

### Boo or Boom?

### Russia's Airstrikes on Ukraine on the First Day of War

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#### Abstract<sup>2</sup>

During the first day of the war, Russia targeted some 30 facilities across Ukraine, firing approximately 100 ballistic and cruise missiles from various land, air, and sea-based platforms. The present article seeks to offer a preliminary analysis of the characteristics of the Russian "opening strike" by examining its target selection, the strikes' degree of accuracy at the tactical level, and its level of conformity to Russia's strategic and operational design.

During the "opening strike," airfields, ammunition depots, anti-aircraft systems, and ports were attacked in line with the Kremlin's strategic design that, in our view, sought to precipitate the collapse of the Ukrainian government while avoiding civilian casualties. What was the Russian objective with the "opening strike" on Ukraine, and what lessons can be learned from its achieved results? In the present article, we probe an alternative explanation to the Russian Air Force's "failure" to gain air superiority over Ukraine and argue that it derived from a lack of intention rather than a lack of capability on the first day of war. Based on our research, it appears that Russia's "opening strike" was not aimed at gaining and exploiting air superiority through the destruction of all targeted facilities but instead aimed at utilizing a shock and awe effect. A large proportion of Ukraine's air defense capabilities, fighter aircraft, and drones were not attacked or damaged during the "opening strike," nor did Russia make any salient effort to swiftly gain air superiority following the failure of the "opening strike."

By simultaneously attacking targets all around Ukraine, the "opening strike" was designed to disorientate Ukrainian leadership and military command regarding the attack's main objectives, showcase Russian military strength for the Ukrainian civilian population, and deter Western powers from intervening in the conflict and providing outside assistance. This latter goal was to be achieved – among other means – by attacking Ukraine's western regions.

In this context, we highlight the role of Russia's use of long-range high-precision missiles, which dovetails with Russia's concept of "deterrence through limited use of force." According to this concept, the use of high-precision long-range missiles, including nuclear-capable ones, is meant to

<sup>&</sup>lt;sup>1</sup> We wish to thank Itamar Heller and Ro'i Zilber, research assistants at Tel Aviv University's Aspire Center for Air and Space Studies, for their extensive contribution to the data collection and analysis at the foundation of this article. Additionally, we wish to express our appreciation to Dr. Tomer Fadlon, Aspire Center for Air and Space Studies' Academic Manager, for his unique insights and suggestions regarding the article's methodology and structure.

<sup>&</sup>lt;sup>2</sup> The views expressed in this article are solely the authors' and do not reflect the position of Tel Aviv University's Aspire Center for Air and Space Studies.

signal Russia's determination against its enemy and its desire to prevent an escalation of the conflict.

In addition, the characteristics of the "opening strike" – "only" 100 missiles and a preference for targeting fixed facilities without follow-up aerial attacks by the Russian forces – alongside its lack of coordination with its other forces, and failure to achieve aerial superiority, suggest that Russia's actual aerial capability and its land and sea firepower abilities fail to match its refined military thinking. It illustrates the failure of Russia's defense procurement plan and theory of warfare to fully implement their vision of a "reconnaissance-strike complex" and create a Russian military structure capable of carrying out real-time, accurate, and continuous attacks on enemy targets.

Based on an analysis of attacks on airfields during the "opening strike" sampling 21 out of 100 missiles, it also appears that Russian missile accuracy rates are lower than the accepted standards for Western GPS-guided munition – a 50-60% direct hit accuracy rate at approximately 10 meters and a 30-40% near-miss rate between 30 and 50 meters.

#### **Background**

By illustrating the present-day military challenges facing a fighting force involved in a large-scale operation, the current war in Ukraine provides a unique learning opportunity. It also deepens our understanding of Russia's doctrinal approach and weapons systems against Western military concepts and weaponry, as the Ukrainian army has adopted NATO standards, relied on weapons systems supplied by the West and on intelligence and other support provided by the US and the UK.

At the time of writing, fighting in Ukraine continues, and there are certain domains in which it is premature to draw conclusions for the future. This is especially true when it comes to analyzing strategic issues. Consequently, we chose to focus our research on a study of the war's **operational aspects** based on completed phases of the conflict that can be examined independently.

This article is intended to be the first in a series of research updates that will examine various aspects of the war in Ukraine. Our first topic is the Russian use of precision-guided missiles in its "opening strike" on February 24, 2022. This choice stems from our observation that Russia's initial military actions in Ukraine were the most carefully planned out of this war. They reflected preliminary Russian planning rather than an attempt to "improvise" solutions to problems encountered during the fighting. Within this framework, we focused on three questions:

- 1. What was the degree of accuracy of these missiles based on the results of the "opening strike"?
- 2. What was the connection between the planning of the "opening strike" and the overall logic of Russian war strategy?
- 3. What were the operational concepts that lay behind the use of long-range missiles at the opening of the fighting?

#### Research Methodology

This research is based on a combination of two conceptual axes. The first one is a *top-down* approach through which we attempted to understand how the use of precision-guided missiles derived from Russian strategic concepts and the Russian army's campaign plan.

The second perspective is a *bottom-up* analysis of the Russian firepower plan. We relied on published works addressing the scope of Russian attacks and targets. Yet, as a primary source of research, we used satellite images of **targeted airfields**, which enabled us to reconstruct the guiding principles behind the planning attack and the actual results of the attacks. We analyzed all the airfield strikes that we were able to connect to the "opening strike" on February 24, 2022: 21 missiles out of 100 fired in total. The generic structure of the airfields helped us identify the approximate targets. The number of strikes that we analyzed and their distribution across eight facilities in different locations across Ukraine provide us with a representative sample that is sufficient for a rough, preliminary assessment of the degree of accuracy of Russian missile strikes on their targets.

This research relies on a range of sources published by research institutes and in the media

regarding Russian attacks, the broader context of military and political moves that Russia has undertaken since the start of its campaign, publicly available assessments from Western and Ukrainian intelligence agencies in the wake of and during the conflict, and information regarding Russian military thinking over the past two decades. We do not have yet any reliable information regarding the campaign logic behind the Russian attack on Ukraine and the opening moves of the fighting. Official Russian statements should be viewed with skepticism, and explanations of Russian activities from Ukrainian and Western sources are not necessarily objective.



#### Attacks on Airfields

# A map of actual aerial attacks carried out by the Russian army in Ukraine on February 24, 2022. Janes<sup>3</sup>

According to various Western sources, Russia used over 100 missiles during its "opening strike."<sup>4</sup> It seems that most missiles used for the attack were surface-to-surface Iskander-M (SS-26 Stone) ballistic missiles, and Iskander-K (SSC-X7) and Kalibr (SS-N-30A) cruise missiles launched from airborne, sea, and ground platforms. It has been suggested that Tochka-U (Scarab-B, SS-21) ballistic surface-to-surface missiles (SSM) were also used on the first day of fighting. When examined on a case-by-case basis – as we did in our research, encompassing hits from 21 out of 100 missiles fired – it appears that the characteristics of damage inflicted to airfields in the attacks fail to confirm the use of Tochka-U SSMs during the "opening strike."

Based on the available satellite images, it is not possible to identify which type of missiles hit the "opening strike" targets. This is due to the similarity of damage caused by these kinds of missiles– each having a warhead of between 500 and 700 kilograms.<sup>5</sup> A significant part of

<sup>4</sup> Brian E. Everstine, Twitter post, February 24, 2022,

<sup>&</sup>lt;sup>3</sup> "Janes Analysis: Ukraine Conflict," Janes, February 25, 2022, <u>https://www.janes.com/defence-news/news-detail/Ukraine-crisis</u> (accessed March 21, 2022).

https://twitter.com/beverstine/status/1496869155420934153 (accessed March 21, 2022)

<sup>&</sup>lt;sup>5</sup> Josh Smith, "Analysis: Russia's missiles see mixed results in Ukraine war as world watches," *Reuters*, February 28, 2022, <u>https://www.reuters.com/world/europe/russias-missiles-see-mixed-results-ukraine-war-world-watches-2022-02-28/</u> (accessed Match 21, 2022).

the missiles targeted airfields and air defense systems. According to Russia's Ministry of Defense spokesperson, 11 air bases, 14 air defense systems, and 36 radar installations were attacked on the first day of fighting.<sup>6</sup>

We analyzed attacks on airfields for which there was sufficient visual documentation. See Appendix A for a detailed analysis of the hits on each of the following airfields during the first day of fighting:

Airfield	No. of missiles	Targets attacked	Principal targets that were not attacked
Kulbakino	4	Mig-29 and Su-25 aprons central apron, bomb storage depot	Mig-29 and Su-24 fighter jets and runway
Ozerne	8	Two central aprons, Su-27 fighter jets, and runway	Su-27 fighter jets deployments
Chuhuiv	4	L-39 aircraft apron and three concentrations of buildings	Su-24 fighter jets, Transport planes, and runway
Vasylkiv	1	Vehicle parking area	Runway and aircraft hangars
Melitopol	1?	Apparent ammunition storage facility	Unknown
Kherson	1?	Apparent fuel reservoir	Unknown
Ivano-Frankivsk	1?	Fuel reservoir	A line of Mig-29 aircraft
Boryspil	1?	Apparent fuel reservoir	Unknown



Location of airfields analyzed in this research (illustration prepared by the ASPIRE Center for Air and Space Studies)

<sup>&</sup>lt;sup>6</sup> "Russia fires cruise missiles at Ukraine military infrastructures," *The Times of Israel*, February 26, 2022, <u>https://www.timesofisrael.com/liveblog\_entry/russia-fires-cruise-missiles-at-ukraine-military-</u>infrastructure/ (accessed March 21, 2022).

#### What was the degree of accuracy of these missiles based on the results of the "opening strike"?

We examined the degree of missile accuracy based on a comparison between the impact point and the estimated target. Our analysis is based on the best estimates as the actual target is unknown. This method has an inherent problem because it makes assumptions about Russian intentions, and projected accuracy levels are low. However, we assume that this rough analysis is sufficiently reliable to conclude that the level of accuracy of Russian missiles is lower than that of standard Western GPS munitions:

- 1. The probability of relatively high accuracy (up to 10 meters): 50-60%.
- 2. The probability of a near miss (30 to 50 meters): 30-40%.
- 3. The probability of missing the target (above 100 meters): 10%.

The reasons for the low accuracy rates are not clear. It is unlikely that the cause is that the striking units were not given enough time to prepare this salvo, since the "first strike" could have been planned secretly and over an extended period.

Possible reasons for relative inaccuracy may be related to:

- 1. Level of Missile Accuracy: The stated accuracy of the Iskander-M ballistic missile, the Iskander-K cruise missile, and the Kalibr-I is just a few meters. Its performance should have been far better than the results seen in the actual attack.
- 2. Geospatial Intelligence Accuracy: The characteristics of hits do not suggest a systematic mistake in geographic coordinates of the targets; rather, random errors whether in coordinates or in missiles.
- 3. Satellite Navigation Jamming Systems: No mention was made in the open sources of Ukraine's use of such systems against the Russians in the first day of the war. Furthermore, Russian missiles use different guidance systems: For example, the Iskander-M uses an electro-optical guidance. Still, as since the campaign's first day, Western forces have aided the Ukrainian army, possibly in navigation jamming.

Due to the present work's scope and limitations, we did not examine the failure percentage of Russian missiles. While some U.S. officials leaked to the Reuter's News Agency that the failure rate could be as high as 60%, however, other "senior defense official" refrained from confirming this estimate and claimed that failure rates changed from day to day.<sup>7</sup> In any case, both sources acknowledged that Russian missiles suffered from a significant failure rate.

# What was the connection between the planning of the "opening strike" and the logic of Russian strategy?

Russia's war against Ukraine was designed to be "a continuation of policy through other means" and was framed as a response to the West's refusal to comply with Russian demands regarding European security architecture. In the last months of 2021, Russia made several demands to the West, including an end to NATO's expansion eastwards, a roll-back of NATO's offensive capabilities from the areas close to Russian borders, and mechanisms to prevent tensions during military exercises and troop movements.<sup>8</sup> In our assessment, which is consistent with intelligence estimates, statements by Western leaders, and the evaluations of leading analysts, President Putin expected that a swift, successful campaign in Ukraine would strengthen his bargaining position in the design

<sup>&</sup>lt;sup>7</sup> Phil Stewart, "Exclusive: U.S. assesses up to 60% failure rate for some Russian missiles, officials say," *Reuters*, March 25, 2022, <u>https://www.reuters.com/business/aerospace-defense/exclusive-us-assesses-up-60-failure-rate-some-russian-missiles-officials-say-2022-03-24/</u> (accessed March 27, 2022).

Senior Defense Official, "Senior Defense Official Holds a Background Briefing", *U.S. Department of Defense*, March 25, 2022. defense.gov/News/Transcripts/Transcript/Article/2979038/senior-defense-official-holds-a-background-briefing/ (accessed March 27, 2022.

<sup>&</sup>lt;sup>8</sup> Andrew Roth, "Russia issues list of demands it says must be met to lower tensions in Europe," *The Guardian*, December 17, 2021, <u>https://www.theguardian.com/world/2021/dec/17/russia-</u>issues-list-demands-tensions-europe-ukraine-nato (accessed March 21, 2022).

of security arrangements with the West with regards to the issues above and also in relation to the global power balance.

In our view, the military strategy behind Russia's initial battle plan included the following components:

- 1. Carrying out a swift offensive from several directions against Ukraine, concomitantly along the front lines and deep inside the Ukrainian territory. The goal was to gain control within a few days it is not clear if actual occupation was intended of the main urban areas within the campaign zone, including the capital, Kyiv, and depose the Ukrainian government.
- 2. Achieving extensive territorial gains via ground forces in the eastern and southern areas of the country east of the Dnieper River and the Azov Sea, where Russian-speaking inhabitants are dominant. It is not clear if the intention was, as the campaign progressed, to also take control of the western territories of the country, where most of the population speaks Ukrainian and is considered to be especially hostile to Russia. It seems that this planning was based on a flawed assessment of the strength of the Ukrainian army and the assumption that it would collapse swiftly as the result of a widespread Russian military campaign.
- 3. Drawing a boundary around the war zone, deterring the Western military from intervening directly in the fighting so that it would only involve Russian and Ukrainian troops. This aim was promoted mostly by threats in the nuclear realm.
- 4. Attempting to avoid significant harm to the civilian population or employment of indiscriminate weapon systems. This attempt was especially evident during the first days of the war and was intended to avoid the creation of anti-Russian sentiments amongst the Ukrainian people. It is also possible that the plan was based on the mistaken assumption that the local population would welcome their "release" by the Russians with "open arms."
- 5. Framing the campaign, in the eyes of the Russian public and the world, as a limited offensive defined as a "special military operation." This is a phrase unique to and invented during this conflict: Fighting on a very limited scale rather than war ("an operation only") with the characteristics of a "special military operation" a concept reserved for special forces/intelligence operations. Additionally, on the opening day of the war and the days following, President Putin described the Russian assault as a preventative step: Russia had no alternative because Ukraine and the West would have acted against Russia if it had not started the fighting.<sup>9</sup>

Along the lines of the components mentioned, the "opening strike" with precise missiles was directed almost exclusively at military targets and was not designed to cause any significant damage. This was most probably due to the Russian planning, that a rapid advance by the of the Russian forces would lead to quick capture of vital facilities. The attack on airfields in the west of the country during the "opening strike" was, it would seem, designed to signal to Western powers and Ukraine that Russia sought to prevent direct Western military intervention in the campaign and to demonstrate its ability to prevent the delivery of Western aid.

# What were the operational concepts that lay behind the use of long-range precise missiles at the opening of the war?

Despite the abundant information, it is difficult to propose a single explanation for Russian campaign logic in general and specifically for the reasoning behind the "opening strike." This derives from Russian military spokespersons' avoidance of providing a detailed explanation about the war-plan. Furthermore, there is a deep gap between the elaborate Russian military doctrinal thinking (held in high esteem before the war by both Russian and Western experts) and the Russian Armed Forces actual performance in the battlefield. The Russian army failed badly, often acting just the opposite of the established military dogmas.

Alike to Western military concepts of the past decades, the Russian military's dominant thinking regarding

<sup>&</sup>lt;sup>9</sup> Website of the President of the Russian Federation, "Obrashcheniye Prezidenta Rossiyskoi Federatsii" [Address by the President of the Russian Federation], February 24, 2022, <u>http://kremlin.ru/events/president/news/67843</u> (accessed March 27, 2022).

the start of war revolved around a massive, multi-dimensional attack, as shown in the Russian conceptualization of "new generation warfare."<sup>10</sup> The Russian army's main threat is a war against NATO forces, and the development of its forces is intended to prepare for such scenarios. Over the past decade, the Russian military has focused on the effective combination of kinetic-military and "non-military" moves – before and after military action.<sup>11</sup> The Russian military has also understood the need to achieve aerial superiority at the start of a conflict<sup>12</sup> and has spent many years developing its "reconnaissance-strike complex" (RUK) capabilities, namely, the ability to direct accurate and continuous fire that is linked to real-time and accurate intelligence data.<sup>13</sup>

As a result, Western experts expected that the war against Ukraine would open as an operational surprise for the Ukrainian army – after the continued buildup of Russian forces prevented strategic surprise – where the Russian troops would attempt to deliver a decisive blow on the "centers of gravity" of the Ukrainian system, both in the heartland and on the front lines. The aim was to crash Ukrainian command and decision-making capabilities. It was expected that the attack would be a combined effort – kinetic, informational, cybernetic, electronic warfare, and synchronized with a political effort. It was estimated that the kinetic component would match the unique characteristics of the Russian army, which is based on massive, statistical firepower combined with modern land, sea, and air capabilities.

While Russian theorists imparted great importance on the "reconnaissance-strike complex" and especially to high-precision firepower, Russian military experts questioned, even before the start of the conflict, the ability of the Russian army to deliver a decisive blow with sufficient quantity of high-precision weapons. This was due to the capabilites' gap between Russian and Western forces in the field of high-precision and guided weapons systems and estimates that Russia has a limited inventory of such weapons.<sup>14</sup>

Additionally, the long-range, high-precision missiles that played a central role in the "opening strike" constitute a major tool in the Russian conceptualization of "strategic deterrence," and especially of "deterrence achieved through a limited use of force." Since most missile platforms used in the "opening strike" have dual capabilities – both conventional and nuclear – their use, apart from any physical damage, emphasizes the ability to use such weapon systems in a nuclear configuration. This signals Russia's determination and its desire to avoid a deterioration to a more severe conflict (according to the Russian escalation management ladder) in which nuclear weapons could be considered. According to the Russian "limited use of force" concept, the targets of long-range missiles are military and economic infrastructures, and they are used to prevent widespread harm to civilians.<sup>15</sup>

The Ukrainian airfield targets selected by the Russians during the "opening strike" suggest that the Russians had no intention of disabling the Ukrainian air force's capabilities. Very few aircraft were

<sup>&</sup>lt;sup>10</sup> Jānis Bērziņš, "Not 'Hybrid' but New Generation Warfare," in *Russia's Military Strategy and Doctrine*, ed. Glen E. Howard and Matthew Czekaj (Washington, DC: Jamestown Foundation, 2019).

<sup>&</sup>lt;sup>11</sup> Michael Kofman, Anya Fink, Dmitry Gorenburg, Mary Chesnut, Jeffrey Edmonds, Julian Wallert, Kasey Stricklin, Samuel Bendett, Russian Military Strategy: Core Tenets and Operational Concepts, CAN Research Memorandum, CNA, August 6, 2021,

https://www.cna.org/CNA\_files/pdf/Russian-Military-Strategy-Core-Tenets-and-Operational-(accessed March 21, 2022).

<sup>&</sup>lt;sup>12</sup> V. B. Zarudnitskiy, "Faktory dostizhenia pobedy v voyennykh konfliktakh budushchego" [Factors of victory achievement in future military conflicts], *Voyennaya Mysl*, no. 8, 2021, 41-42. <u>https://cyberleninka.ru/article/n/faktory-dostizheniya-pobedy-v-voennyh-konfliktah-</u> <u>buduschego/viewer</u> (accessed March 21, 2022).

<sup>&</sup>lt;sup>13</sup> "Genshtab: osobennost'ju konfliktov budushhego stanet primenenie robotov i kosmicheskih sredstv" [General Staff: future conflicts will be characterized by employment of robots and space systems], TASS, March 24, 2018, https://tass.ru/armiya-i-

opk/5062463?utm\_source=google.com&utm\_medium=organic&utm\_campaign=google.com&utm\_ referrer=google.com&utm\_medium=organic&utm\_campaign=google.com&utm\_

<sup>&</sup>lt;u>\_referrer=google.com</u> (accessed March 21, 2022).

<sup>&</sup>lt;sup>14</sup> Mikhail Khodarenok, "Prognozy krovozhadnyh politologov: O vostorzhennyh jastrebah i toroplivyh kukushkah" [Forecasts by Blood-Thirsty Political Analysts: On Thrilled Hawks and Hasty Cuckoos], *Nezavisimoye Voyennoye Obozrenie*, February 3, 2022, <u>https://nvo.ng.ru/realty/2022-02-03/3\_1175\_donbass.html</u> (accessed March 21, 2022).

<sup>&</sup>lt;sup>15</sup> Shmuel Shmuel, "On Missile forces and Eastern Imagination – long range attack concepts," Dado Center, March 2, 2022, <u>link to the article</u> (accessed March 27, 2022)

attacked, and of those few, only some were fighter planes. In general, no critical airfield infrastructures were attacked. Whereas it might have been quite easy for the Russians to incapacitate Ukrainian airbases, by heavy strikes on their runways, as most of them had only one runway, they remained operational. Russian inaccuracy or failures could not explain for all these airfields to suffer only minor damage unless it was their original intent.

The February 24 "opening strike" is, therefore, consistent with familiar Russian operational logic:

- 1. The targets align with early Russian conceptions airports, airbases, air defense systems, weapons depots, and seaports (Appendix B).
- 2. It was integrated into a multi-dimensional attack; the precision missile attack was directed at the entire Ukrainian heartland using land, aerial, and naval platforms. At the same time, a simultaneous land attack was made from the north, south, and west accompanied by coordinated informational and political operations.
- 3. The simultaneous attack across the entire country was apparently designed to confuse Ukrainian leadership and its military command about the main military thrust and create a perception of an overwhelming attack.
- 4. The Russians may have attempted to achieve operational surprise by presenting their continuing build-up of forces as an exercise. It is unclear to what extent the Ukrainian army and the West were surprised. Still, based on media coverage in Ukraine before the attack and immediately after, it would seem that the massive military attack directly striking all areas of the country was indeed a surprise for the Ukrainian public.<sup>16</sup>
- 5. The attacks throughout the whole Ukrainian territory, using long-range missiles that were filmed and photographed by many civilians, combined with the damage, which was "seen" from urban ameliorations (in some cases, the attacks were aimed at fuel reservoirs to create long-lasting smoke clouds), were apparently intended to frighten the county's political and military leadership and to make them aware of Russia's military power.
- 6. The use of long-range missiles removed the need for fighter planes. The reason for this is, apparently, fears for the safety of the aircraft, which brings with it not only an operational "price" but also a public relations/image price. It is possible that the Russians tried to adopt the American model of a "clean," long-range attack. Aircraft also seemingly launched ARM (Anti-Radiation Missiles) and Kh-31 (AS-17) missiles against radar installations, which only made a modest contribution to the efforts to attack the Ukrainian heartland.

Also evident are the significant differences concerning theoretical concepts and fundamental assumptions. Firstly, the "opening strike" at the Ukrainian heartland was weak and failed in its intensity and target selection to achieve the overwhelming effect of the Ukrainian state systems:

1. The plan included an attack of approximately 100 missiles on some 30 facilities in a fashion that avoids destruction and causes limited damage to each facility. An analysis of the attacks indicates significant differences in the nature of the damage. In most of the facilities analyzed, non-critical components were attacked (probably deliberately). Although all military airfields were attacked, a typical attack involved only two to four missiles per facility. The Russians did not choose to carry out a focused attack on a "sample target," as they later did, for example, in the attack on the Yavoriv base on March 13, 2022, which was estimated to have been attacked by 30 cruise missiles.<sup>17</sup> At the end of the campaign's first month, the total number of missiles launched by the Russians was estimated at 1,250, a little more than 40 missiles per facility.

<sup>&</sup>lt;sup>16</sup> Jim Heintz, "The worst sunrise in my life': Ukrainians wake to attack," *Associated Press*, February 24, 2022, <u>https://apnews.com/article/russia-ukraine-europe-russia-kyiv-</u>

<sup>8</sup>bdf0355fca9faf6cc1b70eb86cc387f (accessed March 21, 2022).

<sup>&</sup>lt;sup>17</sup> Russian air strike kills 35 at western Ukraine military base, officials say," Forces.net, March 14, 2022, <u>https://www.forces.net/ukraine/russian-air-strike-kills-35-western-ukraine-military-base-</u>(accessed March 21, 2022)

day.<sup>18</sup> If so, the "opening strike" represents the record-high number of launches during the campaign and could also underscore that relative scarcity of Russian launch platforms is a significant capability constraint. Some of the limitations are also due to the vast size of Russian territory and a large number of adversaries – these prevent the deployment of all national capabilities to the battlefield (in our case, Ukraine) – and considerations regarding stockpiling supplies and systems for escalating and deterioration scenarios.

- 2. Even more than a month into the war, the Ukrainian army has maintained a significant capacity to challenge Russia's freedom of action in the Ukrainian airspace, using aircraft and some of the air defense systems it originally had, in addition to weapon systems seized from the Russians during the fighting and systems supplied by the West.<sup>19</sup> It appears that no Russian attack as successful as it may be would have enabled Russia to gain total air superiority (in light of the abundance of anti-aircraft systems, aircraft and other relevant military facilities in Ukraine). The Russian army's plan of attack seemed to have assumed a rapid advance of Russian forces and disintegration of Ukrainian resistance forces. However, the "shattering" of Russian offensive moves in the first days of the campaign left the Russian army without air superiority and imposed severe restrictions on the subsequent use of its combined forces.
- 3. At some airfields, one can reasonably attribute the minimal damage caused during the attacks to Russia's intention to use them for later invasion needs. For example, the Hostomel airfield near Kyiv, where several attempts were made by marine forces (VDV) using helicopters right from the beginning of the invasion; the Chuhuiv airfield close to Kharkiv, which was captured by the Russians early in the war; and the Vasylkiv airfield, which VDV forces also attempted to capture. Nevertheless, this logic does not explain the minimal damage caused to airfields located further away, in the center and the west of Ukraine.

Secondly, the Russian air force has traditionally been considered a support arm for land-based attacks dating back to the Soviet period. However, over the past years a lot of efforts have been made to upgrade its importance and centrality on the battlefield. The "opening strike" and the continued operation of the Russian air force during the war in Ukraine emphasize that, similarly to the past, the Russian army's conceptual thinking regarding the "reconnaissance-strike complex" significantly surpasses its fighting units' actual capabilities and personal skills of the Russian military:<sup>20</sup>

- The choice of targets for the attack indicates that the Russians avoided the need to launch preliminary intelligence collection operations shortly before the attack. Most of the targets at the airfields had been fixed infrastructures and a small number of parking aprons for aircraft (which were also characterized by static deployment). It is possible that the Russians assumed that the Ukrainians would change aircraft deployment to improve their survivability. However, it seems that, on most bases, the aircraft remained in their permanent parking strips.
- 2. There is an ongoing debate in the military experts community, how significant was the employment of cyber tools and electronic warfare during the first day of the Russian assault. These are areas in which the Russian military was supposed, according to pre-war assessments, to excel and show a distinct advantage compared to Western military forces. The lack of information regarding achievements in these areas strengthens the estimate that, practically, the offensive operations in these domains did not contribute a lot to the potential success of the "opening strike." There is information that suggests that Western forces, especially the United States and the United Kingdom, have secretly helped Ukraine in these

<sup>&</sup>lt;sup>18</sup> U.S. Department of Défense, "Senior Défense Official Holds a Background Briefing," March 25, 2022, <u>https://www.defense.gov/News/Transcripts/Transcript/Article/2979038/senior-defenseofficial-holds-a-background-briefing/ (accessed March 27, 2022).</u>

<sup>&</sup>lt;sup>19</sup> Justin Bronk, "Is the Russian Air Force Actually Incapable of Complex Air Operations?," Royal United Services Institute, March 4, 2022, <u>https://rusi.org/explore-our-research/publications/rusi-defence-systems/russian-air-force-actually-incapable-complex-air-operations</u> (accessed March 27, 2022).

<sup>&</sup>lt;sup>20</sup> Dmitry (Dima) Adamski, "Strategic Culture and Military Innovation: The Influence of Strategic Culture on the Revolution of Military Issues in Russia, the United States and Israel," Campaigns, 2012, pages 76-80.

domains, and if they did so already during the "opening strike", it is conceivable that they had successfully neutralized some of the Russian efforts. Additionally, we would suggest that Russian cyber and electronic warfare attacks against Ukraine and the West over the past few years generated operational friction that helped Ukraine to develop improved defense capabilities and reduced the element of surprise in these areas.

- 3. Beyond the launching of long-range cruise missiles, Russian air force fighter jets (as opposed to helicopters) were not integrated during the first days of the campaign and played too weak of a role later. It became evident, as fighting continued, that the air force had difficulties creating continuous attacks following the "opening strike", either to advance the goal of achieving air superiority or to carry out its missions: bombing, assisting maneuvering forces, and intelligence gathering. Even though the Russian air force did, as fighting continued, demonstrate the ability on several occasions to execute attacks using multiple weapons systems on a single target or to perform hundreds of sorties a day, the question still arises as to why its innovative capabilities, which showed relative success in Syria, have not been sufficiently reflected in the present campaign.
- 4. Many possible explanations have been suggested: Pilots' lack of experience in "hunting down" surface-to-air missiles, insufficient flying time during the peacetime, difficulties in friend-or-foe identification (due to similarity in weaponry and close proximity between Russian and Ukrainian forces) and fear of being shot down by "friendly fire" Russian air defense systems. It has even been suggested that the Russian air force lacks the ability to plan complex aerial operations.<sup>21</sup>
- **5.** This section can be summarized as follows: An "opening strike" that was not based on realtime intelligence and continued air operations during the subsequent few weeks fails to demonstrate that the "reconnaissance-strike complex" concept succeeded in taking roots in the practice of the Russian air force.

#### Summary 5 1 1

The war in Ukraine has been characterized by intense information warfare led by all the actors involved. This makes it difficult to establish facts in the battle, even more so because of the usual "fog of war." Analyzing the Russian "opening strike" may improve our understanding of Russian strategic design and logic prior to thew war, since this operation was clearly planned in advance, well before Moscow encountered any difficulties on the battlefield.

Several complementary explanations can be suggested for the design of the Russian "opening strike" regarding the use of high-precision missiles:

- Positive targets: Their use was designed to showcase accurate attack capabilities, simultaneously on many targets, deep into Ukrainian territory. It aimed to disorient the Ukrainian army regarding the direction of the Russian attack, sow fear amongst the Ukrainian leadership and civilian population, limit damage in hope to enable the later use of infrastructures by the Russians, deter the West from direct involvement – alongside Ukraine – in the warfare, signal the Russian desire to keep the conflict at a relatively low level (as per the Russian concept of "escalation ladder"), and to limit the flow of Western aid.
- 2. Limitations: Constraints regarding the quantity of missiles that the Russian army can launch simultaneously and constraints regarding its armaments inventory. Difficulties also arise regarding real-time intelligence and the ability to implement the "reconnaissance-strike complex" concept.
- 3. **Mistaken basic assumptions:** Expectations of limited resistance from the Ukrainian army and local population and for a swift land operation that would gain control of extensive areas of the country.

The results of the "opening strike," as analyzed in this paper, primarily strengthen the assessment that the accuracy levels of Russian missiles are lower than that of standard Western GPS-guided weaponry. However, it also illustrates the progress that Russia has made over the past decade to

<sup>&</sup>lt;sup>21</sup> Bronk, Op. cit.

reduce the operational gap with the West in the field of high-precision, long-range guided munition systems. The question of high failure rates, if indeed this is shown to be correct, requires additional, in-depth research.

Michael Kofman, one of the West's leading researchers on the Russian army, suggests that based on Russia's previous wars, we should not jump to hasty conclusions and warns against the adoption of mistaken lessons.<sup>22</sup> At this stage, while fighting continues, it may be too early to derive from this war the conclusions relevant to Israel. We plan, in future publications, to focus on additional aspects of Russian warfare and to formulate suggestions and possible lessons for the State of Israel.

<sup>&</sup>lt;sup>22</sup> Michael Kofman, Twitter post, March 13, 2022, https://twitter.com/KofmanMichael/status/1503037150861869059 (March 21, 2022).



#### Appendix A: Detailed analysis of attacks on airfields<sup>23</sup>

#### Airfields examined:

- 1. Kulbakino military airfield, Mikalov in southern Ukraine.
- 2. Ozerne military airfield, in north-central Ukraine.
- 3. Chuhuiv military airfield, in eastern Ukraine.
- 4. Vasylkiv military airfield, in north-central Ukraine.
- 5. Melitopol military airfield, in southern Ukraine.
- 6. Ivano-Frankivisk International Airport, in western Ukraine.
- 7. Kherson International Airport, in southern Ukraine.
- 8. Boryspil International Airport, in north-central Ukraine.

#### **Ozerne military airfield**

Military airfield with Su-27 aircraft.

Five targets were attacked with eight missiles:<sup>24</sup>

- 1. Northern apron two strikes on the northern apron. The distance of the strikes from the center of the lengthways axis of the apron is 10-30 meters.
- 2. Eastern apron two strikes in the sand, third, accurate strike on an aircraft. The distances of the strikes (shown in red) from the center of the lengthways axis of the apron are 50 meters and 150 meters.
- 3. A building located between the two northern aprons one strike close to the structure, some 30 meters.
- 4. Two targets on the runway two strikes on the sand and not the runway. The distance of the strikes from the center of the runway is 50 meters and 30 meters.

#### Melitopol airfield

A military airfield with transport planes. One target was attacked, probably a facility for weapons storage. It is unclear whether it is inside the airfield or nearby.<sup>25</sup>

#### Boryspil, Kherson, Ivano-Frankivsk airports

All three are international airports. Ivano-Frankivsk is also used by Mig-29 fighters that are parked in a line. Each of the three airports was attacked, probably by one missile. The elements attacked are not clear, but in all three cases, the element attacked had caused long burning.

https://twitter.com/JosephHDempsey/status/1498811803484270597 (accessed March 21, 2022).

<sup>&</sup>lt;sup>23</sup> Interpretation of satellite imagery – Israel Air Force Satellite Imagery Unit

<sup>&</sup>lt;sup>24</sup> Joseph Dempsey, Twitter post, March 2, 2022,

General Staff of the Armed Forces of Ukraine in Facebook, February 24, 2022,

https://www.facebook.com/GeneralStaff.ua/posts/257864443193308 (accessed March 21, 2022).

<sup>&</sup>lt;sup>25</sup> Natasha Bertrand, Twitter post, February 24, 2022,

https://twitter.com/NatashaBertrand/status/1496870755245637633 (accessed March 21, 2022).

Grace Rahman, "Video shows explosion at Air Base, not Ukraine's main airport," Full Fact, February 28, 2022, <u>https://fullfact.org/online/ukraine-air-base/</u> (accessed March 21, 2022).

#### Kulbakino airfield

A military airfield. Before the attack, Su-24, Su-25, and Mig-29 fighters, transport planes, and L-39 training aircraft were stationed there. Four targets were attacked with four missiles.<sup>26</sup>



#### Planet Labs PBC satellite imagery

- 1. Su-25 parking apron (two destroyed).
- 2. Parking apron with Mig-29 and L-39 aircraft (six Mig-29 and two L-39 were hit).
- 3. Empty central apron next to the runway some 30 meters from the center of the apron.
- 4. Munitions storage facility the end of the storage facility was hit, some 10 meters from its center.

No additional fighter or transport aircraft were attacked.

#### Chuhuiv airfield

A military airfield and flying school. The airfield had Albatross training aircraft (L-39), Su-24 fighters, and transport aircraft.

 <sup>&</sup>lt;sup>26</sup> David Kime, Twitter post, February 25, 2022, <u>https://mobile.twitter.com/CyberRealms1/status/1497124857477226497</u> (accessed March 21, 2022).
Official web site of the Ministry of Defense of Ukraine, "Address by the Commander-in-Chief of the Armed Forces of Ukraine, Lieutenant-General Valery Zaluzhnyi," February 24, 2022, <u>https://www.mil.gov.ua/en/news/2022/02/24/address-by-the-commander-in-chief-of-the-armed-ukraine-lieutenant-general-valery-zaluzhny/</u> (accessed March 21, 2022).



Planet Labs PBC (before the attack)





During the attack, four targets were attacked by four missiles:<sup>27</sup>

- 1. Training aircraft, probably L-39, apron direct hit on the line.
- 2. Building located to the south of the apron.
- 3. Building located between the northern maneuvering lane, the runway (to the west), and the approach lane (to the east) in this case, a thick cloud of smoke made identification of the damage difficult.
- 4. An additional building located to the east of the main apron.

The runways and Su-24 aircraft were not attacked.

#### Vasylkiv airfield

A military airfield used by Mig-29 aircraft. One target was attacked: Vehicle parking area. Two burnt vehicles can be seen at the side of the parking area. Runways and aircraft hangers were not attacked.<sup>28</sup>

<sup>&</sup>lt;sup>27</sup> Satellite Imagery Gallery. (2021, September 15). Planet-Lab, <u>https://www.planet.com/gallery/#!/post/chuhuiv-air-base (</u>accessed March 21, 2022).

Official web site of the Ministry of Defense of Ukraine, Op. cit.

<sup>&</sup>lt;sup>28</sup> Joseph Dempsey, Twitter post, February 26, 2022, <u>https://twitter.com/JosephHDempsey/status/1497564764259733507?ref\_src=twsrc%5Etfw</u> (accessed March 21, 2022).

<sup>&</sup>quot;Vasylkiv airbase has been targeted in missile strike," Liveuamap, February 24, 2022,



https://liveuamap.com/en/2022/24-february-vasylkiv-airbase-has-been-targeted-in-missile (accessed March 21, 2022).

### Appendix B: The Infrastructure target bank of Russian Intelligence Ukrainian (estimate of the Estonian Intelligence Agency one week before the start of the war).



"Targets in Ukraine compiled by Russian intelligence that, if neutralized, can interfere with the command, recovery, and supply of the Ukrainian Armed Forces and Ukraine's energy supply. Russian intelligence also has similar lists for other European countries...<sup>29</sup>

<sup>&</sup>lt;sup>29</sup> Estonian Foreign Intelligence Service, "Russia is Ready for War," February 15, 2022, <u>https://raport.valisluureamet.ee/en/russian-armed-forces/russia-is-ready-for-war/</u> (accessed March 21, 2022).

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