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Russian Combat Capabilities for 2020: Three Developments to Track

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FOREWORD

Russia's military prowess has increased significantly ever since the appointments of Sergey Shoygu as Minister of Defense in 2012 and Valery Gerasimov's assignment as Chief of the General Staff in 2013. They have diligently worked to fulfill President Vladimir Putin's May 2012 edict that called for modernizing the Armed Forces by 2020 with a focus on electronic warfare (EW) and air-space defense capabilities, among others. The modernization effort offers three areas for Western analysts to track closely in the coming year.

The first topic to track and how it is being implemented is Russian lessons learned during the fighting in Syria. Not discussed in Putin's May 2012 edict (fighting only began in 2015), the Syrian conflict has tested arms and technologies in each of the services along with transport capabilities, and the results and improvements in the force have significantly increased the options available to decision-makers in conflict situations and made Russia into a more formidable military power. A host of leaders at all levels of command gained combat experience as well. The lessons that were learned during the fighting in Syria are now included in the major exercises held each year in one of the military districts, which tests the combat readiness of the force in general for a variety of potential conflicts.

The second topic to track is Russian developments in space. It is apparent that there is a focus on developing "operational art in space" due to the number of references to the topic in the open literature. Whether "operational maneuver groups" have been formed is not known, but a sharp eye should be kept on the lookout for such a development. The ability of Russian satellites to maneuver and conduct operations in space against the satellites of potential foes must be followed, as is the use of these capabilities to employ information-type weaponry at targets on the earth's surface. The May edict's focus on air-space defense, precision weaponry, and robotic-strike systems is particularly relevant for the modernization of satellites, sensors, and other space devices.

Finally, analysts should track Russian plans to disorganize a foe's command and control system (planning exists down to the brigade level) with electronic warfare (radio-electronic or REB capabilities in Russian) means. The thoughts of numerous officers on the topic indicate that once disorganized an opponent's forces face chaos and uncertainty and their entire command and control house of cards falls apart. Russia's recent interference in military and civilian Global Positioning Systems during NATO exercises may be test runs of the concept.

Specific conclusions are presented at the end of each chapter. Thus, as Russia's military continues to modernize, there are several important concepts to track that have either developed (as in Syria) or are home grown and under serious consideration. These developments appear to support the development of a new theory of warfare in Russia that, according to Shoygu and Gerasimov, relies on a combination of classical and asymmetric concepts.

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EXECUTIVE SUMMARIES

Part One: Russian Lessons Learned in Syria

Russia's Chief of the General Staff, Valery Gerasimov, noted in his 2019 speech at the Academy of Military Science (AMS) that Syria was new in that it enabled Russia to carry out "tasks to defend and advance national interests outside the borders of Russian territory." He noted that Russia's strategy in Syria was the "strategy of limited action," in that Aerospace Forces contributed the greatest share of missions to resolving assigned tasks. These tasks involved developing a layered defense against terrorist unmanned aerial vehicles and utilizing precision strikes against targets. Thus, Russian military experience in Syria has proven to be invaluable for invoking updated attack methods against terrorists in areas far from the Motherland and for advancing Russian national interests. The only first-hand commentary of the conflict has come from Russian and Syrian controlled media. As a result, Russia has had close to a free hand in deciding the tempo and context of operations. It has, however, had to learn to work closely with a set of friends that differ 180 degrees from their Warsaw Pact allies of the Cold War era. A local power (Syria), a more formidable regional power (Iran), a terrorist group (Hezbollah), and others had to be integrated into a working coalition, which had issues. Further, it has been forced to work with the United States in regard to air and special operations.

Several points merit special attention for the West to follow, to include Russian preemption capabilities and new methods to deter (scare) adversaries with advanced weapon capabilities. Gerasimov's AMS address noted that Russia's overall "strategy of active defense" is a set of measures for the preemptive neutralization of threats to the state's security—that is, the desire to preempt when threatened and deter potential adversaries in the region, to include Lebanon and Israel. The Syrian experience has allowed Russia to test a host of new weapons and new concepts and has trained a number of leaders in contemporary warfare outside its borders, making it much different than the earlier, more localized fight in Chechnya. New methods of employing Spetsnaz forces and new ways of utilizing private military companies were explored. The Syrian experience has refocused Russia's military on urban warfare and the difficulty of extracting extremists from buildings while trying simultaneously not to harm the local population and to find humanitarian corridors for their extraction from the combat zone. The use of robotics during urban operations, learning ways to use radio-electronic equipment or information technologies to disorganize enemy signals, and defending airfields from UAV attacks were other lessons learned. Finally, Russia is in the process of incorporating these lessons learned into the force through conferences, round tables, and new manuals. Russia's military will undoubtedly be a stronger foe after their Syrian experience than before it.

Part Two: Operational Art/Maneuver Groups in Space

While it is not known for certain whether Russia utilizes operational art in space, there is growing circumstantial evidence supporting that contention. First, Russia considers space as a theater of military operations (TVD), within the boundaries of which operations of a strategic force can be organized and conducted. This TVD hosts Russian satellites of various types that gather and pass information, conduct reconnaissance and communication functions, and maneuver alone or in groups, among other functions. Second, in a 2009 article in Russia's *Air-Space Defense*, one author

was identified as a teacher of the “spacecraft launch and command and control forces operational art and tactics department of the Military-Space Academy.” Third, Russian Defense Minister Sergey Shoygu has called aerospace operations, of which space is an important element in Russian theory, the center of gravity of future conflicts. Fourth, in a 2018 article in the journal *Military Thought* on modern methods of aerospace and air defense practices, the author stated that “operational art in terms of its inherent purpose remains a theory and practice of resolutely changing the situation in aerospace in one’s favor...” Finally, satellites and other equipment are capable of employing the principles of operational art, which include the conduct of deep operations, envelopment, and maneuver; and attacking weak flanks in an integrated and planned fashion, in space. These principles could be carried out in the following way:

- Deep operations could involve Russian strikes against satellites in space or against underwater cables or the use of special operations to destroy critical infrastructure targets (SODCIT) criteria. Satellites perform maneuver operations often to inspect other satellites or to perform other missions.
- Space is underdeveloped at the moment, which indicates it could remain for some time as a place for maneuver.
- Moving satellites to more favorable positions enable either strikes against adversary equipment or the achievement of a strategic position in a specific orbit, such as to conduct inspections of other satellites.
- The use of satellites as an operational maneuver group would be an unconventional form of using such assets and would consist of both ground and space-based weapons that can influence the TVD.
- Russian analysts write that practically every US weapon is hooked to satellite communications, GPS navigation, and the mobile Internet. Russian EW operators claim to be able to shut these space channels down with ease.
- Space may now be considered a flank for planetary operations.
- Space assets that maneuver in the form of groups can operate in deep space to envelop an opponent.

The majority of these operations are present in the planning of Russian aerospace operations today.

The actual equipment employed in space or on the ground (and aimed at space objects) at the moment includes the following items that are capable of conducting maneuver and deep/planetary operations in near or deep space:

- Inspector satellites, such as the Kosmos 2521
- Killer satellites
- Tirada-2s, to thwart communications
- Rudolf, anti-satellite strike system
- Nudol, anti-satellite and missile system
- Peresvet combat laser
- Ground stations that can jam objects in space
- MiG-31 armed with anti-satellite missiles
- Space junk that comes alive
- Reconnaissance-strike complexes or information-strike systems

Also, ground based hackers should be included, since they have attempted to take control of satellites, such as theoretically occurred in 1998.

Russian authors contend that satellites can guide weaponry to distant shores or be the focal point from which an operation unfolds. In a global conflict the destruction of the enemy's group of satellites is vital to success, since it deprives him of communications, navigation, and the capability to conduct reconnaissance. The following citation indicates what distant targets might include:

It is possible to use various space systems in support of each of these operations. Thus, supporting a **strategic operation to destroy critically important enemy targets** necessitates the use of space-based means of reconnoitering these targets; electronic intelligence assets; meteorological reconnaissance assets in the interests of a proper selection of attack weapons and their combat employment methods; and space-based navigation, communications, relay, and strike evaluation systems.¹

Therefore, the emergence of new forms of military operations in near space can be expected that would aim to block and defeat orbital alignments of forces while suppressing radio communication systems in specific areas of space. Satellites, due to their ability to maneuver and move singularly or in swarms, could be capable of acting as an operational maneuver groups (OMG) in space. A contemporary space OMG potentially would consist of reconnaissance-strike units, satellites of various types, counter communication units, and other assets combined into a single organism. These assets are available, but it is unclear what the plans are of the Operational Art Department at the General Staff Academy for using its space assets in a space TV.

Part Three: Russia's Electronic Warfare Force: Blending Concepts with Capabilities

Russian Major General Yuriy Lastochkin, who is in charge of the Defense Ministry's radio-electronic warfare (REB) force, believes REB capabilities will permit his forces "to decide the fate of all military operations" in the near future. They will be arrayed against what Russia considers a major Western weakness, the latter's numerous links to space assets. There is certainly ample evidence to suggest that a significant REB capability is under development. Appendix A at the end of the report lists many capabilities of the ground force, aviation, and naval REB equipment.

There are several key items in the report that require Western consideration. First, while the West worries about Russian A2AD concepts, it is more likely that Russia is putting together a program that will cause chaos in Western control systems. They are working on methods to disorganize an adversary's command and control capability. The Russians also are now expanding the use of REB as an independent branch, experimenting with REB maneuver units, and focusing on developing a disorganization plan for use in each REB brigade. In 2018 Lastochkin stated that the disorganization of enemy troop and weapons command and control and the reduction of the effectiveness of the conduct of reconnaissance and weapons employment by them "is the primary goal of the conduct of electronic warfare."

Second, Russia appears to be experimenting with the disorganization of command and control (C2D) in live engagements, such as the attempts to disrupt the Trident Juncture NATO exercise. It is working on using C2D to protect its Northern Sea Route and access to vital resources there

¹ Vasiliy Y. Dolgov, and Yuriy D. Podgornykh, "Space as a Theater of Military Operations: On Possible Forms and Methods of Combat Employment of Space Command Forces and Assets," *Vozdushno-Kosmicheskaya Oborona Online*, 10 April 2013.

with its Murmansk-BN system, which is designed to interfere with communication systems and the navigation and control systems of ships along this route. These live engagements are helping turn theory into practice.

Third, Western specialists need to become more aware of how REB could be integrated with deception techniques to create fake targets, another issue being practiced in local exercises. Finally, there are a number of actual REB systems that require close study for their potential tactics and techniques. They can be easily placed in specific functional categories if properly analyzed. Reconnaissance, jamming, distorting navigational fields, suppressing radio-controlled mines, and obtaining bearings of electronic wave emission sources (drones, UAVs, missiles, etc.) are all potential capabilities that could be, among others, placed in specific categories.

The article will initially discuss Western concerns about Russian REB and the latter's focus on Western weaknesses and capabilities. It then covers the claims of Lastochkin and another Russian officer that REB is the key to controlling future operations before highlighting prominent military discussions from 2015-2018 of REB by both active and retired officers.

PART ONE: RUSSIAN LESSONS LEARNED IN SYRIA

Introduction

Ever since September 2015, Russia has been battling terrorists alongside Syria's armed forces. The effort has been consistent, with President Vladimir Putin never wavering in his steadfast support of Syrian President Bashar al-Assad. Four issues motivated Russia's support. First, Syrian forces were in jeopardy of losing control of the last vestiges of the nation when Russia decided to intervene. Russian estimates were that Syria controlled only 10 percent of its territory at that time. Failure to act appeared to promise an end to the Assad regime, which was a long-time supporter of Russia. Second, Russia has been involved in the Middle East for decades, has supported numerous autocratic figures there, and does not plan to give away the advantage and influence they have developed over the years. This includes not only the naval bases Russia has maintained in the Eastern Mediterranean but also access to Syria's numerous resources (phosphates, oil, etc.). Third, support to Assad helps balance what the Kremlin believes are Western attempts at power plays in the area. Russia's presence furthers its prestige in the world as well. Finally, and perhaps most importantly, Russia's leadership believes it is better to confront extremists on Syrian vice Russian soil. If not stopped in Syria, the terrorists may decide to strike along Russia's southern border. The Kremlin is aware that several thousand of its citizens and those of Central Asia have fought in Syria on the side of radical extremists and will return home. The latter's borders abut to Russia's southern and central military districts.

Support to Syria has rejuvenated Russia's military prowess, as new weaponry has been tested and new responses developed to terrorist tactics and their 21st century digital or standard warfare techniques. For Russian officers, nonstandard ways of thinking and the development of new means of military art to confront these changing situations are now the norm. For example, military art innovations such as the Syrian berm, tank carousel, free hunt, the inverted front, the strategy of limited actions, and the horseshoe method of patrolling are all discussed below. As a result of participating in this conflict, Russia's Armed Forces are more capable of handling a variety of combat situations than they were prior to their involvement in Syria.

This article will explain some of the military lessons that Russia has gained from its participation in the Syrian conflict. Topics covered include:

- Leader descriptions of how the experience has changed training;
- How Spetsnaz forces were used;
- How urban operations once again have taken center stage;
- How private military companies (PMCs) developed;
- How the region has served as a testbed for new weapons under a variety of climatic conditions;
- How new applications of military art developed;
- And how combat experiences have caused tactical changes as well as improvements in the capabilities of logistics, engineering, and topographic forces.

An entire study of lessons learned, not yet released, has been conducted in the General Staff, which may further reflect changes to equipment and military art in the coming months and years.

Leader Comments

Defense Minister Sergey Shoygu, General Staff Chief Valery Gerasimov, and several of the leaders of military districts (Dvornikov, Lapin, Zhuravlev) who served in Syria have commented on lessons learned as a result of combat operations there. Lessons learned range from the initial deployment of forces to actual combat actions. However, it should be underscored that Western lessons learned in combat during operations in Afghanistan and Iraq are clearly comparable if they do not in fact exceed those learned by Russia. Still, Russian operations are based on their different mindset and approach to problem-solving. This alone offers new ways of thinking for the West about the application of force and ways to defeat terrorists, not to mention new methods of fighting that the terrorists have developed in the past several years.

In 2017 Gerasimov stated that before moving into Syria in 2015, snap inspections were conducted that offered military rehearsals for the transfer of personnel and equipment over long distances. These early deployments allowed for the early establishment of logistics and airpower support to Khmeimim airfield (also translated as Hmeimim or Humaymim) in Syria, an operation carried out in secrecy. Russian air missions supported Syrian ground forces early in the operation, along with the organization of control centers. The creation of the National Defense Management Center (NDMC) in Moscow was a major achievement, as it offered real time communications and actual observation of events as they transpired on screens in real time. Gerasimov noted that the most difficult aspect of planning the operation was the “organization of collaboration with the government troops and with all the various groups.”²

Of interest in regard to the NDMC is that it has been stated to be Russia’s asymmetric answer to America’s network-centric warfare concept. The NDMC is a “computerized automated expert system for monitoring and analyzing the military-political, socioeconomic, and sociopolitical situation in Russia and the world.”³ Numerous automated control systems of troops are combined into a unified system by the Akatsiya-M automated control system. The NDMC is thus a military analog of the Internet providing operational-strategic and operational command and control of the Russian Armed Forces.⁴

Regarding tactical adjustments to confront terrorist operations, Gerasimov requested new responses to changes in the forms and methods of adversary operations. Responses were especially needed regarding suicide vehicle bombers. First there were 2-3 vehicles in an attack, but this soon expanded to the use of 7-8 of them in a single battle. For example, when exiting Aleppo, terrorist vehicles blew up two Syrian roadblocks and formed a breach 500-700 meters wide. Each vehicle

² Viktor Baranets, interview with Valery Gerasimov, “Russian Armed Forces Chief of the General Staff Army General Valery Gerasimov: ‘We Broke the Backbone of Terrorism’s Shock Forces,’” *Komsomolskaya Pravda Online*, 27 December 2017.

³ Aleksey Leonov, “Our Asymmetric Response to America’s Netcentric Warfare,” *Yezhenedelnik Zvezda*, 16 October 2018.

⁴ Ibid.

contains 300-400 kilograms of explosives or more. Terrorists use the civilian population to dig underground tunnels and communication trenches. Unmanned aerial vehicles (UAVs) became a most important asset in the fight against terrorists. Some 60-70 were in the sky every day. They created reconnaissance-strike and reconnaissance-fire loops, and were essential to artillerymen, scouts, and pilots as reconnaissance sources. In addition, several conferences designed to exchange combat experiences in Syria have transpired along with the publishing of a “whole series of manuals generalizing this experience.”⁵

Regarding Russian control over Syrian-force operations, Gerasimov stated that a Russian military “adviser apparatus” is in every battalion, brigade, regiment, or division. It includes an operations staff, a scout, artilleryman, engineer, interpreter, and other officials, who essentially plan combat operations. All Russian military district commanders have served in Syria and 90 percent of division directorates and over half of all regimental and brigade commanders and staffs have served there.⁶

At an open session of the Defense Ministry Collegium in November 2017 Gerasimov addressed the fact that Syria activated the need to master new forms of employing the Armed Forces and new methods of conducting combat operations. Above all this concerned the employment of precision-guided munitions. Their increased range and accuracy have changed approaches to deterring an opponent and have included the use of reconnaissance-strike and reconnaissance-fire loops at the tactical level. Fires were organized on a zonal principle. Long-range Kalibr sea-launched cruise missiles, air launched Kh-101 cruise missiles, and Tu-22M3 bombers were employed within a radius of 4,000 kilometers. Medium engagements up to 500 kilometers were supported by Su-24 bombers and Su-33 fighters carrying special computer subsystems. Near engagements used reconnaissance-strike loops, the Strelets reconnaissance, command and control, and communication complex, and the Su-24M bomber. Specialized groupings (command and control entities, etc.) were established on strategic axes during annual strategic exercises, such as Zapad-2017.⁷

In Gerasimov’s 2019 address to the Academy of Military Science, he made the following comment about Syria:

The Syrian experience has an important role for the development of strategy... carrying out tasks to defend and advance national interests outside the borders of Russian territory within the framework of the ‘strategy of limited actions.’ The principal implementation of this strategy is the creation of a self-sufficient grouping of troops (forces) based on one of the branches of the Armed Forces having a high degree of mobility and capable of making the greatest contribution to resolving assigned tasks. In Syria this role was given to Aerospace Forces formations.⁸

⁵ Ibid.

⁶ Baranets.

⁷ No author provided, “Speech by General of the Army Valery Gerasimov...at an open session of the Russian Federation Defense Ministry Collegium,” *Ministry of Defense of the Russian Federation*, 7 November 2017.

⁸ V. V. Gerasimov, “The Development of Military Strategy under Contemporary Conditions. Tasks for Military Science,” *Vestnik Akademii Voennykh Nauk (Journal of the Academy of Military Science)*, No. 2 2019, p. 9. The author would like to thank Dr. Harold Orenstein for translating this article.

However, in order to implement the “strategy of limited actions,” Gerasimov underscored the need to gain and maintain information superiority, prepare command and control and logistic systems, and prepare the covert deployment of the necessary groupings. Syria also introduced a new form for the employment of the Armed Forces, that being the humanitarian operation, carried out as part of post-conflict management procedures. The peaceful population was withdrawn from the conflict zone while simultaneously Russian forces were eliminating terrorists.⁹

In 2018, General-Colonel A. V. Dvornikov, Commander of the Southern Military District and a former commander of operations in Syria, offered several insights into the changing nature of military art. He singled out the use of “integrated” formations and the growing importance of information warfare as the most important issues he observed. He defined an integrated grouping in the following manner:

Integrated groupings are created on the basis of local resources on the principle of oppositional, national, and religious differences by means of organizing militias into irregular formations and detachments, capable of combining into larger formations with the support and guidance of special operations forces and private military companies of other states, with the employment of other state’s armed forces, foreign air forces, navies, and other groupings, and civilian and nongovernmental organizations to accomplish tasks on strategic (operational) axes in a uniform information and intelligence domain.¹⁰

Using integrated groupings, an obedient government can be established in a chaotic nation where the control of resources is developed, and military bases deployed. Features that characterize integrated subunits included their integrated employment of military force; information and psychological effects; partisan methods of struggle along with classical forms of operations; the use of underground passages and tunnels; and the use of pick-up trucks to conduct raids.¹¹

With regard to information warfare’s importance, Dvornikov added that the results “from information effects can be compared to the results of a large-scale operation with the employment of troops and forces.”¹² Information operations, in his opinion, played major roles in Russia’s successes in Aleppo, Deir ez-Zor, and Ghouta. The practical importance of information confrontation, he stated, was verified.¹³ Dvornikov stated that not only the boundaries between a state of war and a state of peace are being erased but, due to technological advancements,

⁹ Ibid.

¹⁰ A. V. Dvornikov, “Forms of the Combat Employment and Organization of the Command and Control of Integrated Armed Force Groupings on a Theater of Military Operations,” *Vestnik Akademii Voennykh Nauk (Journal of the Academy of Military Science)*, No. 2 2018, p. 38. The author would like to thank Dr. Harold Orenstein for translating this article.

¹¹ Ibid., pp. 38-39.

¹² Ibid., p. 40.

¹³ Ibid.

distinctions in missions at the strategic, operational, and tactical levels are being erased as well. Some strategic goals are now achievable at the tactical level in such cases.¹⁴

In conclusion, Dvornikov stated that “contemporary military art and the experience of conducting combat operations in local conflicts” has shown that creating and employing integrated groupings in new-type warfare is acquiring a greater urgency. Their deployment, employment, and command and control need detailed work.¹⁵

Lieutenant-General Aleksandr Lapin, Commander of the Central Military District (CMD), spoke on his Syrian experience to students at Ural Federal University in 2018. He noted that the CMD contains 49.4 percent of Russia’s area and has five time zones along with the country’s largest military industrial complex. Lapin did not address lessons learned directly. Rather, his talk was aimed at informing students of the inhumane essence of ISIS and at outlining the Russian response.

He noted how Russian forces helped peaceful residents escape from cities blockaded by guerrillas, noting the liberations of Aleppo and Deir ez-Zor. The former has been referred to as the “Syrian Stalingrad” and the latter related to the “defenders of Leningrad,” two historic World War II cities in Russia that were defended till the end against Hitler’s advancing army. The Syrian cities had been under siege for years. Of importance was the Syrian army’s efforts to restore control over the oil and gas fields, which ISIS had begun to control. Russian aircraft, Lapin stated, destroyed 396 illegal petroleum production locations and the plants for its processing along with 4,100 fuel tank trucks. Further, Lapin added that the military-political situation in the CMD appears to be worsening, since terrorist organizations are migrating to the countries of Central Asia, which border the CMD to the south. Thus, the district is focused on increasing and maintaining combat readiness, improving the state of weapons and military equipment, and increasing the reliability of command and control systems of units and subunits. Iskander-M operational-tactical missile complexes, Su-34 new generation aircraft, and other pieces of modern equipment have been added to the districts inventory.

In 2019 Western Military District Commander Colonel General Aleksandr Zhuravlev discussed the impact of Syrian operations on training. His observations are some of the best. He noted that, regarding military thought

When conducting tactical, special tactical, and command-staff exercises, we devote particular attention to unorthodox thinking, departing from established stereotypes, and using nonstandard methods when assignments are being tackled by generals and officers. To this end, they make active use of procedures such as turning movements, envelopment, infiltration, and covertly moving to the attack transition line.¹⁶

¹⁴ Ibid., p. 38.

¹⁵ Ibid., p. 41.

¹⁶ Oleg Pochinok, interview with Aleksandr Zhuravlev, “Taking Account of Syrian Experience in Upcoming Summer Training Period, Maximum Use Will Be Made of It During Training of Troops,” *Krasnaya Zvezda Online (Red Star Online)*, 27 May 2019.

It is important to mislead the enemy and “force him to act in a way that is advantageous to us.”¹⁷ Such ideas are closely related to the definition of reflexive control, getting an opponent to do something for themselves they are actually doing for you. This thinking appears to mimic much of the input Gerasimov provided in 2017 when he noted the importance of developing

the ability of commanding generals and commanders to quickly estimate the situation; anticipate its development, make unconventional decisions, employ methods of operations and stratagem unexpected by the enemy, function actively and purposefully, achieve surprise, take a substantiated risk, and seize and hold the initiative.¹⁸

Zhuravlev stated that terrorist groups make short strikes on isolated facilities and then quickly withdraw. These strikes are effective due to their surprise and coordinated movements. Targets are usually of political or economic importance. Buildings are connected by tunnels which make it possible to covertly regroup. Lower stories of buildings are areas of long-term fire possibilities, and armor and artillery are placed close to hospitals, schools, and mosques so that Russian airstrikes can only be carried out with great caution, if at all. Barricades and mines are employed at crossroads. Terrorists organize systems of defense using high densities of firepower and the rapid concentration of forces in urban areas. Population centers ensure that there is a lack of a clear line of contact with an opponent, where the contact line can extend both vertically and in depth. It is difficult to maneuver forces since the defender has superior knowledge of the locality and terrain. In the 2019 training period, attention focused on the use of “new, nonstandard forms and methods of operations involving integrated reconnaissance and strike and reconnaissance and fire systems, UAVs, and aviation.”¹⁹

Finally, Defense Minister Shoygu stated in 2019 that the satellite reconnaissance and navigation systems were playing a much larger role in terms of the country’s military security. Experiences in Syria showed that “for the effective employment of precision weapons detailed reconnaissance and cartographic information is essential,” which requires modern satellites that can film the Earth’s surface.²⁰

Spetsnaz, Urban, and Private Military Company Operations

Spetsnaz

Syria is a land of deserts, mountains, and urban centers. Spetsnaz has focused its attention on the first two while motorized rifle units have developed assault teams to handle the latter. It is expected that for 21st century wars, this may become a pattern for the use of Spetsnaz. The Syrian experience has caused Russian forces to be more flexible and prepared for different types of armed

¹⁷ Ibid.

¹⁸ No author provided, “Speech by General of the Army Valery Gerasimov...at an open session of the Russian Federation Defense Ministry Collegium,” *Ministry of Defense of the Russian Federation*, 7 November 2017.

¹⁹ Pochinok.

²⁰ No author provided, “Russian Defense Minister Holds Conference Call with Ranking Personnel of the Armed Forces,” *Ministry of Defense of the Russian Federation* (in English), 5 February 2019.

conflicts in contrast to their preparation for conflict with NATO. The new battlefield environment is characterized by situations that now change quickly and must integrate numerous forces. In Syria, forces have included Russian, Iranian, Turkish, Hezbollah, Syrian, US, and others, not to mention Russia's decision to utilize private military companies (PMCs) in Ukraine and Syria.

In the past Spetsnaz forces were used for long-range reconnaissance missions and for sabotage or assassinations. These missions remain, and based on past experiences in Afghanistan and Chechnya, considerable knowledge was accumulated as to how to operate with only a compass, a map, and a minimum of gear. But these operations have begun to recede into the background. In Syria, Spetsnaz forces operated without going past the frontline due to new reconnaissance and weapon systems, according to Russian reporting. Spetsnaz operations are modeled for a specific situation. There are no templates or stereotyping, and officers have learned how to create new forms of combat operations. Transport vehicles, such as the Tigr armored motor vehicle, are now used to transport a team of four to the frontline and conduct a "small war there" using heavy weaponry, antitank guided missiles, and automatic grenade launchers. Using several Tigr or all-terrain vehicles simultaneously can soften a frontline and cause continuous stress in an enemy force. Team members usually consist of a reconnaissance specialist, a forward observer, and a sniper pair, and some have foreign language skills. The desert nature of Syria's terrain also has diminished the need for ambush tactics in this conflict but increased the value of UAVs, who can fly deep into an enemy's rear area, accelerating detection time and the guidance of strike weapons.²¹

Urban operations

With Spetsnaz operating on the frontlines of deserts and mountains, urban operations took center stage as the principal area of armed conflict, since populated areas are where terrorists operate best. Ever since 2016, articles about urban warfare appeared about the fighting in Syria. Such conflict is complex and intense, as Russia's earlier urban experiences in Grozny in 1994-1995 and 2000 demonstrated.

In 2016 retired Colonel V. Kiselev, who, along with I. Vorobyev, writes often on tactics on the pages of *Voennaya Mysl'* (*Military Thought*) and *Armeyskiy Sbornik* (*Army Digest*), discussed urban warfare experiences in Syria. He noted that cities form a kind of matrix, requiring the seizure of each matrix square in order to achieve victory. Terrorists use cities as a base for replacements, supplies, and communications, and a place to hide their artillery and air defense guns. Terrorists extend their perimeter defense 100-200 meters in front of buildings, establish strongpoints, mine terrain, and use urban cover to constantly rotate fighters. Such an elaborate set up requires attackers to rely on detailed reconnaissance of the city before an attack. Kiselev noted that terrorists' underground tunnels in Syria were constructed to a depth of 3-4 meters, which often exceeded the depth of a building's foundation. Syrian forces usually encircled the city but left open one sector from which terrorists could break out at the last moment. The "triple mission" of

²¹ Roman Kretsul and Aleksey Ramm, "Combat Obstacles: How the Syrian Campaign Changed Reconnaissance. The Hunt for Snipers, the 'Small War,' and Other Missions, Which Russian Special Subunits Are Accomplishing in the Syrian Arab Republic," *Izvestiya Online*, 24 October 2018.

government forces was to liberate the city quickly, inflict the least damage as possible, and achieve the fewest human losses.²²

To force terrorist forces out of their positions, maneuvering assault teams became the primary means of attack. Applying some criteria from World War II's lessons learned fighting under urban conditions to the Syrian experience, Kiselev noted that each team usually included seven assault riflemen, five combat engineers, three or four light and heavy machine crews, and two antitank riflemen. The engineer teams determined if minefields were present and disarmed them when possible. Artillery or direct fire was then opened against one corner of a building, then against another to create openings for assault teams. Engineers used explosives to expand the breach, with riflemen shooting at fleeing terrorists. Tanks were employed behind the advancing assault teams, but they were used sparingly, usually only when broad maneuver was allowed.²³

In 2017 P. A. Dul'nev discussed urban operations in much greater detail, to include the use of robotics, in an article for the *Journal of the Academy of Military Science*. He pointed out several features of such conflict:

- It is conducted at close quarters on several levels simultaneously (streets and squares, different floors of buildings, on rooftops, and underground).
- There is a lack of a continuous front, with fighting turned into a series of isolated battles.
- Since the fighting is in small areas, advancing forces are more vulnerable and require more security.²⁴

To capture urban structures, assault groups become an important asset. However, here is where the greatest loss of personnel occurs. One way of helping to prevent such loss is to use robotic-technical complexes (RTKs), which can resolve an entire list of combat and support tasks. Assault "detachments" are battalion sized, while assault "groups" are company sized. A detachment usually contains 2-3 assault groups, a reserve, a covering group, fire support group, and an obstacle-clearing group (on occasion a demolition group may be needed). Assault groups may include the following subgroups: penetration, fire support, ground reconnaissance-fire, air reconnaissance-fire, long-range air reconnaissance, command and control, logistics, and a reserve.²⁵

The following types of RTKs need to be developed in Dul'nev's opinion:

- Heavy RTK platforms: with tank-type armor protection, it would destroy highly protected enemy objectives and with bulldozer attachments overcome mixed minefields.

²² V. Kiselev, "War for Cities in Fighting Terrorists," *Armeyskiy Sbornik (Army Digest)*, December 2016, pp. 5-13.

²³ Ibid.

²⁴ P. A. Dul'nev, "The Employment of Robotic Complexes During the Assault of a Town (Fortified Area)," *Vestnik Akademii Voennykh Nauk (Journal of the Academy of Military Science)*, No. 3 2017, p. 27. The author would like to thank Dr. Harold Orenstein for translating this article.

²⁵ Ibid., pp. 29-30.

- Medium RTK platforms: with BMP-type protection, it covers flanks and holds captured regions as well as providing fire support for heavy RTKs.
- Light RTK platform 1: with a weight up to 1000 kilograms, it has “anti-small arms” protection and can destroy enemy unarmored equipment and guard and defend command posts.
- Light RTK platform 2: with a weight up to 300 kilograms, with anti-shrapnel protection, it can conduct audio-video, operational, and artillery reconnaissance of the enemy and of terrain.
- RTK transport platform: with a weight up to 100 kilograms, is can support operations by assault subunits, to include explosive materials.
- Multi-copter and airplane-type reconnaissance and recce-strike UAVs: designated to conduct reconnaissance and destroy small targets.²⁶

Dul’nev then described how an attack with RTKs might unfold. Initially, a fire support operation in support of an attack would include a recce-fire subgroup of light RTKs, an air recce-strike group to destroy fire resources of the enemy (mortars, heavy machine guns, etc.) that are detected, and a long-range reconnaissance group of UAVs to provide surveillance. Artillery fire would be used to cover the advance of a penetration subgroup of heavy RTKs, which would open direct fire against an opponent. RTKs would create passages through obstacles, and a fire support subgroup of medium and light RTKs would cover the penetration subgroup’s actions. The fire support subgroup would also cover the advance of remote-controlled platforms advancing with explosives toward targets, after which the fire support subgroup would sweep the objective.²⁷

Naturally there are many problems to work out and new technologies to develop. Reconnaissance RTKs, the light platform 2, multi-copter/airplane-types, and recce-strike UAVs, cannot detect underground lines of communication or identify in detail engineer obstacles, most importantly, mixed minefields. Cooperation among subgroups is still difficult since each RTK has a control system developed under a specific type of model. General requirements that still need work include the following:

- Maximum conformity, modularity, compatibility, and integration capability into existing and future structures
- Development of unified, jam-free communication channels and data transmission
- Integration into a unified system of tactical-level command and control, and outfitting RTKs with combat information control systems and “friend-foe” equipment
- Ability for information exchange among RTKs and stability against unsanctioned software effects from an enemy force

²⁶ Ibid., p. 31.

²⁷ Ibid., p. 30.

- Provision for electromagnetic compatibility of military RTKs with other radiating objects such as radio-electronic warfare resources.²⁸

Dulnev's description and RTK employment recommendations were followed with more dramatic changes to field manuals. In 2018 three authors discussed changes that needed to be made to the *Ground Troops Field Manual, Part II*, because the description of how to prepare for the assault of a city was outdated. With the focus of terrorist actions centered on urban areas, such a change was warranted if not demanded. Assault "detachments" consist of a reinforced motorized rifle battalion (airborne or air assault battalions or a naval infantry battalion), whose immediate mission is to seize a strongpoint or 2-3 city blocks. Assault "teams" (which appear to be company sized, like Dul'nev's "group" above) are formed in the assault detachments. The authors stated that Article 230 of the field manual should be changed to reflect the following composition of an assault team:

- 3 motorized rifle (airborne, air assault) platoons
- 1 tank platoon
- 1 flamethrower squad (three flamethrower operators)
- 1 ZSU (self-propelled air defense mount, Shilka or Tunguska)
- 1 engineer obstacle-clearing vehicle
- 1 UR 77 (mine clearing vehicle)
- 1 combat engineer platoon
- 1 medical team (physician and corpsmen)
- 1 technical support squad²⁹

Further, a National Guard platoon could be used as a mopping-up team. The 340,000 strong National Guard, it is to be remembered, once belonged to the Interior Ministry, who was used to conduct these types of operations in the past. The platoon can also clear adjoining terrain of fighters and serve as a prisoner escort team. It is usually appropriate to have artillery subunits and combat helicopters assigned in support of assault teams, which implies that a forward air controller and artillery fire spotter should be at the assault detachment command post with the commander. Helicopters utilize precision-guided weapons, which are more precise in urban combat than artillery. The use of preliminary fire assaults, whether through helicopters or artillery, always make it easier for assault teams to achieve success.³⁰

Once underway, teams are told to avoid movements along streets, where only fighting vehicles should advance. Initial positions are taken up some 200 meters from a building that is to be taken, and robotic devices are used for reconnaissance, detection, and even the engagement of enemy forces. Once a building is taken, a perimeter defense is organized to ensure any

²⁸ Ibid., pp. 31-32.

²⁹ V. Podgorodetskiy, V. Litvinenko, and P. Sergeyev, "The Assault Team: Features of Combat Operations of Assault Teams in Urbanized Areas," *Armeyskiy Sbornik (Army Digest)*, November 2018, pp. 19-25.

³⁰ Ibid.

counterattack would not work. Nighttime seizures of buildings are more difficult. It was stressed that the first objectives to be seized are those that might entail the disruption of the entire enemy defensive system.³¹

Also, in 2018, military expert Anton Lavrov, writing in *Izvestiya*, noted that small attacks from various sides of a city confuses terrorists as to just where the main attack would originate. Simultaneously precise reconnaissance-strike loops should be established against seats of resistance, C2 nodes, and ammunition dumps through the use of Special Operations Forces and UAVs (this was the one article that recommended using Spetsnaz in the city). This allows forces to break up large groups into smaller ones and deprives them of the will to resist. The combination of the impact of devastating firepower and information-psychological operations helped cause the defection of 7,000 guerillas in a former operation.³²

In 2019, at a specialized area known as the urban combat range in the Western Military District, a training exercise was held. The exercise employed infantry fighting vehicles, tanks, mortars, and UAVs. Anti-tank and anti-landing ambushes were also practiced.³³ The Eastern Military District also conducted an urban combat exercise. Subunits rehearsed the movement of a column of vehicles while escorted by a reinforced armed subunit. Servicemen rehearsed various missions, the most important being the organization of communications using open, secure, and satellite communication channels while under an electronic warfare attack from the “enemy.” The main goal of the exercise was to accumulate experience in providing stable communications using the Redut multipurpose mobile communications complex, the R-439-MD2 satellite uplink vehicle, and the R-441-OV “Liven” mobile satellite stations.³⁴

Private military companies in Syria

The first private military company (PMC) to operate in Syria, Russian media reports, was associated with the terrorists. It was called Malhama Tactical and was composed of fighters on the side of radical Islamist groups. The company developed into a skilled marketing operation whose goal was to earn money. The company posted videos on social media and YouTube. It appeared to begin operations in Syria in 2015 and did not take part in many actual skirmishes.³⁵

In 2015 the first revelations and interviews appeared of Russian citizens fighting for a PMC in Syria. They also were doing so to earn money, which was in short supply in many areas of the

³¹ Ibid.

³² Anton Lavrov, “A Polite Combat Assault: On the Advantages of Russian Warfare Tactics, Which Were Developed in Syria,” *Izvestiya Online*, 3 August 2018.

³³ No author provided, “Servicemen of the Western Military District Guards Tank Army Rehearse Holding Population Centers with Fighting within the Framework of a Muster with Battalion Commanders,” *Ministry of Defense of the Russian Federation*, 21 February 2019.

³⁴ No author provided, “Eastern Military District Signals Personnel in Buryatia Repelled an Attack of Notional Saboteurs against a Vehicle Column in Urban Conditions,” *Ministry of Defense of the Russian Federation*, 20 April 2019.

³⁵ Aleksandr Atasuntsev, “How ‘Russian Mercenaries’ Sold Syrian Jihad; Story of the First Russian-Speaking Private Military Company Operating for Terrorists in Syria,” *Gazeta.ru*, 12 March 2017.

nation outside of Moscow and Saint Petersburg. Agreements were signed to keep their participation in such operations secret. The first Russian PMC was the Slavyanskiy Korpus (Slav Corps), which no longer exists. Now only the Wagner PMC and the Turan PMC exist, the latter being a Muslim battalion, according to one PMC member who chose to speak out. Generally, the equipment in the PMCs is very old, which causes many fighters to buy their own weapons. After expenses fighters make about \$2,500 dollars a month.³⁶ The fighter offering the interview did not state to which PMC he belonged or whether such pay was sufficient for the chances he was taking.

In August 2017 the news and media website *Meduza* published an interview with Denis Korotkov, a journalist for the Saint Petersburg publication *Fontanka*. Korotkov had reported earlier on operations in Syria run by the Wagner PMC. The latter organization is led by Dmitry Utkin and appears to have financial ties to Russian oligarch Yevgeniy Prigozhin, who is a close associate of President Vladimir Putin. Korotkov is concerned that Wagner, armed with tanks, artillery, and armored personnel carriers, is not carrying out guard or security details in Syria but is fighting terrorists or, as he wrote, “our oligarchy is waging war.”³⁷ Such a group is not constrained by the law, which a nation’s military force would be, which means its operations are illegal and ethically wrong. Yet members of Wagner have been photographed with Putin and some have received government medals, which provides more than an air of Kremlin recognition/acceptance of the role Wagner is playing. Most fighters serve with Wagner for the money, but others do it for the prestige of being a military commander instead, as Korotkov notes, of finding life only offers them a chance to be, for example, a storeroom clerk.³⁸ Perhaps Russia has decided it is better not to legalize PMC activities, since this enables their most useful feature—plausible deniability—to continue to work. Russia can simply deny knowledge of what Wagner does. Russia’s Defense Ministry seldom refers to PMCs, ignoring requests for information. And it is difficult to even consider Wagner as a PMC, since it is conducting combat operations. More likely, it is an illegal armed formation.

Further, Korotkov noted that he learned (he didn’t say how) about a contract on extracting oil from Syrian territory between Syrian authorities and the Russian firm EuroPolis. There is a link, he adds, between the latter and Prigozhin. So, in addition to supporting the state and the President, Prigozhin may well be in this for oil profits too.³⁹ Another report noted that the original reason Wagner was hired for activity in Syria was to protect oil extraction facilities,⁴⁰ which some believe Assad had promised to transfer to Russian investors.

³⁶ Yekaterina Sazhneva interview with a member of a Russian PMC, “Revelation of a Fighter in a Private Military Company in Syria: ‘The Weapons Situation Is a Disaster.’ Blood and Money in the ‘Sandpit,’” *Moscow MK Online*, 10 October 2017.

³⁷ Yevgeniy Berg interview with Denis Korotkov, “People Think It Doesn’t Affect Them. But It Affects Everyone,” *Meduza* (in English), 30 August 2017.

³⁸ *Ibid.*

³⁹ *Ibid.*

⁴⁰ Irek Murtazin, “Islamists Defeated for the Elections. Why Military Units and Private Military Companies’ Combatants So Far Do Not Intend to Leave Syria,” *Novaya Gazeta Online*, 7 December 2017.

In an October 2017 article in *Novaya Gazeta Online*, Wagner's organization was outlined. There were four reconnaissance and assault brigades listed, with three companies in each brigade. In addition, the organization included an artillery battalion having three batteries, a tank company, a sabotage and reconnaissance company, a signal company, and support personnel. There was a statement that Wagner has 2,000 people in Syria.⁴¹ It is clear why the organization is considered a true military unit and not a simple security company.

The events of early February 2018 offer some rationale for the Defense Ministry keeping its distance from PMCs. On 7 February an oil refinery built in peaceful times by the American company Conoco appeared was the focus of an attack from Wagner. However, some US, British, and representatives from other nations were at the refinery. Wagner fired on the complex and it was met with a strong response from the refinery area that included US airpower. Nearly a hundred Wagner mercenaries perished. Russian authorities have remained silent and did not denounce the strikes, perhaps indicating that they had helped plan the operation that went terribly wrong.⁴²

Weapons Testing

Vice Premier (and former Deputy Defense Minister) Yuriy Borisov stated that the war in Syria has offered Russia a chance to test military hardware and, in turn, reveal problems with some systems. Among the many systems tested were new aircraft, rocket launchers, numerous vehicles, and other equipment that was examined under combat conditions.⁴³ President Vladimir Putin noted that 1,200 representatives from 57 defense enterprises helped eliminate 99 percent of all defects in military equipment.⁴⁴ Even robotics were tested for problems. For example, one blogosphere report noted that a "high-technology" assault had utilized Russian robots along with Syrian infantry and Russian artillery under the control of an UAV and the Andromeda-D battlefield command and control system.⁴⁵

The testing has been extensive, and now covers five plus years of action in the climatic conditions of Syria. Since over 600 pieces of equipment were tested, what follows are several representative samples of the testing in 2017 and 2018, listed according to the dates they were reported.

2017

- A third wave of modernization of the BRDM-2 armored reconnaissance vehicle is being tested in Syria, with the installation of a closed turret with a tank machine gun in which the gunner is protected against enemy projectiles. The

⁴¹ Irek Murtazin, "The Syrian Campaign of the Mysterious 'Wagner Private Military Company': Numerical Strength and Weaponry and Key Operations and Conflict in Defense Ministry Top Echelons," *Novaya Gazeta Online*, 9 October 2017.

⁴² Pavel Felgengauer, "Rout," *Novaya Gazeta Online*, 21 February 2018.

⁴³ No author provided, "Syrian Proving Ground: How the War Helped to Break in Russian Weapons. Yuriy Borisov Talks About the Employment of Russian Military Hardware in Syria," *Gazeta.Ru*, 17 December 2018.

⁴⁴ No author or title provided, *Interfax* (in English), 30 January 2018.

⁴⁵ Nikita Volchenko, "Syria Has Become a Test Range for Testing the Latest Developments of Russia's Defense Industrial Complex," *Vzglyad Online*, 3 February 2017.

vehicle has good off-road capability, with retractable wheels that can negotiate deep ditches and trenches.⁴⁶

- One report noted that Tochka-U tactical missiles and Iskander missiles were fired into “opposition” positions in the city of Idlib. Russia denied the accusations.⁴⁷
- Russia’s leadership in Syria appears to have been provided with new generation armored suits, as one officer appeared at a press outing in heavy-duty Kevlar, also known as aramid fiber, material. It is reportedly five times stronger than steel.⁴⁸
- Spetsnaz forces were seen armed with the Ak-73M3 assault rifle, with the Picatinny rail for mounted daytime sights, the Krechet Collimator sight, and the Lun night-vision monocular.⁴⁹
- Problems were discovered with the onboard electronic apparatus of the latest Russian Su-34 and Su-35 aircraft and their software, as well as the compatibility of the latest weaponry with the onboard systems of long-range aviation bombers. The reliability of defense systems to protect aircraft against man-portable air-defense missile systems was also a problem needing a fix.⁵⁰
- Borisov noted that the weapons tested in Syria include the Su-35S and Su-30SM fighters, Su-34 fighter-bombers, Su-24M frontline bombers, Su-25SM attack aircraft, Tu-22MZ and Tu-95MS long-range aircraft, and Ka-52, Mi-24, Mi-35, and Mi-28 helicopters. While not specifying equipment types, he noted that the latest communications, reconnaissance, space weaponry, and electronic warfare systems along with the Ratnik individual soldier gear were tested.⁵¹
- Defense Minister Shoygu noted that the T-90 tank gave an excellent account of itself in combat against terrorists.⁵²
- Russian engineer forces deployed the PP-2005M pontoon bridge for Syrian troops to cross the Euphrates. The bridge can be erected in roughly an hour and has a carrying capacity of 120 tons.⁵³
- Shoygu noted that Iskander tactical mobile surface-to-surface missiles, Kalibr and Kh-101 cruise missiles, and Tochka-U missiles were all used in Syria.⁵⁴
- It was noted that the Solntsepek TOS-1A heavy rocket launcher has been used in the Idlib Province and earlier in Hama Province.⁵⁵ The Solntsepek is a heavy

⁴⁶ Dmitriy Grigoryev, “Russian Armored Recon Vehicles Have Appeared in Syria,” *Rossiyskaya Gazeta Online*, 3 February 2017.

⁴⁷ No author or title provided, *Interfax-AVN Online*, 9 February 2017.

⁴⁸ Oleg Koryakin, “Russian Officers in Syria Wear Super-Armor,” *Rossiyskaya Gazeta Online*, 6 March 2017.

⁴⁹ No author or title provided, *Interfax* (in English), 9 March 2017.

⁵⁰ No author or title provided, *Vedomosti Online*, 24 May 2017.

⁵¹ No author or title provided, *Interfax* (in English), 24 May 2017.

⁵² Yuriy Gavrilov, “Shoygu Assembled the Generals. The Military is Collating the Syrian Experience,” *Rossiyskaya Gazeta Online*, 18 July 2017.

⁵³ Pavel Ivanov, “Negotiating Rivers. NATO Armies Losing the ‘War of the Bridges,’” *Voyenno-Promyshlennyi Kuryer (Military-Industrial Courier)*, 11 October 2017, p. 1.

⁵⁴ No author or title provided, *Interfax*, 22 December 2017.

⁵⁵ No author or title provided, *Lenta.ru*, 30 December 2017.

flamethrower system packed with a thermobaric mixture which, when detonated, creates the effect of a fuel-air explosion. It is effective on mountain terrain or against urban structures.

2018

- Russia's Kh-101 cruise missile was tested and then upgraded based on local climatic conditions. The "combat-mission sequences" for Syria were adjusted.⁵⁶
- The Tor-M2 air defense system was observed at the Khmeimim airport in Syria. The system can detect, track, and destroy targets at a horizontal distance of 15 kilometers and vertical distance of 10 kilometers. The system can hit four targets simultaneously. It is thought that the system will help counter UAV attacks on the airport.⁵⁷
- One article surmised that the 2S19M1 Msta howitzer or its most recent version the 2S19M2 has been deployed to Syria. The article noted that some equipment, such as the Verba and Tor rocket air defense systems and the Uran robot tanks, were announced as having been in Syria only after their return to Russia. A similar experience is being attributed to the newest Msta howitzer.⁵⁸
- The Mi-8 helicopter with the Richag-AV device, a sonar and radar active jammer, has been noted to be in Syria.⁵⁹
- The Mi-28N and Mi-35 helicopters were deployed due to their multirole capabilities and ability to carry out numerous missions. They conducted "free hunting" of terrorists over Syria and much flying was done at night. Night vision systems could spot a vehicle at a range of 15 kilometers with the Mi-28N and at 6-7 kilometers with the Mi-35.⁶⁰
- Servicing and maintenance procedures under combat conditions have offered mechanics ways to improve urgent aircraft repair and offer better planned services and maintenance. Special attention was paid to electronic gear. Some 68 types of aviation technology underwent battle-testing in Syria according to the official account of the Russian Ministry of Defense. Some models were modified, some dropped altogether. For example, the Mi-28NE dropped the Ataka antitank guided missile and replaced it with Khrizantema-VM 9M123M. Further, the Mi-28NE can reportedly now interface with UAVs.⁶¹
- Terrorists are making UAVs both cheaply and quickly, according to the deputy chief of the state's Unmanned Aerial Vehicle Center, Andrey Laykovskiy. Russia has had to develop systems to counter them. Russian UAVs, on the other hand,

⁵⁶ No author provided, "Kh-101 Air-Based Cruise Missile Improved after Syria Campaign—Designer," *Interfax* (in English), 24 January 2018.

⁵⁷ No author provided, "Cameras Detect New Air Defense System in Syria," *Sputnik*, 27 April 2018.

⁵⁸ No author provided, "Syrian Mystery: Msta Howitzer Present or Absent," *Sputnik*, 10 May 2018.

⁵⁹ No author provided, "Secret Syrian Helicopters Capable of 'Frying Enemy Electronics,'" *Sputnik*, 25 July 2018.

⁶⁰ Nikolay Grishchenko, "Pilot Discusses Mi-28's 'Free Hunting' of Fighters in Syria," *Rossiyskaya Gazeta Online*, 17 August 2018.

⁶¹ Dmitriy Yurov, "Okhotnik Ultimatum: The Capabilities of the New Mi-28NE Attack Helicopter," *Zvezda TV Online*, 24 August 2018.

are experiencing unexpected resistance from electronic warfare systems. Thus, there is much work to be done in this area.⁶²

- The Glaz [eye] individual reconnaissance system has been tested in Syria. It included a high-resolution camera that can view areas where an enemy is concealed in uneven terrain or behind buildings. The system is fired 300 meters into the air with a hand-held rocket launcher. A parachute is deployed, and the camera transmits images to a soldier's tablet. The maximum field of view is about one-half of a square kilometer.⁶³ The Skarabey is a small robotic platform on wheels with a high-resolution video camera, a microphone, and a heat sensor. It is used in tunnel searches, since it is only 15 centimeters high and with an electronic motor it is almost noiseless.⁶⁴
- The SPG-9 Kopye was tested in Syria. It is an accurate antitank grenade launcher. Less expensive than antitank weapons, it has a high rate of fire (up to six rounds per minute), has a range of one kilometer, and will soon get a night sight and more powerful ammunition.⁶⁵

Military Art

Defense Minister Sergey Shoygu, in 2017, noted that considering the trends in the military-political and strategic environments, it is essential to upgrade the theory and practice of military art. This requires out-of-the-box thinking and a capacity for finding and executing new forms and methods for employing forces.⁶⁶ In a late 2018 speech to military attaches in Moscow, Gerasimov stated that with the development of new types of weapons, the practical experiences gained in Syria, and the current analysis of modern military conflicts, a new impetus has been provided for the development of the theory of military art. The latter implies the creative application of thought to how equipment or forces could be used under new technological and contextual conditions. This has resulted in numerous innovations by Russia's military in Syria. Some new concepts, however, appear to have developed independently yet may be destined for use in Syria.

For example, some UAVs self-detonate after reaching their targets while others intercept adversary UAVs with a net-throwing device that captures them and lowers them to the ground with a parachute. Artillery shells can be outfitted with smart fuses that allow the munition to detonate at a certain time and create a cloud of thousands of shrapnel balls to disable a drone or reconnaissance quadcopter. A tactical example was an observation that, in addition to classic static

⁶² Roman Kretsul and Aleksey Ramm, interview with Andrey Laykovskiy, "Lieutenant-Colonel Andrey Laykovskiy, on the Use of UAVs in Syria, the Features of Operator Training, and New Equipment for the Armed Forces," *Izvestiya Online*, 12 October 2018.

⁶³ Aleksey Ivanov, "Russian Soldiers to be Equipped with Rocket 'Eye'," *Rossiyskaya Gazeta Online*, 28 January 2019.

⁶⁴ Yuriy Gavrilov, "The Robot Does Not Fear War: Many Unmanned Combat Assets Have Undergone Battle-Hardening in Syria," *Rossiyskaya Gazeta Online*, 20 August 2018.

⁶⁵ Nikolay Surkov and Aleksey Ramm, "'Polite People' Will Be Armed with Kopye; Special Units Will Get Long-Range Antitank Grenade Launchers," *Izvestiya Online*, 8 February 2018.

⁶⁶ Yuriy Gavrilov, "Shoygu Assembled the Generals. The Military is Collating the Syrian Experience," *Rossiyskaya Gazeta Online*, 18 July 2017.

defense, operations in Syria have shown that the conduct of maneuver defense is important today. Troops are countering the enemy under “the conditions of a so-called inverted front or when the front is everywhere.”⁶⁷ That is, troops must be prepared to confront an attack from any direction at any time. With UAVs, troops must be trained to operate in a creative fashion.⁶⁸ That lesson was further certified after the January 2018 terrorist attack on Russia’s Khmeimim Air Base in Syria.

During the past few years, several advances in military art in Syria have been recorded. The following examples are representative of some of these advances:

1. In Syria a “shock-resistant ball robot” was tested. It can withstand being thrown or dropped from a height of 5 meters, after which it adjusts itself to vertical. With four video cameras and a light-emitting diode (LED), a microphone, and transmitter, it can transmit images from a 360-degree view.⁶⁹ The ball is known as the Sfera intelligence-gathering suite (referred to as the roly-poly in the army) and is used to reconnoiter tunnels.⁷⁰
2. New Syrian-based tactics included the “Syrian berm.” It is a barrier of sand or earth behind which an assault subunit takes cover. A tank group delivers fire through gaps in the obstacles, where the primary target is enemy artillery positions. Another report stated that the berm would be pushed forward by armor-plated bull dozers, allowing the attackers to slowly approach a target. If the berm was of sand, it can deflect lasers and infrared targeting systems.⁷¹
3. A Russian urban warfare tactic was to encircle and blockade a town, preventing supplies or reinforcements. Then a series of offensives were launched against the city from several directions at once. With the defense then spread thin, pockets of resistance were hammered by artillery and air strikes, sapping further any ability to resist. Swift strikes then cut the contested area into isolated pieces to break the will to resist.⁷²
4. An interesting development that the military has discussed for two years is known as the tank carousel method. It employs tanks moving in a circle, which take turns engaging the enemy from the same firing position. As one source noted, servicemen practice “continuous fire with tanks taking turns to change firing position until the pop-up and moving targets at ranges of between 500 meters and 2500 meters are completely destroyed.”⁷³ A 2018 article noted that tanks can “conduct fire from behind a so-called ‘Syrian berm’ and execute fire according to the ‘tank carousel’ method” from subunit to full tank company

⁶⁷ Taras Rusk, “The Combat Priorities of the Siberian Brigades,” *Krasnaya Zvezda Online (Red Star Online)*, 15 May 2019.

⁶⁸ Ibid.

⁶⁹ Nikolay Grishchenko, “Russia to Develop Spy Grenades with Video Surveillance,” *Rossiyskaya Gazeta Online*, 6 February 2018.

⁷⁰ Aleksandr Khoklov, “Tactical Innovations: Why the ‘Tank Carousel’ Behind the ‘Syrian Parapet’ is So Scary for the Enemy,” *Yezhenedelnik Zvezda*, 14 December 2018.

⁷¹ Ibid.

⁷² Anton Lavrov, “Outcomes of the Russian Military Campaign in Syria,” *Moscow Defense Brief*, No. 3 2018, p. 14.

⁷³ *Website of the Ministry of Defense of the Russian Federation* (in English), 30 January 2019.

- strength.⁷⁴ In a 2017 description of the method, it was stated that while the first tank crew delivered fire in place, “the crew of the second loaded the ammunition. When the first tank rolled out for flanking fire, the second took up a position for fire from the halt.”⁷⁵
5. Over the course of the next three years the Kh-25MP tactical anti-radiation missile will be converted to a Kh-25ML model. The latter will be an upgraded precision munition with a laser homing sensor and a modified control unit. It will be able to strike surface-to-air missile complexes and other ground targets such as radars and bridges. Launched from fighters, bombers, or ground attack bombers, the missile has a launch range of about 20 kilometers and a speed of 850 meters a second. The Kh-25ML missile was purportedly tested in Syria.¹⁰⁹
 6. Engineering reconnaissance missions have used the “horseshoe method” to detect explosive objects. Engineers move along both shoulders of a route with electronic warfare assets preventing radio-controlled detonations. Dogs are employed in the reconnaissance effort along with Korshun mine detectors.⁷⁶
 7. The Zavet control vehicle with artificial intelligence elements determines in real time areas hazardous to tanks via its automated control system, which scans the terrain and determines where problems exist. Targets are classified in terms of their immediate threat, and the system then composes a plan for destroying identified adversary equipment, with the coordinates of enemy vehicles sent to crews of antitank weapons.⁷⁷

A. V. Vdovin, writing in *Voennaya Mysl'* (*Military Thought*) in early 2018, provided one other example of a change in military art based on experience gained in Syria. He stated that illegal armed formations (IAF) had forced four such developments, which he pointed out:

1. The method of using assets in a critical sector has changed. It no longer is about concentrating troops, but about maneuvering by fire and strikes to destroy enemy assets.
2. Capabilities at the tactical level have allowed for strategic destruction assets and highly mobile combat capabilities to shift efforts to rout an adversary to include the entire depth of the confrontation.
3. The range and precision of the fire fight are important features of contemporary tactical actions.
4. As the number of adversary assets increases, there is a growing uncertainty as to how a situation will develop. This requires that commanders respond promptly with their mobile elements to changing situations.⁷⁸

⁷⁴ Andrey Sergeevich Ivanayev, interviewed by Viktor Siryk, “Whoever Is Given More Has More Responsibility,” *Zvezda TV Online*, 24 July 2018.

⁷⁵ *Website of the Ministry of Defense of the Russian Federation*, 15 September 2017.

⁷⁶ No author provided, “Combat Engineers from South Ossetia Military Base Perform Engineering Reconnaissance Using the ‘Horseshoe’ Method,” *Ministry of Defense of the Russian Federation*, 7 August 2018.

⁷⁷ Aleksandr Kruglov and Aleksey Ramm, “Defense Ministry Has Adopted the Zavet; Combat Control Vehicle Will Amalgamate Antitank Missile Systems into a Single Fist,” *Izvestiya Online*, 6 February 2018.

⁷⁸ A. V. Vdovin, “Adaptive Approach to the Use of Forces and Means for the Fight with Terrorists Based on the Experience of Armed Conflict Outside Russia,” *Voennaya Mysl'* (*Military Thought*), No. 5 2018, pp. 35-36.

Numerous projects and equipment being tested in Syria are hidden from view. However, one that Russia has discussed openly is the testing of lasers. They have been tested during cool times in the morning when a heat haze rises from the ground and then later during the day, when the air is more heated. These conditions cannot be adequately tested in Russia. This has allowed scientists to make corrections to their equipment and adapt a laser's use to different environmental conditions.⁷⁹ Other open source projects involving Syria discussed robots, which included the Uran-9, a reconnaissance robot, tank-killer and mobile fire support asset; Uran-6, a mine-clearing robot; the Nerekhta, which can be produced as an artillery reconnaissance module or transport module; and the Soratnik, an unmanned armored vehicle used as a fire support or mobile relay robot or for mine-clearing terrain or evacuating wounded.⁸⁰

In late 2016, six Platforma-M's and four Argos robots were purportedly mobilized in Latakia, where the robots' attack was "supported by Akatsiya self-propelled guns and by Syrian soldiers."⁸¹ Robots approached to within 100 meters of enemy fortifications and opened fire. Terrorists responded, exposing their positions. The self-propelled guns fired at them, their fire coordinated by Andromeda-D automated troop command and control system vehicles.⁸²

Tactical Changes Due to Combat Experiences

There were two articles that mentioned "tactics" in the title. The first noted that Syrian combat experiences were incorporated in the Zapad-2017 and Vostok-2018 exercises and maneuvers. At the early stages of the Syrian operation, a problem was coordinating the operations of all the elements involved (Syrian, Russian, Iranian, etc.). An integrated grouping was established thanks to an automated command and control system and communications facilities. General Dvornikov, ex-commander of the Russian grouping in Syria, stated that the following detachments collaborated: The Desert Hawks volunteer formation, the Islamic Revolution Guards Corps Militias, the Syrian Army's 5th Assault Corps, and Hezbollah and Fatimid detachments. Russia's leaders divided Syria into zones of responsibility with up to five officers responsible for coordination along tactical sectors. Air defense forces and C2 specialists were in the command group. The C2 specialists were from the reconnaissance-strike operations and planning sectors. It was noted that a "separate group handled coordination with the armed forces of the Western states, Israel, and Turkey."⁸³

The report noted that so far 63,000 Russian military personnel, to include 434 generals, took part in operations. Further, it was stated that

⁷⁹ Ivan Safronov interview with Boris Viktorovich Obnosov, "The Experience of Actual Combat Operations is Simply Invaluable," *Kommersant Online*, 26 September 2016.

⁸⁰ Gavrilov.

⁸¹ Vladimir Tuchkov, "Russian Robots in Syria: Argo and Platforma-M Strike, Akatsiya Finishes Off. Kalashnikov's Developments Will Soon Strengthen the Combat Might of 'Smart Iron,'" *Svobodnaya Pressa*, 14 May 2017.

⁸² Ibid.

⁸³ Aleksey Abaturov, "'Syrian Berm' and 'Free Hunt': Combat Experience We Have Gained in Syria," *Yezhenedelnik Zvezda*, 2 October 2018.

All personnel in command of military districts, combined-arms armies, and air and air defense armies, divisional commanders, and 95 percent of combined-arms brigade and regimental commanders served in the troop grouping in the Syrian Arab Republic along with their staffs and headquarters teams.⁸⁴

This indicates that combat experience has proliferated throughout the force. Aerospace forces were stated to have made the leading contribution to the terrorists routing. Precision weaponry utilized the SVP-24 Gefest bombing and navigation system, which, when placed on outdated Su-24s, offered a “suitable platform.” Strikes were made based on information from different sources or from the use of the so-called “free hunt.” Aircraft hit targets and terrorist groupings in the outer defense, while missile troops and artillery used their assets against targets in the cities.⁸⁵

Tactics include the “three-shift offensive” that allowed attacking day and night. Outstanding tactical use of “outflanking detachments” (no further description offered) was made in mountainous terrain, while armor plated bulldozers used the tactic of the “Syrian berm” in ground operations. Experience was also gained in the use of all-terrain vehicles, counter-tunnel warfare, and other methods and means of waging armed warfare.⁸⁶

Other tactical lessons learned included the “mountain forest hunt” tactic, which involved sniper pairs bypassing guard posts and “eliminating” commanders of a hostile subunit. New forms and methods of warfare, and new ways of organizing battle and the interaction among artillery, aviation, and UAV subunits were explored to improve combat missions. Grenadiers are trained to engage “jihad mobiles,” those transport vehicles loaded with explosives, with RPG-7Vs or AGS-17s. Regarding humanitarian operations, military police subunits were used to seal off a populated area, UAVs are used to find and then inform local residents of the location of escape corridors, and screening stations with sniffer dogs and teams of doctors and nurses were made available.⁸⁷

Exercises are now taking advantage of various experiences the force has faced in Syria. Commanders are put in conditions that require them to analyze large amounts of information related to the activities of illegal formations. Some situations are designed to make leaders take quick, non-standard decisions and adopt the initiative, manage resources, and efficiently utilize aircraft, artillery, and other assets that are attached.⁸⁸ Some decisions seem odd yet have a definite purpose behind them. For example, Russian Lieutenant-General Yuri Kuznetsov issued an order to jam 2G and 3G cellular networks on the Khmeimim air base and Tartus naval base since UAVs could be guided by a signal from a specific phone number to these military facilities. One other expert noted that the decision could have been made as well to prevent information leaks.⁸⁹

⁸⁴ Ibid.

⁸⁵ Ibid.

⁸⁶ Ibid.

⁸⁷ Aleksandr Khokhlov, “Tactical Innovations: Why the ‘Tank Carousel’ Behind the ‘Syrian Parapet’ Is So Scary for the Enemy,” *Yezhenedelnik Zvezda*, 14 December 2018.

⁸⁸ Yuriy Borodin, “The Syrian Experience Helps in Both Attack and Defense,” *Krasnaya Zvezda Online (Red Star Online)*, 24 August 2018.

⁸⁹ No author or title provided, *RosBiznesKonsalting*, 20 February 2018.

Logistics, Engineer, and Topographic Support

At an assembly of the Academy of Military Science, Deputy Defense Minister D. V. Bulgakov stated that the logistic support for Russian troops in Syria was “proactive,” that is, it was deployed together with the air grouping ahead of troops. The support aided both Russian and Syrian forces. By the time combat aviation arrived on 30 September 2015, both field infrastructure (storage, living spaces, etc.) and 12,000 tons of material already had been delivered. The support system included command and control organs, and storage, industrial, and repair bases on both Russian and Syrian territory.⁹⁰

Tents were not used for living arrangements, as the Afghan experience witnessed too many instances of group illnesses, such as jaundice, dysentery, and other infectious problems. Block modules were used instead. Due to Syria’s epidemiological situation, where plague and cholera occur episodically, control over soldier’s food supplies was strict.⁹¹ Further, Russian cooks, not Syrian employees, were used to eliminate any chances of sabotage or the poisoning of Armed Forces personnel. Special clothing for hot climates was introduced and, for the first time under combat operations, “Voentorg” (PX) facilities were used. At the port in Baniyas, which stores jet fuel reserves, three reservoirs with “an overall capacity of 45,000 cubic meters” were in service. At the basing points of Khmeimim and Tartus, warehouses for rocket-artillery weapons and aviation means were outfitted along with weapon and ammunition storage facilities.⁹² A cargo reception and a transshipment department were established. Naturally a main task was to maintain weapons and military equipment, with more than 130 repair specialists on hand. Separate evacuation teams were established, and more than 8,500 storage batteries were serviced. Bulgakov noted that active military-technical assistance had begun in Syria in 2012, to include mid-size and capital repair of equipment.⁹³

With regard to engineering efforts, as of February 2018, Russian engineer troops in Syria had reportedly cleared mines from 6,500 hectares of territory, 1,500 kilometers of road, and more than 17,000 buildings and destroyed 105,000 explosive devices. The Uran-6 multifunctional mine clearing robotic system, the Skarabey platform that is sent into tunnels, the OKO-2 ground-penetrating radars, radio-controlled device blockers, and the Listva remote-controlled mine clearing vehicle, fitted with a broadband electromagnetic pulse generator, are equipment that is replacing sappers who in the past inspected patrol routes. Russia has organized a mine clearing center in Syria with eight Russian instructors who have graduated 600 Syrian sappers.⁹⁴

The journal *Armeyskiy Sbornik (Army Digest)* noted that Syria contained special features for engineer support. Many areas were isolated, some were inaccessible, and others contained poorly developed road networks. Even the simplest structures utilized filled gabions, as the terrain

⁹⁰ D. V. Bulgakov, “Features of the Logistics Support of the Russian Grouping of Troops (Forces) in the Syrian Arab Republic,” *Vestnik Akademii Voennykh Nauk (Journal of the Academy of Military Science)*, No. 2 2018, pp. 31-32. The author would like to thank Dr. Harold Orenstein for translating this article.

⁹¹ *Ibid.*, p. 33.

⁹² *Ibid.*, pp. 34-35.

⁹³ *Ibid.*, p. 35.

⁹⁴ Aleksey Abaturov, “Skarabey, Listva, and Sfera. What Brand-New Technical Systems Are Being Utilized by Russian Sappers,” *Zvezda TV Online*, 21 February 2018.

was often rocky or contained areas which were inaccessible to earth-moving equipment. An important task was to create passages within mine fields. The detachment also included a canine subunit and Uran-6 mobile robotic mine-clearing complex. Once mines were destroyed or neutralized subunits restored infrastructure, electric power, and water supplies where they had been disrupted.⁹⁵

Finally, with regard to topographic support, electronic maps of major cities were provided and special maps and photographic documents of Syrian terrain and territory were “updated, issued, and transferred to the Group of Forces.”⁹⁶ A new technology was developed to ensure that work on topographic maps included reductions in the time required to get the information to the troops. The accuracy of geospatial information has increased the planning and employment of weapons systems in Syria.⁹⁷

A Russian Military Commentator’s October 2019 Assessment

Aleksei Ramm is a military commentator for the Russian paper *Izvestia*. His commentary on various elements of the Russian Armed Forces has been noteworthy for its comprehensive nature and clear explanations of new developments. He recently wrote an interesting paper on Russia’s Army for the *Center for Naval Analysis*, which contained several highlights of Russian military activities in Syria. These key points are listed in bullet form below:

- The Syrian campaign [author’s comment: the word campaign was used on numerous occasions] was influential in developing Russia’s Command, Control, Communications, Computer, Intelligence, and Satellites (C3-C4IS) and Unmanned Aerial System (UAS) concepts.⁹⁸
- Successful leadership in Syria has led to the promotions of Colonel-General Sergey Surovikin to be the Commander-in-Chief of the Aerospace Forces and there has been word that Lieutenant-General Oleg Makarevich may be appointed Commander-in-Chief of the Navy, making this a time of “Army occupation” in key posts due to the Syrian experiences of Army leaders, according to Ramm.⁹⁹
- Russia’s Syrian contingent was a joint team comprised of Aerospace Force and Navy elements, combined arms and electronic warfare formations, the marines, airborne troops, and so on, with the team being either operational or strategic at different stages of the campaign.¹⁰⁰

⁹⁵ M. Konyshov and O. Kosteneva, “Syria Specifics of the Use of Gabions,” *Armeyskiy Sbornik Online (Army Digest)*, 31 May 2019.

⁹⁶ Aleksandr Aleksandrov, “Military Topography ‘Digitized’: On 8 February It Will Be 205 Years from the Day the Russian Federation Armed Forces Topographic Service Was Formed,” *Ministry of Defense of the Russian Federation*, 8 February 2017.

⁹⁷ Ibid.

⁹⁸ Aleksei Ramm, “The Russian Army: Organization and Modernization,” *CNA Analysis and Solutions*, October 2019, p. 2.

⁹⁹ Ibid.

¹⁰⁰ Ibid., p. 7. The joint team is either temporary or permanent, and is a larger formation activated on the basis of a combined arms army. It leverages army assets and those of the other branches. It usually has several squadrons of

- The Command Brigade in Syria provided C4I and combat service support to the army staff, and included seven battalions (radio-relay, satellite, and other communications) and three independent companies (which used high-bandwidth wireless data networks).¹⁰¹
- Ramm offered, from his perspective, how the Syrian experience has affected the organization of a Combined Arms Army. He believes it now includes the following components: Artillery Brigade; Rocket Brigade; Antiaircraft Brigade; Recon Brigade; Signal Brigade; Mechanized Rifle Brigade; Special Forces Company; Chemical Regiment; ECM Battalion, and an Engineering Regiment.¹⁰²
- The Nuclear, Biological, and Chemical Defense (NBC) Regiment now has a battery of TOS-1A Soltzenek heavy flamethrowers which reinforce advancing troops as part of maneuver formations.¹⁰³ This has upgraded the combat capabilities of units in Syria and provides forces with thermobaric capabilities.
- The Engineer Regiment has deactivated battalions using heavy engineering and road-building equipment and replaced them with assault engineer companies that assault fortified enemy positions buildings and man-made facilities.¹⁰⁴ There was also an increase in the number of personnel involved in demining and mine clearance in Syria.¹⁰⁵ This reinforces the focus on urban operations mentioned in other parts of the discussion above, indicating the forces ability to shift requirements according to the needs of troops on the ground.
- The Electronic Warfare Battalions and the Independent Military Intelligence Brigade are both classified units that have been used in Syria. The latter appears tasked with reconnaissance of the enemy rear while Special Operation Troops appear more likely to be involved in assault operations.¹⁰⁶
- The Syrian campaign has been a real testbed for the ESU TZ, a modernized tactical-level C4 which was integrated with the C4s of other services and reportedly helped establish effective interaction between the Army and Aerospace Force. Campaign videos also show soldiers operating Strelets terminals for forward air control. The system is supposedly used in conjunction with the ESU TZ.¹⁰⁷ The Syrian campaign revealed that the UASs and Strelets have become the key target information providers.¹⁰⁸ The Strelets even interacts with the Tu-22M3 weapon-aiming pod known as the Gefest.¹⁰⁹

attack and transport helicopters and tactical aviation (p. 5). Assets included the reintroduction of heavy artillery batteries (240-mm 2S4 Tulpan mortars and the 2S7 Pion/Malka self-propelled cannons and a UAV company) (p. 14).

¹⁰¹ Ibid., p. 13.

¹⁰² Ibid.

¹⁰³ Ibid., p. 15.

¹⁰⁴ Ibid., p. 16.

¹⁰⁵ Ibid., p. 17.

¹⁰⁶ Ibid.

¹⁰⁷ Ibid., pp. 30-31.

¹⁰⁸ Ibid., p. 41.

¹⁰⁹ Ibid., p. 43.

- A limited number of Akveduk communication systems were deployed in Syria along with the Azart-P system.¹¹⁰ The R-168 Akveduk is a fifth-generation tactical radio system and is the primary tactical radio for the Ground Forces and Airborne units. It provides digital data transmission and resilience against jamming. The Azart-P is a sixth-generation tactical radio and has digital data transmission encryption and electronic warfare resilience capabilities. It has a range of 4 kilometers.¹¹¹
- Syrian lessons learned have included transitioning communication brigades and battalions to a modular organization. First tested in the Zapad-2017 exercise, the modules are probably company sized detachments that use satellite, radio relay, and other communication equipment.¹¹² The Defense Ministry tested in Syria a move toward the so-called “single information space,” where command posts are united into a single network controlling battlefield developments while allowing users instant access to data streams.¹¹³

Near the end of Ramm’s paper he wrote a section titled “Lessons Learned in Syria in the Army Evolution.” He noted that Defense Minister Sergey Shoygu has called for integrating Syrian experiences into combat training. Now, when exercises are discussed in journals, they are often stating that the exercise is using some of the lessons learned in Syria. New tactical techniques include close quarter combat, single-tank combat employment, and anti-tank guided missile (ATGM) counteractions, which were integrated into Army field manuals at the end of 2017. However, Ramm notes, the Defense Ministry has not published official data on the Army’s involvement in the campaign other than to mention that a few artillery batteries (122-mm D-30 and 152-mm MSTA-B) have been involved. A detachment of BTR-82s and T-90A tanks have been noted in photos, probably serving as protection for artillery. Ramm noted that combined arms units are known to operate as task forces, but that was the extent of his comments on Army forces.¹¹⁴ He also stated that the prime campaign result was the experience that battalion, regiment (brigade), and division army officers gained in the distributed command system. A reconnaissance and fire contour (RFC) concept was tested and “warfare was conducted by mission-tailored task forces and combat teams, not the formation of strict military hierarchy.”¹¹⁵ This application of task forces conforms to the concept in Russian military thought that there should be no stereotyping.

The method of promoting officers to the position of Military District Commander apparently has changed as a result of the Syrian experience. It was based on a nominee’s appointment to specific positions in the General Staff and other places, Ramm notes. Now, however, promotions were granted on experience attained in Syria and success in the command of

¹¹⁰ Ibid., p. 33.

¹¹¹ See *Operational Environment Watch (OE Watch)*, February 2018, pp. 2-3 at <https://community.apan.org/wg/tradoc-g2/fmsso/m/oe-watch-past-issues/266059/download>

¹¹² Aleksei Ramm, “The Russian Army: Organization and Modernization,” p. 35.

¹¹³ Ibid., p. 36.

¹¹⁴ Ibid., p. 45-46.

¹¹⁵ Ibid., p. 46.

combined and joint teams. This concept applies to all current district commanders.¹¹⁶ except the Northern Fleet.

Finally, Ramm noted that combined arms firepower has improved. Divisions have long-range anti-aircraft and artillery systems, and pocket-sized Iskanders can engage targets up to 100 kilometers away. Targets within 500 kilometers, due to the capabilities of the ESU TZ, Strelets, and UASs, can be defeated in real time with precision strikes. The all-around layered air defense can engage targets at a distance of over 70 kilometers.¹¹⁷ Kornet and Kornet-D ATGMs, tank-guided missiles, and the Khrizantema long-range missile defense system can eliminate vehicles at a distance of up to 5 kilometers.¹¹⁸

Conclusions

Russian military assistance has enabled Syria to turn the tide of defeat into first a stalemate and then in the direction of success. While a final result has yet to be completely attained, Russia, along with its compatriots from Syria, Iran, Hezbollah, and elsewhere, is close to achieving that goal. *The Economist* noted the following positives and negatives of Russian operations thus far:

Russia is elated by the outcome of its intervention. It saved Mr. Assad at relatively small cost to itself, became the kingmaker in Syria, and returned as a powerbroker in the Middle East for the first time since the dissolution of the Soviet Union.¹¹⁹

Russia is ensnared by its local ally. Mr. Assad is strong enough to resist Russian entreaties to make political concessions, but too weak to be threatened without risking his collapse. Then there are more catastrophic risks: a confrontation with Turkey over Idlib, say, or a Turkish invasion to push back Syrian Kurds, or even a war between Israel and Iran. A surprising number of Russian experts worry about the venture ‘collapsing like a house of cards.’¹²⁰

For Russia, this experience has proven to be invaluable. The battlefield provided Russia with much latitude (and secrecy) in choosing how to conduct operations, since the only first-hand commentary of the conflict came from Russian and Syrian controlled media. As a result, Russia has had close to a free hand in deciding the tempo and context of operations. It has, however, had to learn to work closely with a set of friends that differ 180 degrees from their Warsaw Pact allies of the Cold War era. A local power (Syria), a more formidable regional power (Iran), a terrorist group (Hezbollah), and others had to be integrated into a working coalition, which had issues. Further, it has been forced to work with the United States in regard to air and special operations.

Over the course of the conflicts four-year history Russia has tested a host of new weapons and new concepts and has trained a number of leaders in contemporary warfare outside its borders.

¹¹⁶ Ibid., p. 47.

¹¹⁷ Ibid., pp. 48-49.

¹¹⁸ Ibid., p. 50.

¹¹⁹ No author provided, “Putin’s Road to Damascus,” *The Economist*, 18 May 2019, p. 40.

¹²⁰ Ibid., p. 42.

New methods of employing Spetsnaz forces and new ways of utilizing private military companies were explored. The Syrian experience has demonstrated to Russian officers that terrorists will be utilizing urban centers as their main base. It is a very difficult proposition to extract extremists from such shelters while trying simultaneously not to harm the local population. The use of robotics during urban operations and learning ways to use radio-electronic equipment or information technologies to disorganize enemy signals was another area of learning, as was the security and defense of airfields due to the UAV attacks that terrorists carried out against them. The simultaneous requirements of conducting such combat operations while preparing emergency evacuation routes and humanitarian assistance for locals stretched the military thin.

Russia is in the process of inculcating these lessons learned into the force through conferences, round tables, and new manuals. The experiences gained in Syria are not the only lessons learned, however. Russian testing has taken into consideration how new weaponry might confront not only terrorist but also Western equipment as well. This includes ways to counter Western uses of UAVs and ways to disorganize Western reliance on global positioning services. Russia plans to have 67 percent of its military equipment modernized by the end of 2019. None of the world's armies are capable of reaching this figure, according to Defense Minister Shoygu.¹²¹ Russia is developing new weapons and systems as well. For example, under development are a unique aerial bomb known as Drel' that can destroy objects of varying degrees of protection. The Pantsir surface-to-air missile system is being modified to hit low-speed maneuvering targets.¹²²

Overall, Russia's Armed Forces displayed a much higher degree of competency than they did during their incursion into Georgia and they have not faced the sanctions that resulted from their operations in Ukraine and Crimea. They are again a force with which to be reckoned.

¹²¹ No author or title provided, *Interfax* (in English), 24 December 2018.

¹²² No author or title provided, *RIA Novosti*, 26 December 2018.

Appendix: Acronyms

Term	Definition
AMS	Academy of Military Science
CMD	Central Military District
ESU TZ	Joint tactical control system
IAF	Illegal Armed Formations
LED	Light-emitting diode
MDO	Multi-domain operations
NDMC	National Defense Management Center
PMC	Private Military Company
RFC	Reconnaissance and fire contour
RTK	Robotic-technical complexes
VM	Military Thought

PART TWO: OPERATIONAL ART/OPERATIONAL MANEUVER GROUPS IN SPACE

Introduction

Today, circling high above Earth, are over 2,000 satellites. Some are of commercial origin and some military. In the latter's case, they are responsible for watching military equipment and troop movements in other nations, coordinating command and control activities, and helping weapons and forces navigate their way across the globe, among other issues. Their importance to the way nations plan to deter or conduct modern warfare is hard to overestimate.

Russia's military is and has been deeply embedded in the study and use of such space activities, from the launch of Sputnik in 1957 to today's US reliance on Russian rockets to send astronauts to the International Space Station. In addition, Russian military thinkers are probing deeper into finding ways to use space for military advantage. This domain continues to escalate in importance. In 2015, Russian Defense Minister Sergey Shoygu conceded that aerospace is now the center of gravity (COG) of future wars,¹²³ a reference made even earlier in 2011 by Makhmut Gareyev, a long-time prominent military theorist who is a General of the Army and President of the Academy of Military Science.¹²⁴ In 2018 Shoygu added that "precision-guided munitions and reconnaissance and electronic warfare systems are exerting ever greater influence on the development of operational art."¹²⁵ Another 2018 article on modern methods of aerospace and air defense practices noted that "operational art in terms of its inherent purpose remains a theory and practice of resolutely changing the situation in aerospace in one's favor..."¹²⁶

The thoughts of such Russian experts and leaders make it appear imperative for the West to study and conceptualize how operational art might be applied to the aerospace domain where many of these new capabilities or their control mechanisms are found. Questions abound as a result. Would the use of such a domain be considered separately or, more likely, in conjunction with other operations such as ground-based maneuver brigades? What would joint domain operations look like and how would they be implemented? What would be the configuration of an operational maneuver group (OMG) in space?

Russian authors have noted in the past that operational art, which includes the preparation and planning of missions for large-strategic formations, should not stand still or degrade.¹²⁷ and many authors support this contention. In 2012, for example, Gareyev noted that OMGs, a popular Soviet operational term of the 1980s, were liquidated with the fall of the Soviet Union but that OMGs will "obviously be used in some form or another" in the future.¹²⁸ Such observations most

¹²³ *Interfax* (in English), 3 August 2015.

¹²⁴ M. A. Gareyev, "On the Organization of the Russian Federation's Aerospace Defense," *Journal of the Academy of Military Science*, No. 2 2011, p. 40. The author would like to thank Dr. Harold Orenstein for translating this article.

¹²⁵ No author provided, "Russian Federation Defense Minister Sergey Shoygu Opened Russian Federation Armed Forces Operational-Mobilization Leadership Conference," *Ministry of Defense of the Russian Federation*, 12 February 2019.

¹²⁶ A. P. Korabelnikov, "Modern Methods of Aerospace and Air Defense of Facilities and Prospective Development Trends," *Military Thought* (in English), Volume 1 2019, EastView Publications, p. 34.

¹²⁷ V. K. Kopytko, "The Evolution of Military Art," *Military Thought* (in English), Volume 1 2008.

¹²⁸ M. A. Gareyev, "The Living Embodiment of the Brain of the Army," *Arsenal Otechestva*, No. 2 2012, published 17 June 2013 at <http://arsenal-otechestva.ru/article/111-mozg-armii>.

likely have created a mandate for the Operations Department of the General Staff or professors at the General Staff Academy's Department of Operational Art to continue to work on this theory. Now, as opposed to past developments, theorists must take into consideration the impact of a series of technological advancements that not only affect the theory's content but also its reach, which can extend to the heavens (satellites) or under the oceans (cables, submarines, etc.).

Maneuver, deep operations, and breakthroughs are traits that have long characterized operational art's ground operations. They work in space as well. Satellites maneuver and conduct operations such as extended reconnaissance, inspection, navigation, and other activities. Since operational art planners are not standing still, they may well be working on coordinated and integrated methods to align capabilities with operations in this or in other domains. An operational group, it must be remembered, is a temporary large strategic formation that consists of front forces operating on a separate operational direction or sector of the front,¹²⁹ which in this proposed case would be a space axis. Thus, while the focus is often on Russian maneuver brigades creating an optimal fighting force on the ground, Russian planners may simultaneously be creating an optimal fighting force in space.

Before developing operational art theory, Russian planners look to the future through the prism of trends and forecasting. Operational art theory is then adjusted based on the results of the inquiry to ensure it remains ahead of the present strong technological curve that is driving advances in capabilities. Russia's host of new technological achievements in weaponry that President Vladimir Putin touted in March 2018 offer proposed guarantees of strategic stability and parity with other nations for the Kremlin. These new achievements also affect the preparation and planning of operational art for specific new domains, such as space.

This article will attempt to refocus attention on how operational art might be applied to the space domain in Russia's planning process. Thinking in such terms opens up other vectors for planners to consider beyond just ground operations. These variants can add input to contested environment operations as well, such as when examining Russia's potential operations in the Baltic and Central Europeans areas or even beyond to global operations.

A brief discussion of Russia's concept of an operation in general and operational art in particular is offered, along with the added concepts of an operational plan and a concept of operations, the components of operational art. That initial discussion of definitions is followed with some limited comments on operational art by the noted Soviet theoreticians Aleksandr A. Svechin and Georgiy Isserson. The views of other prominent Soviet military theorists' views on operational art can be found elsewhere.¹³⁰ Svechin and Isserson's discussion is followed by more recent discussions on operational art since 1999, which have been few in number. These Russian sources are followed by the work of two US experts, David Glantz and Jacob Kipp, both of whom have written many articles, and even books, on the concept. Their analysis is important, even though truncated here, for it looks at Russian military literature on the topic of operational art from 1914 to more recent times. The article then concludes with a look at Russian satellite and space

¹²⁹ S. F. Akromeev, main editor, *Military Encyclopedic Dictionary*, Second Edition, Moscow: Military Publishing House, 1986, p. 513.

¹³⁰ See, for example, Wilson C. Blythe's interesting discussion of other prominent Russian officers' views on operational art in World War II and earlier time periods (includes the views of Mikhail Tukhachevsky, N. E. Varfolomeev, Vladimir Triandafilov, etc.) in his work "A History of Operational Art," *Military Review*, November-December 2018, pp. 37-49. The discussion covers US and other nations views on operational art in addition to Russian views.

operations, to include how that nation has tested maneuvering satellites and preparations and plans for operations in space.

Definitions of Operational Terms

There are a few examples of what might be termed “official” definitions of Russian terms, and they can be found in Russia’s *Military Encyclopedic Dictionary* and its *Military Encyclopedia*. There are only a few differences in the two sources used here, the 1986 *Military Encyclopedic Dictionary* and the eight volumes written between 1995-2003 that compose the most recent *Military Encyclopedia*. In the latter case only small snapshots of the definition are offered. The point of the comparison of the two sets of definitions is simply to demonstrate consistency, and therefore should be skimmed.

Operational art is defined in the Soviet Union’s 1986 *Military Encyclopedic Dictionary* as “Encompassing the theory and practice of preparing for and conducting combined-arms, joint, and independent operations (combat actions) by large strategic formations of the armed forces by various branches.”¹³¹ Its tasks include the following:

- An investigation of the mechanisms, content, and nature of modern operations and other forms of the operational employment of large strategic formations;
- An elaboration of the means of preparing for and conducting operations, the means and methods of organizing and maintaining coordination, the comprehensive support of troops taking part in operations, and the command and control of them;
- An elaboration of the operational requirements for organizing and arming large strategic formations;
- The development of recommendations for the operational equipping of theaters of military operations;
- The study of the views of potential adversaries for the conduct of military actions on an operational scale.¹³²

The term operational art was first used in 1922. The division of military art into strategy, operational art, and tactics did not take place until 1926. During World War II, operational art evolved further in the preparation for and conduct of operations.¹³³ In the post-war period, new areas developed in connection with the following:

- Equipping the Armed Forces with new weaponry and military equipment;
- Increasing the combat capabilities of troops;
- The increased scale and intensity of warfare and the mutual penetration and interlacing of the various types of operations;
- And the need to conduct principal operations with the joint efforts of the various branches of the Armed Forces.¹³⁴

¹³¹ S. F. Akromeev, main editor, *Military Encyclopedic Dictionary*, Second Edition, Moscow: Military Publishing House, 1986, p. 513.

¹³² Ibid.

¹³³ Ibid.

¹³⁴ Ibid., p. 514.

Operational art was defined in 2002 in Russia's *Military Encyclopedia* as "Encompassing the theory and practice of preparing for and conducting military operations on an operational scale (operations, battles, combat operations, strikes) by large formations of various branches of the armed forces. Operational art occupies an intermediate position between strategy and tactics..."¹³⁵

An **operation** was defined in the 1986 *Military Encyclopedic Dictionary* as

An aggregate of battles, engagements, strikes, and maneuvers, coordinated and interlinked in objective, task, place, and time by various force organizations, conducted simultaneously and sequentially according to a common concept and plan, to accomplish missions in a theater (theaters) of military actions, a strategic or operational direction (in a specific area or zone) within a specified period of time; a form of military action.¹³⁶

Designations include strategic, front, and army, which can be further differentiated as offensive and defensive or initial and subsequent according to time and sequence of execution. Principal indicators include the number of troops taking part, the width of a zone of action, and the depth or rate of advance. Influence on the content of operations is exerted by war aims and the nature of operational missions performed, military-economic capabilities of the state, and the combat capabilities of both sides.¹³⁷

An **operation** was defined in the 2002 *Military Encyclopedia* as

An aggregate of battles, engagements, strikes, and maneuvers, coordinated and interlinked in objective, task, place, and time by various force organizations, conducted simultaneously and sequentially according to a common concept and plan to accomplish strategic, operational-strategic, operational, or operational-tactical missions in a theater of military operations, a strategic or operational direction, or in a specific vast area (zone) within a specified period of time; a form of military operation.¹³⁸

An **operational plan** was defined in the 1986 *Military Encyclopedic Dictionary* as

the manner, procedure, order and methods of accomplishing military missions as determined by a commander. It includes the concept of operation (s) (commander's concept), missions of the troops, fundamentals of coordination, support, and the organization of command and control. The operation plan (battle) is the basis of the command and control of troops. It is made as a result of sizing up military missions and an estimate of the situation. Data for decision-making is prepared by the staff, chiefs of combat arms, special troops, and services. Operational planning is usually done with a map and refined on the terrain at the first opportunity. In ground force subunits all work connected with decision-making is as a rule performed on the

¹³⁵ S. B. Ivanov, Main Editor, *Military Encyclopedia*, Moscow: Military Publishing House, Vol. 6 2002, p. 63. The entire discussion of operational art was on pages 63-67.

¹³⁶ Akromeev, pp. 514-515.

¹³⁷ Ibid., p. 515.

¹³⁸ S. B. Ivanov, Main Editor, *Military Encyclopedia*, Moscow: Military Publishing House, Vol. 6 2002, p. 77.

terrain. The operation plan (battle) is detailed in the operational planning process; it is formally articulated on a map, with an explanatory note appended.¹³⁹

In 2003 the *Military Encyclopedia* defined an **operational plan** as

the manner, procedure, order, and methods of accomplishing military missions as determined by a commander. It includes the concept of operation (s) (commander's concept), missions of the troops, basic questions for coordination, and the basic organization of command and control.¹⁴⁰

A **concept of operations** was defined in the 1986 *Military Encyclopedic Dictionary* as

basic decisions about forthcoming combat operations. It determines: the direction or axis of the main attack and other thrusts (areas of concentration of main efforts); the sequence and methods of defeating an adversary; the order for delivering fire for effect and, in a nuclear war, nuclear weapons of destruction; group and operational orders of battle (battle disposition).¹⁴¹

The 1995 *Military Encyclopedia* defined a **concept of operations** more explicitly as follows:

The basis for a decision to conduct an operation (battle); the main idea for the method by which a force grouping conducts an assigned strategic, operational, or tactical combat mission in a military theater, along a strategic (or operational) axis, or in an area of terrain. In the zone of operation (battle) the following are defined: the areas where the main efforts are concentrated (the axes of the primary and other strikes); the methods for defeating the enemy (which force groupings, where, in what sequence, and how the defeat will be accomplished; the kind of fire or nuclear strike, and measures to deceive the enemy); the force grouping and their operational composition (order of battle).¹⁴²

Operational Art: Summaries of a Few Important Discussions

If Russia ever did decide to intervene in Europe, whether it be in the Baltics or by attacking Central European countries, or if it decided to conduct operations on a global scale in conjunction with an ally, it is reasonable to assume that the planning of operations and operational art would be a focal point. Operational art is of special interest for its use of front and army operations on a large-scale. The latter has been evident in Russia's yearly exercises in specific military districts (south in 2016, west in 2017, east in 2018, central upcoming in September 2019) or their special operational pairing with China's military. And not to be forgotten is whether, on a mass scale that includes space, Russia would consider the use of operational art on a planetary scale.

The analysis that follows will initially look at two short summaries from the works of General Aleksander Svechin and General Georgiy Isserson, two of the most prominent Soviet authors on operational art in the pre-World War II period. Their short summaries are followed by several works on operational art in Russia over the past 18 years. Surprisingly, very little has been

¹³⁹ Ibid., p. 634.

¹⁴⁰ S. B. Ivanov, Main Editor, *Military Encyclopedia*, Moscow: Military Publishing House, Vol. 7 2003, p. 229.

¹⁴¹ Akromeev, p. 264.

¹⁴² P. S. Grachev, main editor, *Military Encyclopedia*, Moscow: Military Publishing House, Vol. 3 1995, p. 238.

written on the issue recently. Still, the articles that did appear offer several elements of operational art to consider when theorizing what a larger Russian campaign may look like.

General Aleksander Svechin

In the 1927 work *Strategy* by Aleksandr A. Svechin, the noted Russian theorist, there was a section on operational art. Svechin noted that tactical creativity is governed by operational art, and that operational art sets forth a series of tactical missions and logistical requirements based on the goal of an operation. Operational art depends on the manner in which an operation is conducted, material available, time allotted for tactical missions, forces deployed for battle on a certain front, and the nature of the operation itself. Operational art must take into account the possibilities presented by the immediate rear (front logistics). Only on occasion is an ultimate goal achieved in a single battle with combat operations. Rather, it requires a series of operations separated by pauses in different areas of a theater, due to the immediate goals of forces in these areas. An operation consists of drawing up a plan; logistical preparations; the concentration of forces at the starting position; the building of defensive fortifications; marching; fighting battles that encircle or destroy a portion of an adversary's force and force the withdrawal of other forces due to an envelopment, breakthrough, or holding of a line in a geographical area. An operation can become an act of war "if the efforts of troops are directed toward the achievement of a certain intermediate goal in a certain theater of military operations without any interruptions."¹⁴³ Svechin's comments provided much of the initial impetus behind the concept of operational art and strongly influenced the years of work on the concept that followed.

General Georgiy Isserson

Isserson is well known for his seminal work entitled *The Evolution of Operational Art*. In his preface to the second edition of the work, in May 1936, he wrote the following:

The very essence of operational art presupposes freedom of methods and forms which should be carefully chosen each time to fit a concrete situation. All the propositions we advance in the field of modern operational art should be treated as orienting ideas, which find this or that concrete expression only in a given genuine situation.

Therefore, the present work would be of negative value if the ideas it advocates were treated as ready-made schemes. There can be no such schemes in operational art. We aim to show essential distinctions between the conditions of our era with its new forms of the deep operation and the operational art of the past. This is the only significance ascribed to the propositions advanced in the present work.¹⁴⁴

Isserson's comments accord with the well-established Russian view that there should be no stereotyping in the development of military affairs, a view reiterated by a host of contemporary military theorists.

¹⁴³ A. A. Svechin, *Strategy*, Military Bulletin 1927, as translated and published by East View Publications, Minneapolis Minnesota, 1992, Kent Lee editor, pp. 68-69. The work is preceded with introductory essays on Svechin written by Russian Major-General (retired, now deceased) V. V. Larionov; former Russian Security Council Chief and Deputy Minister of Defense A. A. Kokoshin; former Soviet Chief of the General Staff V. N. Lobov, and noted US historian of Russia's military, Jacob W. Kipp.

¹⁴⁴ For a translation of this work, see <https://www.armyupress.army.mil/Portals/7/combata-studies-institute/csi-books/OperationalArt.pdf>.

Major-General E. G. Korotchenko, retired

In 1999, writing in *Voennaya Mysl (Military Thought)*, Korotchenko described where operational art was heading. He noted that the revolution in military art has launched “a radical revision of ideas of the place and role, forms and methods of armed, information, and psychological confrontation.”¹⁴⁵ An important trend is that warfare is switching to a functional-structural and selective impact type of operation. This represents a departure from a principle of using force on force to one using the principle of asymmetrical threats. Assets designed to disorganize command and control of an enemy task force are now important, where a key trend is the evolution of operational forms and means of warfare and the emergence of new ones.¹⁴⁶ The “growing potentials of air and space warfare are increasingly influencing the theory and practice of operational art.”¹⁴⁷ The prevention of an enemy’s domination in space is now important and commanders must “employ the potentials of our space-based systems to the utmost when preparing operations and waging hostilities.”¹⁴⁸ This is because the course and outcome of operations are dominated by space and missile forces.

Maneuver, a typical trend of operational art, has a more important role to play under the current advanced technological situation. Commanders will have to adopt ways to ensure freedom of maneuver. This requires the constant interaction among all services during an operation and an increased reliance on timely logistics. Warfare may be constantly waged along the entire depth of a large strategic formation’s operational deployment. Finally, there is a trend toward greater complexity in operational planning due to the shorter time for preparations. An adversary can prepare the ground for an operation with information and other techniques long before a military conflict begins. Thus, it is important to study how all of these factors affect operational art and to identify the direction in which it is heading.¹⁴⁹

Colonel-General V. Zherebtsov of the Operational Art Department

On 11 April 2001 the Department of Operational Art at the Military Academy of the Russian Federation Armed Forces General Staff celebrated its 65th anniversary. In recognition of that event, the chief of the department, Colonel-General Vyacheslav Zherebtsov, penned an article on operational art for the paper *Krasnaya Zvezda (Red Star)*. He wrote that discussing operational art was now an obligation, since the large battles of World War II had been replaced with different armed conflicts (internal, border, etc.) due to separatism and the escalation of such conflicts, such as in Chechnya, “on the soil of interethnic, territorial, religious, and other differences.”¹⁵⁰ This has required securing victory through skill and ability instead of just by numbers, and required a reassessment of how to implement operational art. Peacekeeping, for example, has become a new direction for operational art. A pressing issue has become the “adaptation of the theory and practice of operational art to the radical changes in the military-political situation at the turn of the century,

¹⁴⁵ E. G. Korotchenko, “Operational Art Today: Where It Goes,” *Voennaya Mysl (Military Thought)*, No. 1, 1999 (in English), p. 13.

¹⁴⁶ *Ibid.*, p. 14.

¹⁴⁷ *Ibid.*, p. 15.

¹⁴⁸ *Ibid.*

¹⁴⁹ *Ibid.*, pp. 15-18.

¹⁵⁰ Vyacheslav Zherebtsov, “Military School: Ensuring That the Thinking Is Ahead of the Times,” *Krasnaya Zvezda (Red Star)*, 7 April 2001, p. 2.

and the need to learn lessons and draw conclusions from the experience of local wars and armed conflicts of recent decades...”¹⁵¹

The direction of military art in the next 10-15 years, Zherebtsov predicted, would take the following directions:

- Armed struggle will transform into an information-focused armed confrontation;
- There will be a new perception of operational art’s content, to include its principles, forms, and methods of conducting operations under conditions of an information-focused confrontation and the massive use of precision weapons;
- New ways and means of resolving tasks will be unveiled to confront modern interstate and intrastate opposition;
- Reliable nuclear deterrence must be ensured and there must be an increase in the combat capability and combat readiness of force groupings;
- Problems associated with repulsing strikes by superior enemy forces must be resolved;
- The quality of command and control must be enhanced along with support for combat operations and for the mental and psychological preparation of personnel.¹⁵²

His predictions have proven to be reliable.

Lieutenant-General A. N. Stolyarov of the Operational Art Department

In 2006 Lieutenant-General A. N. Stolyarov was appointed as the head of the Operational Art Department at the General Staff Military Academy. In 2007 he wrote an article for the journal *Voennaya Mysl (Military Thought)* on the history of the department since its founding in the 1930s. Near the beginning of World War II there were a few significant studies produced on operational art. They were:

- G. S. Isserson’s three works, *The Evolution of Operational Art*, *Fundamental Principles of an In-Depth Operation*; and *The Initial War Period*;
- E. A. Shilovsky’s three works, *The Operation, Breakthrough and Exploitation*, and *Fundamental Principles of an Offensive Army Operation*; and
- A. V. Kirpichnikov’s *Operations by Modern Mobile Armies*.¹⁵³

The Operational Art Department contributed to military theory’s development during WWII. Professors closely followed wartime experience, identifying new trends and patterns in military art’s evolution, and developing recommendations for the conduct of operations, battles, and engagements. In 1948, experiences from the war were included in an in-depth study of new socio-political factors, modern warfare, changes in combat configurations of large strategic formations, and how the organizational structure of military units would affect operational art.

¹⁵¹ Ibid.

¹⁵² Ibid.

¹⁵³ A. An. Stolyarov, “The Evolution and Development of the Theory and Practice of Operational Art at the General Staff Military Academy,” *Military Thought* (in English), Volume 3 2007, EastView Publications, pp. 110-122.

These results were used to examine major aspects of the organization and conduct of operations for the initial period of war.¹⁵⁴

At the end of the first post-war period, 1945-1953, *A Comprehensive Course in the Operational Art* was produced. From 1954-1961 the department studied problems of operational art with respect to nuclear warfare. It also produced a theoretical work titled *A Course in the Operational Art* in four volumes, published between 1957-1959. From 1962-1971, work was performed on developing forms and methods of training and indoctrination for military personnel. Further, new texts were produced on front and army operations dealing with matters concerning the preparation and conduct of operations with the use of nuclear and other types of new weapons, to include future ones.¹⁵⁵

During the period 1972-1990, attention was given to breakthroughs in the development of conventional weaponry and to new forms and methods of operations using them. In particular this pertained to precision weaponry and its impact on future operations. From 1988-1996 the Operational Art Department developed 16 concepts (not specified further) that were “enshrined in legally enforceable documents of the General Staff.”¹⁵⁶ However, it was noted that changes in that period did include those associated with meeting engagements and counter assault and counter insurgency operations, as well as operational concealment, deception, and camouflage. In 1993, it was noted that research regarding local wars and armed conflicts and peacekeeping operations was expanded along with the interaction of branches and arms of service and a priority focus provided to the preparation and conduct of front and army operations in a large-scale war with reduced-strength formations.¹⁵⁷

At the start of the 21st century, a new evolution of operational art took place, Stolyarov added. This was due to “the growing evidence of the threat not only of armed conflicts and large-scale terrorist attacks, but also local and regional wars affecting the Russian Federation.”¹⁵⁸ A significant landmark in 2002 was the publication of the work *Operational Art: The Present and the Future*. Developed by a team of writers, to include Lieutenant-General A. N. Zakharov and Major-General E. G. Korotchenko, the work identified trends and problems with improving the concept. A few years later, new textbooks were produced on the fundamentals of operational art. Defensive and offensive operations were praised, as was a chapter on the basic principles of operational art. Combined-arms operations, forms of military action, effective engagements of enemy forces, and a substantiation of combat strength levels of force in strategic sectors were also addressed.¹⁵⁹

Stolyarov noted that operational art faces new tasks, such as containing an aggressor at an early stage of a crisis situation and conducting large-scale operations simultaneously in several regions amid a wide use of new weaponry. This may also include the employment of unconventional forms and methods of combat action, he noted. There exists a pressing need for conducting air and defensive operations by operational-strategic groupings in strategic sectors, and information warfare operations must also be countered. The countering of weaponry includes precision guided weapons, automated command and control, and reconnaissance systems. The

¹⁵⁴ Ibid.

¹⁵⁵ Ibid.

¹⁵⁶ Ibid.

¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

¹⁵⁹ Ibid.

operational art department is “concentrating its efforts on developing new, unconventional forms and methods of employing large strategic formations and groupings of forces in both large-scale and local wars, as well as in armed conflicts.”¹⁶⁰ The department is analyzing and forecasting the consequences of expected trends in military developments as a whole and operational art in particular. The author ended this article in 2007 noting that “in the very near future, substantial changes will occur in the theory and practice of operational art.”¹⁶¹

Major-General V. K. Kopytko of the Operational Art Department

Major-General V. K. Kopytko became a professor at the Operational Art Department of the General Staff in 2000. He wrote in 2008 on the “Evolution of Operational Art” for the journal *Military Thought* and defined operational art as a “system of theoretical knowledge and practical recommendations on how to prepare and conduct different forms of military operations at the operational-strategic, operational, and operational-tactical levels.”¹⁶² His article was broken down into specific sections addressing the issue of military art; a history of the development of operational art (from WW I to 2008); a definition of operational art; a breakdown of the theory and practice of operational art and the tasks that accompanied them; the structure of operational art at the current stage; and the impact of objective and subjective causes and conditions that assist in the modern development of operational art. This section will only address the last two elements of Kopytko’s article, since many of the historical aspects were covered in Stolyarov’s presentation.

Kopytko wrote that operational art is composed of the following: combined arms operational art (combined arms of large strategic formations), operational art of the services and the centrally controlled arms (Strategic Missile Troops, Airborne Troops, and Space Troops), and operational art of the operational rear services. The structure is not constant but develops in line with the evolution of both weaponry and new combat arms and forces. The impact of subjective factors on operational art is considerable but only if analysts fully and comprehensively estimate the objective factors before them.¹⁶³

The influence of objective factors on operational art include a host of issues, such as:

- The military-political situation in the world;
- Qualitative and quantitative improvements in weaponry and equipment;
- The state’s internal economic, political, demographic, and social condition;
- The state of the Armed Forces;
- The composition and state of the Armed Forces of potential adversaries (and shifts in their methods of preparation and conduct of operations);
- The evolution of strategy and forms and methods of its employment;
- And the historical experiences (lessons learned) of wars and armed conflicts.¹⁶⁴

The newest objective factor in 2008, naturally, was the all-round informatization of military affairs.¹⁶⁵ Information confrontation in general, Kopytko noted, is emerging as a major component

¹⁶⁰ Ibid.

¹⁶¹ Ibid.

¹⁶² V. K. Kopytko, “The Evolution of Military Art,” *Military Thought* (in English), Volume 1 2008, EastView Publications, pp. 204-214.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

¹⁶⁵ Ibid.

of all types of future warfare. Information-related advances in capabilities and other changes offer the possibility to automate the collection and processing of data on an opponent; the ability to react practically in real-time to changes in the situation; and the ability to assign missions to troops quickly and to supervise the efficiency of fire strikes.¹⁶⁶

Subjective factors influencing the development of operational art were the activities of top political and military personnel that influence the development of the military organization and doctrine of the state; the level of ideas associated with the development of operational art and its implementation; training of troops; and the state of military science and the educational component of its leaders.¹⁶⁷

Other Sources

Other than these longer discussions of operational art, there has hardly been any mention of the topic of operational art except for only a few scant references. A 2006 *Military Thought* article noted that the content of an operational method would include troop distribution, regions where the mission is to be accomplished (plus various modes of doing so and in what time); task force development and their operational formations; and troop maneuver means and material.¹⁶⁸ A 2015 *Novaya Gazeta* article stated that Russian operational art has traditionally been built “on the rapid pace of offensive operations supported by the constant buildup of troops’ efforts by means of rear echelons and the reserve, and the expenditure of ammunition in accordance with established destruction norms and densities.”¹⁶⁹ A 2018 article on modern methods of aerospace and air defense practices was the most useful. It noted that aerospace and air defense forces must use the theory and practice of operational art and its methods and techniques. This is a new premise for operational art, the issues of aerospace and air defense tactics. Operational art remains the issue of changing the situation in aerospace in one’s favor. It is further enriched with tactical methods and techniques.¹⁷⁰

The Writings of General of the Army Makhmut Gareyev

Russian General of the Army Makhmut Gareyev is the author of numerous works on topics ranging from strategic deterrence to training to future warfare. He served at the Battle of Kursk in World War II and celebrated his 96th birthday on 23 July 2019. Don’t be fooled by his age. He is still the President of the Academy of Military Science and often advises members of the General Staff. At major parades in Red Square he can usually be found sitting next to President Putin. Two of his works are chosen here (his work on aerospace issues is included later) for their references to operations and operational art.

On Frunze and Operational Art

¹⁶⁶ Ibid.

¹⁶⁷ Ibid.

¹⁶⁸ V. V. Barvinenko and V. R. Lyapin, “On the Correlation of Operational Concepts and Methods,” *Military Thought* (in English), Volume 4 2006, EastView Publications, pp. 37-46.

¹⁶⁹ Vladimir Denisov, “We Have Given Our Adversary a 15-year Advantage and We Cannot Win It Back,” *Novaya Gazeta Online*, 2 December 2018.

¹⁷⁰ A. P. Korabelnikov, “Modern Methods of Aerospace and Air Defense of Facilities and Prospective Development Trends,” *Military Thought* (in English), Volume 1 2019, EastView Publications, p. 34.

In a 1985 book titled *M. V. Frunze: Military Theorist*,¹⁷¹ Gareyev outlined the military thoughts of Mikhail Vasilyevich Frunze on the latter's centennial birthday. He believes that Frunze was able to correctly analyze historical processes and their impact on the development of military affairs. He credits Frunze for his continued use of historical examples and their application to contemporary thought. For example, Frunze pointed to the importance of intuition and scientific prediction as well as the need to grasp the inner logic of complex events. Conforming to the situational context is a major law of military art.¹⁷² Frunze did not favor a strategy of starvation or destruction, but rather, depending on the situation, the use of either strategy. He agreed with Marx that the offensive, with other conditions being equal, was better than the defense.¹⁷³

Frunze considered the most effective method of countering enemy counterstrikes to be “the use of preemptive active operations to thwart the concentration of enemy counterstrike groupings and the destruction of these piecemeal.”¹⁷⁴ Gareyev writes that one of the most difficult tasks is to foresee the possible nature of an enemy's plans at a war's outset (the initial period of war) and work out methods to increase both combat readiness and the strategic deployment of the Armed Forces.¹⁷⁵ This focus on the initial period of war appeared elsewhere in the book and indicates the importance that this “lesson learned” had for the Soviet Union when Gareyev authored this volume. At one point he stated that “the role of the initial period of war will increase further and this may be the main and decisive period which largely predetermines the outcome of the entire war.”¹⁷⁶ Further, he added that the importance of past lessons “act as particles of insipient new methods of conducting armed combat.”¹⁷⁷ The advent of the information and digital age has most likely only reinforced this belief in the mind of Gareyev and other Russia military planners.

Gareyev wrote that operational art's theory arose when an operation began to be viewed as an aggregate of battles and engagements unified in a single overall plan broken in space and time. Developments in both operational and tactical maneuver made it possible to more thoroughly elaborate the methods for preparing and conducting operations.¹⁷⁸ The basis of both operational and tactical maneuver, according to Frunze, was attacks against the weakest points (the enemy flanks and rear) and the envelopment and outflanking of enemy groupings combined with attacks from the front.¹⁷⁹ He focused attention on encircling and destroying the enemy. Decisive actions would be possible with bold maneuvers. This meant carrying out operations without operational pauses, thereby preventing an enemy to get their bearings or to bring up reserves, and to organize the defense. Breakthroughs, Marshall of the Soviet Union G. K. Zhukov noted, offer opportunities for freedom of maneuver and the opportunity to hit the enemy from the worst sector (from the enemy's perspective).¹⁸⁰

Gareyev writes that “In comparison with previous experience, this was a completely new phenomenon in operational art. For this reason, it was considered advisable to prepare ahead of time new troop groupings, to plan the maneuvering of resources, and increase the effort by

¹⁷¹ M. A. Gareyev, *M. V. Frunze: Military Theorist*, Moscow: Military Publishing House, 1985.

¹⁷² *Ibid.*, pp. 146, 148.

¹⁷³ *Ibid.*, pp. 172-173.

¹⁷⁴ *Ibid.*, p. 177.

¹⁷⁵ *Ibid.*, p. 229.

¹⁷⁶ *Ibid.*, p. 237.

¹⁷⁷ *Ibid.*, p. 238.

¹⁷⁸ *Ibid.*, pp. 200, 202.

¹⁷⁹ *Ibid.*, p. 204.

¹⁸⁰ *Ibid.*, p. 234.

committing reserves to battle.”¹⁸¹ The focus on a “new phenomenon” could indicate Gareyev is implying interest in the concept of the OMG, but this was not specifically stated.

On Marshall of the Soviet Union Nikolai Ogarkov

Writing in *Arsenal Otechestva* in 2012, Gareyev discussed the career of General Staff Chief and Marshall of the Soviet Union Nikolai Ogarkov, who was Gareyev’s boss in the 1980s. He writes that Ogarkov was inquisitive, innovative, and creative, and in possession of the ability to perceive new problems of military art. It was thus no surprise to Gareyev that Ogarkov served as General Staff Chief for seven years, dedicating much time on improving the organizational structure and work of commanders and staffs at both the operational-strategic and operational levels.¹⁸²

Ogarkov’s development of the forms and methods of operational preparation were most important. New problems in strategy and operational art were verified and developed, often through the use of exercises. He also worked to improve the relationship with political leaders but this did not end well. Gareyev writes that in 1979 Ogarkov told the Politburo that the introduction of Soviet troops into Afghanistan may have serious international consequences. He was interrupted by I. V. Andropov, head of the KGB at the time, who told him “We have people who take care of politics; you solve the military task assigned to you.”¹⁸³

Ogarkov continued to examine operational issues. He helped create the Center for Operational-Strategic research in the General Staff, a center later headed by General-Colonel V. V. Korobushin. Under Ogarkov’s leadership, a five-volume *Principles of the Preparation and Conduct of Operations* was developed, volumes that contained important tenets of military art and operational-strategic principles of military doctrine. Gareyev added that the maneuvers conducted in 1981 were a creative effort on Ogarkov’s part to introduce new operational-strategic ideas for the Armed Forces leadership. These maneuvers proposed an aggressive advancement in the direction of the flanks as well as into the depths of the opposing force. To accomplish such tasks, formations and units were required to have high maneuverability, independence, and initiative in resolving combat assignments.¹⁸⁴

Most important of all, however, was the decision to create OMGs that could fulfill Ogarkov’s developments, and Gareyev specifically mentioned the concept and its contents as follows:

The main difference between former mobile groups and them [OMGs] was that not only tank armies and divisions were used, but also separate army corps with special organizations, specially created to act as operational maneuver groups, where tank, motorized rifle, artillery, and other units outfitted with the latest equipment, amphibious combat infantry vehicles and armored transports, and self-propelled artillery were combined into a single organism. For the first time, an airborne-assault regiment and army aviation were included in the make-up of these corps.¹⁸⁵

¹⁸¹ Ibid., p. 209.

¹⁸² M. A. Gareyev, “The Living Embodiment of the Brain of the Army,” *Arsenal Otechestva*, No. 2 2012, published 17 June 2013 at <http://arsenal-otechestva.ru/article/111-mozg-armii>.

¹⁸³ Ibid.

¹⁸⁴ Ibid.

¹⁸⁵ Ibid.

Gareyev added that OMGs were liquidated with the fall of the Soviet Union but that operational maneuver groups will “obviously be used in some form or another” in the future. The main priority in the entire system of military development remains the operational-strategic vector.¹⁸⁶ Again, it is important for a Western analyst to know what Gareyev meant by a “form,” for without this understanding, the potential realization of the concept is not clear.¹⁸⁷ Thus, it is possible that OMGs could even be developed for space operations in “some form or another.”

US Experts Jacob Kipp and David Glantz on Russian Operational Art

Dr. Jacob Kipp was an analyst and then the director of the Foreign Military Studies Office at Fort Leavenworth, Kansas in past years. He is the author of numerous papers on Russian strategy and operational art and has served as a long-time consultant on Russian military affairs for numerous Pentagon offices. Kipp defined operational art as the conduct of war at echelons above corps and on the scale of theater-strategic campaigns.¹⁸⁸ The term came into use, he notes, due to the development of new weaponry that not only extended the breadth and depth of the battlefield, but fire’s increased lethality. These weapons caused havoc in the development and application of combined arms, and offered new opportunities for maneuver. This forced more dependence on a commander’s intellect (instead of just eyeballing a situation), which reduced “chance” to a question of “probability.” Calculations became based on an assessment of the mission, theater terrain, the enemy’s force, one’s own forces, and time. All of these circumstances had to be taken into account as operations became more complex.¹⁸⁹

Kipp added that operational art was defined by Aleksandr A. Svechin in a series of lectures on strategy in 1923-1924. These lectures described operational art as the bridge between tactics and strategy. N. Varfolomeev, a deputy head of the Department of Strategy during Svechin’s time, noted that the operation, which had become the base for understanding operational art, was the totality of maneuvers and battles in a given sector of a theater of military action to achieve a common objective.¹⁹⁰ It was this concept of maneuver that appeared to take center stage in many discussions. It seemed that the less developed a theater of war, the greater were the opportunities of employing maneuver forms of combat. Maneuver was meant to disorganize and demoralize an opponent.¹⁹¹

Svechin’s era, Kipp notes, was the time that “the study of past campaigns, current trends in weapons development, and force structure requirements coalesced around the concept of operational art.”¹⁹² Svechin, for example, had formulated two competing postures—annihilation and attrition—as issues regarding the relationship between operational art and future war paradigms. Thoughts focused on combining breakthrough and deep pursuit operations in the

¹⁸⁶ Ibid.

¹⁸⁷ For one explanation of a “form,” see Timothy Thomas, “Russia’s Forms and Methods of Military Operations,” *Military Review*, May/June 2018, pp. 30-37.

¹⁸⁸ Jacob W. Kipp, “The Origins of Soviet Operational Art: 1917-1936,” in *Historical Perspectives of the Operational Art*, Michael D. Krause and R. Cody Phillips, General Editors, Center of Military History, Washington DC, 2005, p. 213.

¹⁸⁹ Ibid., pp. 219-220.

¹⁹⁰ Ibid., pp. 214-215.

¹⁹¹ Ibid., p. 224.

¹⁹² Ibid., p. 229.

conduct of annihilation operations. In such operations logistics became of critical importance in the accomplishment of operational art.¹⁹³

Noted Soviet General V. K. Triandafillov became an important advocate of operational art as well. He laid out in theoretical detail the military context for successive deep operations. Success in such operations, in accordance with the imprint of operational art, required an effective command and control system that would coordinate the operations of several fronts and the establishment of realistic logistical norms. Another Soviet General of renown, M. N. Tukhachevsky, was another advocate of operational art, arguing that it required the complete militarization of the national economy.¹⁹⁴

David Glantz, author of the popular work *Soviet Military Operational Art: In Pursuit of Deep Battle*, noted that between 1932 and 1936 the Red Army's theoretical and practical work on operational art created a model of offensive combat that has endured to the present.¹⁹⁵ This thought was supplemented with a focus on maneuvering due to the mechanization and motorization of ground forces. Operational maneuver was noted to be "the organized shifting of distinct groups of forces during an operation to achieve a more favorable position with regards to an enemy in order to strike a blow against him or repel an enemy attack."¹⁹⁶ Glantz went on to describe how the Soviet Union then incorporated the development of nuclear weapons into the maneuver concept. He quotes Colonel F. D. Sverdlov, a leading maneuver specialist in Russia, as the author behind the defining of the concept known as antinuclear maneuver, which is the withdrawing of subunits from under the possible blows of an enemy nuclear strike.¹⁹⁷

The Soviet Union's perilous political and economic situation in the early 1990s caused the military to switch to a concept dubbed defense sufficiency. This was a military strategy based on premeditated defense. But as the nation gradually improved and moved into the 21st century, the military began to discuss vertical maneuver and envelopment by air assault and the conduct of operational and tactical maneuver again.¹⁹⁸ This has apparently led to the works in *Military Thought* discussed above in relation to operational art.

Russian Use of Operational Art and Maneuver in Space

Based on the discussion above of operational art, several points stand out. Operational art is defined as the preparation and conduct of combined-arms, joint, and independent operations for large-strategic formations. The discussion indicated in several places that a principal element of the concept was the preparation of such operations in peacetime in order to be prepared for the initial period of war, a period now marked by increased speed due to the impact of advanced technology in the information age and its impact on the development of weaponry, reconnaissance assets, and frequency interference capabilities. Being in a superior position during the initial period of war clears the way for the use of operational art in space and helps ensure success.

¹⁹³ Ibid., pp. 230-231.

¹⁹⁴ Ibid., pp. 233-234.

¹⁹⁵ David M. Glantz, "Soviet Operational Art since 1936: The Triumph of Maneuver War," in *Historical Perspectives of the Operational Art*, Michael D. Krause and R. Cody Phillips, General Editors, Center of Military History, Washington DC, 2005, p. 249.

¹⁹⁶ Ibid., p. 269.

¹⁹⁷ Ibid., p. 271.

¹⁹⁸ Ibid., p. 278.

Other important points are listed below. The initial sentence in each bullet is from the discussion above. It is followed by another sentence (from this author, in brackets) which is a conceptualization indicating how satellites and space would fit each concept:

- Maneuver, deep operations, breakthroughs, and integrated operations were listed several times each. [Deep operations could involve Russian strikes against satellites in space or against underwater cables or the use of SODCIT criteria. Satellites perform maneuver operations often to inspect other satellites or to perform other missions.]
- It was noted that the less developed a theater of war, the greater were the opportunities of employing maneuver forms of combat. [Space is underdeveloped at the moment, which indicates it could remain for some time as a place for maneuver.]
- It was argued that an effective command and control system was needed for operational art. [Russia has established such a system with its National Defense Management Center in Moscow.]
- David Glantz wrote that operational maneuver was “the organized shifting of distinct groups of forces during an operation to achieve a more favorable position with regards to an enemy in order to strike a blow against him or repel an enemy attack.”¹⁹⁹ [Moving satellites against other satellites to either strike a blow against them or to simply achieve a strategic position in a specific orbit, such as to conduct inspections of other satellites, relate to Glantz’s thought.]
- The operational art department is “concentrating its efforts on developing new, unconventional forms and methods of employing large strategic formations and groupings of forces in both large-scale and local wars, as well as in armed conflicts.”²⁰⁰ [The use of satellites as an operational maneuver group would be an unconventional form of using such assets.]
- The basis of both operational and tactical maneuver, according to Frunze, was attacks against the weakest points (the enemy flanks and rear) and the envelopment and outflanking of enemy groupings combined with attacks from the front.²⁰¹ [Russian leaders state that they consider the weakest links in Western systems to be their links to space systems, which can be considered a flank.]
- Ground maneuvers proposed an aggressive advancement in the direction of the flanks as well as into the depths of the opposing force.²⁰² [Space may now be considered a flank for planetary operations.]
- Operational maneuver groups will “obviously be used in some form or another” in the future.²⁰³ [Space assets that maneuver in the form of groups can involve the movement of space assets to assist in enveloping an opponent.]

¹⁹⁹ Glantz, p. 269.

²⁰⁰ Stolyarov.

²⁰¹ *M. V. Frunze*, p. 204.

²⁰² “The Living Embodiment...”

²⁰³ “The Living Embodiment...”

The majority of these operations are present in the planning of aerospace operations today. It was noted earlier that two important military leaders (Gareyev in 2011 and Shoygu in 2015) have stated that aerospace is the new center of gravity. A short summary of how Russia's military is discussing concepts related to operational art in space, from a few sources, is summarized below.

In 2009 a report noted that in the future a space strike echelon will accomplish combat missions and carry out combat support of land-based operations. The information-strike operation and a space operation are the result of the change in the nature of armed combat. They will precede air, naval, and land offensive operations. The information-strike operation was defined as

an automated weapons system, which is designed for the highly effective destruction of one, several, or many facilities (targets) using precision-guided strike weapons at great distances in accordance with the operations (combat operations, battle, strike, or engagement) plan or its concept of operations.²⁰⁴

Targets of an information-strike operation include the command and control posts and communication centers of combined formations and formations, aircraft, the missile troops and artillery, reconnaissance-strike (weapon) complexes, reconnaissance, air defense and electronic warfare.²⁰⁵ The reconnaissance-strike complex was defined as an automated weapon complex designed for the destruction of ground-based facilities using missiles, aircraft, and other forces immediately upon detection.²⁰⁶

In 2011, Gareyev, writing in the *Journal of the Academy of Military Science*, noted that the center of gravity of armed struggle is shifting to the aerospace domain, elements of which are increasingly more interconnected. An aerospace defense (VKO) campaign, Gareyev writes, would consist of a series of air operations. They would include bomb, rocket, radio-electronic and other strikes against an adversary's aviation, rocket and naval forces, air defense systems, command posts, industrial, energy, and other important infrastructure objectives and, finally, against the main ground force groupings. This is planned at the very beginning of a war.²⁰⁷

Thwarting an opponent's aerospace attack is of primary significance, since the course and outcome of a war depend on this. Such defensive conditions extend into the space domain. VKO missions include reconnaissance of the aerospace domain (an aerospace theater of military operations can be under consideration) to identify enemy attacks; the implementation of an antisatellite struggle; control over the space domain; and defense against strikes from space as well as an anti-rocket and air defense plan that confronts both strategic and nonstrategic attacks. These are dynamic operations that are acquiring greater importance.²⁰⁸

²⁰⁴ Igor Vitalyevich Morozov, Sergey Valentinovich Baushev, and Oleg Eduardovich Kaminskiy, "Space and the Nature of Contemporary Operations: Gaining and Maintaining Supremacy in the Information and Space Sphere Has a Decisive Impact on the Course and Outcome of a Contemporary High-Tech Armed Confrontation," *Vozdushino-Kosmicheskaya Oborona (Air-Space Defense)*, 14 July 2009, pages unknown.

²⁰⁵ Ibid.

²⁰⁶ Ibid.

²⁰⁷ M. A. Gareyev, "On the Organization of the Russian Federation's Aerospace Defense," *Journal of the Academy of Military Science*, No. 2 2011, p. 40. The author would like to thank Dr. Harold Orenstein for translating this article.

²⁰⁸ Ibid.

Gareyev noted that a probable adversary's command and control system, to include aerospace attack means, is usually located in space. It thus becomes a primary target, where it is necessary

To direct the main scientific and technological efforts towards seeking out the resources and methods aimed at bringing down the entire space communications and command and control system. This will not only create favorable conditions to successfully resolve VKO tasks, but also violate the principal base on which the opposing side structures its entire network-centric system of command and control.²⁰⁹

Such a system requires the creation of an operational group of specialists from the Main Air Force Staff, the Space Force Command, and other command and control organs in the General Staff Military Academy for the assessment of the actual conditions of forces and means.²¹⁰

In October 2013 Russia published its latest, at the time of this writing, military doctrine. It was noted that two principal tasks of the Armed Forces were to provide air and space defense of important structure of the Russian Federation while being ready to repel strikes from aerospace attacks; and to deploy and maintain in the strategic space zone "orbital spacecraft groupings that support Armed Forces activities."²¹¹ Whether these "groupings" were OMGs is not known, but again the possibility remains.

In November 2017 Russia announced it was developing two advanced anti-satellite weapons: Rudolf, a mobile anti-satellite strike system and the Tirada-2S, a mobile anti-communication satellite electronic warfare system.²¹² The Tirada-2S conducts the radio-electronic suppression of satellite communications, even from Earth.²¹³

In 2017, journalists reported on the use of Russia's Space troops to test a "maneuvering" military inspection satellite. The satellite undocked from a Kosmos-2519 space platform and it began an autonomous flight. It first changed its orbit, then returned to the Kosmos platform and inspected it. Such a capability can allow for determining the functional purpose of a foreign satellite and, when required, turn into a space interceptor than can deploy missiles. Independent military expert Valeriy Mukhin stated that such a system can become a deterrence factor for potential enemies, as it can check whether a satellite's stated function "corresponds to reality."²¹⁴

In 2018 a *Wired* magazine article discussed the threat of a war high above the earth among satellites. The article stated that in 2014 the US military noted that a piece of Russian space junk, Object 2014-28E, began to act strangely. It performed complicated maneuvers and came alive. It sided up to American commercial communication satellites. The Object has been joined in years since by "similar space objects of Russian provenance."²¹⁵ The same year a MiG-31 appeared on

²⁰⁹ Ibid., p. 42.

²¹⁰ Ibid.

²¹¹ B. D. Kazakhov and G. K. Isaev, "Recommendations to Clarify the Conceptual Apparatus Used to Describe the Subject Area 'Tactics' as a Component of Military Science," *Vestnik Akademii Voenykh nauk (Journal of the Academy of Military Science)*, No. 3 2018, pp. 30-35. The author would like to thank Dr. Harold Orenstein for translating this article.

²¹² No author or title provided, *Interfax*, 30 November 2017.

²¹³ No author or title provided, *Interfax* (in English), 9 January 2019.

²¹⁴ S. Valchenko, N. Surov, and A. Ramm, "Russia Sends Inspector into Orbit: Military Test Operations of Maneuvering Identification and Intercept Satellite," *Izvestiya Online*, 26 October 2017.

²¹⁵ Garrett M. Graff, "The Outer Limits of War," *Wired Magazine*, July 2018, pp. 48-49.

the Internet with a mockup of a new type (not identified further) of an anti-satellite missile under the fuselage. It would be guided to its target by the Krona space object recognition station at Kazakhstan's Saryshagan range.²¹⁶ Further, the Peresvet combat laser system was advertised as capable of fighting satellites in orbit according to the Russian Defense Ministry, and it has been supplied to the Space Forces.²¹⁷

Another 2018 report noted that a Soyuz-2 launch vehicle fitted with a Fregat upper stage can put into orbit up to 15 inspector satellites. Foreign media, it noted, had dubbed these inspector satellites to be "killer satellites." Russian media reported that a Kosmos-2521 inspector satellite had shifted position after some months in orbit to draw close to and photograph various foreign satellites, American ones included. The article then noted that "preparations to repulse a possible attack utilizing the capabilities of an orbital satellite grouping are under way in all the world's leading states both in space and on Earth."²¹⁸ These vehicles can spend years in space and, on command, instantly mount an attack due to an adversary's aggression. On Earth, techniques are under investigation to suppress satellite signals and create interference.²¹⁹

A final 2018 report listed the "essence and content of the employment of tactical formations that are organizationally part of the space forces." The authors note that space force formations in peacetime are designed to carry out the following missions: implementing continuous control of axes in the space domain that are in danger of operations of ground radar stations of the missile - attack warning system; conducting continuous reconnaissance of regions for the launch of ballistic missiles; detecting space objects and cataloging them; controlling space ships in orbital flight and safeguarding the deployment of orbital space ship groupings while maintaining them in a combat-ready condition; and other tasks. Scientific studies should be aimed at the following: taking into account the opposing sides being equipped with new means of armed struggle and the influence of other operational (tactical) factors; and developing operational-tactical requirements for new and modernized complexes and systems.²²⁰ Thus operational issues are under continuous reevaluation.

In 2019, Russian analysts offered a brief description of the Nudol missile defense system. It is designed to repulse a nuclear strike at distant approaches to Russia, and it is being deployed on the ground and in space. There it can strike at satellites and missiles.²²¹ Nudol is said to be a two-stage missile, with solid-fuel engines for both stages and a warhead equipped with maneuver engines. Equipped with both a conventional and nuclear warhead, the missile can strike targets at a distance of up to 1500 kilometers and with a speed of intercept of Mach 10. By operating against both missiles and satellites, Nudol can eliminate both reconnaissance and target designation satellites of an opponent, which eliminates them from seeing anything. Moscow's layered ballistic missile defense system would thus include satellite groupings, a network of ground-based, long-

²¹⁶ Anton Valagin, "Photos: MiG-31 Tests 'Satellite Killer,'" *Rossiyskaya Gazeta Online*, 30 September 2018.

²¹⁷ No author or title provided, *Interfax* (in English), 5 December 2018.

²¹⁸ Irina Dronina, "The Militarization of Space Threatens Undesirable Consequences for Everyone. A Single Medium-Class Launch Vehicle Can Put 15 Special-Purpose Satellites into Space," *Nezavisimaya Gazeta Online*, 19 June 2018.

²¹⁹ *Ibid.*

²²⁰ Kasakhov and Isaev, pp. 30-35.

²²¹ Viktor Sokirko, "Intelligence Late to Report: US 'Pinpoints' Killer of its Satellites Three Years after the Event. Bad News for the Pentagon: Russia Successfully Testing Nudol System," *Svobodnaya Pressa*, 20 January 2019.

range radar detections stations, and Nudol, thus becoming an aerospace defense system covering air and space.²²²

Finally, also in 2019, President Putin stated that nearly 80 percent of Russia's military and dual-use satellites had been replaced.²²³ Defense Minister Shoygu stated that the throughput of communication channels for Russia's military satellite grouping will increase 2.5 times by 2025 and will raise their jamming resistance.²²⁴ Thus, the improvement in space systems is a clear indication of its growing importance.

With these concepts as background, a truncated potential lineup of equipment that Russian theorists might consider as components of a space OMG that can maneuver and conduct deep/planetary operations in near or deep space include the following, based on the articles used above:

- Inspector satellites, such as the Kosmos 2521
- Killer satellites
- Tirada-2s, to thwart communications
- Rudolf, anti-satellite strike system
- Nudol, anti-satellite and missile system
- Peresvet combat laser
- Ground stations that can jam objects in space
- MiG-31armed with anti-satellite missiles
- Space junk that comes alive
- Reconnaissance-strike complexes and information-strike system
- Ground based hackers who attempt to take control of satellites, such as theoretically occurred in 1998.²²⁵

Conclusions

Western analysts should consider whether the deep operations of operational art normally associated with ground forces are now finding new life in a deep space dimension of Russian planning; and whether the theory is further buttressed by Russia's SODCIT (special operations for the destruction of critical infrastructure targets) concept that aims to take out another nation's economic base or links to space operations in the initial period of war (IPW). Perhaps Russia has even developed a space OMG, the potential components of which were listed for consideration. What is apparent from just these three points (SODCIT, IPW, OMG) is that Russia's military has different focal points of thought than does the West, and they must be considered when developing Western responses to Russian threat indicators in space.

Recent Russian military literature has focused primarily on weapons based on new physical principals (NPP), electronic warfare, artificial intelligence, and other weapon-related interests. Yet ever since the 1920s, Soviet and now Russian military theorists have adjusted operational art to new discoveries in weaponry. Operational art's past characteristics of maneuver, breakthroughs,

²²² Dmitriy Popov, "The Killer Satellite with a Nice Name: The United States Has Nothing to Counter the Latest Nudol System," *Armeyskiy Standart*, 25 January 2019.

²²³ No author or title provided, *Interfax*, 16 May 2019.

²²⁴ No author or title provided, *Interfax* (in English), 3 June 2019.

²²⁵ No author provided, "Using the Force," *The Economist*, 20 July 2019, p. 19.

and deep operations are all applicable to space. These developments are taking place at a time and place (space) that has an unfolding environmental context. There are no rules of space warfare that would be equivalent to the rules of land warfare (although many believe space in the interim should abide by land warfare rules until space rules are developed). To date there is only the Outer Space Treaty of 1967 and not a rule of law. The treaty appears to leave much room for interpretation and was, naturally, unable to envision two things: the current space environment that includes commercial and private spacecraft in addition to government developed ones; and its high-technology equipment (lasers, antisatellite missiles, etc.) that is able to do things (inspect other equipment in space, for example) never before considered.

The four officers who wrote longer articles on operational art made references to both operational art and its characteristics, and also discussed the aerospace domain. Korotchenko stated that the “growing potentials of air and space warfare are increasingly influencing the theory and practice of operational art.”²²⁶ The prevention of an enemy’s domination in space is now important and commanders must “employ the potentials of our space-based systems to the utmost when preparing operations and waging hostilities”²²⁷ since the course and outcome of operations are dominated by space and missile forces. Maneuver, he noted, is a typical trend of operational art and has a more important role to play under the current advanced technological situation.²²⁸ Zherebtsov stated that there will be a new perception of operational art’s content, to include its principles, forms, and methods of conducting operations under conditions of an information-focused confrontation and the massive use of precision weapons; and that new ways and means of resolving tasks will be unveiled to confront modern interstate and intrastate opposition.²²⁹ Stolyarov noted that the operational art department is “concentrating its efforts on developing new, unconventional forms and methods of employing large strategic formations and groupings of forces in both large-scale and local wars, as well as in armed conflicts.”²³⁰ He noted that “in the very near future, substantial changes will occur in the theory and practice of operational art.”²³¹ Kopytko stated that operational art includes combined arms operational art (combined arms of large strategic formations); operational art of the services and the centrally controlled arms (Strategic Missile Troops, Airborne Troops, and Space Troops); and operational art of the operational rear services. The structure is not constant but develops in line with the evolution of both weaponry and new combat arms and forces.²³²

The last section of the article, on the use of operational art in space, noted that being in a superior position during the initial period of war is the primary element that clears the way for the use of operational art in space and helps ensure success. Putting the proper equipment in space during peacetime prepares Russia’s military for the initial period of war. Large-strategic formations would be composed of equipment that includes lasers, satellites, anti-satellite missiles, counter communication, and other pieces of equipment instead of tanks, artillery, and aviation units. Numerous similarities in the characteristics surrounding the use of operational art in ground

²²⁶ Korotchenko, p. 15.

²²⁷ Ibid.

²²⁸ Ibid.

²²⁹ Zherebtsov.

²³⁰ Stolyarov.

²³¹ Ibid.

²³² Kopytko.

operations (weaknesses on flanks, etc.) are present in space, which provide further rationale for Russia conceptualizing the use of operational art or even perhaps OMGs in that domain.

Today, equipment orbits above us and cables wrap the globe together under the seas. Space objects, suspended in orbit, are equipped with capabilities that offer the opportunity to form OMGs in space in a suspended status, awaiting further orders for their activation or integration much like a computer virus. As was noted above by one Russian author, “operational art in terms of its inherent purpose remains a theory and practice of resolutely changing the situation in aerospace in one’s favor...”²³³

A recent US report suggested how the nation might incentivize Russia to fall in line with an international space traffic management (STM) scheme. These recommendations were:

1. Establish red lines in space surrounding critical satellites to quickly and clearly assign liability, when an undesirable space conjunction occurs.
2. With the best data and skills, DoD should take the initiative to develop specific space traffic standards and best practices pertaining to military security in STM. Otherwise, economic agencies and commercial operators could favor economic prosperity over military security.
3. The United States should submit an amendment to the Liability Convention²³⁴ to change the current fault-based liability for damage in space by a space object to absolute liability, just the same as liability for damage on Earth by a space object. The change would also facilitate the rules pertaining to the red lines in 1. to become customary international laws, regulations, and enforcement in STM.
4. The United States should deploy bodyguard spacecraft to get ready in time to protect satellites against the rapidly emerging and growing robotic ASATs.
5. For fairness, the United States should take the lead to make all spacefaring nations have the same indemnification and other provisions in their third-party liability insurance.²³⁵

²³³ A. P. Korabelnikov, “Modern Methods of Aerospace and Air Defense of Facilities and Prospective Development Trends,” *Military Thought* (in English), Volume 1 2019, EastView Publications, p. 34.

²³⁴ The Liability Convention provides that a launching State shall be liable for compensation for damage caused by its space objects on the surface of the Earth or to aircraft for damage due to its fault in space. See the United Nations Office for Outer Space Affairs for more details at www.unoosa.org/oosa/index.html.

²³⁵ Brian G. Chow, “Commercial Space: Space Controls and the Invisible Hand,” provided by Henry Sokolski, e-mail on 5 August 2019.

Appendix: Acronyms

Term	Definition
COG	Center of Gravity
GPS	Global Positioning System
IPW	Initial Period of War
KGB	Committee for State Security
NPP	New Physical Principles
OMG	Operational Maneuver Group
SODCIT	Special Operations To Destroy Critical Infrastructure Targets
STM	Space Traffic Management
TVD	Theaters of Military Operations
VKO	Aerospace Defense
VM	Military Thought

PART THREE: RUSSIA'S ELECTRONIC WARFARE FORCE: BLENDING CONCEPTS WITH CAPABILITIES

Introduction

Military and political leaders in nations around the globe are always on the lookout for ways to solve their national security dilemmas. Once these issues are theoretically and technically resolved, leaders feel more secure in their ability to attend to current and future threats. Military leaders in turn feel empowered to impose their will, if necessary, on potential adversaries with these advanced concepts and capabilities.

Such capabilities, according to one Russian officer, are close to being turned into reality in its Armed Forces. Major General Yuriy Lastochkin, who is in charge of the Defense Ministry's radio-electronic warfare (REB) force,²³⁶ stated in 2018 that REB's men and equipment will permit them "to decide the fate of all military operations" in the near future.²³⁷ This is quite a surprising statement when contrasted against President Vladimir Putin's focus on advanced weaponry (hypersonic and strategic missiles, nuclear torpedoes, equipment blinding lasers, etc.), which made no mention of REB capabilities. Perhaps this is just a specific military branch chief's pride in his force, or a military perspective versus a political one.

Or, perhaps REB represents the asymmetric answer that both General Staff Chief Valery Gerasimov and Putin have called for to offset Western high-technology superiority in other areas. A 2019 article in the Russian journal *Military Thought* noted that the nation's military-technological asymmetric response must deter an adversary from launching a large-scale war. Russia can do so, the article stated, by creating the threat of using asymmetric systems such as electronic warfare countermeasures.²³⁸ Another article stated that REB assets "are one of the main asymmetric means of waging new-generation wars."²³⁹ REB is asymmetric in that it is not so much a force on force concept but rather a way to unravel a force simply through an indirect method, attacking frequencies; and REB uses this indirect method to achieve another asymmetric effect, the disorganization of an opponent's command and control (C2) capability. This is a powerful way to offset an anti-access, area denial (A2AD) concept in particular or the contested environment in general.

The disorganization topic is quite prominent in Russian military literature. It has been the centerpiece of several recent articles in military journals and is underscored in interviews with leading REB experts year after year. Thus, it is not just A2AD but the "C2D" (command and control disorganization) concept that should concern those watching Russian theoretical developments, especially in light of Russia's perceived view of the US as having attained only a limited electronic warfare capability. REB frequencies that disrupt systems (UAVs, EW

²³⁶ Russian sources and translators use the terms electronic warfare (EW and radio-electronic warfare (REB) interchangeably. Both terms are used as they appeared in various articles but have the same meaning.

²³⁷ Aleksandr Stepanov interview with Yuriy Illarionovich Lastochkin, "They Have Deployed a Dome, Which Defends from Missiles, Over the Russian Bases in Syria. Unique Electronic Warfare Systems, Which Are Capable of 'Blinding' Any Precision-Guided Weapon, Provide It," *MK Online*, 15 April 2018.

²³⁸ V. V. Selivanov and Yu. D. Ilyin, "Methodical Frameworks of Asymmetrical Response Formation in Military - Technical Struggles against a High-Technology Enemy," *Voennaya Mysl' (Military Thought)*, No. 2 2019, pp. 5-14.

²³⁹ Anatoliy Sokolov, "Umbrella Over Syria: Russian EW assets Confirmed High Effectiveness and Can Be Considered an Asymmetric Weapon for New-Generation Wars," *VPK Voyenno-Promyshlenn Kuryer Online*, 25 May-31 May 2016.

equipment, radars, etc.) and disorganize C2 cause chaos in planning, inhibit the coordination of efforts, and lead to the defeat of an opponent. The concept is now enhanced even further with a military decision to create a “disorganization plan” in each REB brigade to better confront adversaries. Perhaps the disorganization issue was practiced most recently and vividly during Vostok-2018, when a massive REB strike was practiced for the first time and on such a large scale, resulting in the jamming of the adversary on land, on sea, and in the air.²⁴⁰ That is, the plan was to create total disorganization. Various Russian officers reference the concept nearly 30 times in the sections that follow these introductory remarks.

Returning to Lastochkin’s contention that REB will decide all military operations, there are many capabilities that support his claim. For example, it was noted that Russia’s Divnomorye mobile complex is simultaneously a reconnaissance station and a jamming device. It purportedly can conduct targeting interference on numerous US systems, such as helicopters, UAVs, long-range radars, E-3 AWACS, the E-2 Hawkeye, and the E-8 JSTARS, as well as spy satellites.²⁴¹ If true, then just this one system could affect the fate of several aspects of military operations. The same report noted that Russia will be creating a REB battalion for every combined-arms army. Previously such units were only at the disposal of military districts.²⁴² Today Russia has more than 30 different REB systems in the ground forces alone that attack unmanned aerial vehicles (UAVs), radars, GPS frequencies, cellular networks, and other command and control or communications devices. One system to combat UAVs even utilizes electronic rifles.

Lastochkin believes that REB can create an electronic dome over the battlefield, shut down adversary systems at will, and debilitate the eyes and ears of an adversary. Regarding the latter, for example, along the strategic Northern Sea Route the Murmansk-BN system is designed to interfere with communication systems, navigation and control systems of ships, and submarines and aircraft that illegally cross borders. This ensures that Russia can suppress any intruders.²⁴³ and totally control access to the region by making them blind and deaf.

A recent Russian exercise worked to create a vacuum or safe zone (electronic dome) over troops to protect them against drones, airborne radars, radio-controlled explosive device, and cruise missiles. This was accomplished through the use of three systems working together: a Borisoglebsk signals intelligence gathering capability; a Krasukha system’s ability to suppress aircraft radar emissions and a drone’s radio control channels; and a Zhitel system’s capability to jam satellite communications, navigational equipment, and cellular communications to a radius of 30 km.²⁴⁴

This article will address Russian REB concepts and capabilities. It will initially discuss Western concerns about Russian REB and the latter’s focus on Western weaknesses and capabilities. It then covers the claims of Lastochkin and another Russian officer that REB is the key to controlling future operations before highlighting prominent military discussions from 2015-

²⁴⁰ No author provided, “Deafening Success: EW System to Cover Europe from Near Kaliningrad,” *Izvestiya Online*, 26 April 2019.

²⁴¹ Aleksandr Kruglov and Nikolay Surkov, “Infantry Will Be Covered by an Electronic ‘Umbrella’: Electronic Warfare Battalions Will Appear in All Combined-Arms Armies,” *Izvestiya Online*, 10 October 2018.

²⁴² Ibid.

²⁴³ No author provided, “The Northern Fleet Completed Arming the Electronic Warfare (REB) Center,” *Izvestiya Online*, 7 May 2019.

²⁴⁴ No author provided, “Central Military District Electronic Warfare Specialists Test New Way of Countering Enemy Airborne Assets,” *Ministry of Defense of the Russian Federation*, 10 June 2019.

2018 of REB by both active and retired officers. Finally, some concluding thoughts are offered, after which there is an Appendix that lists the most recent information available (2017-2019) on ground, air, and naval REB equipment and, where available, their operating parameters.

Attempts to Strike Fear in NATO and the US

Numerous Russian articles claim that their military's REB systems are far superior to Western ones. Western EW weaknesses, they note, are many and have been exposed. There may be two purposes for these and other such reports. First, it could be merely a way to deter NATO and the US by implying that Russia might have such superior capabilities, even though they don't. Deterrence works in that way, using fear. Or, second, it could be that Russia has some of these capabilities (but not all of them) and is willing to demonstrate those they have. It appears that elements of both are true. They are demonstrating their capabilities, as Norwegian and Finnish officials state below, and such abilities can act as a deterrent through the introduction of doubt about just how secure other nations' systems really are. Russian analysts are not shy in pointing out their own competency and their consideration of Western EW limitations.

First, regarding Western weaknesses, Russia writes that practically every US weapon is hooked to satellite communications, GPS navigation, and the Internet, and REB operators claim to be able to shut these channels down with ease. Recent DARPA contracts, the Russian analysis noted, appear to focus on upgrading weak systems as DARPA is directing companies to design new systems able to function against electronic interference. Another Western concern is that Russia is not limited to just jamming NATO systems but can also intercept and manipulate US military targeting data. One US analyst, according to the same Russian publication, stated "If the enemy can get into command and control computers to provide wrong data, you could potentially call in airstrikes against your own positions. If troops can no longer communicate, close air support becomes more time-consuming or impossible."²⁴⁵

A second Russian report stated that US concern about Russian REB superiority is buttressed by Russia's successful intrusions into the electronic systems of other nations. The Norwegian Defense Ministry blamed Russia for GPS malfunctions during the NATO Trident Juncture Exercise. Finnish Prime Minister Juha Sipila stated that jamming from the Kola Peninsula had knocked out some of his nation's navigation systems. Israel implied that the Krasukha-4 REB system was to blame for the recent inadequate performance of its Iron Dome air defense system. With an operating range of 300 kilometers, the Krasukha system could reach Israel if deployed in Syria. Zhitel, Divnomorye, or Borisoglebsk-2 systems may also be at fault, according to Israeli experts cited in the Russian report. None of these nations claim to have potential counters to these Russian systems.²⁴⁶

Former US Army EW Chief Laurie Buckhout was cited in the report as having stated that Russian REB capabilities surpass those of the US by an order of magnitude, the reason being that the US has not fought against an adversary capable of impacting communications for decades and thus has put less focus on these systems. Whether Buckhout made the comment about "orders of magnitude" is uncertain, but in other publications she has reiterated her concern over the growing

²⁴⁵ Aleksandr Sitnikov, "US for the First Time 'Shuts Down' Russian Electronic Warfare in Syria. Account Published in America of New Method to Counter the 'Putin Threat,'" *Svobodnaya Pressa*, 18 October 2018.

²⁴⁶ Sergey Ishchenko, "Krasukha with Lysukha Have Struck Terror into NATO and Israel. A Norwegian Frigate on the Shoals, and the Iron Dome—Holes. Is this EW?" *Svobodnaya Pressa*, 13 November 2018.

capabilities of Russian systems. The US Army's Asymmetric Warfare Group was less pessimistic, noting a year and a half ago that "For an anti-access, area-denial, or A2AD bubble to protect Russian brigades in a major ground operation, Russian forces would need larger numbers of EW and air defense platforms than they have. Nearly all such platforms are in Kaliningrad, Ukraine, and Syria."²⁴⁷ Today things are different for Russia's military, as it reportedly has a REB brigade in each military district and there are companies in tank brigades and divisions.²⁴⁸

Retired US Lieutenant General Ben Hodges, former commander of the US Army's European forces, did not say that Russia's capability was greater than NATO's but did note that it is of value:

The [Russian] electronic warfare capability; again, that's something we never had to worry with in Afghanistan and Iraq. The Ukrainians live in this environment. So, you cannot speak on a radio or any device that's not secure because it's going to be jammed or intercepted or worse, it's going to be found and then it's going to be hit.²⁴⁹

Finally, Russia states that their competency has advanced to the testing of electromagnetic weapons, which can be regarded as the further development of electronic warfare devices. One such weapon is the Alabuga, described in 2017. These jammers explode at a height of 200-300 meters and shut down electronic equipment within a radius of 3.5 kilometers. The system takes out electronic components in the affected areas out of commission.²⁵⁰ Another is the Afghanit system, a microwave weapon now fitted on military vehicles. There appear to be specific projects for the creation of electromagnetic weapons, according to the report. They include projectiles, bombs, and missiles that carry magnetic explosion generators to burn adversary electronics or the homing heads of missiles. Perhaps these weapons can also be regarded as asymmetric responses.

A Russian Defense Ministry Website offered an opinion on the performance of such weapons:

Ultra-high-frequency weapons (microwave weapons) are a type of electromagnetic weapons whose harmful effects come from super-powerful electromagnetic radiation in the microwave range (0.3-300 GHz). They are intended to disable radio-electronic and optical elements of equipment and weapons (including space objects), suppress air defense and antimissile defense systems, disorganize control, protect against high-precision weapons, and so on.²⁵¹

Another report stated that electromagnetic guns are continuously being tested in laboratories and firing ranges in Russia. They will be able to disable the warheads of self-guided missiles, and there are plans to install electromagnetic guns on 6th generation UAVs.²⁵²

²⁴⁷ Joe Gould, "Eyeing Russia, Lawmakers Aim to Boost Army Electronic Warfare," *Defense News*, 10 October 2017.

²⁴⁸ Roman Azanov, "With What Can Russia's Army 'Blind' and 'Suppress' an Enemy: The Automated Jamming Station from the 'Borisoglebsk-2' Electronic Warfare Complex," *TASS*, 15 April 2019.

²⁴⁹ Mike Eckel, "Ex-US Army Commander Warns of Russian Capabilities in Ukraine," *Radio Free Europe*, 24 January 2018.

²⁵⁰ Aleksey Ivanov, "Electromagnetic Bombs Created in Russia," *Rossiyskaya Gazeta Online*, 28 September 2017.

²⁵¹ Oleg Bozhov, "We Have It! The Invisible Sword; Russia is Testing Electromagnetic Weapons That Burn the Insides of Enemy Missiles," *Armeyskiy Standard*, 12 October 2018.

²⁵² No author provided, "Microwave Guns: Tests of New Weapons Have Started in the Russian Federation. Russia

Overall, however, it must be remembered that the accuracy of Russian reporting on REB systems is sometimes overstated, especially regarding their capabilities (see, for example, the discussion of the Zaslon-REB in the Appendix at the end of this article). However, Russia does possess impressive REB capabilities and is clearly willing to discuss and demonstrate them.

Russia's Chief of Electronic Warfare

One of the chief sources of information about Russian REB is naturally its commander, Lastochkin, who has offered interviews and written articles from 2014-2019. REB day is recognized on 15 April, and he sometimes is interviewed on this day. Other times he simply writes for a journal such as *Military Thought*. His interviews/articles are summarized below, including three separate discussions in 2019. One is a short interview with another REB Major General and the other two REB-associated articles were found in the Russian ground force journal *Armeyskiy Sbornik (Army Journal)*.

In 2014 Lastochkin, a Colonel in charge of REB at the time, noted that radio-electronic systems provide the technical foundation for most of the state-of-the-art armaments and military equipment. He viewed the employment of REB methods against high-tech items as an asymmetric measure designed to nullify an adversary's ability to wage armed combat. It is desirable to engage an adversary's assets on his own territory and to use "the emergence of assets for the functional kill of an adversary's electronic assets...and the employment of special assets to disrupt the operations of computerized command and control systems built on the network principle."²⁵³

Among them are:

- Selecting C2 and intelligence-gathering systems as priority targets;
- Developing new ways to disrupt radio wave propagation;
- Creating technologies to reduce armament signatures;
- And employing assets creating a complex REB environment for an adversary's technical reconnaissance and intelligence-gathering facilities.²⁵⁴

In 2015 Lastochkin wrote on REB's future in the journal *Military Thought*, concentrating on the offense which included jamming opponents and then attacking them with REB. The latter becomes an asymmetric response to level the other side's advantages, such as an adversary's high-tech weaponry.²⁵⁵ REB offers the opportunity to suppress an adversary's REB assets to the full depth of his operational order of battle and its effects can be similar to those possessed by high-precision munitions, he noted. REB can be used alone or with fire assets and special operations forces to gain information superiority; and it can perform information warfare missions to protect against technical reconnaissance assets. Lastochkin correctly predicted that REB's capabilities will allow it to play a larger role in conflict and its status will be upgraded.²⁵⁶

Has Begun Field Tests of Electromagnetic Weapons," *Gazeta.Ru*, 1 October 2018.

²⁵³ Yuriy Lastochkin, interviewed by Viktor Khudoleyev, "Troops for the Battle in the Ether," *Krasnaya Zvezda Online*, 15 April 2014.

²⁵⁴ Ibid.

²⁵⁵ Yu. I. Lastochkin, "The Role and Place of Radio-Electronic Warfare Actions in Contemporary and Future Conflicts," *Voennaya Mysl' (Military Thought)*, No. 12 2015, pp. 14, 16.

²⁵⁶ Ibid., pp. 17-18.

No interview with Lastochkin was found for 2015 on REB day. In 2016 he noted that a special REB troop range would be created by 2018. The range will offer units compressed time periods to execute missions and will include specific operational-tactical situations and the opportunity to organize coordination on a planned virtual battlefield. The Magniy-REB simulator training complex is being supplied to help carry out this training.²⁵⁷

In 2017 Lastochkin noted that a new arena of confrontation had emerged, that being the information and telecommunications environment. REB missions had expanded in terms of effectiveness, such that their employment “is comparable to the effective engagement of the target with precision weapons.”²⁵⁸ REB forces are designed to engage adversary facilities and offer the integrated control of countermeasures against an adversary’s technical means thereby protecting friendly forces. REB forces are:

- Building electromagnetic radiation weapons;
- Developing software that can disrupt the accessibility, integrity, and confidentiality of adversary information;
- Applying the means to mimic false electromagnetic environment and deceive adversary systems;
- And improving decision-making algorithms through a single C2 loop.²⁵⁹

Lastochkin, in whose office there reportedly is a situation center, singled out the Zaslonev REB system as a guaranteed capability to block channels where information might be leaked by establishing an electronic dome over the Defense Ministry’s facilities and installations; and he stated that REB is the “sole effective method of combatting miniature UAVs.”²⁶⁰ Training time has doubled for REB operations, and the volume of missions in a strategic section “will increase by a factor of 100-150 percent” and will form the basis for an effective air-ground REB system.²⁶¹

The military newspaper *Krasnaya Zvezda* interviewed Lastochkin as well in 2017. He added that new REB systems can neutralize a probable adversary’s electronic hardware countermeasure systems; and that introducing disinformation into an adversary’s C2 system can deceive him regarding Russian troops actual concept of operations and the location of its military facilities. Missions of REB included ensuring the electromagnetic compatibility of electronic systems, the international legal protection of military electronic systems, and planning for the use of radio frequencies. Russia also plans to complete the integration of electronic warfare information resources into the Armed Forces Single Information Space, which will provide to command authorities the capability to use all the information about the operational and electronic situation for the organization of Russian REB.²⁶²

²⁵⁷ No author provided, “Special EW Troop Range Will Be Established in Russia by 2018,” *RIA Novosti*, 15 April 2016.

²⁵⁸ Oleg Falichev interview with Yuriy Lastochkin, “Dome over the Defense Ministry. Zaslonev-REB System Blocks Any Channels of Information Leakage,” *VPK Voenno-Promyshlennyy Kurier Online*, 26 April-2 May 2017.

²⁵⁹ *Ibid.*

²⁶⁰ *Ibid.*

²⁶¹ *Ibid.*

²⁶² Gennadiy Miranovich interview with Yuriy Illarionovich Lastochkin, “On the Cutting Edge of Technologies: The Electronic Warfare Troops Are Celebrating Their Professional Holiday—15 April is Electronic Warfare Specialist’s Day,” *Krasnaya Zvezda Online*, 14 April 2017.

Lastochkin's most important REB article may have been written in 2017 in conjunction with three other analysts for the journal *Military Thought*. They discussed how REB had become an important method of implementing operational art. The latter is in a continuous state of development, depending on "the emerging military and political situation, the quality of weapons and equipment standards of one's own Armed Forces and foreign armies, as well as changes in the views on conducting combat actions."²⁶³ Further, REB forces are integrated into reconnaissance-fire and-strike systems, which provide real-time responses to target identifications. This makes the disorganization of adversary C2 more of a priority and may increase REB's role two or three-fold.²⁶⁴

Regarding the forms and methods of REB use, the latter was singled out. First it was recommended to "construct a tree of combat employment methods at the head of which there should be methods of disorganizing adversary C2."²⁶⁵ These can be various fragmentation methods. Second, fundamental disorganization methods include an information blockade of C2 bodies and information blocking of complex electronic equipment. Finally, there are physical methods of disorganizing, such as destruction, distortion, and misinformation. These would include destroying circuitry with electromagnetic radiation or using special programs to impact software and databases.²⁶⁶ With REB force under consideration to be the fifth arm of the ground forces (after motorized rifle formations, tanks, artillery, and air defense assets), it will necessitate the creation of operational art basics for this new arm of the ground forces. They must, the authors note, be both original and unorthodox.²⁶⁷

Also, in 2017 Lastochkin solicited help in compiling a thematic anthology titled "Electronic Warfare in the Russian Federation Armed Forces." The anthology was to include organizations and enterprises that develop electronic warfare systems, problems, and tasks facing military experts and developers of modern electronic warfare systems. Information about current and future projects would also be provided. The planned publication date was March 2018.²⁶⁸

Lastochkin's 2018 interview was shorter than the 2017 interview on REB Day, but it was far more important in terms of bravado. The following three quotes from the interview sum up all of the major points he made:

I will say more: qualitative changes in the development of **electronic warfare** men and equipment will permit them to **decide the fate of all military operations** already in the near future. The matter is for the practical realization of the potentially high prospects for contemporary electronic warfare.

The **disorganization of enemy troop and weapons command and control** and the reduction of the effectiveness of the conduct of reconnaissance and weapons employment by them **is the primary goal of the conduct of electronic warfare**. With respect to the spatial scale, we are capable of accomplishing missions on a global scale in individual physical fields, in other words, to selectively carry out

²⁶³ Yu. I. Lastochkin, Yu. L. Koziratsky, Yu. Ye. Donskov, and A. L. Morescu, "Combat Employment of Radio-Electronic Warfare Troops as a Basic Component of Ground Forces Operational Art," *Voennaya Mysl' (Military Thought)*, No. 9 2017, pp. 18-25.

²⁶⁴ Ibid.

²⁶⁵ Ibid.

²⁶⁶ Ibid.

²⁶⁷ Ibid.

²⁶⁸ Unattributed author and title, *Informatsionnyy Most*, 9 August 2017.

jamming against facilities, which are located practically at any location of the world and outer space.

Our equipment’s capabilities permit us to create, as you say, a ‘dome’ not only over a missile complex but also to provide full-fledged protection from air and space reconnaissance, for example, of a major command post or the country’s other important facilities.²⁶⁹

The focus on disorganization was underscored in a report three days later about US airstrikes on Syria, due to the latter’s use of chemical weapons. Lastochkin stated that “It is impossible to achieve superiority over an enemy, which is achieved through the disorganization of his information management and telecommunication systems, without state-of-the-art electronic warfare systems.”²⁷⁰

Lastochkin’s 2019 article on REB Day was the shortest of his REB Day explanations. He noted that REB is the main form of operational (combat) support and that it aims to disrupt adversary information systems through REB suppression of transmission channels. He stressed that fitting REB systems to missiles, combat aircraft, helicopters, warships, and armor is being accomplished to protect them against intelligence gathering and precision weapons. REB assists in reducing the detectability of many types of equipment, to include the Su-57 fifth-generation aircraft, Armata, Bumerang, Kurganets, and Tayfun armored vehicles, and surface warships such as Project 20380 and Project 22350 corvettes.²⁷¹

Another important interview was that of Major General Sergey Klindukhov, Chief of the Eastern Military District REB Headquarters. He stated that an adversary’s destruction is accomplished via the employment of traditional strike weapons and electronic reconnaissance and suppression complexes. He made one very interesting comment about combat operations, which provided an indication of how Klindukhov felt future wars would be conducted:

Contemporary armed conflicts are characterized by surprise and short duration and a dramatic change of the operational situation. And the primary factor, which influences success in operations, is the seizure of the initiative and superiority in the information environment through rapid decision-making and immediate reaction to threats...²⁷²

Klindukhov stated that electronic facilities are now mobile and include remote control or programmed command and control methods. He mentioned that the Silok and Pole-21 jamming complexes can block an adversary’s UAV remote control and suppress its transmission of photo and video context and target coordinate data. He added that REB mobile teams have been created,

²⁶⁹ Aleksandr Stepanov interview with Yuriy Illarionovich Lastochkin, “They Have Deployed a Dome, Which Defends from Missiles, Over the Russian Bases in Syria. Unique Electronic Warfare Systems Which are Capable of ‘Blinding’ Any Precision-Guided Weapon, Provide It,” *MK Online*, 15 April 2018. Bold print did not appear in the original.

²⁷⁰ Vladimir Mukhin, “‘Krasukha’ Prevented the Tomahawks from Reaching the Targets. Russian Electronic Warfare Systems Successfully Underwent Baptism by Fire in Syria,” *Nezavisimaya Gazeta Online*, 18 April 2018.

²⁷¹ Yuriy Lastochkin, “EW Troops Guard the Airwaves. In the Realm of Information and Telecommunications, Supremacy Will Be with Us,” *Krasnaya Zvezda Online*, 15 April 2019.

²⁷² Aleksandr Pasmurtsev interview of Sergey Klindukhov, “The Strike Force of Netcentric Wars,” *Suvorovskiy Natisk*, 26 April 2019.

such as a team with a Borisoglebsk-2 complex, to detect radio sources and jam an adversary's C2 channels.²⁷³

The journal *Armeyskiy Sbornik (Army Journal)* carried a few recent articles on how to use REB to hamper an enemy force. One article devoted to missile troops and artillery noted that the problems for REB to solve involve increasing the effectiveness of disorganizing enemy command and control, fire control, reconnaissance, and REB. The Rtut-BM and Infauna systems were singled out as important REB systems. It was noted that a methodology providing for a quantitative-qualitative estimate for the contribution of REB was needed to fulfill strike operation requirements. While the seizure of the initiative and achievement of surprise were other important issues that were stressed the concluding line of the article noted that “in future wars the outcome of combat operations also will be determined to no small degree by the potential of REB.”²⁷⁴

A second article noted that the consequences of even an insignificant failure in the C2 sphere can rapidly and irreversibly affect the course of the operation (engagement) as a whole. This requires that superiority be attained in C2 issues, as it can define the operational efficiency and quality of day-to-day (local) decisions, which must be timely and adequate for the developing situation in the areas of combat operations. Future operations (engagements) will require C2 information support close to real time and with reference to the current situation.²⁷⁵

***Military Thought* Articles, 2015-2019**

This section examines a few articles in the stated time period that focus on REB and operational art, tactics, trends, forms, and other issues of importance.

In 2015 three authors wrote on REB tactics, although the discussion was not specific as to what type of tactics Russian units might employ. They noted that REB is conducted to disorganize adversary troop and weapons control and thereby achieve superiority over an opponent. REB uses specific forms and methods when committing weapon assets in battle. It was noted that “the theoretical and practical sides of the planning and conduct of an engagement add up to tactics, an element of military art.”²⁷⁶ REB tactics depend on the forms in which they are employed, and the methods used to fulfill combat tasks. Studying closely an adversary's electronic systems and his assets help inform Russian commanders about an opponent's strengths and weaknesses. Such criteria provide the input that allows for a commander's creativity on the battlefield.²⁷⁷

REB abilities include jamming communications, radars, and radio navigation systems of an opponent, and the ability to then hit them with fire from other assets.²⁷⁸ REB tactics are different from other forces due to their type of use.²⁷⁹ REB goals are:

²⁷³ Ibid.

²⁷⁴ M. Il'in, “Different Missions, One Goal,” *Armeyskiy Sbornik Online*, No. 1 2019, pp. 30-33.

²⁷⁵ V. Khranov and A. Leontyev, “To Make an Operational Decision. The Intellectualization of the Electronic Warfare (EW) Command and Control Processes as One of the Primary Ways to Increase Its Effectiveness,” *Armeyskiy Sbornik Online*, 31 May 2019.

²⁷⁶ V. A. Dvornikov, I. I. Korolev, and V. N. Pavlov, “On the Tactics of Electronic Warfare Forces,” *Voennaya Mysl' (Military Thought)*, No. 3 2015, p. 10.

²⁷⁷ Ibid., p. 14.

²⁷⁸ Ibid., p. 10.

²⁷⁹ Ibid., p. 12.

- Accomplished through the massive and joint employment of forces at selected stages of an operation;
- Through the extension of the zone of combat to an adversary's full depth and the use of REB maneuver units and systems of electronic strikes;
- And through close cooperation with REB and other tactical units.²⁸⁰

In 2016, one article noted that REB is a main asymmetric way of waging war. The author added that REB's main capabilities must be concealed from probable enemies to the maximum extent and be a surprise when the tactics employing them are unleashed. REB equipment should rely on domestic components and there should be an active development of millimeter and terahertz bands of working frequencies.²⁸¹ The goal is to create a difficult electronic environment for an adversary's troops in which to work. There are also some REB institutes (Electronic Warfare Scientific Research and Test Institute as part of the Zhukovskiy and Gagarin Air Academy; the EW Troops Military-Scientific Committee; and two science companies for REB) that have been created, among others.²⁸²

Another 2016 article included a discussion of REB methods. It was clearly stated that the "target orientation lies in disorganizing the adversary's information support for combat actions and the guided weapons used by him."²⁸³ Tasks include the following:

- Disorganizing the adversary's information support when he directly controls combat activities during an operation;
- Disorganizing the adversary's information support when he employs guided weapons;
- And disorganizing the adversary's information support for electronic warfare forces (counter EW).²⁸⁴

Jamming, naturally, is the main method to disorganize an opponent, of which node jamming is a specialized aspect.²⁸⁵ Delaying timely information support to decision-makers, misguiding them with false information, constructing information blockades, warping databases, and destruction are other methods.²⁸⁶

In 2017 LTC O. G. Nikitin wrote on REB trends. He noted that the principal content of future operations will be the struggle against information infrastructures. A prominent role in disorganizing these structures belongs to REB forces, which no longer appears to be a support force but an independent force with its own missions, methods, and forms of combat

²⁸⁰ Ibid., p. 13.

²⁸¹ Sokolov.

²⁸² Yuriy Lastochkin, "Not a Day Goes by Without Interference: Electronic Warfare is Conducted Strictly According to Science," *VPK Voyenno-Promyshlenny Kuryer Online*, 27 April 2016.

²⁸³ I. I. Korolyov, O. G. Nikitin, and S. N. Kozlitsin, "Problems in Determining the Methods for Using the Forces and Means of Radio Electronic Warfare as an Arm of the Ground Forces," *Voennaya Mysl' (Military Thought)*, No. 9 2016, pp. 14-15.

²⁸⁴ Ibid., p. 15.

²⁸⁵ Ibid., p. 16.

²⁸⁶ Ibid., p. 17.

employment.²⁸⁷ He noted that a decision-making support system (DMSS), a higher form of information technology, will be designed to disorganize an adversary's executive elements. He stated that a DMSS of a REB force's command and control organ would be understood as

A hardware and software complex that makes it possible for the appropriate officials at all stages of the organization and direct employment of REB forces (troops) and means to resolve both structured and non-structured tasks with respect to forming rational decision variants on the combat employment of various forces and means enlisted to accomplish the task of disorganizing enemy command and control of troops and weapons.²⁸⁸

Software, linguistic, information, mathematical, and technological support are all elements that make up the DMSS concept. The most critical adversary C2 processes and organs taking part in the DMSS must be identified. It is first necessary to develop an appropriate disorganization plan, a model of the adversary's C2 system, and the adversary's critical information areas.²⁸⁹

This requires identifying the operational, information, and radio-electronic situation, which assists in the identification of targets and helps with allocating the resources of other branches to disorganize enemy C2. The assessment of an opponent's operational situation involves examining his correlation of forces, forecasted changes, and an opponent's most important C2 organs. The information situation involves identifying the level of informatization of C2 organs and critically important targets, with the latter understood to be that which carries out the receiving, processing, sorting, and transmitting of information. The radio-electronic situation is a component of the operational and information situations, assessing numbers, characteristics, conditions, capabilities, methods, and sequence of use. It is important to select C2 processes that lead to the disorganization and the sharp reduction in an opponent's combat operational effectiveness at both specific stages of an operation or for the operation as a whole.²⁹⁰

C2 processes identified as targets are known as fragmentation targets. Nikitin stated that it is possible "for each set of fragmentation subjects to propose specific methods of disorganization (types of fragmentation) and that the type of effects utilized depends on the makeup of friendly forces. The ultimate aim is to select the appropriate forms and methods of use. The latter could include blocking C2 organs or information support elements.²⁹¹ The REB chief must be presented with one or several variants of a plan to distribute forces and means against targets identified in the operational, information, and radio-electronic situations. The plan is coordinated with fire destruction resources as well.²⁹² Of interest is that in this article Nikitin used the term disorganization 21 times, making it truly a goal of Russian REB formations in his opinion.

Another 2017 article discussed the development of weapon strategies, defined as traditional (the progressive development of existing weapons); innovative (new-generation weaponry is anticipated via the use of artificial intelligence technologies, etc.); and breakthrough (creation of

²⁸⁷ O. G. Nikitin, "Trends in Increasing the Effectiveness of the Organization of the Combat Employment of Radio-Electronic Warfare Troops in the Operations of Ground Forces Formations," *Voennaya Mysl'* (*Military Thought*), No. 5 2017, p. 23.

²⁸⁸ *Ibid.*, p. 24.

²⁸⁹ *Ibid.*, p. 25.

²⁹⁰ *Ibid.*, p. 27.

²⁹¹ *Ibid.*, p. 28.

²⁹² *Ibid.*, p. 29.

fundamentally new and nontraditional models).²⁹³ The actual goal of REB development is the integrated use of all three strategies, where the proportions between principal supporting strategies must be justified and an optimum balanced correlation of strategies implemented. Traditional strategies may predominate in a period of threat, innovative strategies when the threat is unclear, and breakthrough strategies when there are no visible threats.²⁹⁴ Research criteria included an understanding of the forms and methods of employing REB forces, and methods for disorganizing enemy command and control systems.²⁹⁵

In 2018, an article addressed ways to attain command and control superiority in ground operations. C2 superiority was deemed to be an operational goal that must include information and intellectual superiority for decision-makers as well as military and technological superiority. Primary targets for disorganizing an adversary are the latter's control bodies and troop and weapons control systems. The authors noted that it is important to isolate an adversary's C2 structure from information critical to determining the course and outcome of combat actions. This is primarily accomplished through impacting electronic assets that service C2 bodies. The disorganization of information support systems is most important.²⁹⁶

Conclusions

Lastochkin believes that REB operations will decide the fate of all military operations. His bravado indicates he finds "asymmetric and A2AD gold" in the application of REB capabilities against what Russia considers a major Western weakness, the latter's numerous links to space assets. There is certainly ample evidence to suggest that a significant REB capability is under development. There are numerous REB systems in Russia (see Appendix below) that handle various missions. They can create distorted navigational fields, suppress radio-controlled mines, obtain bearings of electronic wave emission sources, and create interference against the notional adversary's communication systems. Jamming opponents and conducting electronic strikes against them enable the disorganization of an adversary's force, a primary goal of REB.²⁹⁷ In some exercises, decoy lines of communication are created in an adversary's networks and command posts and artillery positions are covered with an electronic umbrella to keep them safe from a precision missile strike.²⁹⁸

Of note was the consideration that REB no longer appears to be a support force but an independent force with its own missions, methods, and forms of combat employment. Another important point was the use of REB capabilities to deceive opponents into carrying out instructions that had been interfered with or manipulated by Russian forces. Of course, the consistent use of the term's "disorganization," "disorganize," and "disorganizing" used throughout the discussion indicated that this is a major method for attaining superiority and is a focal point for REB operators

²⁹³ V. A. Orlov, Iu. N. Laygin, and D. M. Byvshikh, "Planning the Strategies for the Development of a System of Radio-Electronic Warfare Weapons," *Voennaya Mysl' (Military Thought)*, No. 5 2017, pp. 14-22.

²⁹⁴ Ibid.

²⁹⁵ Ibid.

²⁹⁶ Yu. Ye. Donskov, A. L. Morarescu, and P. N. Besedin, "Achieving Superiority in Command and Control as a Goal for the Use of Radio-Electronic Warfare Forces in Ground Force Operations," *Voennaya Mysl' (Military Thought)*, No. 1 2018, pp. 28-32.

²⁹⁷ No author provided, "Central Military District Electronic Warfare Specialists Disabled a Notional Adversary's Combat UAVs Outside Orenburg," *Ministry of Defense of the Russian Federation* (in English), 3 October 2018.

²⁹⁸ No author provided, "Eastern Military District Electronic Warfare Subunits in Buryatia Blocked the Operation of an Aggressor Communications Center," *Ministry of Defense of the Russian Federation* (in English), 15 April 2019.

and planners. For this reason, the C2D concept was suggested as an adjunct to the more commonly used A2AD reference. REB maneuver units were another interesting development.

Another conclusion drawn from the discussion is that there are often times when systems are integrated. For example, in the Eastern Military District on REB Day in 2019, state-of-the-art jamming stations, namely the Leer-3, Zhitel, and Rtut-BM were deployed against an aggressor communications center.²⁹⁹ The same day a Leer-3 UAV, a Zhitel automated jamming station, a Borisoglebsk-1 system, and a Lava-RP cellular communications jamming system worked together in another exercise.³⁰⁰

On REB Day 2019, *TASS* singled out electronic intelligence collection and the destruction of an adversary's command and control system as the most important REB missions. This is how you disorganize an opponent and develop chaos in his force. The article noted that REB units are proliferating throughout the Armed Forces, adding the following:

In the ground troops, separate REB brigades were formed in all four of the military districts. There are companies in tank brigades and divisions as well as within the ranks of the Airborne Troops. In addition, there is also a similar subunit in the Arctic motorized-rifle brigade. In the Navy, ground REB forces are combined in separate centers in all four fleets. In the Aerospace Forces, there are separate REB battalions in the order of battle of the Air and Air Defense Armies.³⁰¹

Thus, there appears to be a serious focus in Russia on the use of REB capabilities. It is rising in importance as an asymmetric way to counter A2AD capabilities and a way to deceive or, most important of all, disorganize an opponent. REB is asymmetric in that it is not so much a force on force move as it is a way to unravel a force simply through an indirect method, attacking frequencies. REB's ability to disorganize A2AD force planning is seldom considered in the West, where the focus is primarily on countering missiles and aircraft. Seizing the initiative in REB allows Russian forces to quickly implement decisions while seriously hampering an opponent's decision-making abilities, especially when deceptive measures are employed.

²⁹⁹ "Eastern Military District..."

³⁰⁰ Ibid.

³⁰¹ Roman Azanov, "With What Can Russia's Army 'Blind' and 'Suppress' an Enemy: The Automated Jamming Station from the 'Borisoglebsk-2' Electronic Warfare Complex," *TASS*, 15 April 2019.

APPENDIX: Russian Ground, Air, and Naval REB Equipment

[REB systems for which no information could be found in the last three years include the ground system Parodist; and the Navy systems TK-28, MP-411, KT-308, Prosvet-M, MDU-2, and Ugolok].

Ground Forces:

Spektr—On REB day 2019 the Southern Military District stated that the mobile technical viewing and monitoring complex Spektr was employed by electronic warfare subunits. While this may not be a piece of REB equipment, it is one of several reconnaissance assets used by REB operators. It is designed to track designated territories where dangerous objects could appear via air optical-electronic, ground optical-electronic, and radio and radio-technical monitoring. REB specialists used the complex to conduct surveillance and the detection of targets, information that was then passed to command authorities.³⁰²

Avotobaza—This system combats UAVs by disrupting communications. It has been described as a ground radar jammer, an electronic intelligence system, and a radio-technical reconnaissance system.³⁰³

Brisoglebsk-2—The systems jamming stations electronically suppresses an aggressor's command and control system's components.³⁰⁴ The system collects and analyzes reconnaissance information and generates radio interference, which limits an adversary's ability to use precision guided weapons and to conduct reconnaissance.³⁰⁵ It can suppress the signals operating a UAV within a radius of 30 kilometers.³⁰⁶ During one exercise using the Borisoglebsk-2, servicemen created decoy radio communication lines inside a hypothetical enemy radio network to provide cover for friendly infrastructure.³⁰⁷

Bylina—This system independently selects and identifies targets (radio stations, communication systems, radars, long-range radar detection aircraft, satellites, and other facilities) within seconds. It decides how to effectively suppress them and selects the jamming stations to do so. It operates in the short-wave band.³⁰⁸ It automatically interfaces with battalion and company command posts and individual REB stations. It specifies the sequence of actions after identifying a situation and

³⁰² No author provided, "Southern Military District Electronic Warfare Specialists Conducted Optical-Electronic Monitoring of the Forward Edge of the Aggressor's Defense in an Exercise in Stavropol Kray," *Ministry of Defense of the Russian Federation*, 15 April 2019.

³⁰³ No author provided, "Armenia to Get from Russia All Weapons on State Loan Before Year End—Armenian Defense Minister," *Interfax* (in English), 2 October 2017.

³⁰⁴ No author provided, "Central Military District Electronic Warfare Specialists Ensure Armored Convoy's Safe Movement in Exercise Near Yekaterinburg," *Ministry of Defense of the Russian Federation*, 22 April 2019.

³⁰⁵ No author provided, "Electronic Warfare Subunits Near Orenburg Use Borisoglebsk-2 Complex to Jam the Communication Systems of a Notional Enemy," *Ministry of Defense of the Russian Federation*, 27 December 2018.

³⁰⁶ No author provided, "Central Military District's EW Specialists Prevent UAV Attacks on Command Post Using Borisoglebsk-2 System during Exercise in Orenburgskaya Oblast," *Ministry of Defense of the Russian Federation*, 18 March 2019.

³⁰⁷ No author or title provided, *Ministry of Defense of the Russian Federation*, 7 March 2019.

³⁰⁸ No author provided, "Bylina System RB-109A," *TAdviser*, 29 September 2017.

conducts operations that do not affect friendly REB stations. The system uses artificial intelligence algorithms for the conduct of automated decision-making.³⁰⁹

Dzyudoist—The system can jam the signals of radio-controlled high-explosive rounds. The term means “Judo Fighter.” It is an automated system that can also jam cellular communications. The system uses radio interference to disrupt a range of frequencies and to disable a navigational system, such as that of a drone, from more than 50 kilometers away and prevent them from approaching the forward edge of their troops.³¹⁰

Filin—This optical jammer is designed to dazzle enemy optical sensors, both visual and electrical. For those soldiers or sailors (the system is now being placed on ships) using sights for firearms or other weapons, it modulates bright light beams, where low-frequency oscillation causes agitation of the optical nerves, producing a temporary and reversible disruption to one’s sight. It was reported that one in five soldiers experienced hallucinations, while about half felt disoriented and dizzy/nauseous. The system can affect laser rangefinders in the infra-red range, night-vision devices, and guidance systems for anti-tank guided missiles up to five kilometers. The export version is reportedly the Grach.³¹¹ The effective range is 500-700 meters in a sector 10-15 degrees wide. It is called a nonlethal weapon.³¹²

Grach—This system is, as implied in the Filin discussion above, a similar system. It is simpler and lighter and can be installed on second-tier surface ships and on armored and specialized vehicles for security bodies. The systems liquid cooling allows it to be used in various climatic conditions. It can jam television and thermal devices, or electro-optical equipment that is used for detecting targets. It can be used by the Navy or Ground Forces.³¹³

Infauna—The system can suppress operations of an adversary’s radio-electronic communications means and various types of UAV navigation systems operating at a distance of up to 100 kilometers in mountainous terrain.³¹⁴ It can jam radio communication lines for remote-controlled charges and mines.³¹⁵ A recent report noted that, using an aerosol jamming system installed on an Infauna complex, it was possible to hide a convoy and simultaneously jam radio communication lines that controlled an adversary’s remote-controlled mines along the convoys path.³¹⁶

³⁰⁹ Aleksey Ramm, Dmitriy Litovkin, and Yevgeniy Andreyev, “Troops Will Get Electronic Warfare Artificial Intelligence System; Bylina System Will Independently Find, Identify, and Suppress Enemy Radar, Communications, and Satellites,” *Izvestiya Online*, 4 April 2017.

³¹⁰ No author provided, “Electronic Warfare Specialists Use Modern Dzyudoist System to Jam Signals of Guided Projectiles: After Using Radio Jamming to Suppress a Range of Frequencies and Disabling the Navigational Systems of Notional Enemy Drones at a Distance of More Than 50 Kilometers, Servicemen Prevent Drones from Approaching the Forward Edge of Their Troops,” *Zvezda TV Online*, 8 July 2018.

³¹¹ No author or title provided, *BBC Monitoring* (in English), 3 February 2019.

³¹² Aleksey Kurilchenko, “The ‘Eagle Owl’ and ‘Rook’ Have ‘Flown’ to the Ships and Landed and Blinded All. Russia’s Navy Begins to Take Delivery of the 5P-42 Filin Visual-Optical Jammer, Which Blinds the Enemy,” *Yezhenedelnik Zvezda*, 12 February 2019.

³¹³ *Ibid.*

³¹⁴ No author provided, “Special Tactical Exercises with Electronic Warfare, Unmanned Aerial Vehicles Subunits Begin in Armenia,” *Ministry of Defense of the Russian Federation*, 16 April 2019.

³¹⁵ No author provided, “Russian Electronic Warfare Specialists Neutralize Radio-Controlled Minefields in Tajikistan Exercise,” *Ministry of Defense of the Russian Federation*, 11 September 2018.

³¹⁶ No author provided, “Central Military District EW Specialists in Tajikistan Learned to Cover a Vehicle Column from Enemy Precision-Guided Weapons,” *Ministry of Defense of the Russian Federation*, 30 May 2019.

Leer-2—This system conducts electronic intelligence reconnaissance of radio radiation and jams electronic equipment. It can simulate operations of various electronic systems and conduct an assessment of the electromagnetic situation.³¹⁷

Leer-3—This complex has three Orlan-10 UAVs and is known as a smart UAV, since it is fitted with the capability to jam 3G and 4G mobile communications, conduct reconnaissance, and transmit data to artillery crews. It can send out mass SMS messages to cell phones³¹⁸ and can disable remotely controlled explosive devices of illegal armed formations.³¹⁹ It can be classified as a virtual cellular station and it can send out audio messages and small video clips. The Orlan-10s have jammers on them as well as disposable jammers that can drop to the ground. The Leer-3 is designed to suppress the Global System for Mobile Communications (GSMC) networks.³²⁰

Lesochek—The system’s jamming stations prevented radio-controlled IEDs, that were camouflaged along a movement route, from detonating.³²¹ A mobile closed radio zone, organized by installing small scale Lesochek jamming stations on combat vehicles, was also developed based on experience gained in modern military conflicts.³²² A report noted that the system can disable enemy satellite reconnaissance systems and radio traffic as well.³²³ Another report stated that the Lesochek’s frequency band is three times wider than its predecessors and that it can be carried on vehicles, in a backpack, or in a briefcase.³²⁴

Less—The system has integrated equipment monitoring command and control posts and portable radio monitoring complexes that would be used during the training assemblies.³²⁵

Leyer-3—This system suppresses enemy electronic resources and makes it possible to perform such tasks at a distance of more than 100 kilometers from the subunits’ place of deployment for a period of 10 hours.³²⁶ The system can block equipment operating in the GSM-900 and GSM-1800

³¹⁷ No author provided, “New Leer-2 Mobile Complexes Have Arrived at the Electronic Warfare Subunits of the Russian Military Base in Abkhazia,” *Ministry of Defense of the Russian Federation*, 16 May 2017.

³¹⁸ Nikolay Grishchenko, “Army Personnel Have Demonstrated Secret Electronic Warfare Equipment in Action Near Rostov,” *Rossiyskaya Gazeta Online*, 25 August 2018.

³¹⁹ No author provided, “Smart UAVs Protect Peacekeepers Engaged in Separating Conflicting Sides,” *Ministry of Defense of the Russian Federation*, 23 August 2018.

³²⁰ Aleksey Ramm and Vladimir Zykov, “The Russian Army Has Obtained a Cellular Weapon: The Modernized Leer-3 Complex Will Be Able to Send Instant Messages and Audio and Video Messages,” *TASS*, 25 January 2017.

³²¹ “Central Military District Electronic Warfare Specialists Ensure...”

³²² No author provided, “In Amurskaya Oblast Electronic Warfare Specialists Defend Military Vehicle Convoys during a March against Combat Drone Attacks by Setting Up a Defensive ‘Radio Dome,’” *Ministry of Defense of the Russian Federation*, 18 April 2019.

³²³ No author provided, “Eastern Military District Unmanned Aerial Vehicle Combat Composite Detachment Provides Cover for Artillery Operations during an Exercise in Priamur’ye,” *Ministry of Defense of the Russian Federation*, 23 October 2018.

³²⁴ No author provided, “Brand-New Lesochek Electronic Warfare Systems Delivered to the Western Military District Tank Army,” *Ministry of Defense of the Russian Federation*, 5 December 2018.

³²⁵ No author provided, “Training Assemblies with Electronic Warfare Specialists Are Occurring in the Western Military District,” *Ministry of Defense of the Russian Federation*, 22 November 2017.

³²⁶ No author provided, “Southern Military District Electronic Warfare Specialists Conduct Electronic Countermeasures against Notional Enemy in the Mountains of Dagestan,” *Ministry of Defense of the Russian Federation*, 8 October 2018.

bands. It was noted that “there is the capability of shutting down the bands of all cellular networks of a simulated enemy within a radius of six kilometers with jamming from a special UAV.”³²⁷

Lorandit-AD—This airdroppable system is supplied to the Airborne Forces. It uses direction-finding to suppress illegal armed formations and sources of interference.

Krasukha-2.0—The system is designed to search for and jam any ground-based and airborne radars. It blinds and deafens aircraft at a distance of 300 kilometers and intercepts command and control channels of unmanned aerial vehicles and cruise missiles.³²⁸

Krasukha-S4—The system combats aviation radars, communications, and data transfer systems. It can jam the signal of all current radar stations. The system’s estimated range is 150-300 kilometers.³²⁹ The system protects convoys from UAVs.³³⁰ One article noted that it can cover several hundred kilometers of territory with an umbrella that is impervious to electromagnetic waves. It can stun long-range radar aircraft or satellites used to guide missiles to targets. It can burn out electronic systems of aircraft, missiles, and satellites in low orbit. Finally, the system can create the appearance of targets yet withhold identifying information, making a determination of friend or foe difficult.³³¹ Russia might supply Syria with state-of-the-art Krasukha-S4 electronic warfare (EW) systems, but it would need to be adjusted for this region both in terms of software and intellectually. It will have its own electronic memory and will be fully integrated with air defense systems, anti-aircraft missile systems, radio-engineering systems, and fighter aircraft so that it can operate as part of a combined control system.³³²

Moskva-1—The complex includes an intelligence collection module and a command-and-control post for jamming subunits (stations). The complex can conduct radio and radio-technical intelligence collection at ranges up to 400 kilometers; classify all radio emitters according to threat level; provide air surveillance support; support target allocation and imaging of all data; and support reverse monitoring of the effectiveness of the subunits separate EW asset operations, which it commands.³³³

Murmansk-BN—It is used to conduct electronic reconnaissance for communications and radar site detection of ground and airborne reconnaissance, and to conduct concentrated electronic strikes at aggressor command and control and communication systems.³³⁴ The system was deployed on Kamchatka such that, along with the Krasukha and Divnomorye systems, the entire

³²⁷ No author provided, “Southern Military District Electronic Warfare Specialists Held a Special Tactical Exercise in Communications Jamming of a Simulated Enemy in the Mountains of Dagestan,” *Ministry of Defense of the Russian Federation*, 25 August 2018.

³²⁸ Anton Valagin, “The Electronic Troops Switched Off a Flying Radar Near Kursk,” *Rossiyskaya Gazeta Online*, 9 October 2018.

³²⁹ Aleksey Ramm, Bogdan Stepovoy, and Aleksey Kozachenko, “Electronic Shield: Defense Ministry Deploying Electronic Warfare Resources in Syria. New Systems Already Delivered to Humaymim Airbase,” *Izvestiya Online*, 25 September 2018.

³³⁰ “Central Military District Electronic Warfare Specialists Ensure...”

³³¹ No author provided, “Troops Being Equipped with New Jammers,” *Rossiyskaya Gazeta Online*, 16 April 2019.

³³² No author provided, “Russia May Supply Syria with Krasukha-S4 EW Systems, Zhitel Radar-Jamming Stations,” *Interfax* (in English), 28 September 2018.

³³³ Roman Azanov, “With What Can Russia’s Army ‘Blind’ and ‘Suppress’ an Enemy: The Automated Jamming Station from the ‘Borisoglebsk-2’ Electronic Warfare Complex,” *TASS*, 15 April 2019.

³³⁴ No author provided, “Central Military District EW Specialists Conducted an Electronic Strike Against the Aggressor’s Communications Centers during the Course of an Exercise in Yekaterinburg,” *Ministry of Defense of the Russian Federation*, 25 April 2019.

Northern Sea Route will be covered by REB forces. The systems can interfere with communication systems, navigation and control systems of ships, and submarines and aircraft that illegally cross borders. This ensures that Russia can suppress any intruders.³³⁵ The Murmansk-BN is present in the Kaliningrad Region as well. It can jam military communication networks at ranges up to 5,000 kilometers and in some conditions up to 8,000 kilometers. The system is a short-wave shore-based REB system that can gather electronic intelligence information and can intercept and jam signals in all shortwave bands;³³⁶ and it can operate at an operational-tactical and operational-strategic level. The system entered service with the 841st Separate EW Center of the Baltic Fleet at the end of 2018. It may include several EW battalions and companies to carry out combat missions.³³⁷ The technology allows for “disorganizing any system of shortwave communication.”³³⁸

Orlan-10 UAVs—This system, and probably other UAVs, not only can conduct reconnaissance and generate targeting data for fire resources, but also can block GSM-standard cellular communications and distort the navigational field for GPS systems.³³⁹

Palatin—This is an operational-tactical level REB system that can suppress existing and future radio communication systems of an adversary; conduct electronic reconnaissance; blind an adversary with short-wave and ultra-short-wave frequencies; deprive an aggressor of his cellular and trunked communications; and integrate various friendly REB and electronic reconnaissance systems into a single working network.³⁴⁰

Pishchal—This is a counter-drone gun whose operating range exceeds two kilometers.³⁴¹

Pole-21—The system has suppression/jamming modules designed to counter drones and reduce the effectiveness of cruise missiles. It is being provided to the Central Military District. It will cover vital military and civilian infrastructure and provide security from the use of high-precision weapons. It can suppress signals going through various satellite channels, to include GPS, Galileo, and Beidou.³⁴² Further, the system’s equipment allows for the installation of up to 100 radio jamming posts in a shielded zone and each has 1-3 modules with a suppression range outside the zone of up to 150 square kilometers. The remote-controlled maintenance-free modules can be installed on cellular network towers up to 60 meters in height.

REX-1—This system is an electronic rifle that can protect forces from UAVs. It suppresses drone signals and has an operating range of 500 meters, with the signal propagating in a 30-degree sector. The rifle can block GPS global positioning systems signals in a radius of two kilometers. A drone’s

³³⁵ No author provided, “The Northern Fleet Completed Arming the Electronic Warfare (REB) Center,” *Izvestiya Online*, 7 May 2019.

³³⁶ No author provided, “Russia Is Deploying the Murmansk-BN Electronic Warfare System to the Kaliningrad Region,” *Izvestiya Online*, 26 April 2019.

³³⁷ “Deafening Success...”

³³⁸ No author provided, “The Northern Fleet Has Completed Its New Center for Radio-Electronic Warfare,” Kirkenes *The Independent Barents Observer* (in English), 21 May 2019.

³³⁹ No author provided, “Central Military District Artillery Formations Acquire First Separate UAV Subunits,” *Ministry of Defense of the Russian Federation*, 13 March 2019.

³⁴⁰ No author provided, “First Palatin Radio Electronic Warfare System in the Russian Armed Forces Arrives in the Western Military District Combined-Arms Army Troops,” *Zvezda TV Online*, 10 April 2019.

³⁴¹ Vladimir Tuchkov, “Russia Has Opened the Hunting Season on Unmanned Aerial Vehicles. ‘Taran,’ ‘Sapsan,’ and ‘Solyaris-N’ Have Learned to Strike Enemy Drone Swarms,” *Svobodnaya Pressa*, 1 November 2018.

³⁴² No author provided, “Pole-21 Systems for Countering Drones Control Systems to Be Put into Service in Central Military District for the First Time,” *Interfax* (in English), 15 April 2019.

optical-electronic devices are suppressed as well, both the reconnaissance and the missiles seeker head.³⁴³

Rtut-BM—This electronic warfare complex counters enemy munitions equipped with radio-controlled detonators.³⁴⁴ The system is designed “to protect manpower and equipment, provide cover for troops concentration areas, separate stationary and mobile facilities, and is capable of neutralizing shells, fitted with proximity fuses, on a territory measuring up to 50 hectares.”³⁴⁵ The system creates a “dome” over a protected site, causing shells to detonate at a safe distance or deactivate.³⁴⁶ It can jam frequencies used by an adversary for radio communications.³⁴⁷

Samarkand—This system jams high-precision weapons such as the US Tomahawk.³⁴⁸ There are 13 Samarkand-U, Samarkand-SU-PRD-K2, and Samarkand PU-PRD-D complexes on Russian territory, designed to generate interference and disrupt an adversary’s communications.³⁴⁹

Sapsan—This system has an operating radius of 100 kilometers. Its search capabilities include radar, the visible and infrared optical ranges, and electronic reconnaissance. It conducts a directed flow of electromagnetic jamming that halts an attack from a swarm of drones from a single axis.³⁵⁰

Serp—This system is mounted on an air defense complex (BUK) chassis and can handle swarms of small drones. It is a microwave gun that burns electronics. An active phased array antenna detects the drones at a range of 20 kilometers. The system can also target precision-guided munition seeker heads.³⁵¹ The system blocks and suppresses the control and navigation channels of a UAV; and it can pinpoint who and from where the UAV is controlled up to 3 kilometers from the object. The directional antenna conducting this work has the name “Cheremukha (cherry).”³⁵²

Shipovnik-Aero—This system has a 10-kilometer range, and it can take over a UAV’s command and control if the drone’s model is in its memory. It can determine the coordinates of the location from which the command and control is being conducted with an accuracy of 1 meter for transmission to an artillery battery.³⁵³

Silok—The system jams UAVs of various types at a range of more than four kilometers and across a wide range of frequencies.³⁵⁴ The system detects UAVs automatically, independently determines

³⁴³ Vladimir Tuchkov, “Russia Has Opened...”

³⁴⁴ No author provided, “During Exercise in Buryatiya Eastern Military District Electronic Warfare Subunits Disrupt Troop Command and Control System of Notional Adversary,” *Ministry of Defense of the Russian Federation*, 27 December 2018.

³⁴⁵ No author provided, “Central Military District Electronic Warfare Subunits in Siberia Receive Newest Rtut-BM System,” Yekaterinburg *Ural’skiye Voyennyye Vesti*, 8 May 2019.

³⁴⁶ No author provided, “EW Specialists Placed Command Post Under Protective Dome during Exercise in Kemerovskaya Oblast,” *Ministry of Defense of the Russian Federation*, 19 March 2019.

³⁴⁷ No author provided, “Central Military District EW Subunits in Siberia Receive Newest Rtut-BM System,” *Ministry of Defense of the Russian Federation*, 13 March 2019.

³⁴⁸ No author or title provided, Minsk *Salidamasts*, 29 October 2018.

³⁴⁹ No author or title provided, *Zvezda TV*, 28 October 2018.

³⁵⁰ Vladimir Tuchkov, “Russia Has Opened...”

³⁵¹ Ibid.

³⁵² Pavel Kutarenko, “‘Serp’ System: Staff Testing of a New Hunter of Unmanned Vehicles,” *Zvezda TV Online*, 30 April 2019.

³⁵³ Tuchkov.

³⁵⁴ No author provided, “Western Military District Electronic Warfare Subunits Use Silok to Bring Down ‘Terrorist’ Unmanned Aerial Vehicle’s in Leningradskaya Oblast,” *Ministry of Defense of the Russian Federation*, 2 November 2018.

their coordinates, and jams the control, telemetry, and communications channels of the equipment.³⁵⁵ One report noted that Silok and Zhitel systems were used in Syria and they applied this experience during Vostok-2018.³⁵⁶

Solyaris-N—The system is said to be a brand-new smart system for protecting a site against drone intrusions. It can reportedly protect an area of up to 80 square kilometers against automated means of aerial reconnaissance and attack. The complex works automatically, without an operator. It detects an airborne object, analyses the trajectory and also the structure of the signal, and from the results decides autonomously whether the object is friend or foe and decides what to do next. If enemy, the Solyaris applies electronic interference to shut down the data transmission channels and block the navigation and timing equipment. The complex has a modular design able to fit to specific battlefield environments.³⁵⁷ The system is equipped with a radar and can defend an area of 80 square kilometers from UAVs. It disconnects the UAV from its command and control center and can work in a full automation mode without an operator’s involvement. The Solyaris-mini is used to jam cellular communications and the Solyaris-keys defends against IEDs.³⁵⁸

Stupor—This electronic rifle suppresses communication channels and satellite navigation and blinds UAV optics. Its range is 600 meters with a 20-degree propagation zone. It paralyzes drones with between 4 and 25 seconds of irradiation, depending on the electronics of the drones’ jamming resistance.³⁵⁹

Svet-KU—This is a system often associated with a separate Airborne Troops (VDV) formation. Specialists use the system to monitor the information environment and monitor various sources of radio signals. In automatic mode, the system monitors signals of various radio-electronic systems, analyzes them, and determines their coordinates at the source. It processes information in the frequency ranges from 25 megahertz to 18 gigahertz.³⁶⁰ Guards Colonel Aleksandr Valitov, Commander of Airborne Troops 56th Guards Separate Airborne Brigade, stated that the Svet-KU is a mobile means of radio-technical control and protection of information against a leak over technical wireless communication channels. The system “makes it possible completely to block all communications at a distance, let us say, of 60 kilometers from this system and also to monitor them if necessary.”³⁶¹

Taran—This system repels swarm attacks with greater capabilities than the Pishchal. Installed on a tripod, it can cover defended facilities with a diameter of 2700 meters.³⁶² It is designed to detect

³⁵⁵ No author provided, “Silok Systems Used for First Time to Intercept Enemy Unmanned Aerial Vehicles in CSTO Exercise,” *Ministry of Defense of the Russian Federation*, 2 November 2018.

³⁵⁶ Pavel Nastin, “This Has Never Happened Before: Brilliant Premieres at Vostok-2018 Exercises. During the Maneuvers Our Servicemen Had to Perform Certain Combat Training Tasks for the First Time,” *Zvezda TV Online*, 13 September 2018.

³⁵⁷ Aleksandr Khokhlov, “Like a Combat Laser at Flying Iron: The Top Five Russian Anti-UAV Weapons. Russia’s Armed Forces Now Have the Means to Counter Any Type and Make of Potentially Hostile Drone,” *Yezhenedelnik Zvezda*, 15 November 2018.

³⁵⁸ Vladimir Tuchkov “Russia Has Opened...”

³⁵⁹ Ibid.

³⁶⁰ No author provided, “Separate VDV Formation in Volgograd Oblast Receives Unique Mobile Radio-Electronic Warfare System,” *Ministry of Defense of the Russian Federation*, 29 June 2017.

³⁶¹ “Military Council” interview with Guards Colonel Aleksandr Valitov, Commander of the Airborne Troops 56th Guards Separate Airborne Brigade, by Anatoliy Yermolin, no title provided, *Ekho Moskvy Online*, 1 July 2017.

³⁶² Vladimir Tuchkov, “Russia Has Opened...”

and recognize hypothetical enemy communications assets such as radar stations, radio navigation, and radio-teletype systems.³⁶³

Tirada-2S—The system reportedly was detected in the Lugansk People’s Republic. It is designed to disrupt the operation of telecommunications equipment and block operations of radar and electronic intelligence collection equipment.³⁶⁴

Torn—This system is used by Russian peacekeepers. It is an automated mobile reconnaissance system that helps to collect intelligence data in buffer zones and between opposing forces. It searches for signals in ranges up to 3000 MHz and can conduct direction finding and source locations at a distance of up to 70 kilometers using the azimuth method.³⁶⁵

Zaslon-REB—This system was highlighted in 2017 and stated to be a smart control and monitoring complex that creates an “information security dome” over military forces. It can block unauthorized exchanges of information and jam signals of “all known mobile communication radio frequency bands,” including GSM, LTE, CDMA, and Wi-Fi.³⁶⁶ A day later an article appeared that stated the Zaslon’s capabilities were overblown. Rather, its capabilities were stated to be extremely limited, since they only cover small facilities. Further, the article notes that many of the capabilities of the system were present in Soviet times and that they may have been “endowed with state-of-the-art technological properties” which appear modest at the moment.³⁶⁷ It is unknown which description of the capability is more accurate.

Zhitel—The Zhitel automated jamming station combats UAVs at ranges of more than 20 kilometers. Crews in one exercise rehearsed the complete radio suppression of satellite and cellular communication stations that use the GSM and GPS standard, destroying the notional enemy’s command-and-control system.³⁶⁸ It can jam homing devices of cruise missiles and precision weapons,³⁶⁹ and it fixes on and jams reconnaissance equipment on a UAV at any altitude and on any frequency band.³⁷⁰ Zhitel can detect, get the bearings of, and jam satellite and cellular communication stations, and also satellite navigation systems (including GPS) over a radius of 20-30 kilometers.³⁷¹ It appears that Zhitel and Svet complexes are being used for defense from unmanned aerial vehicles in tandem. Zhitel jams in the radio frequency range, jamming cellular and satellite communications. For example, a drone could lose the connection with its operator and, depending on the software program that has been loaded into it, either lands or becomes totally unserviceable and crashes. Svet systems can precisely determine the location of the person

³⁶³ No author provided, “Central Military District Electronic Reconnaissance Specialists Intercept Hypothetical Enemy Radio Signals in Exercise in Southern Urals,” *Ministry of Defense of the Russian Federation*, 10 January 2019.

³⁶⁴ No author provided, “Ukraine Announced Detection of the Latest Russian Electronic Warfare Equipment,” *Avia.pro*, 24 March 2019.

³⁶⁵ No author or title provided, *Ministry of Defense of the Russian Federation*, 23 May 2019.

³⁶⁶ Aleksey Ramm and Vasilisa Belokopytova, “Military Units Have Been Sealed Off by the Impenetrable ‘Zaslon’,” *Izvestiya Online*, 19 April 2017.

³⁶⁷ Aleksandr Sharkovskiy, “The Modest Potential of the ‘Zaslon-REB’ Complex. The Capabilities of the New Information Security System Are Extremely Limited,” *Nezavisimaya Gazeta Online*, 20 April 2017.

³⁶⁸ No author provided, “Electronic Warfare Specialists Practice Suppression of Notional Enemy Unmanned Aerial Vehicles Near Chelyabinsk,” *Ministry of Defense of the Russian Federation*, 27 June 2018

³⁶⁹ No author provided, “Special Groups for Combatting UAVs Created in All Central Military District Formations,” *Ural’skiye Voyennyye Vesti*, 6 July 2018.

³⁷⁰ No author provided, “Newest Counter-UAV Complexes Will Be Employed for the First Time in the Vostok-2018 Maneuvers,” *Ministry of Defense of the Russian Federation*, 12 September 2018.

³⁷¹ “Electronic Shield: Defense Ministry...”

controlling the drone. The complex conducts analysis and calculates the coordinates of the source of the signal of any electronic system. While Zhitel disables the control systems of unmanned aerial vehicles, Svet permits it to find who is controlling this vehicle. ³⁷²

Aviation Complexes:

Name unknown—There was a report noting that electronic warfare systems have been developed for the Kh-101 (stealth air-to-surface cruise missile) and the Kh-102 (a nuclear version of the same cruise missile) that are carried by the Tu-22M3, Tu-95, and Tu-160 strategic bombers. ³⁷³

Gimalai—This system is an updated version of the Khibiny. It is fitted to the Su-57 fighter. The system is fully integrated onboard and designed as a separate element of the aircraft's fuselage. The antenna system allows it to fulfill several functions at the same time: reconnaissance, REB, location, and so on. It can deliver active and passive jamming to the infrared seeker head of modern missiles and radars. ³⁷⁴

Khibiny—This system is installed on the Su-34 front line bomber. It can create a false electronic situation. When it flew over the US Destroyer Donald Cook in 2014, it created electronic clones of additional targets. This meant that the destroyer's data and combat command and control weapon system were blocked as well. A new Khibiny-U system was attached beneath the wing at a suspension point and was developed for the Su-30SM. ³⁷⁵

Rychag—This EW complex often on helicopters of the Mi-8MTPR-1 variety, can blind an enemy within a radius of several hundred kilometers and can suppress several targets at the same time. Such jamming causes enemy intercept complexes to lose their capability to detect targets. ³⁷⁶

Tarantul—This is a containerized system designed to protect the Su-34 and other aircraft. It is not certain, however, that the system ever reached the stage of implementation on any air frame.

Vitebsk—The complex can be adapted for any class of aircraft, to include military-transport and civilian aviation. The Su-25SM ground attack aircraft are equipped with this on-board complex. The export version is known as the President-S. ³⁷⁷ In Crimea, Russia turns on the Vitebsk REB jamming stations in its helicopters to preclude Ukraine's military, in Russia's estimation, from conducting an unauthorized launch against it. ³⁷⁸

Naval Complexes:

MP-405—This complex can warn of detection and analyze and classify classes of illuminating electronic equipment and their carriers as to threat level. It can support the electronic suppression of all intelligence collection equipment and weapons. ³⁷⁹

³⁷² Timofey Borisov and Sergey Ptichkin, under the rubric, "The Army": "A Radar Field Will Defend Russian Cities from Unmanned Aerial Vehicles," *Rossiyskaya Gazeta Online*, 23 June 2018.

³⁷³ No author or title provided, *RIA Novosti*, 9 November 2018.

³⁷⁴ Roman Azanov, "With What Can Russia's Army 'Blind' and 'Suppress' an Enemy..."

³⁷⁵ Ibid.

³⁷⁶ Ibid.

³⁷⁷ Ibid.

³⁷⁸ No author provided, "Helicopters of the Russian Federation Aerospace forces in Crimea Turn on Electronic Warfare Stations Due to Threats of Provocation on the Part of Ukraine," *RIA Novosti*, 4 June 2019.

³⁷⁹ Azanov.

TK-25—This is the primary ship-based EW complex, according to the article. It supports the creation of pulsed disinformation and simulation jamming using digital copies of signals from the ships of all primary classes. It can analyze up to 256 targets simultaneously and support the protection of the ship.³⁸⁰

³⁸⁰ Ibid.