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The Russian Reconnaissance Fire Complex Comes of Age

Lester W. Grau and Charles K. Bartles[i]

May 2018

The Soviet Union, and now Russia, have long worked on the development of twin concepts for the detection and assured destruction of high-value targets in near-real time. The Reconnaissance Strike Complex (*разведивательно-ударный комплех-RYK*) was designed for the coordinated employment of high-precision, long-range weapons linked to real-time intelligence data and precise targeting provided to a fused intelligence and fire-direction center. The RYK functioned at operational depths using surface-to-surface missile systems and aircraft-delivered "smart" munitions. The Reconnaissance Fire Complex (*разведивательно-огновой комплех ROK*) was the tactical equivalent. It linked intelligence data, precise targeting, a fire-direction center and tactical artillery to destroy high-value targets in near-real time. The Soviets were making good progress in development of both systems before the Soviet Union collapsed. After a period of chaos and adjustment, Russia is back on track and modernizing her armed forces. Part of that modernization is the fielding of a functioning and renamed reconnaissance strike system and reconnaissance fire system. The reconnaissance fire system (*разведивательнфая-огновая система ROC*) has now been successfully deployed and battle tested and is part of Russian Field Artillery capabilities. In the words of Deputy Chief of Staff of Ground Forces, Major General Vadim Marusin, "Today the cycle (reconnaissance -- engagement) takes literally 10 seconds."[ii]

An article appeared in the February 2017 edition of *Армейский Сборник* [Army Digest] that provides a look at present and future tactical artillery developments that will fit nicely with the reconnaissance fire system as well as standard artillery missions.[iii] Artillery has long held pride of place in the Tsarist and Soviet ground forces and continues that today. Like its predecessor, the Russian Army is an artillery army with a lot of tanks. Fire enables maneuver and the Russian ground forces combine tactical strike-maneuver with longer-range fire destruction of the enemy. To Russian military thinking, artillery is a maneuver element whose destructive capabilities may perform ground-gaining missions.

The Russians envision that modern maneuver war will not be a repeat of World War II with massed armies dug-in shoulder-to-shoulder stretching over hundreds or thousands of miles. Rather, it will be a series of fast-moving strike-maneuver fights with open flanks secured by fires, strong points and counter-attack forces.

> A new method is the employment of combined arms tactical groups, each consisting of one or two battalions, each fighting on separate axes. Alongside the offensive, the combined arms formation may conduct defensive actions primarily by delaying and blocking actions as well as by conducting a dispersed defense utilizing brigade subunits. The dispersed defense can consist of platoon strong points combined with mine-field obstacles and a preplanned system of artillery fires. Artillery will be attached to the combined arms subunits or will provide artillery support under the direction of the senior commanders.iv

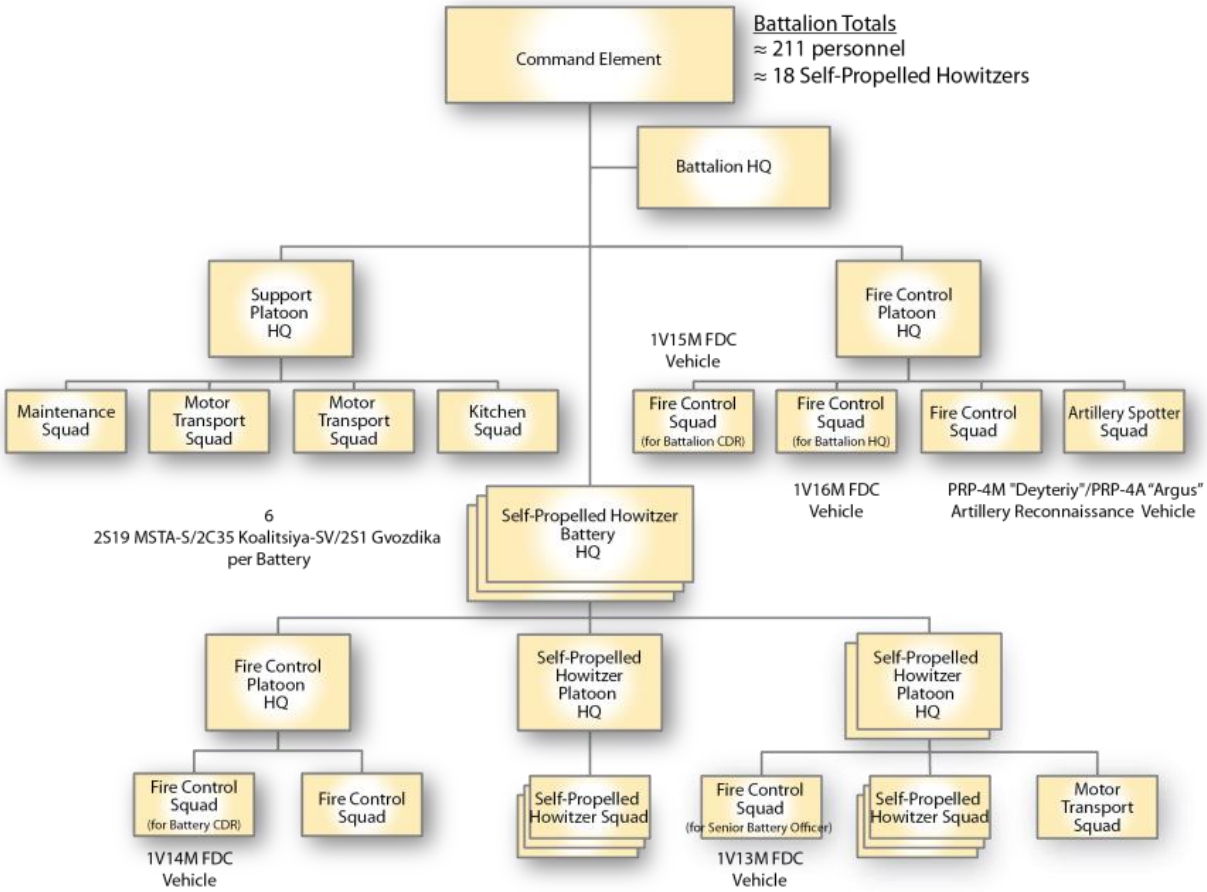
Russian military analysts conclude that artillery batteries from direct support artillery battalions and brigade artillery continue to play the most decisive role in the fire destruction of enemy. Further, the role of artillery in contemporary combined arms combat and armed conflicts of varying intensity will only grow. Analysis of limited wars (the Soviet war in Afghanistan, combat in Chechnya, the fighting in Syria) require that new-type artillery tactical formations be capable of:

- *conducting highly-maneuverable combat with motorized rifle (and tank) subunits, complete multi-kilometer combined road marches, conduct river crossings, etc;*
- *inflicting fire destruction of enemy subunits (or targets) throughout the depths of his combat formation;*
- *destroying enemy targets through direct and indirect fire;*
- *annihilating tactical precision-guided munitions and other weapons as well as artillery from firing positions and from the march;*
- *suppressing and destroying command posts and weapons, radar, electronic combat systems and air defense;*
- *conducting timely and effective defeat of enemy personnel and their weaponry in assembly areas and fighting positions, tanks, command posts and engineer equipment during the preparation for an attack by motorized rifle (or tank) subunits, during combat in the depth of the enemy defense, during the repulse of the enemy counterattack and during the conduct of the defense;*
- *conducting counterbattery fire;*
- *destroying enemy antitank weapons, tanks and other armored vehicles;*
- *fighting effectively against the approaching enemy reserve and irregular armed elements;*
- *dispersing within the brigade combat formation while preserving the ability to mass fire in time and space.*[v]

Russian analysis and combat experience shows that the execution of fire destruction missions against an enemy should be assigned directly to the organic brigade artillery without establishing temporary formations such as artillery groups.[vi] Further, in future fire engagements, artillery systems may be integrated into a unified reconnaissance-fire system (ROC) responsible for conducting zone and point reconnaissance and engaging the just-detected enemy in near-real time. The primary method of executing reconnaissance-fire missions will be to engage newly-discovered enemy targets with brief fire assaults and subsequent changes of position to avoid retaliatory fire. However, it may be possible to conduct multiple fire missions without shifting firing positions when engaged in support of low-intensity conflicts.[vii]

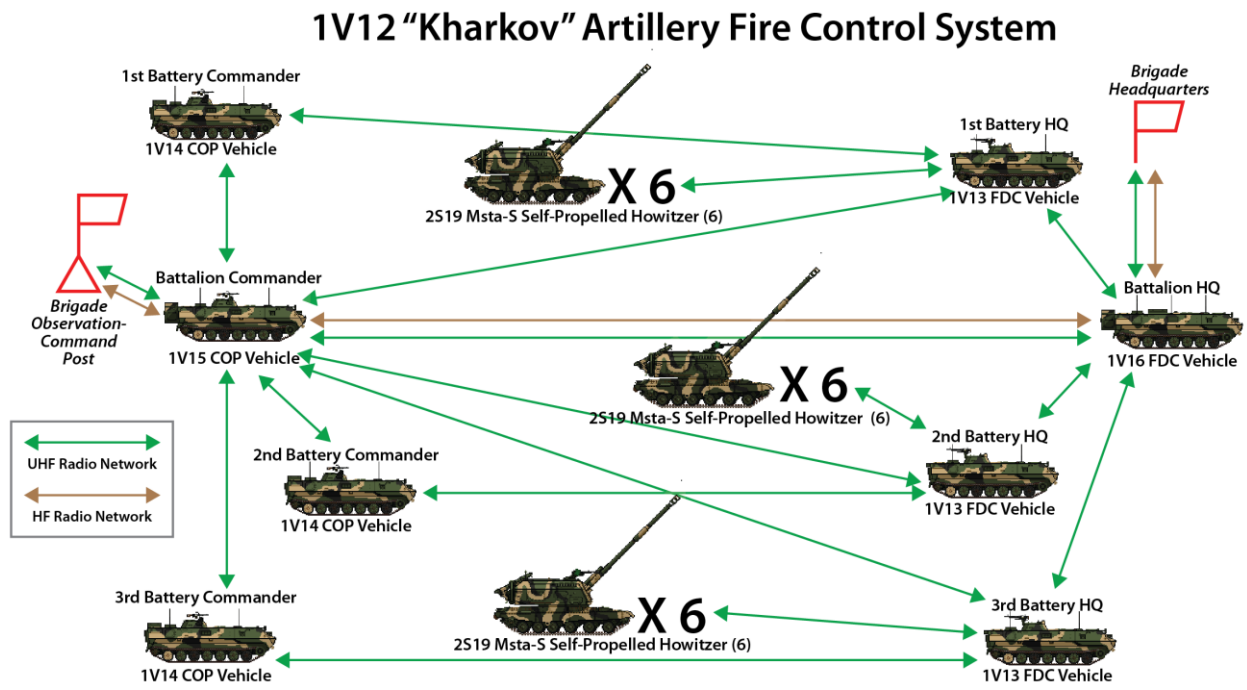
The regional conflicts of the 21st Century have confirmed Russian analytical thinking that highly-maneuverable enemy armored vehicles should be engaged with high-precision munitions, whereas high explosive-fragmentation and cluster rounds can be used for engaging enemy personnel and dug-in weapons and when attacking objectives using various kinds of conventional barrage fire.[viii] Russian artillery units will expend far more conventional rounds than expensive, high-precision rounds. Massed conventional artillery fires achieve a mathematically-determined guarantee of desired target destruction while producing psychic terror. Further, conventional rounds with point-detonating fusing cannot be jammed by electronic jamming or smoke. High-precision rounds will be used in reconnaissance strike systems, but there will be a choice between high-precision and conventional rounds (depending on the target) in reconnaissance fire systems. High-precision rounds are used for high-value mobile targets. Armored vehicles are better candidates for high-precision rounds, whereas soft-skinned targets such as transmitters, radar, jammers, logistics sites and headquarters are more commonly addressed with conventional rounds-unless there is a reason for their immediate destruction.[ix]

The Basics of Russian Artillery Fire Control



The Russian and Western systems for the command and control of artillery differ substantially. In the Russian system, the artillery commanders do not sit with their artillery pieces. Instead, artillery battalion and battery commanders are typically collocated with the supported maneuver commander in order to relay calls for fire to the artillery; or they are on the battlefield, calling for fire on targets of opportunity. Artillery commanders have Command Observation Post (COP) vehicles with appropriate communications, navigation, and sighting gear to fulfill this function.[x] The fire control for artillery units is provided by the chief of staff for battalions, and senior battery officer (the senior platoon leader) for batteries. These officers, not the commanders, are the ones actually collocated with the artillery, providing them with fire solutions. They man Fire Direction Center (FDC) vehicles to fulfill this function.[xi] At the battalion level, there typically is an Artillery Reconnaissance Vehicle (ARV), such as the PRP-4A "Argus," that provides additional targeting acquisition capabilities. At the brigade level, vehicle mounted radar such as the 1RL232-2M "SNAR-10M1" Radar Vehicle and 1L219M "Zoopark-1M" Counter-Battery Radar Vehicle may be found.

Battalion-Level Artillery C2 Architecture



Vehicle icons courtesy Caddaric79 at http://www.shipbucket.com

The Russian Armed Forces use a variety of artillery fire control systems, but they all generally function as the following description of the 1V12 "Kharkov" Artillery Fire Control System describes.

1V12 "Kharkov" Artillery Fire Control System

The 1V12 "Kharkov" Artillery Fire Control System is based upon the MT-LBu chassis, and is primarily designed to service self-propelled howitzer units. A battalion level set consists of eight vehicles: three 1V13 battery FDC vehicles, three 1V14 battery COP vehicles, one 1V15 battalion COP vehicle, and one 1V16 battalion FDC vehicle. The 1V12M "Faltset" artillery fire control system is a modernized version of the 1V12 Kharkov, and its constituent vehicles follow the same naming convention as the 1V12 Kharkov system, except with an "M" suffix (IV13M, IV14M, IV15M, IV16M).

The IV13 functions as the FDC for the battery, and is manned by the senior officer of the battery (typically the first platoon leader). It has direct radio communications with the battery COP (IV14), the battalion COP (IV15), and the battalion FDC (IV16).

IV13M Fire Direction Center Vehicle
Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

The IV14 functions as the COP for the battery. The IV14 is typically collocated with the COP of the supported maneuver unit commander so targets can be relayed from the supported unit to the artillery, or is on the battlefield calling for fire. It has direct radio communications with the battery FDC (IV13), the battalion COP (IV15), and the battalion FDC (IV16).

The IV15 functions as the COP for the battalion. The IV15 is typically collocated with the COP of the supported maneuver unit commander so targets can be relayed from the supported unit to the artillery, or is on the battlefield calling for fire. It has direct radio communications with the battery FDCs (IV13), the battery COPs (IV15), and the battalion FDC (IV16).

The IV16 functions as the FDC for the battalion, and is manned by the battalion's chief of staff. It has direct radio communications with the battery FDCs (IV13), battery COPs (IV14), and the battalion COP (IV15).

1L120 “Kredo-M1” Portable Radar

The Kredo-M1 Portable Radar is designed for the detection of moving surface targets. It is also used to adjust friendly artillery fire, especially for antitank units. The Kredo-M1 is a man-portable system capable independent operation, but it can be networked with other systems.

Field of view:	
Range (km)	.2-32
Azimuth (degrees)	12-180
Elevation (degrees)	±18
Detection range for moving targets:	
Personnel (km)	≤15
Tanks (km)	≤30
Trucks (km)	≤32
155mm shell detonations	≤10
Median error for moving target coordinates:	
Range (m)	25
Azimuth (degrees)	.3
Weight (kg)	51

1L120 “Kredo-M1” Portable Radar Stats
Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

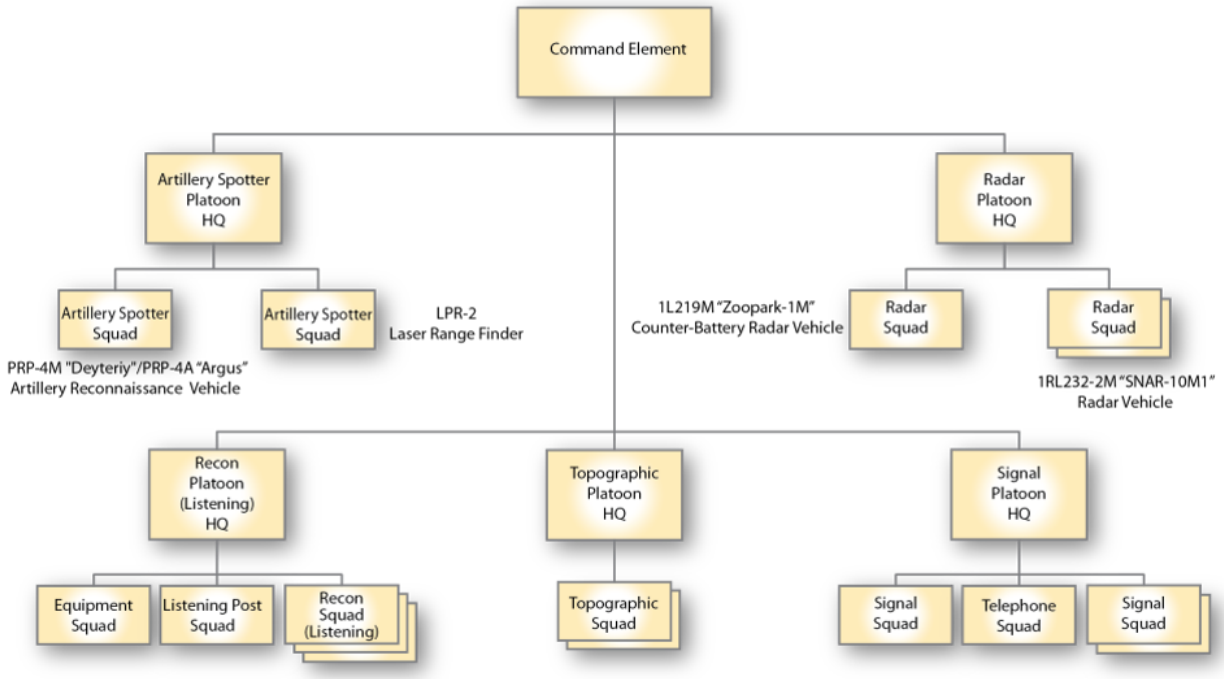
1L271 “Aistenok” Portable Counter-Battery Radar

The Aistenok is primarily a counter-battery radar designed to determine the coordinates of 81–120mm mortar firing positions and monitoring their flight trajectories. It is also capable of monitoring 122–155mm artillery shell bursts, and determining the coordinates of “tank-type” moving surface targets.

Field of view:	
Range (km)	.2-20
Azimuth (degrees)	360
Median error, subject to positioning devianceof no more than 3-5m (m):	
Mortar (ascending path)	30
Mortar (descending path)	200
Mortar (Point of impact)	30
Moving ground targets	40
Artillery shell burst	40
Minimum range for target detection (m):	
Mortar firing positions	750
Moving ground targets	200
Weight (kg)	135

1L271 “Aistenok” Portable Counter-Battery Radar Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

Brigade-Level Artillery C2 Architecture



Maneuver brigades usually have a deputy commander for artillery. The brigade's fire control battery [батарея управления и артиллерийской разведки] is commanded by, or reports to this officer. As would be expected, the fire control battery contains assets for detecting, determining coordinates, and the transmission of targeting data and orders. The typical configuration for brigade-level fire control batteries include platoons for: artillery spotting (PRP-4A Argus), radar (1RL232-2M SNAR-10M1 and 1L219M Zoopark-1), listening posts, geodesy, and communications.

PRP-4A Argus

The PRP-4A Argus artillery reconnaissance vehicle (also organic to artillery battalions) is used to conduct artillery reconnaissance of point and mass, fixed and moving, and open and camouflaged targets, and process, store and transmit this data to artillery units. It is equipped with optical, electro-optical, and radar siting devices, a GLONASS enabled navigation system, and radios. The PRP-4A has two workstations and an equipment set for a remote observation post.

Weight (ton)	12.7
Crew	4
Field of view:	
Range (km)	.2-40
Azimuth (degrees)	12-360
Moving target detection range:	
Personnel (km)	15
Tanks (km)	35
Shell/mortar detonation- ground surface (km)	10
Shell/mortar detonation- water surface (km)	20
Median error for moving target coordinates:	
Range (m)	10
Azimuth (degrees)	.12

PRP-4A "Argus" Artillery Reconnaissance Vehicle
Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

1L219M "Zoopark-1M" Counter-Battery Radar Vehicle

The Zoopark-1 counter-battery radar vehicle is designed to determine the coordinates of enemy artillery positions (field artillery, MLRS, mortars,) and tactical missile launch positions such as the 9K52 Luna-M (Frog-7) to provide targeting information for counterbattery missions, and to adjust friendly artillery fire. The Zoopark-1 can reportedly determine the coordinates of 60 batteries in a minute, and the position of a concealed mortar in an urban environment. The Russians consider the Zoopark-1 to be an equivalent of the AN/TPQ-36.

Scanning Range (degrees)	90
Number of Targets Simultaneously Tracked	12
Set-up/Tear-down time (min)	5
Detection of Launch Position Range (km):	
Mortars	20
Field Artillery	15
MLRS	30
Tactical Missiles	40
Fire Correction Range (km):	
Mortars	22
Field Artillery	20
MLRS	35
Tactical Missiles	40

1L219M "Zoopark-1M" Counter-Battery Radar Vehicle
Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

1RL232-2M "SNAR-10M1" Radar Vehicle

The SNAR-10M1 is a battlefield surveillance radar vehicle used to locate moving ground and sea-surface targets. The SNAR-10M1 is designed to locate convoys, ground targets, sea-surface targets, and low-flying aircraft and UAVs. The system is also used to locate shell bursts in order to adjust friendly artillery fire. The SNAR-10M1 is equipped with modern radios and communications systems to facilitate the automated data transmission. It also has a GLONASS enabled navigation system and digital terrain map.

Weight (ton)	12.7
Crew	4
Field of view:	
Range (km)	.2-40
Azimuth (degrees)	12-360
Moving target detection range:	
Personnel (km)	15
Tanks (km)	35
Shell/mortar detonation- ground surface (km)	10
Shell/mortar detonation- water surface (km)	20
Median error for moving target coordinates:	
Range (m)	10
Azimuth (degrees)	.12

1RL232-2M "SNAR-10M1" Radar Vehicle
Image Courtesy: Vitaly Kuzmin/ http://www.vitalykuzmin.net

UAV Integration into the Russian Ground Forces

Russia currently organizes its UAV fleet by putting all of the brigade's UAVs into a single company. The companies are divided into platoons based on the size and range of the UAVs they operate. For instance, the "mini-platoon" operates the hand-launched Granat-1, while the "short-range platoon" operates the larger *Orlan-10*, *Granat-4*, *Eleron-3SV* and airframes. Russia likely places all of its UAVs in a single company and splits the companies into platoons based on size instead of function to more easily facilitate C2 and maintenance of these high value and limited assets. Since there is mention of "payloads" on the UAVs, there appears to be some capability for repurposing of mission if needed. (artillery reconnaissance, electronic warfare, and communications, etc.) The Orlan-10 is used for both artillery reconnaissance and electronic warfare missions.[xii] In terms of personnel, it appears that enlisted personnel operate most UAVs, but officers do fly certain missions. Russia does practice a conscription system, but all UAV operators are "contract NCOs" that attend the UAV operator course at the Inter-Branch Center for the Training of Specialists for the Ground Troops in Kolomna, Russia. Conscripted soldiers do serve in the UAV companies, but they serve in support roles such as wheeled vehicle drivers.[xiii]

Orlan-10 UAV
Image Courtesy: Russian Ministry of Defense/ http://mil.ru/

Putting the Reconnaissance Fire System together

European Russia consists of wide rolling plains, marshland, broad rivers, and forests. The road network is sparse by Western standards and mainly connects cities and towns. Longer-range artillery reconnaissance has been problematic in this terrain due to the limited high ground. The Unmanned Aerial Vehicle (UAV) now provides this longer-range reconnaissance capability. The Russian military got off to a late start in fielding UAVs to its forces, but has been working steadily to catch up and surpass the West. Currently, the *Orlan-10* and the *Eleron-3SV* are part of the UAV Company being assigned to each motorized rifle brigade in the Russian Ground Forces. The Russians are concentrating on UAV reconnaissance, electronic retransmission and electronic warfare missions, but will likely soon weaponize UAVs similar to the Western approach.[xiv] Additionally, Orlan-10 will become organic to Russian artillery brigades and the remaining artillery regiments. "An organization and establishment structure is currently being drawn up for new artillery reconnaissance subunits, which will be armed with these artillery reconnaissance unmanned systems. During the first stage, reconnaissance UAVs will be part of combined-arms armies' artillery brigades and will later be included in the reconnaissance equipment of motorized rifle and tank divisions' artillery regiments."[xv] The use of UAVs for artillery spotting significantly supplements forward observation capabilities, a very important technological development for an artillery-centric post-Soviet army. For artillery purposes, UAV support is provided by the "mini" and "short-range" UAV platoons of the Brigade UAV Company.[xvi]

UAV Integration into the Reconnaissance Fire System

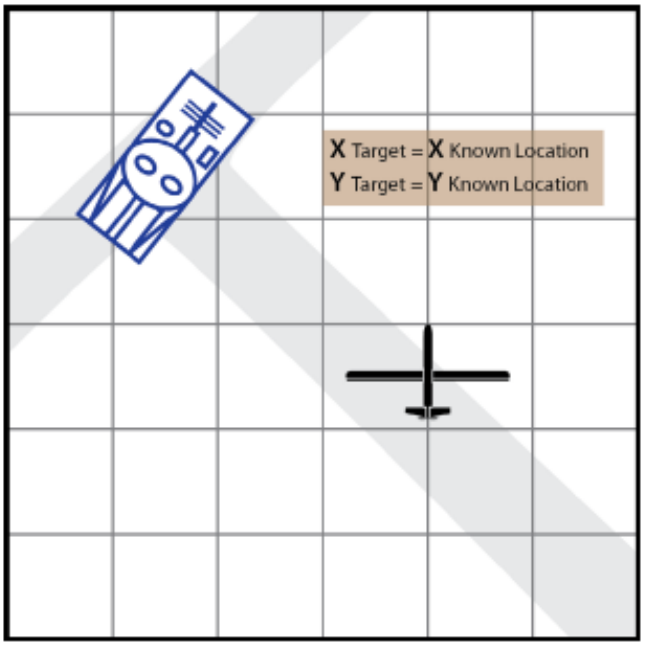
Although the Russians have emphasized digital interoperability among different command and control systems, humans are still an essential element of UAV integration into the Reconnaissance Fire System. It is clear from various video segments and articles that the UAVs do not communicate directly with the fire control elements of the batteries.[xvii] Instead, Russian UAV operators determine target coordinates and relay that information to forward observers on Artillery Reconnaissance Vehicles (ARVs), such as the PRP-4A "Argus," who in turn relate the information to fire control element. There are typically two UAV personnel present when conducting this mission (presumably one pilots the UAV, while the other operates the sensors). Russian UAV operators are so often embedded with ARV crews, that Russia is even considering MTOE changes so the UAVs are permanently assigned to ARVs.[xviii] When UAV operators are conducting artillery spotting missions, but are not collocated with the ARVs, they are typically found with the Command Observation Post (COP) or Fire Direction Center (FDC) vehicles.

Methods of Target Acquisition

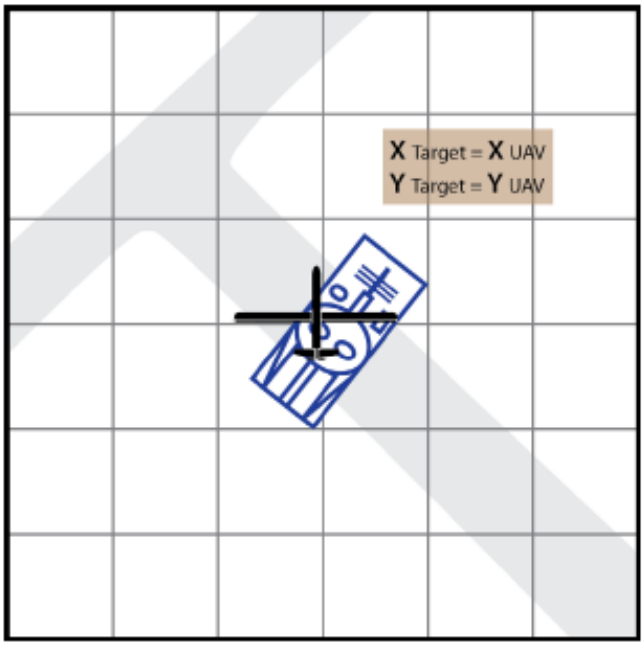
On July, 7 2015, The *TASS* news service published an article about the training of officers in the use of the Orlan-10 UAV for artillery spotting purposes. The following day, a Russian blogger posted his theory of how artillery spotting can be conducted with UAVs, and observed that the Orlan-10 is only capable of conducting the two simplest methods of artillery spotting. (see graphic Artillery Spotting Methods for UAVs) The blogger appears quite knowledgeable of Russian UAV capabilities and the modern battlefield, and his observations agree with observed Russian artillery procedures as viewed on various online videos. Although the Orlan-10 and Granat-1 are not capable of the more advanced methods of artillery spotting, they can still be quite effective. Although less desirable than some other methods, the capability to affix a targets location by relative terrain feature (method 1) is sufficient for many Russian artillery purposes. As Russian artillery batteries and battalions have several area bombardment missions that make precise target information useful, but unnecessary. In addition, the Russian Federation has a strong cartographic tradition, undoubtedly any Russian serviceman referencing terrain features for targeting purposes would have access to high quality, large scale, digital maps of most places within the former Soviet Union. Although current UAV artillery spotting capabilities may be adequate for current purposes, these capabilities are very likely to continue to develop.[xix]

The following graphic depicts four probable methods of using the Orlan-10 for artillery reconnaissance[xx]:

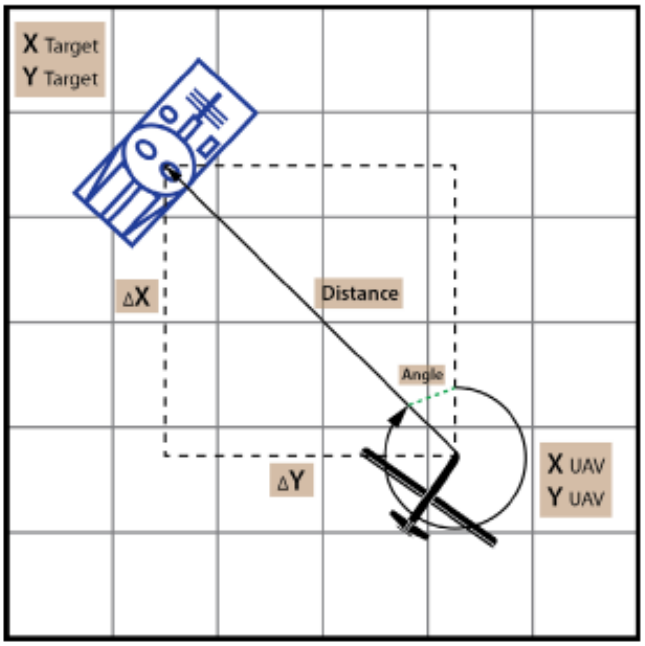
Artillery Spotting Methods for UAVs



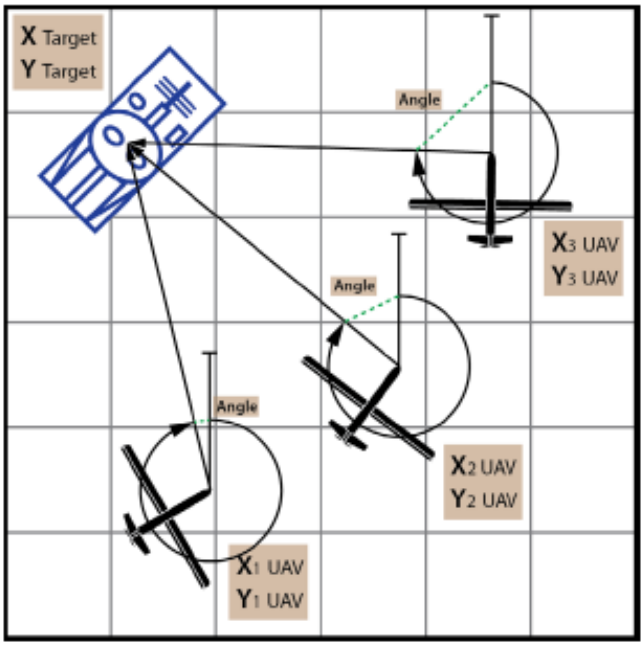
1st Method- Use of a reference point. This method can be used if the coordinates of a given reference point (landmark or intersection) are known. The disadvantage of this system is that the coordinates of the reference point must be known with certainty, requiring detailed maps and/or GIS data. In addition, target accuracy diminishes the farther the target is from the reference point. Conclusion: This method works, but is the least suitable for artillery spotting.



2nd Method- Fly above the target. The UAV flies above the target and its position is recorded. Target accuracy depends on the accuracy of the UAV's navigation system. The disadvantage of this is method is that it requires flying over the target, meaning that only a limited number of targets may be acquired and that the UAV is extremely susceptible to enemy fire. Conclusion: This method works, but is most suitable for less organized adversaries, such as insurgents.

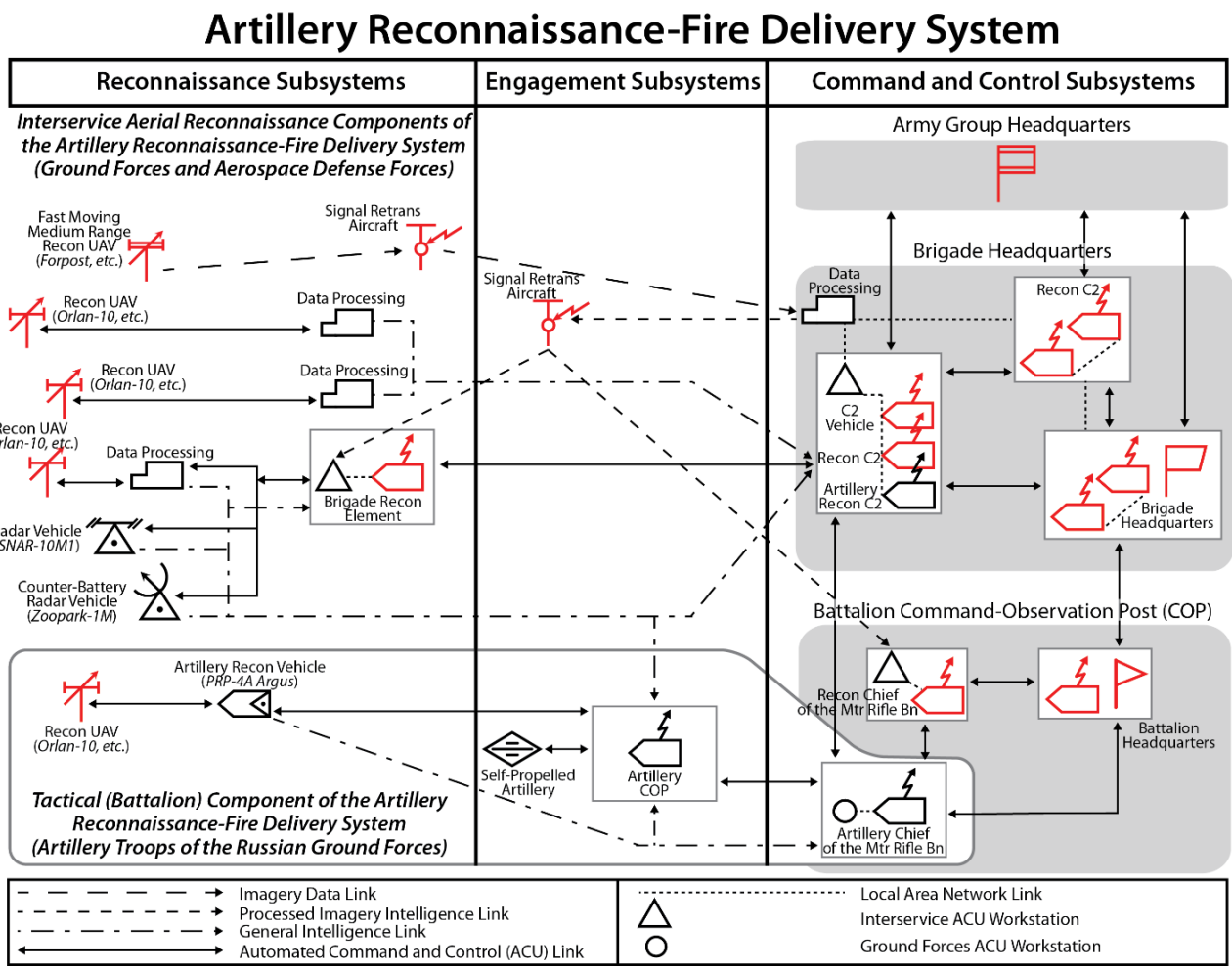


3rd Method- Use of range finder. Requires a gyro stabilized electro-optical system with a laser rangefinder. The coordinates of the target are calculated using basic trigonometry. The accuracy depends on the accuracy of the UAV's navigation system and rangefinder. This method provides good accuracy and the capability to acquire many targets, sufficient for several batteries or battalions. The disadvantage of this is method is the use of an active sensor (the laser) which can be easily detected by modern military equipment. Conclusion: This method is very effective, but requires a sophisticated UAV and would be more susceptible to enemy fire.



4th Method- Use of multiple azimuths. The UAV takes several azimuths on a given target, while in flight. Trigonometry is than used to calculate the position of the target. This method provides good accuracy and the capability to acquire many targets. This method requires a sophisticated UAV, but is completely passive, an advantage that can significantly increase the UAV's life expectancy above the modern battlefield. Conclusion: this is preferred method for UAV artillery spotting.

The UAV is clearly central to the revitalization and realization of the reconnaissance-fire system. The next graphic shows the probable communications and FDC link-up to support the reconnaissance-fire system at battalion and brigade level.[xxi]



The diagram shows the integration of operational and tactical imagery feed from fast-moving UAVs or reconnaissance aircraft, tactical UAVs, reconnaissance helicopters, and radar reconnaissance. The solid straight lines indicate Automated Command and Control (ACU) links; long-dashed lines indicate imagery data links; short-dashed lines indicate processed imagery intelligence links; short-and-long dashed lines indicate general intelligence links; and dotted lines indicate local area networks. Both the brigade and battalion are capable of conducting stand-alone reconnaissance fire missions. Only one artillery system is indicated on the graphic, but with three battalions of indirect-fire artillery, the brigade has plenty of options. The optimum way to respond is with precision-guided munitions such as the improved Krasnapol round. However, rapid massed fires of conventional rounds may create the same damage at much less cost-and the reduced expenditure of conventional mass fire missions.

Units in the Urals, Siberia and the Volga River regions have been using a "multi-circuit reconnaissance-fire system" during exercises in the Chebarkul Training Center in the southern Urals. Each circuit links cannon artillery, MLRS, heavy mortars, tactical SSM and aviation to an automated command and control system and reconnaissance assets that provide precise target coordinates. The reconnaissance collectors are aircraft, helicopters, *Fara* ground radar, the *Eleron-3SV* hand-launched UAV, the *Orlan-10* rail-launched UAV, and the high-flying *Forpost* UAV. These are linked to the *Strelets* hand-held command, control, communications and reconnaissance computer. Detection-to-engagement time is reported as three-to-four minutes.[xxii]

Putting the Russian Reconnaissance Strike System (RYS) Together

The Strelets reconnaissance, command and control, and communications system
Image Courtesy: Russian Ministry of Defense/ http://mil.ru/

The Reconnaissance Fire System (ROS) is designed to detect, engage and destroy enemy targets in near-real time within the range of tactical units (maneuver battalion and brigade with supporting artillery). On occasion, an artillery brigade or helicopter gunship brigade (a tactical/operational formation) could conduct ROS missions. However Army Corps and Army Group units normally conduct RYS missions-engaging, detecting and destroying operational targets in near-real time using longer-range reconnaissance and strike systems (especially SSM and aviation systems).

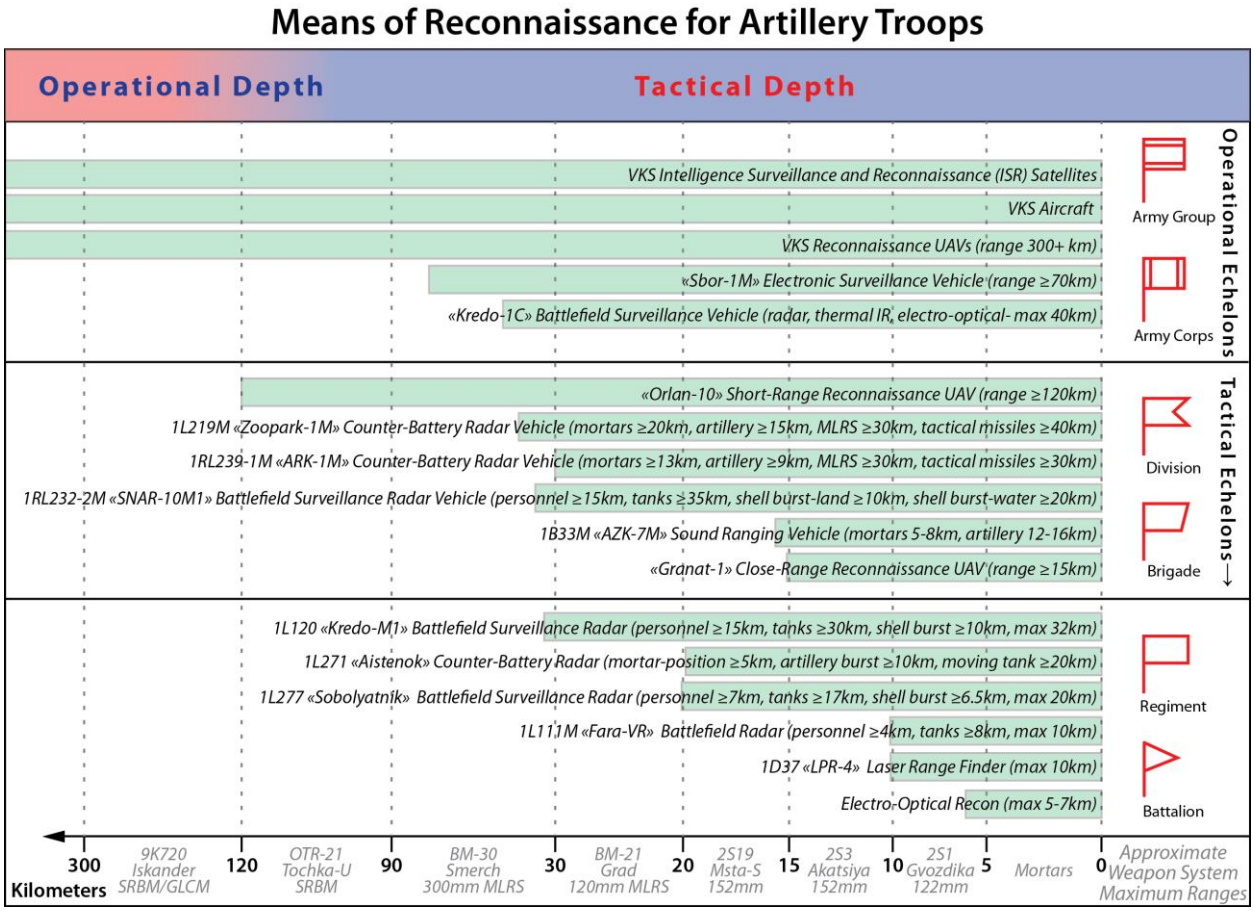
In practice, ROS is being implemented through the Strelets reconnaissance, command and control, and communications system (KRUS) [комплекса разведки, управления и связи (КРУС)]. The Strelets was developed in 2007, but was only fielded in large numbers beginning in 2011. It has undergone several modifications and hardware upgrades, and its use by Russian Forces in Syria is well publicized. The 'targeting' component of the Strelets is primarily used by the Ground Forces, Airborne, and Naval Infantry, and GRU Spetsnaz; and consists of a small tablet computer that can be worn on a tactical vest. The *Strelets* (likely based on the Linux operating system), reportedly can interface with legacy Soviet and Russian intelligence collection equipment, and can interface with a variety of sensors (azimuth determination, radar, electro-optical, thermal-imaging, acoustic, target designation and sighting, etc.), to include UAV based sensors. Russia's next generation of man-portable short-range reconnaissance radar, the *1L277 Sobolyatnik* and the*1L111M Fara-VR*, appear to have been designed from the outset to integrate with it. The *Strelets* can also interface with other Russian Automated Command and Control Systems (ACUs) to include the Aerospace Defense Forces (VKS) *Metronom* strike-aviation ACU, and the Airborne Troops (VDV) *Andromeda-D* ACU.

The *Strelets* reportedly allows a serviceman to simply annotate the position of a target on digitized maps contained in the Strelets. The targets' coordinates are then transferred in real time to command posts, artillerymen and pilots, reportedly halving the amount of time needed to lay fires. The *Strelets* has several levels of accessories, the base variant is for individual serviceman, up to squad leader. The next accessory level is intended for platoon leaders and company commanders, having a powerful computer and multifunction keyboard. The highest-level accessory package is for battalion and brigade commanders. The *Strelets* has an organic communications capability to communicate with other *Strelets* systems up to 1.5 kilometers away, and can retransmit communications from other *Strelets* transmitters. Presumably, it can also be integrated into existing communications networks for longer distance communications. The *Strelets* also has an organic GLONASS satellite receiver for navigation, and can likely use U.S. GPS signals as well, and has an inertial navigation capability that is automatically activated in satellite navigation denied or degraded environments. Perhaps one of the more interesting features is the 'friend-or-foe' recognition system, with range depending on the specifications of the sensors to which the *Strelets* is interconnected. (The *Strelets* sends a query to the unrecognized object, if the object is a 'friend' then the serviceman hears an audible notification in the earpiece. If quiet, The *Strelets* defines the object as 'foe') There has also been some reporting that Strelets is also used for medical evacuation (MEDEVAC) purposes.[xxiii]

Initially, the *Strelets* was only designed to direct artillery and aircraft fires, but the system has reportedly been upgraded to allow the direction of naval fires, namely the Kh-35 "Zvezda" (AS-20 Kayak/ SS-N-25 Switchblade/ SSC-6 Sennight), 3M-54 "Kalibr" (SS-N-27 Sizzler), P-800 "Oniks" (SS-N-26 Strobile), and presumably the forthcoming 3M22 "Tsirkon" (SS-N-33) hypersonic cruise missile. The true value of the Strelets is signified by much more than the fielding of a computer tablet that allows the rapid direction of fires. The real value of Strelets is the behind-the-scenes infrastructure that creates the conditions for a network-centric C4ISR system that successfully integrates operators, reconnaissance assets, command elements, and very different fires systems to include ground-based tube artillery and rocket artillery; ballistic and cruise missile; strike aviation; and ship and coastal naval fires. If Strelets truly functions as described, the Russian Armed Forces will need only one system to task fires rapidly at all levels of battle, from front line artillery to deep strike aviation, through rear area missile strikes, truly fielding a unified Reconnaissance Fire System that facilitates fires at both the tactical and operational depths.[xxiv]

Russian Artillery of the Future

Russian analysis of recent conflicts and technology developments determined that future ground force formations should be better equipped with unmanned aerial vehicles (UAVs) based on their importance in providing reconnaissance to weapons systems as well as in delivering strikes on important targets. There is a need for an increase in the number of UAVs in artillery subunits as they are the only technical reconnaissance assets satisfying artillery requirements in terms of reconnaissance range, promptness of reconnaissance information and providing accurate firing coordinates.[xxv]



Russian analysts have also determined that future ground forces will also require a system of seismic, acoustic and electro-optic reconnaissance sensors. These sensors can help monitor the force's flanks and rear and detect and observe enemy movement over very-rough terrain and hard-to-reach areas. In Afghanistan, Soviet forces widely employed 1K18 "Realiya-U" seismic sensors. They were emplaced on hard-to-reach caravan routes and detected the passage of Mujahideen caravans. The Soviets plotted artillery battery concentrations on these sensor locations. When the sensors triggered, the reconnaissance sensor monitor immediately called in a heavy artillery strike on the location. Employing these seismic reconnaissance systems helped achieve Soviet missions with fewer friendly troop losses.[xxvi]

Russian analysis of regional conflicts determined that new-type combined arms tactical forces should include the necessary mix of artillery subunits so that they can carry out a wide range of independent indirect-fire combat missions. Subsequently, in the new combined-arms brigade, there are now two 152mm howitzer battalions and a 122mm MLRS battalion. Each motorized rifle battalion has a 120mm mortar battery. Russian analysts have determined that future artillery systems and groupings of artillery and MLRS must provide for*:*

- *automated command and control systems that interface with the combined arms formation's command and control systems;*
- *an expanded number of artillery rounds and types including present-day ammunition and those under development;*
- *interface between current and future artillery reconnaissance assets including locking-on moving targets radar and reconnaissance UAVs;*
- *the ability to destroy small moving targets with indirect fire;*
- *the capability to conduct flat trajectory and high-angle fires;*
- *the capability to conduct an "iterative fire strike", whereby a single artillery piece can fire on a single target using rounds with different charging packets-the result being that the target is hit simultaneously by several rounds;*
- *he ability to conduct "series fire", whereby a single artillery piece can fire 12-15 rounds-per-minute at a single target on a single trajectory with an identical propelling charge so that all the rounds fired during that minute will still be in the air as the self-propelled artillery piece is changing its firing position;*
- *the development of unmanned self-propelled artillery pieces controlled by a manned command vehicle (or command-reload vehicle) that supports weapon displacement, fire control and ammunition resupply;*[1]
- *the development of self-propelled artillery pieces capable of firing on the move throughout the entire range of trajectories within the sector of fire, and;*
- *providing a range of fire of at least 50 kilometers.*[xxvii]

Russian battlefield simulations have demonstrated that artillery must be able to destroy enemy armored companies and battalions at long-range in in order to guarantee mission success. Artillery must hinder the enemy advance and frustrate the enemy deployment into attack lines in order to negate or frustrate the full application of enemy combat power while reducing friendly casualties. Future Russian artillery composition within combined arms tactical formations should be capable of:

- *conducting reconnaissance-fire missions while on the move;*
- *conducting effective fire to the full depth of the formation's zone of responsibility;*
- *accomplishing a high rate of effective fire using precision-guided as well as conventional munitions;*
- *quickly preparing for and conducting fire missions;*
- *conducting counter-battery maneuver, and;*
- *destroying crucial targets with high accuracy and to the required degree in armed conflicts of varying scale and intensity.*[xxviii]

Precision fires have their place and quick destruction of high-threat targets is optimum for survival, but the Russians have not abandoned their use of massed artillery. Massed artillery not only destroys-it produces paralysis and psychic terror. "The experience of modern wars and armed conflicts shows that artillery is still the god of war. Airstrikes cannot replace massed artillery fire. And the most effective way to protect your troops from enemy artillery is to destroy that artillery with counterbattery fire, when enemy artillery positions are detected and instantly suppressed."[xxix] So, the Russians plan to improve their reconnaissance-fire system while retaining their ability to dominate the battlefield through massed artillery fire.

Conclusion

The Russian Federation is making great efforts to develop a robust C4ISR systems to quickly direct various types of fires, or more simply stated the Russians are developing fast and reliable means to put steel (rounds, shells, missiles, etc.) on target. Although UAVs are an important part of this capability, UAVs only complement the Reconnaissance Strike System, and the RYS is by no means solely reliant upon them. The Russian Federation has made great efforts to incorporate UAV capabilities, but is also incorporating other sensors (such as ground-based radar) and communications systems to build a unified Reconnaissance Strike System. The difficulties of fielding a unified ROS are likely more related to interfacing various technologies and ensuring rapid and reliable communications. In practice, ROS is being implemented through the *Strelets* reconnaissance, command and control, and communications system. If *Strelets* truly functions as described, the Russian Armed Forces will need only one system to rapidly task fires at all level of battle, from front line artillery to deep strike aviation, thru rear area missile strikes, truly fielding a unified Reconnaissance Fire System.

[i] The opinions expressed in this article are those of the authors and do not necessarily represent those of the Department of Army, Department of Defense or US Government. The views and opinions expressed in this article are those of the author and do not necessarily represent the views of the Changing Character of War Centre, or the University of Oxford.

[ii] Aleksandr Stepanov, "Find and Destroy in Seconds: How Reconnaissance Works," *Moskovskiy Komsomolets* Online, 2 November 2017, <http://www.mk.ru/politics/2017/11/02/nayti-i-unichtozhit-za-sekundy-kak-rabotaet-voennaya-razvedka.html>, accessed 15 July 2015.

[iii] V. Litvinenko and S. Voronkov, "Artillery Fire and Maneuver: The Role of New-type Tactical Artillery Elements in Armed Conflicts of the late-20th, early-21st Centuries", *Army Digest*, February 2017, 34-38.

[iv] Ibid, 34.

[v] Ibid, 35.

[vi] This is clearly a shift from Soviet artillery methods and formations where artillery would be physically massed and controlled by creating regimental artillery groups (RAGs), division artillery groups (DAGs) and Army Artillery Groups (AAGs) where artillery battalions would be attached to regiments, divisions and armies. AAGs may still be formed, however a maneuver brigade (motorized rifle or tank) already has four artillery battalions organic (two howitzer, one MLRS and one antitank). The brigade has its own brigade artillery group (BrAG) which incorporates its organic howitzer and MLRS battalions plus any attached battalions. The BrAG is expected to handle tactical artillery missions.

[vii] Ibid, 35-36. The US relies on air attack for deep and close target attack. The Russians are far more reliant on surface-to-surface missile and MRLS attack for reconnaissance strike systems and tube artillery and MRLS for reconnaissance fire systems. Helicopter gunships may be used for reconnaissance fire missions provided that they are close enough and in the air. Usually, however, the Russians use air assets for other missions.

[viii] Ibid, 36. For a discussion of Russian artillery fire planning, see Lester W. Grau and Charles K. Bartles, *The Russian Way of War: Force Structure, Tactics and Modernization of the Russian Ground Forces*, FMSO: Leavenworth, 2017, 243-250.

[ix] Should the Russians encounter an enemy that is careless with camouflage and deception, the artillery commander may be faced with multiple targets. The Russian Motorized Rifle Brigade normally carries 12,960 152mm howitzer rounds, so resupply of artillery ammunition may prove challenging in a high intensity fight. The Russians employ a push logistics system which should save time in resupply. Grau and Bartles, 329.

[x] Antitank artillery units typically do not align to this command and control scheme. This difference is likely due to the different role that antitank units fill in the Russian Armed Forces, and the fact that the antitank artillery does not need as sophisticated system for command and control since targets are generally within line of site. In terms of reconnaissance assets, most antitank artillery units have portable ground surveillance radar instead of artillery reconnaissance vehicles. These radar are appropriate for the antitank units' primary mission, securing enemy high-speed avenues of approach.

[xi] One of the differences between NATO-standard and Russian designed fire computation is that the NATO standard circle has 6400 mils, while the Russian-standard has 6000 mils. The computing results of each will differ slightly due to this basic difference in standards.

[xii] Charles K. Bartles, "Russia's Use of Unmanned Vehicles as Electronic Warfare Platforms," *OE Watch* Online, August 2015.
"Russian Servicemen in Tajikistan Improve UAV Skills," *Interfax*, 28 March 2014.
Yuri Gavrilov, "Electronic Warfare Units in Far East Will Get Leer-3 Drones," *Rossiyskaya Gazeta* Online, 28 June 2015, <http://rg.ru/2015/06/28/leer-site.html>, accessed 15 July 2015.

[xiii] Viktor Litovkin, "They Installed UAVs behind a Desk: Reporting from the Inter-Branch UAV Center," *Nezavisimoye Voyennoye Obozreniye* Online, 6 December 2013, <http://nvo.ng.ru/forces/2013-12-06/1_drones.html>, accessed 20 July 2015.
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[xiv] Lester W. Grau and Charles K. Bartles, *The Russian Way of War: Force Structure, Tactics and Modernization of the Russian Ground Forces*, FMSO: Leavenworth, 2017, 371.

[xv] Aleksey Ramm: "Russian Artillery Troops Will Receive UAVs for Use against Radar", *Izvestiya* Online, <https://iz.ru/news/636937>, 10 October 2016, accessed 11 October 2016.

[xvi] Grau and Bartles, 373.

[xvii] "Enemy's Gun Posts Destroyed by Artillerymen in Primorskiy Kray With Aid of Reconnaissance and Strike Complex," Interfax, 14 January 2015.
UAV Granat-1 in artillery units, as found at: <https://www.youtube.com/watch?v=Vu2baqAexCU>, published 19 January 2015, accessed 20 July 2015.

[xviii] Vitaliy Kuzmin, "Modernized Artillery Reconnaissance Vehicle for Russian Federation Army May Get a UAV," *TASS* Online, 19 November 2015, <http://tass.ru/armiya-i-opk/2452314>, accessed 5 June 2017.

[xix] Charles K. Bartles, "The Orlan-10 and Artillery, Let's Ponder How They Work Together…" *OE Watch* Online, August 2015.
"Officers of Western Military District Adjusts Fire with Help of the Orlan-10 in 3D," *TASS* Online, 7 July 2015, <http://tass.ru/armiya-i-opk/2099301>, accessed 1 August 2015.
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[xx] Ibid, 375.

[xxi] Graphic derived from a combination of the writings of Litvenko and Voronkov as well as Grau and Bartles.

[xxii] "Over 1,500 Servicemen Used New Forms of Combat in the Urals," *TASS* Online, 21 April 2011, <http://tass.ru/armiya-i-opk/4200654>, accessed 26 April 2017.

[xxiii] "Southern Military District Spetsnaz Locate Notional Wounded Serviceman Using Strelets System During Exercise in Stavropol Kray," *Ministry of Defense of the Russian Federation* Online, 14 March 2018, <https://function.mil.ru/news_page/country/more.htm?id=12166650@egNews>, accessed 10 May 2018.

[xxiv] "The Caspian Flotilla Naval Infantry's Artillerymen Have Conducted an Exercise Using Strelets System for the First Time," *Ministry of Defense of the Russian Federation*, 7 July 2017, <http://function.mil.ru/news_page/country/more.htm?id=12132414@egNews>, accessed 15 August 2017.

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[xxv] Litvenko and Voronkov, 37.

[xxvi] Ibid. For an example, see Lester W. Grau, "Artillery and Counterinsurgency: The Soviet Experience in Afghanistan", *Field Artillery Journal*, May-June 1997, <http://www.dtic.mil/dtic/tr/fulltext/u2/a434984.pdf>.

[xxvii] Ibid, 38.

[xxviii] Ibid. Litvenko and Voronkov cite the following sources in their research: *Боевой устав артиллерии Сухопутных войск* [Combat regulations for Ground Forces' Artillery], Part I, Moscow; Voyenizdat, 2013; *Боевое применение РВ и А.Учебник* [Combat application of Rocket Forces and Artillery-a Textbook], Moscow: Russian Federation Armed Forces Combined Arms Academy Military and Scientific Center, 2014; and Примеры из опыта боевых действий артиллерии в ВОВ и Республике Афганистан.Тематический сборник [Examples from artillery combat experience in the Great Patriotic War and the Republic of Afghanistan-a thematic digest], Moscow: Voyenizdat, 1991.

[xxix] Ibid.