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Revisiting RAND's Russia Wargames After the Invasion of Ukraine

Summary and Implications



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About This Report

In mid-2022, after the opening months of the Russian invasion of Ukraine, a group of RAND Corporation researchers assembled an internal workshop to examine the recent events of the Russia-Ukraine War. All the participants had been involved in the design and execution of RAND tabletop exercise wargames involving Russia during the preceding eight years, mostly centered on the challenges facing a North Atlantic Treaty Organization defense of the Baltic states. The focus of their deliberations was understanding the reasons for the similarities and differences between how Russian forces had fared in those games and the relatively poor real-world performance of the Russian armed forces in Ukraine. This report summarizes the unclassified conclusions of the workshop that followed a comprehensive review of wargaming methods and analysis used, and it identifies implications for future wargaming and analysis of potential conflicts involving major power adversaries. This is not an in-depth research report about Russian military capabilities or the war in Ukraine but rather the proceedings of an internal workshop from experienced wargamers reflecting on recent events. This report should be of interest to defense and security analysts, policymakers, and wargaming practitioners.

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Revisiting RAND's Russia Wargames After the Invasion of Ukraine

Introduction

In March 2022, as Russia's "special military operation" in Ukraine was devolving from a blitzkrieg intended to achieve victory within a few days or weeks into an unfolding military fiasco for the invaders,¹ we reexamined tabletop exercise (TTX) wargames involving Russia that were conducted by the RAND Corporation during the preceding eight years. Mostly focusing on scenarios involving a Russian invasion of the Baltic states, these TTX games tended to feature powerful Russian attacks against the North Atlantic Treaty Organization (NATO) that the United States and its allies were hard pressed or, more commonly, unable to fend off using their planned and programmed force postures and military capabilities.² The contrast between the hypothesized capabilities of Russian forces in these TTXs and Russia's conspicuously poor real-world performance in the opening phase of the invasion of Ukraine was striking.³ This report summarizes our most salient observations and conclusions about how Russian capabilities and actions were represented in the wargames by our designers and players. The joint warfighting functions (command and control, information, intelligence, fires, movement and maneuver, protection, and sustainment) provided the framework used for capturing and organizing senior researcher observations for this review.⁴ Using these observations, we discuss the nature of and reasons for the differences between the wargames and the actual patterns of warfare observed during the first phase of the 2022 invasion of Ukraine (through mid-April when Russia abandoned its offensive to seize Kyiv) and implications that analysts and planners should consider in the future when conducting wargames or interpreting their results.⁵

¹ Andrew Osborn and Polina Nikolskaya, "Russia's Putin Authorizes 'Special Military Operation' Against Ukraine," Reuters, February 23, 2022.

² See, for example, David A. Shlapak and Michael W. Johnson, *Reinforcing Deterrence on NATO's Eastern Flank: Wargaming the Defense of the Baltics*, RAND Corporation, RR-1253-A, 2016; and David Ochmanek, Peter A. Wilson, Brenna Allen, John Speed Meyers, and Carter C. Price, *U.S. Military Capabilities for a Dangerous World*, RAND Corporation, RR-1782-RC, 2017.

³ For a description and analysis on the initial phase of the Russian invasion of Ukraine in 2022, see Mykhaylo Zabrodskyi, Jack Watling, Oleksandr V. Danylyuk, and Nick Reynolds, *Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine, February–July 2022*, Royal United Services Institute, 2022.

⁴ Joint Publication 3-0, *Joint Operations*, Joint Chiefs of Staff, October 18, 2022.

⁵ For a discussion of the use of wargames as a tool for policymaking and analysis, including their value for exploring what might happen in the future and their unsuitability for predicting what *will* happen, see Elizabeth M. Bartels, *Building Better Games for National Security Policy Analysis: Towards a Social Scientific Approach*, dissertation, Pardee RAND Graduate School, RAND Corporation, RGSD-437, 2020; and Stacie L. Pettyjohn and David A.

Wargame Design Objectives and Scenarios

The analysis examined a selection of seven wargames or wargame series conducted between 2015 and 2021 that were representative of our larger body of Russia-related wargaming during this period.⁶ Although the wargames' analytical focuses varied, as did the services and agencies sponsoring the games and the players participating as Red and Blue teams, all games in our selection were multidomain in scope. The games ranged from tactical to theater level and employed a variety of methodologies, rule sets, and classification levels. Some were played only a few times, others were conducted repeatedly with a wide variety of different players.⁷ This report (1) focuses more on the design of the games and the representation of the combatant forces within them than on in-game player decisions and outcomes and (2) addresses patterns that were obtained or observed across multiple games, not events or observations from individual wargames.

The scenarios for the wargames examined here shared the following basic characteristics:

- Conflicts involved a Russian (Red) combined arms attack against one or more of NATO's Baltic members (except for one game that was set in Ukraine). U.S. and other NATO forces (Blue) fought to defend against this attack. The scenarios varied regarding which NATO states were contributing Blue forces, and some postulated that Sweden would actively support the NATO effort. In most cases, Red players were allowed to deploy Russian forces in Belarus and to conduct operations from its territory if they chose.
- Red military objectives varied across games. They most often involved seeking to defeat and at least temporarily occupy some or all of the Baltic states, but some Red teams instead pursued limited-aims strategies intended to seize more modest amounts of territory, usually in Latvia and Estonia, placing the onus of deciding whether to fight a costly war to reverse those gains on NATO.
- Russia's objective was to win the war quickly and at a relatively low cost, before the full weight of U.S. and other NATO allies' capabilities could be brought to bear against Russia, and to the extent possible to prevent escalation of the conflict into a world war. However, Red players were typically permitted to use nonstrategic nuclear weapons later in the operation if needed to head off Blue buildup and rollback of early Red gains.

Shlapak, "Gaming the System: Obstacles to Reinvigorating Defense Wargaming," *War on the Rocks*, February 18, 2016.

⁶ Our analysis examined a comprehensive range of military missions and functions represented in these wargames; this summary report focuses on the unclassified observations from those wargames that appeared most salient for drawing comparisons with the opening phase of the 2022 Russian invasion of Ukraine. Conversely, we do not discuss all of the factors that shaped the course of the fighting in Ukraine, only those that parallel or contrast with the earlier wargames in ways that are noteworthy.

⁷ Karl P. Mueller, "Paper Wargames and Policy Making: Filling the Baltic Gap or How I Learned to Stop Worrying and Love the D6," *Battles Magazine*, No. 11, May 2016. Players in the various games were typically a combination of military and civilian personnel from the U.S. armed services and the U.S. Department of Defense and subject-matter experts from the intelligence community, RAND, and other policy analysis organizations, but they also included officers and government officials from approximately a dozen European allied and partner countries.

- Blue players were usually tasked with the objective of restoring the territorial integrity of invaded NATO members while avoiding the use of nuclear weapons or other major escalation.
- Although both sides in the conflict sought to limit its geographic spread, fighting extended into other parts of Europe and Russia (although Blue players were often restricted from striking deep into Russian territory). Combat sometimes spread beyond the European theater to include strikes against U.S. or Russian targets in other parts of the world, and usually into space and cyberspace domains.
- Scenarios were set at least five years in the future, and usually ten to 15 years (resulting in scenario dates ranging from the late 2010s to the early 2030s). None of the games discussed here was based on or designed to assess actual U.S. or NATO war plans.
- Depending on the purpose of the game, hypothesized future Russian forces and capabilities were pitted against existing U.S. and NATO capabilities, expected future capabilities based on currently projected defense programs, or potential capabilities and force posture not currently programmed to explore the use and value of alternative future forces.

The selection of scenarios for these games did not signify an expectation that an invasion of the Baltic states was likely to occur or that a large-scale conventional attack was the most likely form that Russian aggression in Europe might take. Instead, it reflected defense strategy priorities and assessments by the game sponsors and/or the researchers that such a conflict was plausible and that the magnitude of its potential consequences made examining how to deter or defend against it an issue of great policy importance.⁸

The policy motivation for a professional wargame is, or at least should be, central to its design. These games typically focused on generating insights regarding two overlapping policy goals: (1) deterring a Russian attack against NATO and (2) preventing Russia from achieving a military success if deterrence failed. A third goal, avoiding catastrophic escalation, lay in the background—and often moved to the foreground—of each game. These considerations led to three key premises in nearly all the scenarios, two of which loom large in comparing the games with real-world events in Ukraine.

First, the game scenarios and the combat strengths and other capabilities assigned to units and formations assumed that the Russian aggression would be well resourced, intelligently organized, and competently executed at the operational level within the bounds of known or projected Russian military doctrine and capabilities. In short, the game designers, and the Russia experts among the Red players, posited that Russia would not launch an attack against NATO that it was poorly prepared to carry out.⁹ This prediction was due, in part, to making assumptions based on Russian doctrine and past performance (as will be discussed in the following sections of this report) and also to the policy goals that drove the research. We were tasked to explore

⁸ Karl P. Mueller, David A. Shlapak, Michael W. Johnson, and David A. Ochmanek, “In Defense of a Wargame: Bolstering Deterrence on NATO’s Eastern Flank,” *War on the Rocks*, June 14, 2016.

⁹ However, some of the games did explore *cold start* scenarios in which Russia launched its attack with minimal preparation to give the defenders little time to prepare.

stressing cases for NATO, not rosier situations in which Russian invasions were weak or inept, or in which the Kremlin needed to be convinced that launching such an attack would be a bad idea. An adversary that lacks confidence in its own military capabilities tends to be easy to deter, thus wars are usually started by states that anticipate, rightly or wrongly, that their armed forces have a reasonable prospect of success at an acceptable cost.¹⁰ The result often means that, on one hand, the adversary can have a relatively accurate assessment of its prospects for success in war but, on the other hand, a possible overconfident assessment that can potentially lead them to underperform in war. This finding seems to have played out in Russia's 2022 invasion of Ukraine.

A second scenario premise, which was not a worst-case assumption for Blue, was that regardless of Russia's prewar expectations, the invaded countries, the United States, and other key NATO members would energetically resist the Russian attack. This scenario was again driven by policy salience: It might be interesting to know what a Russian invasion of Ukraine that faced minimal resistance would look like, but it would not be very useful for U.S. policymakers. However, there was considerable variation among the game scenarios with respect to the Western defense posture and capabilities they included, the extent of contributions from specific Alliance members and partners, and other factors.

Finally, the games generally focused on the first days or weeks of an invasion of Ukraine, in the expectation that this phase would be the decisive period for deterrence.¹¹ If Russian forces could surround or seize the cities that are the capitals and principal population centers of the Baltic states in short order, the outcome would be unsatisfactory for NATO. More importantly, if Russian leaders expected to be able to quickly and inexpensively achieve their operational objectives on the battlefield, presenting the major Western powers with a *fait accompli*, there would be a plausible path to deterrence failure in spite of NATO's greater size and wealth—they could believe that Alliance members would be unwilling or unable to fight a long and costly war with high escalation risks to liberate lost territory from the control of a powerful, nuclear-armed enemy.¹² Therefore, threatening Russia with eventual defeat over the long term would be less appealing for the Western allies as a deterrent than convincing Moscow that an invasion would fail to achieve even initial success, and the direction given to Blue players was typically to prevent Russian forces from seizing or surrounding and bombarding Tallinn, Riga, or Kaunas. Thus, these games were not based on an expectation that a Russian attack against NATO would lead to a short war, but on the premise that making a short, victorious war appear unachievable to Moscow should be a central objective of U.S. and allied deterrence strategy against Russia. In hindsight, having a longer focus of how Russia might proceed if the conflict lasted months or

¹⁰ Geoffrey Blainey, *The Causes of War*, 3rd ed., Free Press, 1988.

¹¹ David A. Shlapak, *The Russian Challenge*, RAND Corporation, PE-250-A, June 2018.

¹² Karl P. Mueller, "Conventional Deterrence Redux: Avoiding Great Power Conflict in the 21st Century," *Strategic Studies Quarterly*, Winter 2018.

even years might have highlighted weaknesses in Russia's military capabilities—and that longer focus was not the underlying premise and focus of the games we conducted.

These scenario assumptions were not predictions, except to the extent that the game designers presumed that Russia would not launch an attack against NATO without having some expectation of success. Nevertheless, the differences and the similarities between the post-2014 Russia wargames and actual events in Ukraine are striking. When Russia invaded Ukraine in early 2022, unlike in the wargame scenarios, Russia's offensive was not well resourced relative to the ambitious tasks that Russian forces were given, well organized, or well executed in the face of staunch Ukrainian resistance supported by Western intelligence and other aid. In contrast, NATO countries were conspicuously united and energetic in helping Ukraine even though it was not an Alliance member. With regard to duration, the Russia-Ukraine War turned out to be far removed from the short, decisive military action that the Kremlin intended or even the harder-fought Russian battlefield successes that often played out in the Baltic defense wargames.

Campaign Design, Organization, and Command and Control

Across various capability areas, the most basic assumption made by the game designers about the Russian armed forces in the wargames was that they would function more or less as intended, although their performance would reflect known limitations and deficiencies in materiel, personnel, organization, logistics, and training. With respect to command, control, and communications (C3), this function entailed having the ability to plan, coordinate, and conduct combined arms operations coherently, at least in the absence of Blue actions to disrupt Red operations, consistent with Russian military doctrine. This effort included the expectation that Russia's theater C3 would be adequate to manage an invasion on multiple axes of advance and to direct a basic though not exquisite level of cooperation among the Russian army, Russian airborne forces (VDV), Russian aerospace forces (VKS), and other components allocated to the operation. As noted above, this approach served the wargaming objective of examining whether and how Western forces could be effective against Russian forces that were performing at a reasonable level of competence.

Because even overoptimistic Russian leaders would presumably consider an attack against NATO to be serious business involving considerable risk, game scenarios generally assumed that Russia had carefully planned its attack, chosen a time and manner for starting the conflict that would work to its advantage, and brought at least the leading echelons of its forces to a high state of readiness prior to the invasion. A typical force-sizing assumption was that each Russian brigade in the proximate military districts would be able to form one or two deployable, fully manned battalion tactical groups (BTGs) from its contract troops and that competing demands on Russian forces would be light enough to allow a large proportion of these and other units to be committed to the operation. How Russia could mobilize the country to wage a long war was generally not a matter of concern given the games' focus on the initial stages of conflict.

Assumptions about how much strategic and operational warning NATO would have and how well prepared its forces would be to meet the attack varied depending on the scenario, but the games tended to assume a gradually developing crisis followed by a week or two of unambiguous warning during which NATO could begin deploying additional forces. (Scenarios in which NATO was taken entirely by surprise were rarely considered because there would be little to learn from seeing a Russian invasion easily overwhelm a woefully unprepared opposition.) The United States and its allies were also often given credit for having developed the ability to mobilize and deploy NATO Response Forces and to unpack and field pre-positioned equipment sets faster in the games than was plausible at the time, although these aspects were not sufficient to offset Russia's expected numerical and geographic advantages on the Baltic front.

The 2022 invasion of Ukraine mirrored these assumptions in some respects. Russia enjoyed many of the advantages posited in the wargames: abundant time to prepare its plans and forces for the attack, freedom to choose when and how the war would begin, the ability to operate from Belarusian territory, and an absence of competing security demands that would limit its ability to shift forces from elsewhere in Russia to participate in the operation. Russia's 2022 invasion of Ukraine enjoyed a numerical advantage in ground forces relative to Ukraine's defense forces, though still a smaller numerical advantage for Russia than in the Baltic wargame scenarios. Russia did have, however, a great preponderance of airpower in its favor in its 2022 invasion, in contrast to the aerial disadvantage it faced against NATO in the wargames. In addition, although Ukraine as a whole is larger than the Baltic states, the distance from the Russian border to Kyiv is comparable to that from Russia to Riga or Tallinn.¹³

In the actual invasion, Russia's strategy and organization for the campaign squandered these advantages. Designing an operation based on the optimistic assumption that a lightning attack would overwhelm a weak Ukrainian defense opened the door to a catastrophic Russian failure when the defenders turned out to be far more determined than expected.¹⁴ Effective command and control was undermined by a lack of unity of command, a dearth of planning and preparation for how to overcome serious resistance, and the remarkable decision not to inform most of the participants in the invasion force that they were going to conduct an invasion until it was about to begin.¹⁵

¹³ Kyiv is roughly 210 km from Russian territory as the crow flies and 130 km from Belarus, while the distances from Russia to Riga and Tallinn are some 220 km and 180 km, respectively. Odesa is approximately 220 km from Russian-occupied Crimea.

¹⁴ Although it is not a point of contrast between the TTXs and the Russia-Ukraine War, it is important to note that Ukrainian capability and will to resist a Russian invasion were also widely underestimated in the United States.

¹⁵ Dara Massicot, "What Russia Got Wrong: Can Moscow Learn from Its Failures in Ukraine?" *Foreign Affairs*, March/April 2023.

Land Force Fire and Maneuver

The rapid Russian advances that were often observed in the Baltic wargames, especially when Blue was playing with current or programmed future forces,¹⁶ were primarily due to the following three factors:

- projected Russian numerical advantages, particularly in armor and artillery
- Russian ability to conduct rapid movement and bypass stubborn resistance
- dense Russian air defenses limiting NATO employment of airpower over the battlefield.

Force Composition and Performance

The Russian invasion force posited in the wargames—typically on the order of 60 fully manned BTGs heavily supported by additional artillery and air defense units, based on assuming that ongoing and projected Russian military expansion would continue through the date of the scenario—greatly outnumbered the land forces of the Baltic states and other NATO forces expected to be available in the region at the start of hostilities. This disparity was particularly large with respect to heavy mechanized forces, cannon and rocket artillery, and ground-based air defenses,¹⁷ even with the assumption that the rotational U.S. armored brigade combat team (ABCT) stationed in Eastern Europe under the European Deterrence Initiative (EDI) would be mostly or fully assembled in northeast Europe prior to the invasion.¹⁸

Unit combat ratings were estimated based on standard weapons effectiveness index scores and assumed continued modernization of Russian ground forces in the years preceding the date of the scenario setting. However, they were adjusted to reflect the expectation that NATO forces would fight more capably and be more effective than Russian forces, in addition to differences in the quality of armored fighting vehicles (AFVs) and other systems. For example, a combined arms battalion in a U.S. ABCT was typically rated as being roughly twice as powerful as a first-line Russian tank or mechanized infantry BTG. However, the games assumed that Russian forces would fight well within the bounds of their training and doctrine and that they would follow that doctrine. For example, Russian forces would lead with powerful artillery barrages against known enemy units before contact to offset NATO advantages in direct fire.¹⁹ In general, capabilities

¹⁶ Most notably, “Russian forces eliminated or bypassed all resistance and were at the gates of Riga, Tallinn, or both, between 36 and 60 hours after the start of hostilities” (Shlapak and Johnson, 2016, pp. 4–5).

¹⁷ Scott Boston, Michael Johnson, Nathan Beauchamp-Mustafaga, and Yvonne K. Crane, *Assessing the Conventional Force Imbalance in Europe: Implications for Countering Russian Local Superiority*, RAND Corporation, RR-2402, 2018.

¹⁸ In typical Blue orders of battle for Baltic defense TTXs, fewer than a dozen maneuver battalions in the mobilized armies of the Baltic states, augmented by three multinational battalion-sized NATO Enhanced Forward Presence battlegroups, might be reinforced during a two-week crisis prior to hostilities by up to three brigade equivalents of U.S. and allied airborne forces, the EDI ABCT, a Germany-based Stryker brigade combat team, and possibly one brigade from the Polish army. However, NATO airborne infantry units are not mechanized like VDV, and few of the Baltic units were equipped comparably to their allies’ heavy forces.

¹⁹ Scott Boston and Dara Massicot, *The Russian Way of Warfare: A Primer*, RAND Corporation, PE-231-A, December 2017.

demonstrated by Russian forces in Syria and the post-2014 fighting in the Donbas were assumed to have become characteristic of the broader Russian ground forces by the time of the attack against NATO. VDV were expected to be able to operate effectively in concert with regular ground forces, and they were generally used as additional ground maneuver forces or as reserves for the invading armies.

Partly because of the short war focus of the games, the morale of Russian forces was expected to be sufficient for units to be able to continue fighting until they had suffered heavy losses, so attrition was assessed on the basis of physical damage to systems. NATO forces were expected to defend tenaciously but were disadvantaged by their relatively small numbers and overstretched by the space they had to defend.

The Russian force that invaded Ukraine in 2022, with more than 100 BTGs assembled over a period of months, was larger than the Red invasion forces in the wargames, but it did not enjoy a similar numerical advantage over the large, mechanized Ukrainian army. Moreover, many of its units appear to have been understrength, particularly with respect to infantry, and they were not well prepared for (or, in many cases, even informed in advance about) the operation they were to conduct. Finally, expecting to face only weak opposition, the units did not effectively employ Russian tactical doctrine in the early fighting, their combat performance was often unimpressive, and they suffered heavy losses that fell disproportionately on VDV and other relatively elite units being employed as the spearhead of the invasion.

Movement, Terrain, and Force-to-Space Ratios

The design of the Baltic TTXs anticipated that Russian forces would be able to move quickly during their invasion and that they would prioritize maintaining a high rate of advance to reach their objectives before NATO's superior airpower had enough time to inflict heavy attrition against them. Doing so depended on the invasion force being able to move on multiple lines of advance, with tactical units able to operate off-road, and on Russian training and coordination being sufficient to enable units to maneuver around enemy forces that had engaged units ahead of them if these could not be quickly overrun.

This approach appeared plausible for a Baltic invasion because of two factors. First, the terrain would be relatively amenable to rapid advance, with few natural barriers to movement toward the Baltic capitals, such as substantial rivers, provided that Russian forces chose a suitable time of year for their attack with an eye on trafficability of the ground. Urbanization in the Baltic states is sparse because of their low population density, and secondary and logging road networks in the forests of eastern Estonia and Latvia appeared to be sufficient to enable such an offensive, assuming the Russian forces were prepared to take advantage of them.

Second, force-to-space ratios for the Baltic defenders would be extremely low, preventing them from maintaining a continuous defensive line. Fewer than ten Baltic and other NATO brigades, several of which would be unmotorized leg infantry, would be defending an area about the size of West Germany, creating many opportunities for an invading force in a hurry to bypass

enemy forces, provided it had sufficient intelligence, surveillance, and reconnaissance (ISR) to track them and C3 capabilities to redirect advancing units as the situation developed.²⁰

Ukraine in 2022 presented a very different set of conditions. Particularly in the advance on Kyiv, the Russian force was largely limited to advancing along major roads, natural obstacles were plentiful (and the defenders were able to strengthen them), and the invaders faced heavy attacks by light units armed with very large numbers of antitank guided missiles (ATGMs) and light antitank weapons, Ukrainian armored forces, and, most potently, Ukrainian artillery, operating on the basis of a good intelligence picture of Russian movements. These defenses could not be bypassed, and the drive toward Kyiv broke against them. Not all Ukrainian territory was as favorable for defense, but Ukraine's geographic size meant that it had a far greater ability to trade space for time as the Russian forces advanced than the defenders of the Baltic states would have.

Artillery and Attack Aviation

The Baltic wargames assumed that both sides' artillery could fire out effectively to maximum range and that the availability of sufficient ammunition for tube and rocket artillery would not be a limiting factor on operations. They did not assume unlimited numbers of missiles for short-range ballistic missile (SRBM) units, but in short-war scenarios, the Russian forces generally did not run out of missiles. Russian artillery targeting was expected to be supported by unmanned aerial systems (UASs) and other ISR resources and used particularly for bombardment and combined arms fire support against massed targets that were stationary or on the march through predictable choke points. The games assumed that Russian sensor-to-shooter performance would be on par with capabilities demonstrated on a smaller scale in Syria and in the Donbas after 2014²¹ and that counterbattery capabilities would be respectable, provided targeting was available. UASs were expected to be particularly useful in the Baltic invasion because of the scarcity of short-range air defenses (SHORAD) in the U.S. and NATO order of battle.

Similarly, Russian attack helicopters were expected to be capable and effective in providing fire support for the advancing invasion forces. Although they would be vulnerable to SHORAD and man-portable air defense systems (MANPADS), they would generally not face a high density of such defenses in a Baltic invasion based on then-current modernization plans for the NATO armies, and losses did not exceed sustainable levels in the games.

In Ukraine in early 2022, effective artillery support for Russian maneuver forces often turned out to be scarce, although artillery fires would later emerge as the backbone of Russia's combat power as its force employment reverted to more traditional doctrinal behavior. Russian attack

²⁰ It is important to note that, in the mid-2010s, the large territorial defense forces of the three Baltic allies were only lightly armed, limiting the extent to which they could be expected to seriously delay an invasion by a large, mechanized force that was prepared to clear obstacles as it advanced.

²¹ Michael Simpson, Adam R. Grissom, Christopher A. Mouton, John P. Godges, and Russell Hanson, *Road to Damascus: The Russian Air Campaign in Syria, 2015 to 2018*, RAND Corporation, RR-A1170-1, 2022.

helicopters were soon discouraged from venturing close to Ukrainian units because of losses suffered to SHORAD and MANPADS, particularly after additional supplies of the latter began arriving in Ukraine in large numbers from Western donors. Unsuppressed Ukrainian air defenses also greatly limited the use of stand-in fixed-wing air support.²²

Logistics and Sustainment

Sustainment of Russian forces during an offensive was not an area of focus in wargames examining the initial days of a Russia-NATO conflict because such a focus would have needed to be in games about prolonged conflicts. Assumptions that Russian forces would seek to advance as quickly as possible (both for strategic reasons and for self-protection) and would be able to bypass points of serious resistance led to an expectation that the invasion force would generally rely on unit basic loads of consumables to sustain its initial advance and that equipment maintenance would not be a serious problem in the opening days of the war. Therefore, interdicting the Red logistics tail tended not to be as urgent a priority for Blue as blunting the initial offensive, particularly as NATO would have to make hard choices about how to allocate its airpower in the face of potent Russian air defenses.

This deemphasis on representing Russian logistics was also fed by an assumption that, before launching an attack against NATO, Russia would have made the preparations necessary to sustain it. For example, even if Moscow expected that its forces would quickly overrun the Baltic states, sustaining the occupation force would require having mobilized or acquired large numbers of trucks to transport supplies forward from Russian depots and railheads in the face of NATO airstrikes and partisan resistance.²³ (Multiplying the number of vehicular targets in the advancing force would also complicate targeting for NATO attacks seeking to selectively strike high-value combat systems, such as AFVs and artillery.)

In 2022, in spite of months of preparation, Russia's invasion of Ukraine was not supported by such a robust logistics effort, reflecting the expectation that it would meet little effective resistance, and this became a key vulnerability of the offensive thrust toward Kyiv in particular. These problems were exacerbated by the poor maintenance condition of many Russian combat and logistics vehicles at the start of the operation.

Some of the games devoted significantly more attention to the sustainment challenges facing NATO and the difficulties associated with moving Blue reinforcements toward or into the Baltic states before and during a conflict, because this was a matter of considerable concern for U.S. planners, and these are generally considered longer-duration scenarios because sealifting heavy

²² Justin Bronk, *Russian Combat Air Strengths and Limitations: Lessons from Ukraine*, CNA, April 2023.

²³ On the logistics challenges of Russian expeditionary operations, see Ben Connable, Abby Doll, Alyssa Demus, Dara Massicot, Clint Reach, Anthony Adler, William Mackenzie, Matthew Povlock, and Lauren Skrabala, *Russia's Limit of Advance: Analysis of Russian Ground Force Deployment Capabilities and Limitations*, RAND Corporation, RR-2563-A, 2020.

forces from the United States to Europe and mobilizing Western European armies would require considerable time. That being said, Blue teams were often given the benefit of optimistic assumptions about the availability of artillery ammunition and the speed with which reinforcements could be mobilized and deployed in the future time frame being represented.

Unlike general sustainment considerations, the effects of having limited inventories of key high-end munitions for both sides, particularly cruise and ballistic missiles, figured prominently in most of the games, with both Russia and NATO easily able to exhaust their stockpiles of such weapons in a matter of days.

Issues related to national defense production capacities or the effects of economic sanctions on the belligerent nations' economies were generally not addressed in these games. Neither side was expected to be able to sustain operations at high intensity—much higher than those in Ukraine in 2022—for many months or years. Taking into account the context of an overarching scenario in which Russia would attack NATO countries in the Baltics, these wargames assumed that Russia (1) would not start a war it expected to last that long and (2) would likely seek war termination if a conflict against NATO became prolonged to the point that Russia was unable to sustain its war operations.

Airpower, Air Defense, and Long-Range Strike

Russia's tendency to perform well in Baltic TTXs had much more to do with its land power than its airpower. However, Russia's long-range strike capabilities and its integrated air defense system (IADS) profoundly shaped the hypothetical conflicts.

Command of the Air

In the air, NATO's position of disadvantage relative to Russia on the ground in Baltic invasion scenarios was reversed. VKS faced superior U.S. and allied ability to generate sorties and the superior training and technological capabilities of the NATO air forces; in particular, the Russian forces faced U.S. Air Force F-22 fighters and bombers and NATO F-35s fighters. However, three factors offset these advantages.

First, Russia's multilayered, mobile air defenses—ranging from large numbers of tactical surface-to-air missiles (SAMs) deployed with their ground forces to highly capable long-range strategic SAMs deployed forward from positions around Moscow and St. Petersburg to extend an air defense over most of the Baltic states—seriously limited NATO's ability to operate aircraft over the battlefield in the early period of the war and posed a dilemma for Blue teams. Earlier-generation NATO fighters were subject to very heavy losses when they flew into the reach of the Red IADS, and even fifth-generation jets suffered substantial losses when they did so. However, holding back at safer stand-off ranges until a campaign aimed at suppression of enemy air defenses (SEAD)/destruction of enemy air defenses (DEAD) could degrade the IADS threat would allow Russian forces to advance toward their objectives with only modest interference

from NATO airpower, unless Blue was provided by the scenario with hypothetical weapons capable of hunting and killing armored targets from long range. Even then, the games assumed that Russia would be adept at using decoys and other camouflage, concealment, and deception (CCD) measures to make targeting their forces from long range difficult.

Second, as discussed below, Red teams in the games devoted considerable resources to suppressing NATO's sortie generation by attacking key air bases with ballistic and cruise missiles.

Finally, operating on the offensive, Russia could husband its airpower and rely on its IADS to protect the ground forces most of the time (also helping to avoid fratricide by Russian SAMs), then selectively launch very large strike packages at key targets, such as key reinforcement columns passing through the Suwalki Gap, using superior numbers to overwhelm NATO combat air patrols that were spread thin providing around-the-clock cover for the Blue forces. These would entail costly losses, but it was expected that Russia would accept this outcome in a major war against NATO.

The underperformance of Russian airpower in Ukraine has been among the most striking features of the war—and, for many observers, the most surprising.²⁴ Compared with the smaller and materially less modern Ukrainian air force, the VKS had a wide margin of quantitative and qualitative superiority and have been constrained primarily by Ukraine's IADS and by their own deficiencies in training and capability. The performance of the VKS in the invasion of Ukraine and subsequently suggests that their actual capabilities were overestimated in the design of the Baltic TTXs in some key areas, such as targeting nonstatic targets and being able to assemble and employ large strike packages sometimes involving upward of 100 aircraft. Over Ukraine, formations of more than a few VKS fighters have been rare. Russian abilities to conduct fixed-wing close air support were not rated highly in the TTXs, as turned out to be the case in Ukraine, where even the limited close air support capabilities that the VKS demonstrated in Syria were not replicated.²⁵

Air Defenses and SEAD/DEAD

In the wargames, degrading the Russian IADS tended to be a slow and costly process. Russia's numerous long- and medium-range SAM and SHORAD systems were assessed to be very effective, and Russian SAM units were assumed to be good at exploiting their mobility and CCD techniques to avoid attack. NATO SEAD efforts were more effective when scenarios included a long-range anti-radiation missile for the F-35, an initiative that was notional at the time of the original Baltic TTXs but is now part of the U.S. Air Force's and Navy's acquisition

²⁴ For an overview, see Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, 2022.

²⁵ Ismail Khan, *The Aerial War Against Ukraine: The First Six Months*, FOI, February 2023.

programs, along with joint SEAD efforts to use such weapons as the Army's Precision Strike Missile in concert with airborne sensors to attack enemy air defenses.

Russia's SEAD capabilities were not rated highly in the wargames, for reasons that were later illustrated in Ukraine—it is not a mission of great emphasis or training priority for the VKS—but this was not very consequential, because NATO's ground-based air defenses in the Baltic theater were projected to be extremely limited. If Patriot batteries, which are not elusively mobile, were deployed in the Baltic states, Russian forces would typically destroy them at the outset of the conflict using modest-sized salvos of Iskander (SS-26) SRBMs.

In the Russia-Ukraine War, the inability of the VKS to cripple Ukraine's mobile IADS has been enormously important, largely denying Russian manned aircraft access to the airspace over Ukrainian-controlled territory. This has both greatly limited Russia's ability to use airpower against enemy forces at the front and caused Russia to rely entirely on long-range missiles and loitering munitions for conducting attacks deeper in Ukraine—a position essentially symmetrical to the constraints imposed on Ukrainian airpower by Russia's IADS.

Long-Range Missiles

In the Baltic wargames, launching long-range attacks against targets inside Russian SAM threat rings was a major activity and persistent challenge for Blue teams. However, in many of the games, strikes deep into Russian territory were out of bounds under the rules of engagement posited for NATO due to concerns about escalation risks. Even when not prohibited by the control team, typically there was little reason in the game to expect that striking targets far from the front lines would do much to stop a fast-moving invasion of NATO territory quickly enough to matter.

Red teams, on the other hand, had strong reasons to launch attacks into Western Europe to reduce NATO's ability to generate airpower and to interfere with the movement of reinforcements to the east. In such forward areas as Poland, the weapons of choice for this mission were SRBMs fired from Kaliningrad or Belarus along with ground-launched cruise missiles. Against targets at greater distances—air bases, air operations centers, ports, and prepositioned equipment sites in Germany and beyond—attacks relied heavily on air-launched cruise missiles (ALCMs), such as the Kh-101 (AS-23), which can range most of Western Europe from launch points over Russia, supplemented by land-attack cruise missiles (LACMs) launched from submarines and Kinzhal (AS-24) air-launched ballistic missiles, which were well suited for attacking cruise-missile defenses at targets before the ALCMs arrived.

The TTXs assumed that these weapons would generally strike their targets accurately (a consciously optimistic assumption for some of the missile types, as illustrated by experience early in the invasion of Ukraine) and that Russia's systems for planning strikes against air bases and other fixed targets would perform adequately. Both sides faced limits on their available inventories of modern ALCMs and other long-range weapons, requiring judicious choices about target selection and the timing and the size of attacks: Large salvos of cruise missiles would

deplete the arsenal more quickly, but small attacks risked being insufficient to overwhelm defenses, or simply ineffective—as was illustrated in 2022 by several of Russia’s missile attacks in Ukraine. Russia was able to inflict substantial damage on NATO air bases in the wargames, but it was hampered by having limited numbers of weapons and NATO’s large array of potential operating locations in Europe, provided the Alliance’s air forces had invested in the capabilities needed to take advantage of them; in a war against China, the adversary missile arsenal would be larger, and the number of bases considerably smaller.

When Russia invaded Ukraine in 2022, numerous air-, ground- and sea-launched missile attacks struck targets across Ukraine, including air defense facilities, air bases, C3 nodes, and transportation infrastructure, and these deep strikes have continued throughout the conflict. In general, Russian target intelligence appears to have been more uneven than the Baltic TTXs assumed, and Russian strikes have been more numerous but correspondingly distributed in smaller salvos than typically occurred in the wargames. Russia’s greatest challenge in this area has been its general inability to target and strike mobile targets before they move to new locations, which has proved most consequential in preventing the destruction of Ukraine’s IADS.

Maritime Forces

Although NATO aircraft carriers generated a significant share of the Alliance’s airpower in the Baltic games and carrier strike group escorts contributed hundreds of LACMs for strikes against Russian targets, surface naval forces otherwise played a marginal role in the Baltic defense games. Because both sides possessed potent antiship cruise missile (ASCM) capabilities that could range most or all of the Baltic Sea from aircraft and, in Russia’s case, coast-defense cruise missile batteries in Kaliningrad, during the opening phase of the conflict surface action groups operating in the Baltic Sea tended to be destroyed in short order by salvos of ASCMs large enough to overwhelm their defenses. Russia had much greater freedom to operate surface ships in the northern Black Sea during the invasion of Ukraine, although this access was reduced following the sinking of the cruiser *Moskva* by a Ukrainian ASCM attack in April 2022.

Russian amphibious operations in the wargames were similarly discouraged by the dangers of operating on the Baltic Sea and by the limited size of their amphibious capabilities, a pattern paralleling the events of 2022 when Russia did not attempt amphibious landings in the Black Sea against defended Ukrainian territory. When the Russian Baltic Fleet did mount naval infantry landings in the TTXs, typically as zero-hour *coups de main* against lightly defended coastal areas, the resulting lodgments were small and precarious in the face of NATO airpower.

Both sides in the wargames operated their small numbers of conventional submarines in the Baltic Sea for sea denial, mining, and ISR missions; the Russian Baltic Fleet’s submarines possessed cruise missile capabilities like their counterparts in the Black Sea in 2022, but using these in the games was risky and offered little marginal value when Russia had abundant air- and ground-launched cruise missile capabilities available. Submarine and antisubmarine warfare in

the North Atlantic and the Mediterranean centered on countering Russian submarine threats against NATO carrier strike groups and, for Red, LACM attacks against air bases in Western Europe and sometimes the continental United States.

In general, Russian naval forces were given credit for having been brought to a relatively high state of repair and readiness prior to the conflict, to the degree that this effort was plausible given the age of their older ships.

ISR and Space

Russian military doctrine emphasizes the importance of a reconnaissance-strike complex with rapid sensor-to-shooter connections, and the wargame scenarios generally credited Red with having such capabilities, not least because of Russian kill-chain performance in eastern Ukraine after 2014. The games also assumed that Russia would have devoted considerable effort to intelligence preparation of the battlefield (IPB) prior to initiating the conflict, including having an extensive network of special operations forces and other observers on the ground in the Baltic states and near major NATO installations to augment overhead and other means of intelligence collection where Blue was expected to have an advantage. Thus, both sides were credited with having a good general picture of adversary force posture and large-scale movements, and knowledge of the prewar locations of fixed adversary targets; finding and tracking mobile targets during hostilities accurately enough to attack them depended on the availability of appropriate sensors and the ability to overcome adversary CCD measures.

ISR and targeting were arguably the areas in which Russian capabilities (as revealed by Russia's operations in Ukraine) fell most short of those assumed in the Baltic wargames. Even allowing for the games being set some years in the future, they clearly overestimated the effectiveness of the Russian reconnaissance-strike complex when applied to a large-scale operation, although the degree of Russian IPB failure in Ukraine should not be assumed to predict performance in future conflicts. In contrast, the U.S. ISR picture of the Russia-Ukraine crisis and war has been exceptionally good, and the extent to which this intelligence has been shared with Ukraine has been unprecedented among relationships between the United States and non-allied partners.

Because of the stakes involved in a Russia-NATO war, the wargame scenarios generally posited that the Russian government would be inclined to use antisatellite (ASAT) capabilities against the United States and its allies if doing so appeared to offer substantial military benefits. The degree to which Blue teams had latitude to conduct destructive offensive and defensive counterspace actions varied, given U.S. and allied escalation concerns and the possibility of future major conflicts elsewhere in the world. Dazzling and jamming space-based ISR, communications, and position, navigation, and timing were used more widely than kinetic attacks, and they were routinely employed by Red teams because of the Blue side's greater dependence on space in the Baltic scenarios.

It is not surprising that counterspace activity in the Russia-Ukraine War has not followed this pattern, making it difficult to compare observed capabilities with those hypothesized in the wargames. The stakes in the ongoing conflict are lower, and Russia is not directly engaged in hostilities with the United States and the other powers that are using their space systems to support Ukraine through intelligence-sharing and other means. It is also worth considering that wargame players may tend to be less reluctant to use ASAT capabilities in simulated conflicts than national decisionmakers, at least on the Blue side, would be in real life.

Electronic Warfare, Cyber, and Information Operations

Cyberattack, exploitation, and defense was a prominent component of many RAND operational wargames involving Russia, using rules that concentrated on identifying and adjudicating cyber warfare actions that would have significant effects on the generation and use of military power in the theater battlespace. Players were allocated finite resources for cyberattack and defense, and notably were required to make decisions about prewar preparation of cyber operations prior to the start of the scenario, reflecting the long timelines generally required to gain access to adversary systems. Typically, the Red and Blue teams were credited with having roughly equivalent levels of power in this domain, though not identical capabilities. The rules incorporated a considerable degree of uncertainty regarding how severe, lasting, and widespread cyber effects would be, reflecting both the nature of the domain and the fact that a scenario set five or ten years in the future would involve a future in which the cyber landscape would likely have evolved significantly. On occasion, cyberattacks were quite potent, particularly if one of the combatants managed to penetrate a network that was widely used across the enemy's forces.

As with space warfare, comparisons between events in Ukraine and hypothetical major conflicts between Russia and NATO must consider the stakes involved and the different nature of U.S. and allied involvement in the two cases. Although Red and Blue players in the wargames had to balance the pros and cons of using a prepared cyber weapon versus those of saving such a weapon for future use, the war they were fighting was not likely to be followed by another, more important war in the near future. In 2022, Moscow faced greater incentives to withhold cyber actions that might be useful in a future direct conflict against NATO. Nevertheless, the TTXs generally credited Russia with possessing extensive and potent cyber warfare capabilities than have been apparent in its invasion of Ukraine.²⁶

Electronic warfare was treated more abstractly in the wargames, mainly through incorporating its effects into the adjudication of ISR and attack actions by the forces. In general,

²⁶ Microsoft Digital Security Unit, *An Overview of Russia's Cyberattack Activity in Ukraine*, Microsoft, April 27, 2022; James A. Lewis, "Cyber War and Ukraine," Center for Strategic and International Studies, June 16, 2022.

it was assumed that Russian electronic warfare capabilities, which are emphasized in both Russian doctrine and force structure, were significant and were greater than NATO's.

Strategic communications were generally deemphasized in the wargames except to the extent to which they could potentially have an effect in the battlespace. As with economic warfare and diplomatic sanctions against the adversary, it was assumed that both sides would conduct information operations directed at third parties but that this would not affect the course of the war in the short term, which was the principal focus of the games on which players were directed to concentrate. Communications of threats and negotiation offers among the combatants or with other governments in the region were assumed to be transmitted and received successfully.

Escalation and Nuclear Weapons

The possibility of nuclear escalation loomed over all of the Baltic wargames, often driving substantial restrictions on whether, how far, or under what circumstances Blue teams were permitted to launch strikes against targets in Russia. The games did not explore the possibility of the early use of U.S. nuclear weapons against a Russian invasion that could not be stopped by conventional means because this option—prominent in NATO strategy 30 years earlier—did not appear plausible as a representation of Western decisionmaking in the 2010s.

Red players usually desired (and were often directed) to avoid both horizontal and vertical escalation of the conflict to the extent possible without jeopardizing Russia's prospects for military success, because a short and relatively inexpensive war was expected to best serve Moscow's interests. However, once the fight was joined, launching strikes into Western Europe became almost inevitable given the importance of air bases to NATO's combat power and key logistics nodes to its ability to move ground forces toward the battlefield. Conventional attacks against targets in Western European countries could also be attractive as a means of coercing NATO members or partners to reduce their participation in the war or accept a cessation of hostilities on Russian terms.

Red teams invariably saw using even nonstrategic nuclear weapons as inherently costly and risky, and they were not inclined to consider employment of nonstrategic nuclear weapons when they expected to be able to achieve their objectives using conventional forces alone. They turned to explicit nuclear threats, and occasionally to actual nuclear use, in two types of situation. One was whether the United States conducted kinetic or nonkinetic attacks against such targets as strategic bomber bases or command and control systems that appeared to threaten Russia's nuclear retaliatory capabilities (although in some games Blue teams were precluded from conducting such attacks by their orders to avoid triggering escalation). The other was whether the war had progressed to a point where NATO was poised to take away the invaders' gains and inflict a major strategic defeat on Russia—in which case, nuclear threats could be seen as a potential tool for bringing about war termination, and nuclear strikes against a relatively small number of key NATO air bases or other targets promised to seriously degrade the Alliance's ability to continue generating combat power.

Key Distinctions Between Real-World Russian Operations in Ukraine and Hypothetical Russian Invasions in Earlier Wargames

In summarizing the causes of divergence between the course of the Russia-Ukraine War in the months following the February 2022 invasion and the patterns of earlier RAND wargames centering on the Baltic defense problem, it is useful to distinguish between two categories of factors. The first is the inherent differences between the two conflicts and between Russia's strategy and behavior in Ukraine and how it was expected to act in the game scenarios. The second is those areas in which the games estimated Russian capabilities, modeled conflict dynamics, or focused on particular dimensions of their subjects in ways that recent observations from Ukraine suggest should be reexamined or approached differently in future wargames about Russia-NATO conflicts or other scenarios.

Different Problems, Different Results

Although there are many parallels between NATO defending the Baltic states against a Russian invasion and Ukraine defending itself against one with Western assistance—too many to list here—the inherent differences between them are great. This finding is magnified when looking specifically at Russia's 2022 invasion of Ukraine, with its remarkably optimistic assumptions and campaign design and execution that were dysfunctional even by normal Russian standards.

- **Russian forces did not follow their own correlation-of-forces planning principles, although they did achieve overwhelming superiority in some battles.** In the Baltic games, Russian ground forces greatly outnumbered the defenders and were consistently on the favorable side of even larger imbalances of heavy armor and artillery firepower. Although NATO's airpower was superior to Russia's, its impact on the initial fighting on the ground was limited by the Russian IADS and attacks on NATO air bases. Although an underdog in its fight, Ukraine's army was relatively large and mechanized, had substantial artillery and air defense components, and was provided with exceptional numbers of ATGMs and MANPADS as the flow of Western arms increased.
- **Russian forces were contained to the road network and could not travel off-road because of the terrain, conditions, and command and control limitations.** Russian forces had to fight their way through the defenders on limited avenues of advance, particularly in the approach to Kyiv, rather than often being able to bypass opposition as Red forces were able to advance in the Baltic TTXs because of the low NATO force-to-space ratios and less defensible terrain.
- **There were poor assumptions about the Ukrainian will to fight.** Having expected Ukrainian resistance to collapse quickly, the Russian offensive was neither organized nor prepared to deal with staunch opposition; the Baltic games assumed that Moscow would prepare more seriously for a war against NATO. With Russian forces in Ukraine advancing slowly as a result, and being largely road-bound, the defenders had considerable time to inflict attrition with ATGMs, artillery, and UASs. Early losses were particularly heavy among unit leadership and for elite forces that were leading the invasion, which eroded Russian combat power for later fighting.

- **Russian airpower was not decisive in the face of capable air defenses.** Although Russian airpower did not dominate the skies in the Baltic wargames because of the capabilities of the NATO air forces, it was far less capable over Ukraine due to the failure of the initial missile strikes and subsequent VKS attacks to seriously degrade Ukraine’s mobile air defenses, in addition to its training deficiencies, inadequate targeting, and other force employment problems.

Revealed Deficiencies in Russian Performance to Inform Future Wargames

There were several areas in which reflecting on events in Ukraine suggests that the wargames may have overestimated the prospects for Russian success in a Baltic invasion. These areas offer opportunities to modify assumptions and expectations when designing future games about this or related subjects.

- **Logistics and sustainment-focused wargames.** Sustainment problems affected the Russian army in Ukraine from very early in the war. This was due, in large part, to the deficiencies of the invasion’s strategy and organization and excessive secrecy that precluded adequate planning. It raises questions about how feasible sustaining a blitzkrieg advance to the Baltic capitals, including protecting lines of supply and communication through occupied territory, would have been even with a sounder invasion plan and more diligent preparation. (The logistical challenges for Blue of defending the Baltic states under the conditions anticipated in the TTXs were also discounted in favor of focusing on short-war operational dynamics, however, so it is not clear how much a more restrictive treatment of sustainment considerations would have disadvantaged Red relative to their opponents.) Full incorporation of sustainment factors into operational wargames is a persistent challenge for game designers, and it is most important in long wars and during fighting in places with limited transport infrastructure.
- **Wargaming dysfunctional Red actions.** As discussed earlier in this report, the Baltic wargames intentionally focused on the problem of defending against a well-equipped and competent attacker pursuing a reasonably sensible military strategy. The former involved making assumptions about recent and future Russian military reform, expansion, and modernization that were favorable for Red (although the same was often done regarding U.S. and other NATO forces). Fighting in Ukraine revealed a Russian force that was more poorly equipped and less well trained than expected, that was seriously hollowed out by corruption and other institutional factors, and that could not employ capabilities at a large scale that it had demonstrated in miniature in Syria and the Donbas, to a degree that suggests some of the wargames’ worst-case assumptions about enemy strength may have been less plausible than they were thought to be. Failures of effective combined arms and cross-domain integration and difficulties tracking mobile targets loom large in this assessment. Although the above assumptions may not matter when the goal is to explore what an optimistic enemy (or a realistic but competent one) may expect if it goes to war, it is obviously important when using wargames as a tool to reveal what might happen on the battlefield.
- **Intangible factors versus tangible ones.** Estimating and incorporating the impact of “soft” human factors, such as training and morale, into wargame designs and unit ratings is particularly challenging, especially if intelligence assessments give these factors short shrift compared with information about more readily measurable indicators of military

capability. However, as events in Ukraine have illustrated, their effects can be far reaching, and they are unlikely to be adequately represented by simply discounting or multiplying the combat ratings of units based on their national training standard. For example, forces that are better or worse than their opponents (or their allies) at CCD or at locating enemy units prior to contact will enjoy advantages or suffer disadvantages that may be challenging to represent in TTXs that do not incorporate double-blind play or other limited-intelligence mechanics.

- **Rethinking maneuver rates.** Rates of movement and operational tempo in Ukraine suggest that the Baltic TTXs likely overestimated both of these variables, especially but not only in prolonged operations, leading to an unrealistically hyperactive battlefield. In a conflict that proceeds slowly, there is more opportunity to impose attrition by means other than decisive battles. This is an important area for examination in the design of future RAND wargames and intersects with reconsidering such factors as training and personnel quality because better troops can be expected to outperform worse ones in these respects, much as NATO air forces can be expected to generate more sorties per day with a given number of aircraft than their Russian counterparts can. Conversely, representing the disruptive results of combat, along with force exhaustion and other frictional effects, is an important part of realistic combat adjudication, although it can be messier than estimating equipment losses and munitions expenditure.
- **Reconsidering theater strike assumptions.** The relatively modest impact of Russian long-range strikes on Ukrainian military operations suggests that it would be valuable to reexamine expectations about how effectively Russia would have been able to interfere with NATO force flows and air operations through missile and other attacks against targets in Western Europe. The availability of such enablers as space-based ISR for targeting and battle damage assessment and the quality and capacity of systems for responsively generating targets should be central to forming such assumptions about each combatant.

Concluding Observations

In closing, several additional observations and caveats are in order. One is that the Russia-Ukraine War illustrates the value of examining a variety of scenarios involving a potential adversary, reflecting different potential conflicts but also variations on familiar ones. Another is that Russia's performance in Ukraine may not reflect how it would have approached a potential fight with NATO. Once Russia rebuilds the parts of its forces that have been shattered or depleted by the war with Ukraine, in whatever form that takes, it would be unwise to assume that Moscow would make the same assumptions about adversary unwillingness to fight that it did in Ukraine in 2022 when planning and executing its next war.

For wargamers, comparing the assumptions and hypothetical capabilities in Baltic TTXs with real-world events in the war in Ukraine is a reminder of the importance of clearly explaining the reasons for and the significance of the assumptions made in game and scenario design to participants and other audiences seeking to draw insights from the game afterward so they will learn appropriate lessons. In practice, this would have meant providing detailed explanations as to what the outcomes might have been if these assumptions did not hold true in an actual war.

This was notably an issue in the Baltic TTXs, where examining what Russia might expect to be able to accomplish with an invasion was too easily interpreted as a predictive analysis of what the results of such a conflict would actually be.

Abbreviations

ABCT	armored brigade combat team
AFV	armored fighting vehicle
ALCM	air-launched cruise missile
ASAT	antisatellite
ASCM	antiship cruise missile
ATGM	antitank guided missile
BTG	battalion tactical group
C3	command, control, and communications
CCD	camouflage, concealment, and deception
DEAD	destruction of enemy air defenses
EDI	European Deterrence Initiative
IADS	integrated air defense system
IPB	intelligence preparation of the battlefield
ISR	intelligence, surveillance, and reconnaissance
LACM	land-attack cruise missile
MANPADS	man-portable air defense systems
NATO	North Atlantic Treaty Organization
SAM	surface-to-air missile
SEAD	suppression of enemy air defenses
SHORAD	short-range air defense
SRBM	short-range ballistic missile
TTX	tabletop exercise
UAS	unmanned aerial system
VDV	Russian airborne forces
VKS	Russian aerospace forces

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