.

²³³ "Ukraine Conflict Monitor, Issue 231, 26 December, 2022–1 January 2023," Rochan Consulting.

problem and was fairly pervasive in some areas, it was only one factor affecting Russian logistics operations and was not deterministic.)

The Russian armed forces were not well prepared to sustain a war of this scale for so long. Many of their preparations before the war were premised on a different set of assumptions. For example, the Russian military figured that it would have two months' notice in advance of a major regional or large-scale war to enact partial mobilization.²³⁴ During the war in Ukraine, however, the Kremlin waited seven months into major combat operations to begin mobilizing. By then, much of the force had already been expended, and much of the rest was in disarray.²³⁵ Consequently, Russia's logistical failures stem in part from simply not doing what was previously planned, agreed to, and doctrinally accepted.²³⁶ Similarly, the defense-industrial complex began adding shifts and mobilizing its efforts only over the summer, with much of the system still operating under peacetime conditions during the initial phases of the campaign.²³⁷ Unsurprisingly, a system that planned to mobilize in advance, or at the outset of a major war, found itself struggling to implement the initial plans once these efforts were launched much later in the conflict.²³⁸

As mobilization finally began to get underway in earnest in September 2022, reports and videos about shortages of personal protective equipment and other gear for newly mobilized soldiers were common. There was also anecdotal evidence of a rapid growth in demand and a corresponding increase in prices for clothing and medical equipment needed for newly mobilized personnel.²³⁹ Russian Duma deputies were animated by this issue, asking the

²³⁴ Michael Kofman et al., *Russian Military Strategy: Core Tenets and Operational Concepts*, CNA, DRM-2021-U-029755-1Rev, Oct. 2021.

²³⁵ Vladimir Frolov, "New Commander, New Goals for Russia in Ukraine," *Carnegie Politika*, Nov. 2022, <https://carnegieendowment.org/politika/88301>.

²³⁶ See, for example, Michael Kofman and Rob Lee, "Not Built for Purpose: The Russian Military's Ill-Fated Force Design," *War on the Rocks*, June 2022, <https://warontherocks.com/2022/06/not-built-for-purpose-the-russian-militarys-ill-fated-force-design/>; Kofman et al., *Russian Military Strategy*.

²³⁷ Pavel Luzin, *Russia's Military Industry Forecast 2023-2025*, Foreign Policy Research Institute, Apr. 2023, <https://www.fpri.org/article/2023/04/russias-military-industry-forecast-2023-2025/>; Juliusz Sabak, "Russian Defense Industry to Operate 24/7?," *Defense24*, July 15, 2022, <https://defence24.com/industry/russian-defence-industry-to-operate-247-commentary>; András Rácz, Ole Spillner, and Guntram Wolff, *Russia's War Economy: How Sanctions Reduce Military Capacity*, German Council on Foreign Relations, DGAP Policy Brief No. 3, Feb. 2023, <https://dgap.org/en/research/publications/russias-war-economy>.

²³⁸ Mark F. Cancian, "What Does Russia's 'Partial Mobilization' Mean?," *Center for Strategic and International Studies*, Sept. 26, 2022, <https://www.csis.org/analysis/what-does-russias-partial-mobilization-mean>.

²³⁹ Maria Perevoshchikova, Evgeniya Pertseva, and Veronika Kulakova, "Clothing Way of Life: Prices for Goods for the Mobilized Increased in Russia" (Вещевой уклад: в России выросли цены на товары для мобилизованных), *Izvestiya*, Sept. 28, 2022, <https://iz.ru/1402061/mariia-perevoshchikova-evgeniia-pertceva-veronika>

Russian prosecutor general to launch investigations into issues of profiteering and determine how MTO funds were being spent under Bulgakov's leadership.

In January 2023, there was a scandal about the quality of winter uniforms provided to the MoD by two suppliers. One of the companies benefiting from this scandal was a new entrant into the military uniform supplier ranks, a company owned by the 22-year-old son of Russian government official Dmitry Stepanenko that reportedly sought to charge the MoD much higher prices per uniform.²⁴⁰

Faced with enduring resource shortfalls and persistent high prices, soldiers began turning to regional governors and volunteer support networks for help.²⁴¹ The equipment that should have been available was already consumed by this time or perhaps was not properly procured in the first place.²⁴² Thus, the Russian logistics system found itself ill prepared to process such a large intake of manpower and to properly train and equip the nearly 300,000 troops that

kulakova/veshchevoi-uklad-v-rossii-vyrosli-tceny-na-tovary-dlia-mobilizovannykh; Alina Savitskaya, "Join Stores: Citizens Buy Equipment and First Aid Kits" (Примкнуть магазины Граждане закупаются снаряжением и аптечками), *Kommersant*, Sept. 29, 2022, <https://www.kommersant.ru/doc/5583282>.

²⁴⁰ "Layout': The Ministry of Defense of the Russian Federation Fired Three Generals Responsible for the Form" (Вёрстка": Минобороны РФ уволило трёх генералов, отвечавших за форму), *Svoboda*, Feb. 14, 2023, <https://www.svoboda.org/a/vyorstka-minoborony-rf-uvolilo-tryoh-generalov-otvechavshih-za-formu/32271136.html>; "In Bad Shape: The Ministry of Defense Was Dismissed Due to the Quality of Military Uniforms" (в плохой форме: В Минобороны произошли увольнения из-за качества военной формы), *Verstka*, Feb. 13, 2023, https://verstka.media/skandal-iz-za-kachestva-formy-minoborony?tg_rhash=86cf5f61f61288; "Corruption: Contract for New Uniforms" (Производитель показал новую форму для военных в зоне спецоперации Подробнее на РБК), *RBC*, Feb. 9, 2023, <https://www.rbc.ru/society/09/02/2023/63e3b0f79a7947b95a3c8cfc>; "The Prosecutor's Office Checked the Scandalous Company of the Son of the Ex-Chairman of the Yaroslavl Government 'OKB Gardarik'" (Прокуратура проверила скандальную фирму сына экс-председателя ярославского правительства ОКБ Гардарика), *echo76.ru*, Mar. 21, 2023, <https://echo76.ru/news/22/02/prokuratura-proverila-skandalnuyu-firmu-syina-ekspredsedatelya-yaroslavskogo-pravitelstva-%C2%ABokb-gardarika%C2%BB.html>; "The Ministry of Defense Revealed the Price of a New Form for the Participants of the Special Operation" (Минобороны раскрыло цену новой формы для участников спецоперации), *RBC*, Feb. 10, 2023, <https://www.rbc.ru/politics/10/02/2023/63e67b9f9a79473c04784cbd>.

²⁴¹ Ivan U. Klyszcz, "The New Boyars? How Russia's Governors Facilitate Mobilisation," *Royal United Services Institute*, Dec. 2022, <https://rusi.org/explore-our-research/publications/commentary/new-boyars-how-russias-governors-facilitate-mobilisation>; Mikhail Vinogradov, "As War Comes to Russia, Governors Are Left to Formulate a Response," *Carnegie Politika*, June 6, 2023, <https://carnegieendowment.org/politika/89912>; Elena Teslova, "Putin Orders Newly Elected Governors Ensure Partial Mobilization Is Conducted Properly," *Anadolu Agency*, Oct. 10, 2022, <https://www.aa.com.tr/en/world/putin-orders-newly-elected-governors-ensure-partial-mobilization-is-conducted-properly/2707339>.

²⁴² Isabel Van Brugen, "Russia Admits It's Running Out of Equipment for Mobilized Soldiers," *Newsweek*, Oct. 27, 2022, <https://www.newsweek.com/russia-equipment-weapons-shortage-peskov-soldiers-ukraine-1755057>.

were inducted into the armed forces to support the war effort.²⁴³ In some respects, this outcome was not entirely unexpected because the Russian military was designed as a partial mobilization army.²⁴⁴ As designed, however, the Russian armed forces were anticipating an influx of about 150,000 troops during mobilization to raise readiness levels of Russian combat units from 70 percent to near 100 percent in the ground forces. The sudden mobilization of more than 300,000 troops was double the expected number, and this large influx of troops exceeded the capacity of available training ranges and equipment stocks and the ability of combat units to absorb this manpower. Initially, this situation led to the deployment of combat personnel who were poorly trained and equipped for the ongoing campaign.²⁴⁵

Over time, however, the Russian military was able to adjust mobilization demands and deploy better armed and better trained troops to the front (see Figure 7). The influx of these newly mobilized soldiers proved instrumental in helping the Russian military stabilize the front in eastern Ukraine after the successful Ukrainian Kharkiv offensive. The newly mobilized soldiers were also crucial for raising manning levels across a range of depleted units and building out mobilized regiments of territorial troops. The latter were used primarily as a reserve force to supplement existing units. Through mobilization, the Russian military was able to restore the balance of forces on the ground in Ukraine.

²⁴³ Anna Neplii, "Russia Has a Problem: Training and Equipping Mobilized Reservists," *Kyiv Post*, Sept. 22, 2022, <https://www.kyivpost.com/post/1107>.

²⁴⁴ Kofman et al., *Russian Military Strategy*.

²⁴⁵ Isabel Coles and Thomas Grove, "Russia's New Offensive in Ukraine Exposes Blunders, Poor Training," *Wall Street Journal*, Feb. 21, 2023, <https://www.wsj.com/articles/russias-new-offensive-in-ukraine-exposes-blunders-poor-training-28a14b1e>; Michael G. Anderson, "A People Problem: Learning from Russia's Failing Efforts to Reconstitute Its Depleted Units in Ukraine," *Modern War Institute*, Jan. 26, 2023, <https://mwi.westpoint.edu/a-people-problem-learning-from-russias-failing-efforts-to-reconstitute-its-depleted-units-in-ukraine/>; Nicholas Slayton, "Russia Mobilized 300,000 New Soldiers. They're Just Poorly Equipped and Trained," *Task & Purpose*, Oct. 30, 2022, <https://taskandpurpose.com/news/russia-mobilization-poor-training-equipmen/>.

Figure 7. Manufacturing of personal protective equipment



Source: Russian Federation Ministry of Defense, mil.ru.

Russian Lessons Learned from Ukraine

This part of the paper focuses on how leadership and authoritative thinkers in the Russian military logistics community discuss lessons learned from the ongoing conflict in Ukraine and other recent operations and highlight evolutionary priorities for the logistical system, given Russia's need to prepare for a long-term adversarial relationship with the West.

In December 2022, Shoigu announced a Russian military reorganization that would involve the reversal of many 2010 reforms. Although details are sparse as of this writing, this reorganization would see the creation of Moscow and Leningrad MDs, the creation of and restructuring of numerous military formations, and an increase in the overall numbers of the Russian armed forces,²⁴⁶ all of which would have important implications for the MTO system.

Development priorities

As broader MoD reform efforts are ongoing, the MoD leadership has also learned lessons from the war in Ukraine and other recent engagements that required MTO involvement. According to one recent report, Russian leaders are not planning to make major changes to the way the MTO is currently organized, nor do they plan to reverse the decision to create a consolidated MTO through the merger of the logistics and technical services. In a December 2022 interview, then head of the MTO Mizintsev maintained that the MTO system as a whole does not require significant reforms. Instead, he argued that it needs restructuring of “single structural elements, reformatting of their functions, and the algorithm of their work.”²⁴⁷

Mizintsev highlighted the following areas in need of further development, suggesting that these are among the principal areas of deficiency:²⁴⁸

- Keeping the system at a high level of military and mobilization readiness
- Equipping the troops with modern armaments and military equipment, as well as incorporating innovative methods of their technical repair

²⁴⁶ “An Expanded Meeting of the Board of the Russian Defense Ministry Was Held in Moscow Under the Leadership of Supreme Commander-in-Chief of the Armed Forces Vladimir Putin” (В Москве под руководством Верховного Главнокомандующего Вооруженными Силами Владимира Путина прошло расширенное заседание Коллегии Минобороны России), Russian Ministry of Defense, Dec. 21, 2022, https://function.mil.ru/news_page/country/more.htm?id=12449212@egNews.

²⁴⁷ Smurov, “Military Economy - Logistic Support.”

²⁴⁸ Ibid.

- Optimizing the infrastructure of MTO services by (re)building facilities
- Providing quality material and housing resources
- Preparing quality MTO specialists

Mizintsev further emphasized the following priorities for 2023:²⁴⁹

- Implementing activities according to MoD plans
- Comprehensively supplying troops participating in Ukraine, Nagorno-Karabakh, and Syria
- Constructing the second branch of the Baikal-Amur railway
- Completing financial planning and signing of contracts for next year

Mizintsev also noted the importance of holding those responsible for logistics failures accountable and ensuring that things that are reported as completed are actually completed. It is worth noting that Mizintsev himself was replaced in May 2023, although the cause appeared to be infighting between the MoD and the Wagner Group. The military was seemingly starving Wagner of necessary supplies as a policy because of bureaucratic competition, and Mizintsev may have been working to circumvent this policy to help Wagner's leader, Yevgeny Prigozhin, gain access to ammunition.²⁵⁰ Ultimately, however, Mizintsev's tenure proved short-lived.

Beyond the measures advocated by Mizintsev, the Russian military has continued to adapt its logistics approach under the pressures of the war in Ukraine. The main themes that have emerged include expanding the size of the MTO forces to improve performance and support an expanded force size; addressing shortcomings in maintenance and repair of military equipment in the field, which has failed to keep up with demand; increasing the speed and mobility of logistics operations; and modernizing MTO equipment and resources.

Expansion of MTO force size

Expanding the size of the MTO will likely be a key priority for the Russian military as it reconstitutes its forces both to provide greater logistical support for ongoing and future military operations and to effectively support planned increases in the size of the armed forces. The creation of new MTO brigades will be necessary, for instance, to support the new Moscow and Leningrad MDs. Additional MTO formations will also be needed to support the planned expansion of ground force units that will include at least three new motorized rifle divisions, a

²⁴⁹ Ibid.

²⁵⁰ "Ukraine Conflict Updates," Institute for the Study of War, Aug. 15, 2022, <https://understandingwar.org/background/ukraine-conflict-updates>.

new army corps in Karelia to offset Finland's entry into NATO, and conversion of multiple motorized rifle brigades into divisions.²⁵¹

According to the MoD, the VDV will be expanded as well, with the planned formation of two additional airborne assault divisions.²⁵² In October 2022 came news of plans to create an MTO brigade within the VDV under the VDV branch command.²⁵³ The plans draw on VDV experiences in Kazakhstan, where rapid deployment of troops and supplies was needed as part of a Collective Security Treaty Organization (CSTO) deployment.²⁵⁴ Reports noted similar needs during training in Orenburg in 2021 as part of the "Peace Mission" counterterrorism operation. This effort is intended to resolve the issue of the VDV being too reliant on the larger MTO structure, which had problems supporting lengthy autonomous actions, and is in part reversing some of the 2010 reforms that sought to consolidate MTO activities because MTO brigades are primarily found in the ground forces' CAAs.

Repair facilities

Addressing shortcomings in the MTO's maintenance, repair, and overhaul capabilities has been cited as another key priority. The war in Ukraine has highlighted the need for additional repair facilities for military equipment. Minister of Defense Shoigu has indicated the need to invest additional capabilities into repair services because the repair capacity in the troops has been found to be severely lacking. He noted that efforts to outsource repairs between 2008 and 2012 "practically destroyed repair units in the troops," which has had negative consequences for military equipment. He noted that 2023 would see the creation of three repair facilities and additional efforts invested into building this capacity in the units.²⁵⁵ Furthermore, there were Russian media reports in September 2022 about the creation of repair facilities for military equipment near Moscow and Rostov and legal changes enabling these to work overtime.²⁵⁶

²⁵¹ "An Expanded Meeting of the Board of the Russian Defense Ministry."

²⁵² Ibid.

²⁵³ Roman Kretsul and Aleksey Ramm, "Projectile Out of Turn: The Airborne Forces Will Have Their Own Rear Unit" (Снаряд вне очереди: в ВДВ появится собственное тыловое соединение), *Izvestiya*, Oct. 12, 2022, <https://iz.ru/1408667/roman-kretcul-aleksei-ramm/snariad-vne-ocheredi-v-vdv-poiavitsia-sobstvennoe-tylovoe-soedinenie>.

²⁵⁴ See summary in Roger McDermott, "CSTO Props Up Presidential Succession in Kazakhstan," *Eurasia Daily Monitor*, Jan. 19, 2022, <https://jamestown.org/program/csto-props-up-presidential-succession-in-kazakhstan/>.

²⁵⁵ "An Expanded Meeting of the Board of the Russian Defense Ministry."

²⁵⁶ Anastasia Larina, "Mishustin Instructed to Create Two Armored Plants for the Repair of Military Equipment" (Мишустин поручил создать два бронетанковых завода для ремонта военной техники), *Kommersant*, Sept. 5, 2022, <https://www.kommersant.ru/doc/5547483>.

Increasing mobility

Russian MTO specialists have also written about the need for increased mobility of MTO assets and personnel because of the constant shifting of front lines and extensive adversary ISR on the battlefield. Relatedly, the need to increase the speed and productivity of MTO operations has also been raised as an important requirement. Articles in the MTO journal point to challenges of basic functions. One example is baking bread (using a mobile mechanized bread factory) because the factory must be close to the front line and move with it. The current requirement is to be able to bake bread in less than seven hours, but the associated equipment—which is needed to prepare the dough, carry water, and supply electricity—takes six vehicles to carry. All this equipment takes time to set up and break down every time there is a need to move. Furthermore, the 30 troops involved in the bread-baking process at each mobile bakery do not have their own dedicated transport to enable them to move with the equipment.²⁵⁷ Analysts note that there is a much more mobile bread-baking solution that requires less effort to deploy and relocate, but even though it was deployed into the forces, it may not have been used in the war as of December 2022.²⁵⁸

In the bread-baking case, MTO has developed innovative solutions, but they have not yet been implemented. In other cases, MTO specialists have been working on new concepts. Articles suggest efforts to develop more mobile and comprehensive solutions for shower and laundry vehicles.²⁵⁹ Innovation is also ongoing regarding fuel supply troops using unmanned systems for reconnaissance and route planning, which would lead to much speedier operations.²⁶⁰

MTO equipment modernization

Modernizing the MTO's equipment and infrastructure base has been cited as yet another key priority. According to former MTO head Mizintsev, the optimization of the infrastructure of logistics services through the reconstruction and construction of new equipment and facilities (e.g., refueling complexes) is yet another important logistics priority.²⁶¹ In many cases, MTO troops have been forced to operate with aging and obsolescent equipment. Efforts are underway to rectify such deficiencies, as exemplified by recent deliveries of new piledriving equipment to assist in the rapid installation or repair of roadways to support logistics operations. Likewise, the MTO recently received a new universal railway ramp to facilitate

²⁵⁷ Vladimir Popov, "The Bread Smells Like Gunpowder" (Пахнут Порохом Хлеба), MTO VS RF, Dec. 2022.

²⁵⁸ Ibid.

²⁵⁹ Vladimir Popov, "Uroki Donbassa" (Уроки Донбасса), MTO VS RF, Sept. 2022.

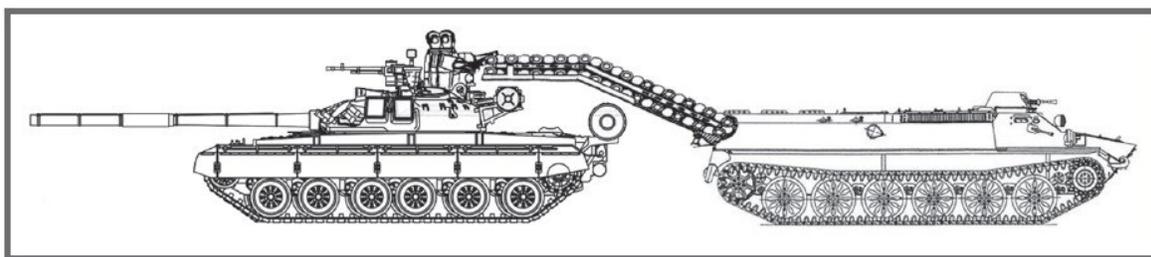
²⁶⁰ Ibid.

²⁶¹ Smurov, "Military Economy - Logistic Support."

offloading of cargo from trains at locations without automated lift equipment. The development of new equipment in other areas will be a key long-term priority for the MTO going forward.

At the same time, the MTO is looking to capitalize on emerging high-tech solutions, including artificial intelligence and roboticization. Despite Western sanctions that could impede the progress of development, testing, and introduction of robotic technologies across the Russian armed forces, MTO is still discussing solutions involving these technologies. They include robotic systems in the Railway Troops, discussed in detail by Russian officials.²⁶² They also involve proposals to create intellectualized transport columns and continue work on several types of robotic prototypes for various types of supply and repair operations.²⁶³ As one article argues, “A significant reduction in the time for a certain cycle of providing [troops] with materiel due to the accelerated dynamics of combat actions in modern operations has shown the need to develop and implement an urgent delivery subsystem based on advanced technologies, ground and air” robotic technologies (see Figure 8).²⁶⁴

Figure 8. Future universal robotic transport-loading complex



Source: Vladimir Trishunkin et al., “Process of Improvement, Part 2” (Процесс совершенствования), MTO VS RF, Oct. 2022.

²⁶² Roman Kretsul and Alexi Ramm, “Robotic Systems Will Soon Be Adapted by Railroad Troops” (Роботизированные Системы Скоро Наудт Применение в Железнодорожных Войскак), *Izvestia*, Feb. 11, 2022, <https://iz.ru/1289710/romankretcul-aleksei-ramm/robotizirovannye-sistemy-skoro-naidut-primenenie-v-zheleznodorozhnykh-voiskakh>.

²⁶³ Vladimir Trishunkin et al., “Process of Improvement, Part 2” (Процесс совершенствования), MTO VS RF, Oct. 2022.

²⁶⁴ Trishunkin et al., “Process of Improvement, Part 2.”

Emerging MTO concepts

In addition to the tangible reforms described above, the MTO is also looking to adopt new concepts of operation. Articles note that the experiences of Ukraine, Syria, Nagorno-Karabakh, and Kazakhstan are facilitating the development of novel “military measures of strategic deterrence, means of employing military formations, their comprehensive support at distant locations and activities of post-conflict resolution.”²⁶⁵ There is an emphasis on the importance of the expeditionary approach to MTO, including in the Arctic context, that would involve the pre-positioning of larger numbers of stocks as well as equipment that can both operate in harsh weather conditions and work within a coalition. Some writings focus on the model of the NATO Joint Logistics Group as a potential example for emulation.

New concepts suggest the idea of a “preventive deployment of the MTO” system for the purposes of supplying the Russian armed forces in peacetime as well as during strategic deployment.²⁶⁶ This approach would include “advance basing of weapons and military equipment and materiel and their ‘faceless’ (impersonal) use; advance preparation of MTO areas; the use of state structures [and] commercial organizations of the host country.” Articles further suggest that the “effectiveness of the considered method is confirmed by the positive Syrian experience in the use of troops on ‘unfamiliar training grounds’ and the results of special MTO exercises.”²⁶⁷ Articles also point to the need to improve command and control, develop additional command points and software, and create modern decision support systems.²⁶⁸

Statements by officials and articles also suggest that lessons for MTO have been learned from recent coalition operations, including the deployment of Russian forces as part of the CSTO mission to Kazakhstan in January 2022. These lessons suggest more need for readiness for prompt operational deployment of MTO troops, even though such deployments could be impeded by

unfamiliar theater of operations; operational indicators (range, duration); national approaches to the preparation and conduct of joint military operations; insufficient level of training of military formations; weak operational equipping of a possible area for the use of troops (forces); incompatibility of a number of national military systems; underdeveloped

²⁶⁵ Ibid.

²⁶⁶ Vladimir Trishunkin et al., “Process of Improvement, Part 1” (Процесс совершенствования), MTO VS RF, Sept. 2022.

²⁶⁷ Ibid.

²⁶⁸ Trishunkin et al., “Process of Improvement, Part 2.”

network of transport infrastructure facilities; and the complexity of the logistics of supply transportation.²⁶⁹

²⁶⁹ Ibid.

Conclusions and Key Findings

Russia began the war in Ukraine with a military whose force design made important trade-offs that would constrain available logistical capacity for such an operation. Specifically, Russian ground forces had a weak ratio of MTO support units to CAAs and a force optimized around decisive use of fires. These decisions were driven by the assumption in Russian military strategy that strategic ground offensives were unlikely to be a significant feature of modern warfare and that the battlefield would be characterized by smaller formations engaged in maneuver defense or offense rather than large groupings of forces holding extended lines.²⁷⁰ The invasion of Ukraine was not intended as a fundamental break with those assumptions but as a “special military operation” existing outside of doctrinal constructs and expectations for force employment. Hence, the operation as launched represented a major mismatch with Russian military planning assumptions on force design and force employment, which were optimized around a short-duration contingency with NATO.

The Russian military invaded with formations generated for short conflicts that lacked self-sufficiency and were unprepared for prolonged combat operations. Logistical support could not keep up with, or scale to, the operation being conducted in the early days of the war. Russian force employment did not align with either logistical capacity or the way in which the Russian military was organized to fight. Despite the collapse of the initial effort, Russian logistics began to adapt to the follow-on Russian campaign in the Donbas starting in the spring of 2022, and the modified logistics effort was able to provide sufficient supply for Russian forces to establish a significant overmatch in fires. In terms of aggregate outputs, Russia’s artillery was adequately supported, although the overall organization made the system vulnerable to long-range precision strikes. Furthermore, Russian efforts at recovery, repair, and replacement appeared overwhelmed at times, given the overall load being placed on the system. Russia’s defense-industrial capacity was likewise ill prepared for mobilization in support of a prolonged war of this type, and little was done in advance of the war to prepare it to meet the demands of a protracted conflict.

The US introduction of long-range strike systems proved highly effective in interdicting logistics operations, but it also led to further reorganization and adaptation within the Russian forces. In time, these measures helped reduced the overall impact and efficacy of HIMARS and other long-range precision strikes by Ukrainian forces. However, these adaptations came at the expense of a degraded fires advantage for the Russian military. Mobilization similarly strained a different part of the Russian logistical system in the fall of 2022, considering it was neither

²⁷⁰ Kofman et al., *Russian Military Strategy*, pp. 14–15.

designed nor optimized to take in so many mobilized personnel on such short notice. Russian planning for mobilization assumed that it would take place before, or at the outset of, combat operations, rather than many months into a war when the system's capacity was already depleted and struggling to keep up with support for ongoing combat tasks. Consequently, even seven months into the war, the Russian military's capacity to adapt was circumscribed by political decisions that prevented rational force employment and preparation relative to the planning in extant doctrine and strategy.

Importantly, even before the war in Ukraine, the Russian logistics and combat service support system was in a state of consistent adaptation, dealing with organizational, capacity, and technical challenges. Therefore, the reforms to this sector were ongoing and incomplete. Overall, modernization programs prioritized other elements of the Russian armed forces over logistical support and MTO units. New systems, from forklifts to conveyers, were developed, but they struggled to enter serial production at scale in time for the war in Ukraine. However, the experience of this war may well lead the Russian military to take a fresh look at the importance of logistics, the ratio of MTO units to operational formations, and the overall priority given to this part of the force. Current efforts to increase defense-industrial output, refurbish equipment in storage, and repair damaged equipment continue to strain the system, but the Russian government has taken several important steps to establish additional capacity.

Measures to improve military logistics will take time to implement, however, and will require substantial additional funding. Over at least the near term, funding and resources for MTO reform and modernization will have to compete with efforts to reconstitute Russia's armed forces, especially its ground forces, once major combat operations in Ukraine have ended. Over the mid term, however, we should expect Russia to take additional measures to strengthen military logistics based on lessons learned during the war in Ukraine and new thinking about the kinds of war that Russia will likely face going forward.

Although the General Staff is still in the early stages of assessing Russia's future military requirements in light of its experiences in Ukraine and protracted confrontation with the West, we are already seeing early indicators of what the Russian military, and military logistics in particular, may look like after reconstitution. If Russia carries through on announced plans to expand the size of its armed forces, this will imply a renewed belief in the need to carry out large-scale, protracted military operations in its near abroad, if not necessarily against NATO itself. Waging protracted, large-scale military operations will in turn require not only an expanded and reequipped ground force but also a substantially larger and more capable MTO force.

Scaling up and supporting protracted ground operations will at a minimum require a sharp increase in both the size and capacity of Russian military logistics. The ratio of MTO forces to combat and combat support troops would need to increase substantially from the current 5-

to-1 ratio. The new force would also require a substantial influx of new and modernized logistics equipment, although many of the systems required for such an effort are already available or in various stages of development. The Russian MoD would need to restock its storage systems with new equipment and ammunition, given that current stocks have been substantially depleted in Ukraine. The MoD also would have to scale up production of artillery ammunition and other key systems and supplies while shifting over more fully to precision artillery as well.

Achieving these objectives in full will be a tall order for Russia post-Ukraine, and it will likely take at least a decade to complete the next cycle of reforms, given the military's pressing need to reconstitute its ground forces and other competing priorities. Moreover, whether Russia will succeed in overcoming its enduring logistical challenges remains an open question given the many structural problems facing the armed forces as a whole, including technological backwardness, systemic resistance to reforms, endemic corruption, Western sanctions, and an institutional preference for weapon systems over logistical capacity. Although the MTO has proven adaptable over time, whether future reforms will fully integrate with changes made elsewhere (from operational-tactical shifts to leadership dynamics and beyond) remains an open question.

Moreover, even if the next cycle of MTO reforms proves largely successful, Russia will be hard pressed to mobilize its forces for a protracted conflict with NATO. Partial mobilization was only a partial test of Russia's mobilization capabilities, and even this required considerable supply, processing, and transportation capacity. Initial assessments have noted both the sclerotic nature of the mobilization and its initial chaos, even though it gradually succeeded in raising and deploying a substantial number of troops.²⁷¹ Yet full mobilization of Russian society to support a protracted conflict with NATO would require a far greater economic, industrial, labor, and societal effort, and there is little evidence that Russia would be up to the task even after a decade of reforms.²⁷² However, given Moscow's not unreasonable assumptions that a future war against NATO would of necessity be a short war, Russia's ability to mobilize society

²⁷¹ Anna Kruglova, "Mobilisation in Russia: How to Convince Men to Fight in Ukraine?," RUSI, Mar. 20, 2023, <https://rusi.org/explore-our-research/publications/commentary/mobilisation-russia-how-convince-men-fight-ukraine>; Alisa Orlova, "Russia's Mobilization: How Kremlin Conscripts Men via Electronic Summons and Use of Facial Recognition to Track Down 'Draft Dodgers,'" *Kyiv Post*, Apr. 25, 2023, <https://www.kyivpost.com/post/16269>; "After Weeks of Chaos, Russia Says Partial Mobilisation Is Complete," Reuters, Oct. 31, 2022, <https://www.reuters.com/world/europe/russia-completes-partial-mobilisation-defence-ministry-2022-10-31/>.

²⁷² Nicholas Trickett, "Can Russia's Economy Withstand Another Wave of Mobilization?" *Riddle Russia*, June 15, 2023, <https://ridl.io/can-russia-s-economy-withstand-another-wave-of-mobilization/>; Katarzyna Chawryło and Iwona Wiśniewska, "Mobilisation in Russia: Society's Reactions and the Economic Consequences," Centre for Eastern Studies, Jan. 20, 2023, <https://www.osw.waw.pl/en/publikacje/osw-commentary/2023-01-20/mobilisation-russia-societys-reactions-and-economic>.

for a protracted armed conflict with the West is unlikely to be a high priority during the next cycle of MTO reforms.

Yet even if the armed forces fall short in certain areas, an expanded and revitalized Russian military supported by a larger and more capable military logistics system would pose fresh challenges for Ukraine and the other former Soviet republics and for Finland and the Baltic countries as well. Although it will be difficult for Russia to fully restore the reputation of its armed forces after the debacle in Ukraine, fielding a revitalized force that is centered on mass and precision firepower and able to support extended military operations in Russia's near abroad would significantly enhance Russia's regional deterrence capabilities while offering the Kremlin an expanded array of military options for future contingencies.

Appendix A: MTO's Stated Goals

According to the Russian MoD, the MTO is responsible for the following:²⁷³

- provision of the Armed Forces of the Russian Federation with weapons and military equipment for the performance of tasks by servicemen to defend the Fatherland;
- (re)fueling of military equipment;
- how a soldier is dressed, shod and fed, how his life is organized;
- what material means (uniform, equipment, household items, etc.) are issued for the use of military personnel and in accordance with what standards;
- washing servicemen, changing, washing and repairing linen in stationary and field conditions;
- repair and restoration of road and rail access roads of non-public use to the facilities of the Ministry of Defense of the Russian Federation;
- organization of the transportation of military cargo, as well as the travel of military personnel for personal reasons and for official activities, including during the period of conscription campaigns;
- receipt, storage, accounting and delivery of material resources from warehouses;
- organization of operation and repair of weapons, military equipment and materiel;
- maintaining the good condition of barracks, buildings, structures located on the territory of military camps, cleaning them, providing utilities;
- ensuring the accuracy and reliability of measurements;
- training of military personnel and junior specialists for their further service in formations, military units and logistical support units;
- veterinary and sanitary control of food, environmental protection measures and fire protection at the facilities of the Ministry of Defense of the Russian Federation.

The MTO is also responsible for “liquidating” consequences of flooding events and natural disasters, facilitating humanitarian relief in Syria, and providing some other Russian assistance to foreign nations (e.g., Italy during the COVID-19 pandemic).²⁷⁴

²⁷³ “Материально-техническое обеспечение Вооруженных Сил Российской Федерации,” Russian Ministry of Defense, accessed Jan. 9, 2022, <https://function.mil.ru/function/mto/info.htm>.

²⁷⁴ Hairemdinov, “The Forge of Quartermaster Manpower—the Rear—MTO.”

Appendix B: MTO Structure

Entity	Mission
Logistics Headquarters of the Armed Forces of the Russian Federation	Responsible for planning and coordinating material-technical support activities across the armed forces in peacetime and wartime
Department of Transport Support of the Ministry of Defense of Russia Units: - Office of military communications - Automobile road service - Service of the auxiliary fleet	Responsible for organizing and planning military railway, air, sea, river, and road transport; construction, management, and repair of military roads; management of the auxiliary fleet
Department of Resource Support of the Ministry of Defense of Russia Units: - Clothing management - Food management - Propellant and fuel management - Military district (fleet) resource support	Responsible for organizing and planning measures to provide material goods and services to the armed forces
Department of Operational Maintenance and Provision of Utilities for Military Units and Organizations of the Russian Ministry of Defense	Responsible for organizing and planning operations of military infrastructure facilities, including troop housing; works related to heating and improving energy efficiency; participation in international military-technical cooperation
Main Armored Directorate of the Russian Ministry of Defense	Responsible for the planning and coordination of the system of tank technical and auto-technical support to the armed forces; development of policy in the development, operation, and repair of armored weapons and vehicles; foreign cooperation in areas of competency

Entity	Mission
<p>Main Missile and Artillery Directorate of the Russian Ministry of Defense</p> <p>Units of military command:</p> <ul style="list-style-type: none"> - Main Rocket and Artillery Command and its science-technical committee - Weapons numbers accounting department - Missile-artillery weapons services of districts (fleets), etc. <p>127 Center for the examination and testing of weapons of Main Rocket and Artillery Command</p> <p>Military units of missile and artillery-technical support (arsenals, warehouses, repair bases, etc.)</p>	<p>Responsible for organizing and planning the provision of military equipment and missile and artillery to the armed forces; issues related to missile-technical support and artillery-technical support of the armed forces</p>
<p>Main Directorate of the Chief of the Railway Troops of the Russian Ministry of Defense</p>	<p>Responsible for planning and coordination of the management of military Railway Troops and their readiness; military railways, including ensuring their survivability; and floating railway bridges</p>
<p>Metrology Department of the Armed Forces of the Russian Federation</p>	<p>Responsible for ensuring the uniformity of military measurements and metrological support of the armed forces</p>
<p>Department of the Russian Ministry of Defense for monitoring the logistics system</p>	<p>Responsible for the collection and analysis of data pertaining to the military-technical support system, as well as the conduct of checks and audits</p>
<p>Directorate of the Russian Ministry of Defense for enshrining the memory of those killed in the defense of the Fatherland</p>	<p>Responsible for works related to those killed and missing in action as the result of military service of the Russian Federation, including abroad; fingerprinting servicemembers</p>

Sources: Russian Ministry of Defense, <https://function.mil.ru/function/mto/info.htm>; <https://structure.mil.ru>.

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Abbreviations

BTG	battalion tactical group
CAA	combined-arms army
CMTO	centralized military logistics center
COA	course of action
CSTO	Collective Security Treaty Organization
HIMARS	High Mobility Artillery Rocket System
ISR	intelligence, surveillance, and reconnaissance
MD	military district
MLRS	multiple-launch rocket systems
MoD	Ministry of Defense
MRO	maintenance, repair, and operations
MTO	material-technical support
MTO HQ	MTO headquarters
NATO	North Atlantic Treaty Organization
OSK	Operational Strategic Command
PLC	production and logistics center
POL	petroleum, oil, and lubricants
RFID	radio-frequency identification
RUSI	Royal United Services Institute
VDV	Russian Airborne Forces

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DRM-2023-U-036065-Final

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