Russian Military Autonomy in a Ukraine Conflict

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Abstract

The Russian military is rapidly fielding new unmanned systems into its branches having learned lessons from recent conflicts. Should Russia enter a conflict with Ukraine, it will use many of the unmanned systems it has tested in other theaters such as Syria. It may also use the opportunity to test new systems. This report looks at the various lessons learned and the possible systems that would play a role in Russian military operations against Ukraine.

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The Russian military continues to mass military forces opposite Ukraine and recent diplomatic efforts between the United States, NATO, and Europe do not seem to have prevented a possible invasion of Ukraine by Russian forces. If the Russian military does conduct operations in Ukraine, it will do so with a burgeoning set of autonomous capabilities that it can use to enhance a diverse set of operations, including reconnaissance and fire and command and control.

The Russian political and military leadership have placed a high value on the need for Russia's military forces to integrate higher levels of autonomy in order to increase its warfighting capabilities and help preserve combat power. In almost every domain—from air, ground, and sea, to the electromagnetic spectrum—the Russian military is testing new autonomous systems and technologies.

Lessons learned

Syria

Unmanned aerial vehicles (UAVs) have played a crucial role in Russian intervention in the Syrian civil war. Since its entry into the conflict in 2015, Russian military UAV operations have steadily increased. Defense Minister Sergey Shoigu remarked in October 2017 that Russian UAVs were carrying out 24/7 monitoring and surveillance over Syria while conducting 16,000 missions, with a total of 96,000 flight hours.[1] By July 2018, the number of UAV flight missions had climbed to over 23,000, with 140,000 flight hours, with drones flying more often than manned aircraft.[2] Chief of the General Staff General Valery Gerasimov noted in late 2017 that

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[1] "Russian drones conduct round-the-clock control in Syria, said Shoigu" (Российские беспилотники ведут круглосуточный контроль в Сирии, заявил Шойгу), Ria.ru, Oct. 27, 2017, https://ria.ru/20171027/1507669571.html.

[2] "Russian drones during the operation in Syria spent in the air more than 140 thousand hours" (Российские беспилотники во время операции в Сирии провели в воздухе более 140 тысяч часов), official website of the Russian MOD, July 6, 2018, http://syria.mil.ru/news/more.htm?id=12184627@egNews.

Russian forces operated 60–70 UAVs on a daily basis, a major increase in drone use since 2012.[3] This drone lineup included Eleron-3, Zastava, Orlan-10, Granat-4, and Forpost drones.[4]

When it comes to unmanned ground vehicle (UGV) use and testing in Syria, the Uran-6, Scarab, and Sphera demining vehicles were rated highly by Russian engineering forces, and the Ministry of Defense (MOD) is starting to acquire these vehicles.[5] However, these UGVs were designed to have the operator in close proximity. Attempts to test combat UGVs proved more complicated. Russia's Uran-9 combat UGV experienced several failures when tested in "near-combat conditions"—among them transportation, communication, firing, and issues with the operator's situational awareness.[6] The Russian military claimed that such issues were taken into account in modernizing this vehicle for its acquisition, begun in 2021. Russia also managed to test an unmanned underwater vehicle (UUV) in Syria: in February 2018, the Russian Military-Industrial Commission announced that the "Galtel" underwater "robotic complex" was engaged in the search for undersea unexploded ordnance; it also conducted sea-floor mapping and protection of the Tartus port area, where Russia has a naval base.[7]

The Russian military was greatly influenced by the Syrian militants' use of small, commercially available quadrocopter and multirotor drones that were often difficult to detect. Their relatively cheap cost when compared to the cost of destroying them with military-grade air defense systems showcased the possibility that any military force can acquire aerial combat capability. Therefore, in 2019, the MOD announced it would start acquiring small quadrocopters, and in January 2021 it confirmed mass quadrocopter acquisition across all services to augment existing drone-based intelligence, surveillance and reconnaissance (ISR)

[3] "Chief of the General Staff of the Armed Forces of Russia Army General Valery Gerasimov: 'We have broken the spine of the shock forces of terrorism'" (Начальник Генштаба Вооруженных сил России генерал армии Валерий Герасимов: «Мы переломили хребет ударным силам терроризма»), KP.ru, Dec. 26, 2017, https://www.kp.ru/daily/26775/3808693/.

[4] Anton Lavrov, "Russian UAVs in Syria," CAST.ru, 2018, http://cast.ru/eng/products/articles/russian-uavs-in-syria.html.

[5] Kelsey Atherton, "Russia orders a dozen new demining robots," *C4ISRNET*, Feb. 4, 2019, https://www.c4isrnet.com/unmanned/2019/02/04/russia-orders-a-dozen-new-demining-robots/.

[6] "Problematic issues of the development of military robotic systems" (Проблемные вопросы развития робототехнических комплексов военного назначения), *BMPD* (blog), June 16, 2018, https://bmpd.livejournal.com/3239351.html.

[7] Российский подводный робот выполнил боевую задачу в Сирии, Feb. 22, 2018, https://rg.ru/2018/02/22/rossijskij-podvodnyj-robot-vypolnil-boevuiu-zadachu-v-sirii.html.

capabilities.[8] Such drones could also potentially be equipped with small munitions for a very tactical strike at ground targets, something in which the Syrian militants became very experienced during their prolonged conflict with the Assad government. In fact, the Ukrainian government has long suspected that the Russian military secretly used such small drones to target Ukrainian arms depots and warehouses, a claim that the Russian government denied.[9]

Ukraine

UAVs have reportedly played a large role in Russian military operations in eastern Ukraine, especially during periods of direct Russian military involvement. Given the deniability sought by the Russian leadership and subsequent lack of Russian aerospace forces in that conflict, UAVs played a particularly important role in reconnaissance and targeting of Ukrainian forces.

The UAVs used include the Granat UAV series, along with Orlan-10, Eleron-3, Zastava, Takhion, and Forpost ISR drones that were occasionally downed by the Ukrainian defenses.[10] Additionally, the Russian military utilized the Leer-3 electronic warfare (EW) system in Ukraine. This complex, which is built around several Orlan-10 drones and a ground control station, is capable of jamming and manipulating cellular signals and interfering with cell towers' operations.[11]

Nagorno-Karabakh and Kazakhstan

During the Nagorno-Karabakh 2020 war, the Russian military drew several key lessons from Azerbaijan's heavy use of combat drones and loitering munitions to overwhelm and ultimately destroy Nagorno-Karabakh forces—the main lesson was that Russia would also benefit from

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[8] Anton Lavrov, Roman Kretsup, "С дроном в разведку: стартует массовое оснащение армии квадрокоптерами," Iz.ru, Jan. 15, 2021, https://iz.ru/1111609/anton-lavrov-roman-kretcul/s-dronom-v-razvedku-startuet-massovoe-osnashchenie-armii-kvadrokopterami.

[9] Tony Wesolowsky, "Ukraine's Exploding Munition Depots Give Ammunition To Security Concerns," RFERL.org, Oct. 6, 2017, https://www.rferl.org/a/ukraine-exploding-munitions-security-concerns-russia/28777991.html.

[10] "Ukrainian military shoot down Russian drone in Donbas," Ukrinform.net, Mar. 1, 2019, https://www.ukrinform.net/rubric-defense/2651313-ukrainian-military-shoot-down-russian-drone-in-donbas.html; "Russia uses more than eight types of UAVs in the Donbas," Informnapalm.net, Sept. 3, 2019, https://informnapalm.org/en/russia-uses-more-than-eight-types-of-uavs-in-the-donbas/; "Drone downed in Donbas in service with twelve Russian army units," Ukrinform.net, July 4, 2020, https://www.ukrinform.net/rubric-defense/3000100-informnapalm-drone-downed-in-donbas-in-service-with-twelve-russian-army-units.html.

[11] "Russian Leer-3 system spotted in Donbas again," InformNapaalm.org, Apr. 11, 2019, https://informnapalm.org/en/russian-leer-3-system-spotted-in-donbas-again/.

these types of drones.[12] Additionally, during Russia's January 2021 mission for the Collective Security Treaty Organization (CSTO) in Kazakhstan, Russian forces were seen using Orlan-10 ISR drones, along with Leer-3 EW systems to strengthen their situational and informational awareness and capabilities.[13]

The role of autonomy in an invasion of Ukraine

General Gerasimov elaborated that today's combat is "unthinkable without drones—they are used by gunners, scouts, pilots—everyone."[14]

UAVs and reconnaissance strike and fire

One of the most significant weaknesses of Russia's military during the Cold War was its ability to gain and maintain battlefield awareness. In a conflict, once the military was able to make and keep contact with an enemy, it was believed that it could bring tremendous firepower to bear. Since the beginning of the Russian military's modernization efforts, the military leadership has sought to address this weakness through new integrated command and control systems, greater use of space-based assets, and ground-based radar and electronic warfare advances. Many of these systems use increasingly automated control modes to quicken response times, for example, in air defense systems that have to quickly detect and assess a disparate array of airborne threats.

UAVs, in particular, play an essential role in increasing the Russian military's situational awareness and ability to maximize its strike systems on the modern battlefield. UAVs are playing a much greater role in aerial ISR, target acquisition and designation, airstrike coordination, and artillery fire. These UAVs have become a key part of what the MOD calls the

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[12] Ruslan Pukhov, "Вторая карабахская: промежуточные итоги," NVO.ng.ru, Oct. 22, 2021, https://nvo.ng.ru/realty/2020-10-22/1_1114_karabakh.html.

[13] Joseph Trevithick, "Russia Sent Electronic Warfare Systems And Armored Vehicles To Kazakhstan For Peacekeeping Mission," TheDrive.com, Jan. 6, 2022, https://www.thedrive.com/the-war-zone/43785/russian-sent-electronic-warfare-systems-and-armored-vehicles-to-kazakhstan-for-peacekeeping-mission; and Российские миротворцы развернули беспилотники в аэропорту Алма-Аты, Ria.ru, Jan. 10, 2022, https://ria.ru/20220110/kazakhstan-1767222028.html.

[14] "Chief of the General Staff of the Armed Forces of Russia Army General Valery Gerasimov: 'We have broken the spine of the shock forces of terrorism'" (Начальник Генштаба Вооруженных сил России генерал армии Валерий Герасимов: «Мы переломили хребет ударным силам терроризма»), KP.ru, Dec. 26, 2017, https://www.kp.ru/daily/26775/3808693/.

"reconnaissance fire and strike complexes."[15] These "complexes" refer to the grouping of various sensor and strike platforms, with integrated information sharing networks, to do the following:

> Increase the degree of potential fire capabilities…reduce the "reconnaissance-destruction" cycle…for the timely detection and infliction of specified damage to important objects, groupings of enemy troops, and the main elements of state and military infrastructure.[16]

The Orlan-10 UAV, with a range of up to 120 km, makes up the largest share of the Russian 2000+ drone fleet. Other UAVs, such as Zastava, Eleron-3, Takhion, Granat, and ZALA, currently in service, provide ISR coverage at the tactical level, with a range between 12 and 100 km, giving Russian forces extended coverage of the battlefield. Two other key UAVs in the Russian military are medium altitude, long-endurance (MALE) Forpost and Orion drones. Russian forces conduct drills and exercises using these drones on a regular basis in all military districts and fleets. An interesting recent development with the Orlan-10 drones, noted by Ukrainian forces in eastern Ukraine, is that they can fly at an altitude of 6 km, perhaps complicating Ukrainian attempts to interdict them. There are also reports by Ukrainian solders that the upgraded Orlan-10s are more impervious to electronic countermeasures.[17]

Another important upgrade to both the Orlan-10 and Forpost drones is their evolution from a pure ISR platform to a combat UAV. During the Zapad-2021 military joint exercise with Belorussian forces, the Russian military used Forpost-R (newer drone version) and Orlan-10 combat versions that employed munitions and bombs.[18] Arming the Orlan-10 and Forpost is a particularly important development for the Russian UAV fleet. With hundreds of Orlans and dozens of Forposts in service, the MOD gains significant ground attack capability that was

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[15] Lester W. Grau and Charles K. Bartles, "The Russian Reconnaissance Fire Complex Comes of Age," Changing Character of War Centre, May 2018, http://www.ccw.ox.ac.uk/blog/2018/5/30/the-russian-reconnaissance-fire-complex-comes-of-age.

[16] D. Mishin, "Understand the Basics: Features of the organization of combat training of units of the missile troops and artillery of the Ground Forces, which are part of the reconnaissance-strike and reconnaissance-fire complexes" (Понять основы, Особенности организации боевой подготовки подразделений ракетных войск и артиллерии Сухопутных войск, входящих в состав разведывательно-ударных и разведывательно-огневых комплексов), *Armeyskiy Sbornik, Journal of the Ministry of Defense of the Russian Federation,* July 15, 2021, https://army.ric.mil.ru/Stati/item/334380/.

[17] Комбриг 58-й бригады ВСУ об эффективности БЛА и РЭБ противника на Донбассе, Diana-Mikhialova.livejournal.com, Jan. 3, 2022, https://diana-mihailova.livejournal.com/7441044.html.

[18] На учениях «Запад-2021» впервые применили ударные БПЛА «Иноходец» и «Форпост», Vedomosti.ru, Sept. 13, 2021, https://www.vedomosti.ru/technology/news/2021/09/13/886473-na-ucheniyah-zapad-2021-vpervie-primenili-udarnie-bespilotniki-inohodets-i-forpost.

largely absent from its UAV force in previous years. The Russian MOD also recently tested Orion's ability to attack low-flying adversarial drones, possibly hinting at the ability to strike Ukrainian UAVs such as the recently imported Turkish Bayraktar drone. While the Orion unmanned combat aerial vehicle (UCAV) is a recent acquisition and few are in service, the Russian military has a sufficient number to employ in a limited role in a conflict with Ukraine.[19] Beyond just the Orlan-10, the Russian military is researching and producing smaller-sized ammunition, making it more available to other platforms.[20]
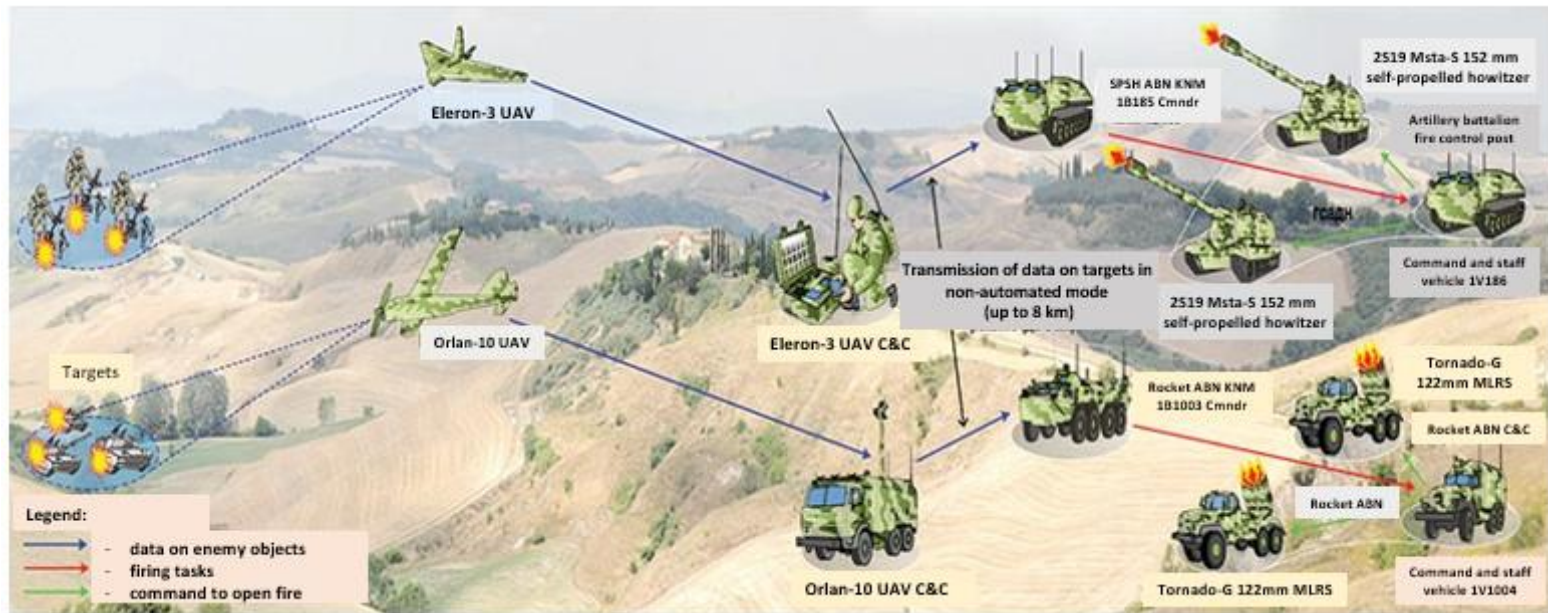
The growth of Russia's UAV fleet, together with the increased weaponization of these systems and their experience in Syria, means that they will likely play a key role in the Russian military's attempt to target command and control nodes, air defenses, and military units. Another key factor is the development of munitions (both regular and high-precision) and missiles for the Russian drone lineup, including those that can be utilized by manned aircraft.[21]

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[19] Anton Lavrov, Aleksei Ramm, "Свободный пилот: Минобороны приняло программу развития ударных дронов," Iz.ru, Jan. 8, 2022, https://iz.ru/1270469/anton-lavrov-aleksei-ramm/svobodnyi-pilot-minoborony-prinialo-programmu-razvitiia-udarnykh-dronov.

[20] "Russian defense firm developing small-sized munitions for drones," TASS, Feb. 20, 2020, https://tass.com/defense/1120097.

[21] "Head of KTRV: unified ammunition for drones and front-line aviation is under development" (Глава КТРВ: создаются унифицированные боеприпасы для беспилотников и фронтовой авиации), Tass.ru, Jan. 24, 2022, https://tass.ru/armiya-i-opk/13504149.

Figure 1. Russia's reconnaissance fire and reconnaissance strike concepts

Source: Concepts translated from Col. D. Mishin, "To understand the fundamentals: Organization of combat training of Ground Forces' missiles and artillery units that are part of the reconnaissance-strike and reconnaissance-fire complexes" (Особенности организации боевой подготовки подразделений ракетных войск и артиллерии Сухопутных войск, входящих в состав разведывательно-ударных и разведывательно-огневых комплексов), July 15, 2021, accessed Jan. 31, 2022, https://army.ric.mil.ru/Stati/item/334380.

Unmanned ground vehicles

Russian military autonomy is not as advanced in UGVs as it is in UAVs, and so we are likely to see only limited UGV use in any conflict with Ukraine. While the MOD is training its forces to use a slowly growing number of combat UGVs, as it did during Zapad-2021,[22] UGVs are unlikely to make a major appearance in a conflict with Ukraine. The current suite of UGVs are remote controlled, with their operator being in relatively close proximity to the vehicles during operations.

However, the MOD's experience using the Uran-6 demining UGVs in Syria—along with the Scarab and Sphera small vehicles mentioned earlier—could mean that the military could use them in Ukraine to clear pathways for Russian soldiers and equipment through minefields.[23] Russian ground and engineering forces could also employ recently acquired Uran-14 firefighting UGVs that the military has used to fight battlefield-related fires on vehicles and buildings.[24]

Figure 2.   Recent Russian combat UGV

Source: "General Salyukov: "Uran-9" and "Kungas" robots were successfully used in Zapad-2021 exercises," Federal News Agency (Riafan.ru), Dec. 27, 2021, accessed Jan. 31, 2022, https://riafan.ru/1578351-general-salyukov-roboty-uran-9-i-kungas-uspeshno-primenyalis-na-ucheniyah-zapad-2021.

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[22] Kirill Ryabov, "Впервые на учениях. Новинки техники и вооружений на «Западе-2021»," TopWar.ru, Sept. 16, 2021, https://topwar.ru/187158-vpervye-na-uchenijah-novinki-tehniki-i-vooruzhenij-na-zapade-2021.html.

[23] В Оренбургской области пройдут учения с участием более 300 военнослужащих и робота «Уран-6», Ural56.ru, Dec. 13, 2021, https://www.ural56.ru/news/672591/.

[24] Инженерные войска усилили робототехническими комплексами "Уран-6" и "Уран-14," https://rg.ru/2021/11/07/inzhenernye-vojska-usilili-robototehnicheskimi-kompleksami-uran-6-i-uran-14.html.

Unmanned underwater vehicles

Like UGVs, Russian use of maritime unmanned vehicles in a conflict with Ukraine would be limited. The above-mentioned use of the Galtel UUV near Syria suggests that it could be used near the Ukrainian shore, reporting on underwater mines and topography in support of military operations. Russian forces may also employ other countermine unmanned systems such as the Marlin-350 tethered UUVs. The MOD recently decided to start acquiring these vehicles in large numbers.[25] Russian minesweepers can also use the "Diamant" mine detection/destruction system, comprising several integrated unmanned surface vehicles (USVs) and UUVs.[26]

Consistent with the earlier discussion of battlefield awareness, the Russian Navy has been experimenting with UAVs as a way of extending its ships' detection ranges. Systems such as the Orlan-10 could extend these ranges.[27]

Figure 3. Marlin-350 UUV

Source: ТАСС/Лев Федосеев via Aleksei Ramm, Bogdan Stepovoi, "Минное море: на тральщиках ВМФ появятся подводные роботы," Iz.ru, Jan. 14, 2022, accessed Jan. 31, 2022, https://iz.ru/1276787/aleksei-ramm-bogdan-stepovoi/minnoe-more-na-tralshchikakh-vmf-poiaviatsia-podvodnye-roboty.

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[25] Aleksei Ramm, Bogdan Stepovoi, "Минное море: на тральщиках ВМФ появятся подводные роботы," Iz.ru, Jan. 14, 2022, https://iz.ru/1276787/aleksei-ramm-bogdan-stepovoi/minnoe-more-na-tralshchikakh-vmf-poiaviatsia-podvodnye-roboty?destination=node/1276787.

[26] Aleksei Ramm, Bogdan Stepovoi, "Минное море: на тральщиках ВМФ появятся подводные роботы," Iz.ru, Jan. 14, 2022, https://iz.ru/1276787/aleksei-ramm-bogdan-stepovoi/minnoe-more-na-tralshchikakh-vmf-poiaviatsia-podvodnye-roboty?destination=node/1276787.

[27] Aleksei Ramm, Aleksandr Kruglov, Bogdan Stepovoi, "Ракетные корабли-невидимки впервые вооружили дронами," Iz.ru, July 24, 2018, https://iz.ru/768745/aleksei-ramm-aleksandr-kruglov-bogdan-stepovoi/raketnye-korabli-nevidimki-vpervye-vooruzhili-dronami.

Conclusion

The Russian military and political leadership believe that military autonomous systems are key to future battlefield success, and have been directing the military to acquire these systems for some time. Russia's most capable systems remain UAVs, and these are likely to play a large role in any conflict with Ukraine. However, the Russian military is also making headway in its use of UGVs and naval UUVs and UAVs. Table 1 in the appendix lists the UAVs, UGVs, and UUVs/USVs that Russia could potentially use in a conflict with Ukraine.

Appendix: Potential Systems That Russia Could Use in a Russia-Ukraine Conflict

Table 1.   Autonomous systems that Russia could use in a Russia-Ukraine conflict

Type	Name	Manufacturer	Purpose
Unmanned aerial vehicles (UAV)			
UAV	Eleron-3 (Элерон-3)	Eniks (ЭНИКС)	Tactical ISR
UAV	Granat-1,2,4 (Гранат-1, 2, 4)	Kalashnikov (Калашников)	Tactical ISR
UAV	Takhion (Тахион)	Izhmash («Ижмаш — Беспилотные системы»)	Tactical ISR
UAV	Orlan-10 (Орлан-10)	Special Technology Center (STC) (Специальный технологический центр – СТЦ)	Tactical ISR and close-support combat
UAV	Leer-3 RB-341V (РБ-341В «Леер-3)	Special Technology Center (STC) (Специальный технологический центр – СТЦ)	EW platform
UAV	Zastava	UZGA (УЗГА)	Tactical ISR
UAV	Forpost-R	UZGA ((УЗГА)	MALE ISR and combat platform
UAV	Orion	Kronshtadt Design Bureau (Кронштадт)	MALE ISR and combat platform
UAV	KUB	Rostec (Ростех)	Tactical loitering munition
UAV	Lancet	Rostec (Ростех)	Tactical loitering munition
UAV	ZALA	ZALA AERO	ISR quadrocopters
Unmanned ground vehicles (UGV)			
UGV	Uran-6 (Уран-6)	Rostec (Ростех)	Demining operations
UGV	Uran-14 (Уран-14)	Rostec (Ростех)	Firefighting operations
UGV	Scarab	CET-1	ISR for demining forces

Type	Name	Manufacturer	Purpose
UGV	Sphera	CET-1	ISR for demining forces
Unmanned underwater vehicles (UUV) and surface vehicles (USV)			
UUV	Galtel (Гальтель)	Institute for problems of Marine Technologies RAS (ИПМТ ДВО РАН)	Autonomy for ISR and situational awareness
UUV	Marlin-350 (Марлин-350)	Tetris-Pro (АО «Тетис Про»)	ISR and destruction of mines
UUV/USV	Diamant (Диамант)	Александрит-ИСПУМ	ISR and destruction of mines

Source: CNA.