



HIGH-PRECISION WEAPONS

12+



Rostec

High-Precision Weapons Holding

Special Edition, Autumn 2016

EXHIBITIONS 2016

The largest world defensive exhibitions in which the enterprises of High-Precision Weapons Holding complexes participate in 2016

DEFEXPO INDIA 2016

March 28 – 31
India

FIDAE 2016

March 29 – April 03
Chile

DSA 2016

April 18 – 21
Malaysia

KADEX 2016

June 02 – 05
Kazakhstan

ARMY-2016

September 06 – 11
Russia

ADEX 2016

September 27 – 30
Azerbaijan

ARMS & Hunting – 2016

September 29 – October 02
Russia

INTERPOLITEX 2016

October 18 – 21
Russia

INDODEFENCE 2016

November 02 – 05
Indonesia



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High Military Art

Russian High-Precision Weapons on the Global Market

For the Russian High-Precision Weapons holding (a part of the Rostec State Corporation) 2016 develops very successfully, including in the supply of products to foreign markets. The work of the enterprises of the holding to ensure existing export contracts and the conclusion new is being conducted almost constantly. There is every reason to believe that this year's results will surpass last year's figures, when the High-Precision Weapons recorded the high efficiency of their foreign economic activities.

Moreover, it is obvious that the demand for the high precision weapons continues to grow. This is the weapon that scarcely misses its target, it is mobile, fast, maintenance-friendly, reliable and top-notch, developed with the usage of the latest technological solutions. 20 years ago, the share of high precision weapons used in local military conflicts was 7%. In the last few years, this share increased to 90-95%.

In 2015, the High-Precision Weapons holding topped the planned revenue value by more than one milliard US dollars. The holding is gradually taking a more important position in the global arms market. A considerable amount of holding's production enterprises supplies is carried out serving the interests of many regions. Moreover, the arms produced by the holding constitute the basis of high precision weapon park of many countries. The High-Precision Weapons holding is the biggest developer and producer of the top-notch high precision weapons in Russia. The value and potential of the holding on the world stage is also increasing: According to the top 100 global arms producers rating of Stockholm International Peace Research Institute (SIPRI), the Russian High-Precision Weapons holding occupies the 39th position. As compared to 2014, the volume growth of supplies, provided by the High-Precision Weapons within the State Defense Procurement for the Armed Forces of the RF increased by 26%. The general supplies structure of the holding within GOZ-2015 includes 92% of serial production, 5.5% of NIOKR (Research and Development) and 2.5% of service contracts.

Such success (before time, the holding was not included in the TOP-100 global arms rating) is conditioned by the volume growth of the High-Precision Weapons supplies both serving the interests of The Armed Forces of the Russian Federation and the global markets. According to the SIPRI experts, "Russian com-



panies appear to be at the peak of the national military expenses and arms export growth". The TOP-100 now includes 11 Russian companies, and the joint revenue growth in 2013-2014 was 48.4%".

The High-Precision Weapons Holding was founded in 2009. The holding consists of a number of largest leading defense enterprises that are well known on the world arms market. It is sufficient only to mention such brands as the JSC "Shipunov KBP Instrument Design Bureau", the "Tula Arms Plant", "Tulatochmash", the "Tactical Missiles Corporation", the "Nudelman Precision Engineering Design Bureau", the "Kovrov Electromechanical Plant", the "V.A. Degtyaryov Plant", the All-Russian Scientific Research Institute "Signal", and others. As of today, there are 19 companies joined in the holding. Most of them are national and international leaders in their segments.

The products of the holding's companies are well known on all continents and much sought after on international arms markets. Interest in the products of the High-Precision Weapons Holding grows due to the objective situation.

The exports of the holding are based on warfare systems well known on the international market such as "Pantsir-S1", "Palma", "Kornet-E", "Konkurs", "Metis-M1", "Igla-S", "Arkan", "Verba", "Shmel", "Kapustnik", and others as well as on training systems, armored vehicles upgrade, and so on (for more details,

see this issue of the newspaper "High-Precision Weapons").

The holding's products are well known and much sought after on the markets in the Middle East, the Gulf, Northern Africa, Latin America, India, Central and Southern Africa. The holding is constantly expanding the geography of its exports. This is due to product line extension, development of new models and upgrade of products in demand as well as well thought-out service policy.

The holding invests much into the development of promising designs of weapons and military equipment, enhances and augments its development and production potential, and invests in the development of models of tomorrow.

Most of the High-Precision Weapons holding developments are the best of its kind globally, and they determine the vectors of development in their segments. There is no doubt that the main goal of the High-Precision Weapons holding is to serve the Russian military build-up purposes, supply the Armed Forces of the Russian Federation with the top notch and the most reliable high precision weapons. Within the contract liabilities, the holding provides the Ministry of Defense of the Russian Federation with the planned amount of weapons on a regular basis. The most important supplies include "Iskander-M", "Pantsir-S", "Verba", "Shturm-SM" and others. Thanks to the holding, the Russian Army is now one of the most military equipped in the world.



Universal solution

Unlimited Use of the ADS Assault Rifle

Combat diver units appeared in our country in the latter half of sixties. In 1967 an Inshore Undersea Warfare Unit was organized (IUWU) at the Black Sea fleet. The reason for this was active foreign development work on regular combat diver units to perform commando-type reconnaissance operations. Fresh in the memory was the wreck of the Novorossiysk battleship happened in the bay by Sevastopol on 29 October of 1955. Although assumption of sabotage was least probable (even now), to write off such danger was impossible. The divers of counter underwater warfare support required a weapon capable of undersea firing.

The 5.66mm APS assault rifle and 4.5mm SPP-1 pistol designed for this purpose are of particular interest in the range of underwater weapons due to unusual engineering solutions.

Despite the advantages of the systems, a significant shortcoming with them is ineffectiveness when firing on land. In addition, it must be noted that life of the APS assault rifle when firing on land is just 180 shots. Therefore, special forces going on a combat mission both underwater and on land, had to take two weapons: undersea for water and regular for surface combat.

Modern marine special forces are multifunctional because they mostly comprise universal combat divers capable of performing any tasks: underwater sabotage in enemy's seaports, protection of water areas against

enemy underwater swimmer saboteurs and while doing so, act as normal scout saboteurs on land. Russian and foreign experience of using by such units confirms that they fulfill their tasks on land in 80-90% cases. Therefore, such units required to have special multipurpose (underwater and above water) in-service weapon, a sort of universal amphibious rifle. Its firing effectiveness (accuracy, grouping, armour penetration), however, must equal the 5.45mm AK-74 assault rifle on land and 5.66mm APS assault rifle under water.

In 2007, KBP Subsidiary TsKIB SOO completed its development work on the 5.45mm ADS special amphibious assault rifle, designated as ADS that solved the problem of firing under and above water.

The objective of developing the ADS assault rifle was to create a special amphibious assault rifle and special underwater cartridge to replace

the in-service APS assault rifle as a combat weapon for special forces of the Russian Navy.

The assault rifle is designed for enemy manpower engagement and fire weapon neutralization: on land — when firing assault rifle with any standard 5.45x39mm cartridges and underbarrel grenade launcher with standard 40mm VOG-25 and VOG-25P rounds; under water — when firing special underwater 5.45x39mm cartridges.

It was made possible by developing a new underwater cartridge with the same overall dimensions as standard land cartridges. The ADS special amphibious assault rifle with integrated underbarrel grenade launcher features bull-pup layout that enables shorter assault rifle length in comparison to conventional layouts (with the same barrel length), enhanced manoeuvrability, better balance and eliminates unfolding/folding of the buttstock.

Forward ejection of fired cases with sealed receiver reduces gas contamination at shooter's face, prevents from injuring by a case when working in a group, also (unlike sideward ejection) makes it possible to fire by a left or right-handed shooter without swapping any parts. Use of impact-resistant plastic, special materials and coatings contributes to enhanced corrosion resistance and lower weight of the weapon. A gas regulator added to the gas system enables to switch between "water" and "air" gas operation.

At present, the ADS assault rifle is being tested by marine special forces subunits of the Northern, Black Sea and Pacific fleets of Russia. It has been positively evaluated by the units employing it for its versatility and compact size. For the first time in global practice, one weapon allows the combat diver to perform missions under water and on land.



PALMA from Russia

To Defeat All Types of Air Attack Weapons

PALMA designed to defeat all types of air attack weapons, including antiship missiles flying at low and extreme-low altitudes at close approaches to the carrier ship. System SOSNA is intended to protect army units in any form of combat including on the march against all types of air attacks and reconnaissance means diving and flying at low and extreme-low altitudes.

Combined armament consisting of specially de-signed SOSNA-R high-speed precision-guided laser beam riding missiles and two AO-18KD rapid-fire cannons. This combination provides for a layered air defense against the adversary's air attack weapons in the area of responsibility of the system. Unique specially designed multi-channel automatic all-weather day/night optoelectronic control system of high precision. Armament and surveillance and target designation radar are installed directly on artillery mount on "the same axis" to exclude the errors caused by ship strains. Automatic, semi-automatic and inertial operating modes.

SOSNA's system construction is based of new small-size highly effective air defense guided missile and new high-precision ECM-protected optronic control system. The missiles and optronic control system are installed on the turning unit (mount) with gears for lay-

ing of two packages of missiles in containers. 12 SAMs are ready to launch and placed compactly enough on a launching mount owing to small weight and dimensions of missiles. The turning part is made as firing compartment which can be mounted on various carriers (load-carrying capacity more than 3.5 tons).

Structurally the firing module is comprised of an artillery mount with gear system and optronic control system. As armaments of firing models are used two AO-18KD rapid-fire modernized cannons guns with linkless ammunition feed, increased projectile muzzle velocity and with essentially increased service life, and also highly effective eight SOSNA-R light hypersonic SAM.

SAM SOSNA-R has two stages and consists of march stage (shell) and droppable solid-propellant low smoke booster that has short working time. The missile has canard configuration and two-channel aerodynamic guidance configuration that is realized by two pairs of orthogonal aerodynamic control surfaces. SOSNA-R missile is deployed in a launcher container. It is maintenance-free. The missile is launched for the container.

The missile is rolling during the flight. Initial rotating is received during its movement inside the container, during the flight the rotating is continuing due to wing unit. To control the rolling missile, gyroscope meas-

ures missile attitude position by list. The combined control system is used for missile guidance. On launching trajectory — a smoke-protected radio command system that is function in radiolocation mode. At High-precision guidance of march phase is realized in laser information field received by photodetector that is installed in the missile back end. The missile munitions includes blast warhead, rod-fragmentation warhead, impact fuse and

laser noncontact target sensor with continuous radiation.

The optronic control system of PALMA ADMGS ensures the target detection, automatic acquisition, tracking, measuring of angular coordinate and distance, and also laying of an information field of laser-beam control channel to the target at any time in the conditions of jamming and natural noise.

Optronic control system consists of gyro-stabilized platform with two-channel stabilization and guidance system, TV system, thermal imaging channel, thermal imaging channel of missile direction finder, missile control laser-beam channel, laser range finder, digital computer, automatic control unit for target and missile acquisition and tracking, stabilization and guidance system equipment, display and control equipment.

Main advantages of PALMA ADGMS:

1. Combination of high combat performance, rather low cost and jamming immunity, hiding operations, impossibility of the system destruction by antiradar missiles.
2. High firepower attained as a result of a merger of two factors: short flying time of the missile to the target and the ability of the gun mount to conduct rapid fire.
3. PALMA ADMGS and SOSNA ADMS have two common structural components: SOSNA-R SAM and Optronic control system.



To Win at Any Latitude

The Masterpiece of High-Precision Weapons — Pantsir-S1

Nowadays and in the near future Pantsir-S1 ADMGS fully satisfies all requirements for successful fighting modern air threats. Appropriateness of the implemented technical solutions and high performance specifications of the Pantsir system were proved by acceptance trials and State Tests, more than 500 SAM launches were performed, serial production is established. For several years already Pantsir combat vehicles march down the Red Square as a participants of the Victory Day Parade, to demonstrate the power of innovation of Russian weapons.

The analysis of the latest local conflicts shows that high-precision air assault weapons along with unmanned aerial vehicles are of primary importance among air threats. The large number and high density of air threats in an air strike require the air-defence assets to provide not only high combat performance but a large ready-to-fire ammunition load and capability of its quick replenishment.

Nowadays and in the near future Pantsir-S1 Air-Defence Missile-Gun System (ADMGS) fully satisfies all requirements for fighting modern air threats thanks to the specific features of its design: combined missile and gun armament that allows to create an entire engagement zone of up to 20 km in range and up to 15 km in altitude; jam-proof multimode and multispectral radar-optical control system operating in decimetric, millimetric and infrared wavebands; automatic operation; capability to fire on the move and from short stops; short reaction time of 4-6 sec due to automatic tracking of up to 20 targets by a search radar and high-precision target designation (0.3° in azimuth, 0.5° in elevation, 60 m – in range) providing for quick fine search and target lock-on by multifunction tracking radar and optronic system; self-contained combat operation and coordination of actions within a battery; simultaneous firing against four targets within a sector of ±45° in azimuth and elevation.

Pantsir-S1 high performance specifications make an AD system equipped with it significantly superior over the SHORAD systems manufactured worldwide. Pantsir-S1 underwent a large scale of live tests and proved its high performance in various conditions of combat use.

Development of the Pantsir-S1 ADMG system adapted for a wide range of Customers required solving a number of scientific and technical challenges.

Among them are: layout and structural challenges to ensure modular design of the system; development of the new multifunction radar for target and missile tracking; communicational integration of the Pantsir-S1 into Customer's Armed Forces; development and integration of IFF system customized for the particular Customer; development of automated day/night all-weather control system common in terms of instrumentation and featuring customized settings and combat operation algorithms according to the Customer's requirements; development of common ammunition load for customized variants of the system, unified SPTA and training systems.

Great R&D experience of the company provided for successful coping with all challenges and allowed designing and developing of an air-defence missile-gun system that meets the highest tactical and technical requirements and doesn't have counterparts within the spectrum of SHORAD systems.

A novel approach in designing the Pantsir-S1 system as a modular structure pro-



vides for its installation onto various chassis including tracked one as well as for creation of stationary and sea-based variants of the system (for protecting sea oil platform, vital administrative, military-tactical and other objects), for installation of the system onto railway platforms, ensuring its integration into Customer's existing maintenance, training and logistics systems with minimum cost. The said approach also provides for development of the system variants taking into account particular geotopographical conditions in which the system is to be used by the Customer.

Moreover, the modular design of the system ensures its capability to be upgraded in future in terms of increasing its combat efficiency with minimum cost that undoubtedly raises its commercial interest for the Customer.

Outfitting Pantsir-S1 system with the multifunction tracking radar ensuring tracking of three targets and transmission of control commands to four SAMs provided for efficient counteraction against a wide range of air threats: fixed and rotary-wing aircraft at stand-off ranges, small-size guided missiles and bombs as well as remotely piloted UAVs.

Thanks to development of a single multimode and multispectral radar-optical control system operating in dm, mm, and IR wavebands, featuring a multifunction tracking radar as one of its components, high jamming immunity of the system was achieved and, as a consequence, drastic increase of combat efficiency was obtained.

Current practice of using air-defence missile-gun systems sets forth very strict

requirements on their absolute informational integration into Customer's existing AD system.

The said requirements are determined by the following factors:

- mandatory availability of the same target environment at all levels and all components of a common air-defence system;
- complicated geotopographical conditions dictate the necessity of flexible target distribution both between combat vehicles (CVs) within a battery and within a common air-defence system;
- continuous growth of high-precision weapons and UAVs among air threats imposes a specific requirements to the use of anti-aircraft systems consisting in capability of combat vehicle operation without radar emission getting the required data from neighboring CVs and remote search radars.

Availability of mapping computer with digital maps ensures efficient automatic planning of combat actions taking into account particular geotopographical conditions of the Customer.

The task of protecting the transmitted data from jamming was successfully solved. When a command post is used as a part of the system an increase in data transmission range (up to 20 km) is obtained and interfacing with all types of Customer's existing command posts is provided without major modifications.

Adherence to modular concept was applied not only to design of the system but to its software as well. That was the way to solve the issues of integration into IFF system existing with each of the Customers. The

issue of upgrading the IFF system in case the Customer's decision to change it was also worked out.

The use of the self-contained day/night all-weather control system significantly increases engagement zone in all conditions, reduces psychophysical load on the crew, minimizes human factor in tough and strained combat environment.

The following specific problems were solved for the particular Customers:

- search radar operation without false tracks in conditions of complicated terrain pattern;
- targets detection over water and even desert surface;
- determination of optimum frequency-spatial separation to provide electromagnetic compatibility, within the existing AD system as well, taking into consideration particular topographical pattern of the Customer;
- integration into Customer's existing IFF system;
- minimizing of time required for shaping of search and track zones by a topographic map (with limited resolution in azimuth) thanks to the use of built-in mapping computer and digital maps of the particular Customer;
- integration into Customer's existing air-defence system and creation of a potential for AD system development basing on the combat actions control principle implemented in Pantsir-S1 ADMGS;
- implementation of various ways of SAMs destruction ensuring safety of their use according to Customer's requirements:
 - a) air-blast initiated by a command on climb trajectory;
 - b) air-blast initiated by a command on dive trajectory;
 - c) dive trajectory without air-blast, destruction by ground impact.

Modular structure, unification of units and assemblies design ensure successful integration into Customer's existing chassis maintenance system, supply of maximum unified individual, common, and base-stored SPTA kits, arrangement of service centers and crews training system.

Constant combat readiness of the Pantsir-S1 system is ensured by built-in test equipment in each combat and maintenance vehicle.

Modular design allows to develop various variants of the system and install it onto a range of chassis as well as to develop its stationary modifications. The system can be installed onto lightly armoured vehicles and can be used as lethal air-transportable AD asset. It can also be mounted on wheeled and tracked chassis in Air Force Air Defence Units and on Navy ships.





HIGH-TECH EXPORT

BRIEFLY

9 MM SPECIAL ASSAULT RIFLE AS

The 9 mm assault rifle AS is intended for noiseless and flameless shooting. The automatic reloading is based on the work of powder gases. The assault rifle is intended to engage the enemy manpower protected with bulletproof jackets and the non-armored vehicles. The design features of the assault rifle are: high characteristics in the accuracy of fire and closely-grouped fire are achieved due to original design of the assault rifle barrel; the high hitting is guaranteed due to the subsonic velocity of a bullet; making single and automatic shots; the folding metal buttstock and the quick detachable silencer make it possible to reduce assault rifle dimensions; mounting seats for optical and night sights; absolute harmless handling is guaranteed with safeties. The advantage of the assault rifle is a detachable double-column sector-type magazine with the cartridges located in a chess-board order and interchangeable with VSS and AM magazines. It fires the 9-mm armor-piercing cartridge SP6 or 7N12 and 9-mm sniping cartridge SP5.

9 MM SMALL-SIZE ASSAULT RIFLE AM



The 9 mm small-size assault rifle is intended to engage the enemy manpower wearing bulletproof jackets as well as the non-armored vehicles at a distance of 200 m. The automatic reloading is based on the work of powder gases. The design features of the assault rifle are: the magazine quick "ejection" mechanism; the metal folding buttstock reduces the overall dimensions and allows to deliver aimed fire with folded or non-folded stock; the assault rifle dimensions are the same as a submachine gun has but the firing range and hitting effect of the assault rifle are considerably better. The advantage of the assault rifle AM is a detachable double-column sector magazine with the cartridges located in a chess-board order and interchangeable with magazines of the AS and VSS firearms. The 9-mm armor-piercing cartridge SP6 and 9-mm sniper cartridge SP5 are used for shooting.

ANTI-TANK GUIDED MISSILE 9M113M



The missile is intended to engage modern vehicles equipped with the explosive reactive armor, fortified fire emplacements, both moving or stationary surface and afloat targets, low flying helicopters at any time and weather conditions. The operating temperature range is from -50°C to $+50^{\circ}\text{C}$. The missile may be launched from a combat vehicle or remote launcher. The control of the missile is semi-automatic, the commands are transmitted over the wire communication line.

Russian «Verba»

The Best Shoulder-Launched Surface-To-Air Missile

«Verba», the Russian man-portable air-defense system (MANPADS) of the new generation, is a unique and second-to-none design. «Verba» has been developed by the «Engineering Design Bureau» (KBM). The «Verba» MANPADS was unveiled at the Army-2015 International Military-Technical Forum in Kubinka (Moscow region, Russia) last fall. Due to its performance and capabilities, this MANPADS is superior to all comparable foreign counterparts in use.

The man-portable air-defense system is intended to be fired by one person. «Verba» is a further development of the well-known «Igla-S» system. Even though the new MANPADS looks similar to its predecessors, this is a fundamentally different weapon with new performance. «Verba» can successfully engage not only traditional air targets – aircrafts and helicopters – but also targets with low thermal radiation, such as cruise missiles and drones.

Its differences from the predecessor are substantial. For the first time, the multispectral optical heating-seeking head (the three-spectrum seeker) is used.

Three sensors constantly recheck each other, which enables faster discrimination between

appropriate targets and decoys, and decreases the chance of disruption from countermeasures. The seeker automatically "selects" decoys and concentrates on the proper object, even though its thermal radiation is lower. However, this in an object to engage. The sensitivity of the seeking head is increased eightfold. The track initiation and air engagement area increased respectively, namely by 2.5 times compared to the «Igla-S» MANPADS of the previous generation. The system is equipped with the «Maugli-2» night sight. The new engine of the missile enables the shooter to hit a target at a distance of 6 kilometers. The minimum engagement altitude is 10 meters; the maximum engagement altitude amounts to 3.5 kilometers. The weight of the launch installation with a battery and a loaded missile only amounts to 17.25 kg.

Those are second-to-none defense technologies. According to Valeriy Kashin, General Designer

of KBM, the missile is "completely digital" and hermetically sealed. The materials used for its production are not sensitive to aggressive media. In flight, the missile is controlled off-line. The self-guidance system has been designed in such a way that the missile can deceive the missile protection system of the targets. The shooter only has to pull the trigger. The missile will do the rest. The identification friend-or-foe system significantly reduces the risk of shooting down the friendly aircrafts.

The «Verba» MANPADS can be fired not only while held on one's shoulder. It is intended to mount «Verba» on ships and helicopters. From the very beginning, the «Verba» MANPADS was developed with consideration for an opportunity to use it on "another armored vehicles". What vehicles? It only remains to be seen.

In its tactical and technical characteristics, the «Verba» MANPADS is superior not only to the Russian systems such as «Igla-1», «Igla», «Igla-S» currently accepted into service but also to its foreign counterparts such as the American «Stinger-Block-I» and the Chinese «QW-2». «Verba» is superior to the American MANPADS in all indices.



Pecheneg and Others

Submachine-Guns to Precision Missiles

The Degtyaryov Plant equips the navies, air forces and armies of 17 countries all over the world. The facility's products range from submachine-guns to precision missiles. What makes this diversity of weapons similar is that whatever sees the light of the day thanks to the efforts and talent of Degtyaryov's team always hits the target.

7.62 mm Pecheneg machinegun

The major modernization of the PKMs pawned a new 7.62 mm machinegun designated as Pecheneg. The emphasis was made on achieving greater density of hits, longer service life of the barrel, and improving performance. Required were measures to get rid or compensate partially accuracy degrading factors. These include barrel vibration, heat induced ballistic performance degradation, and mirage caused by barrel heat in front of the sight (optical sights are particularly affected). The new weapon proved to be a powerful fire support asset in infantry units combining the power of a medium machinegun and flexibility of a light machinegun. The 7.62 mm machinegun that was adopted by the Armed Forces was designated as Pecheneg (6P41) Kalashnikov Infantry Machinegun. Its derivative compatible with a night sight received another index – 6P41N.

The special design of the barrel assembly and jackets that were introduced to it made

the barrel more rigid, improved its cooling properties, protected the assembly from weather impact, reduced vibration, and protected the line of sight from heat mirage. A slit between the jacket and surface of the barrel, ribbing, and ejector at the muzzle provide forced air-cooling evenly over the barrel part.

RPG-7D3 light anti-tank weapons system

The year of 2011 marked the 50th anniversary of the RPG-7, but the weapon is still among the best AT systems in close combat. The Americans in Iraq and Israelis in Lebanon in the summer of 2006 lost a great number of their tanks, including recently developed, to RPG-7 grenade launchers used by their enemies. Its specific feature is that it was the first among light anti-tank weapons (LAWs) to adopt the rocket-propelled solution for grenade launching.

While the system was developed at Bazalt, the RPG-7 originated at the OKB-575 design bureau in Kovrov. Its mass production was also set up there. Its effectiveness, reliability, and simplicity in operation earned the RPG-7 fame across the globe and contributed to its proliferation.

New technologies nudged our designers to look into ways of boosting LAW capabili-

ties. A range of new rounds for the grenade-launching system made it effective not only against armored equipment, but also exposed infantry of the enemy, his personnel in buildings and field shelters. The weapon also poses a threat to enemy's ammunition and POL depots.

New projectiles for the RPG-7V, with greater weight and ballistic features changed to a certain extent, required the weapon to be upgraded. For better handling properties, the RPG-7 got a removable bipod. Its sighting devices also needed some work on them: the optical sight, dubbed PGO-7VZ, as well as iron sights received a new range dial.

12.7 mm 6S8 sniper system

One of the products developed most recently at the Degtyaryov Plant is the 12.7 mm 6S8 (6S8-1) sniper system. It is a special weapon designed to destroy lightly armored and soft equipment, personnel of the enemy regardless of whether they have their personal protection gear on, single and group targets, and technical assets at a range of up to 1,500 m. The system is also effective against enemy's snipers. The 6S8 consists of the 6V7 sniper rifle, 7N34 sniper rounds, 1P71-1 optical sight, and 1PN111 night sight. The 6S8-1 has no night sights. Unlike previously designed Russian rifles for snipers that are automatic, the 12.7 mm 6V7 is loaded manually.

This improves density of hits. To minimize the size of the rifle, its long barrel notwithstanding (1,000 mm), the designers adopted for it the bullpup configuration. Never before had this solution been used in large-caliber sniper weapons. The 6V7 is also lighter than its foreign counterparts, whose weight is above 20 kg and sometimes 30 kg, for example, rifles produced by South Africa's Truwello and Denel. The shorter barrel of the American Barrett M107 does not help, leaving it heavier and bigger than the Russian 6V7.



Against Any Tanks

The best in the world Kornet-EM multipurpose missile system

As of today the 3rd generation Kornet-E portable/portable laser beam-rider system developed by KBP and adopted in 1998 is the weapon definitively complying with the concept of advanced ATGW, being state-of-the-art specimen of multipurpose tactical short range weapon system allowing engagement of virtually any small-size target within the system's line of sight. Aiming for further enhancement of Kornet-E ATGW combat capabilities, KBP Instrument Design Bureau developed a new multipurpose missile system — Kornet-EM.

Antitank guided missile systems (ATGM) have been developed and produced globally for already half a century. Since then they became the most popular and wanted type of high precision weapons (HPW) thanks to their usability and relatively low cost. A future ATGM system must be a versatile defensive-offensive guided weapon, whose portable and combat vehicle transportable modifications ensure a wide range of applications in close range tactical zone in various combat environments.

The weapon is designed as an automatic combat system, incorporating, besides the firing unit itself, both reconnaissance and control assets, and ensuring full automation of all combat operation constituents – target detection and distribution, issuing and processing of target designation, missiles' guidance. The operator's task within such system is limited to supervision of its proper functioning and launch of missiles.

The open architecture of the system in terms of data exchange with higher-rank and peer units along with its combat capabilities makes it a vital element of Army network-centric system.

Kornet-EM multipurpose missile system provides for engagement of modern and future tanks, various fortifications (pillboxes, bunkers) and low-velocity aerial targets (helicopters, assault aircrafts and UAVs) in day&night and adverse weather conditions under enemy ECM and optical jamming at ranges up to 8-10 km.

The Kornet-EM system comprises:

- combat vehicle with two automatic launchers and operator's panel with a display;
- battery commander's reconnaissance and control vehicle, equipped with combined surveillance system including TV, IR and radar reconnaissance aids, navigation, communication and data exchange systems, automated control suite and weapon system (Kornet-EM ATGM and PKTM machine-gun),
- guided missile with HE warhead with impact and proximity fuses and firing range of up to 10 km;
- an antitank guided missile with a maximum firing range of 8000 m and shaped charge warhead armour penetration of 1100-1300 mm which enables the Kornet-EM system to engage modern and future tanks bearing in mind the tendency to growth of their armour protection.

Due to implementation of state-of-the-art but, however, low cost technical solutions, Kornet-EM acquired a number of new features, allowing significant broadening of its combat capabilities to counter both conventional ground targets, as well as non-inherent to this class of systems ability to engage low-velocity aerial targets:

- the use of computer vision along with automatic target tracker makes it possible to exclude an operator from missile guidance process and in fact implements the "fire-and-forget" principle, thus giving a 5-times increase in accuracy of target tracking during real combat.

- engagement of targets in automatic mode reduces psychophysical stress to operators, requirements to their skills and duration of their training.

- automation of guidance process along with automated target detection and distribution, target designation commands generation and processing result in virtually fully automatic combat system, limiting the operator's task to supervision of its proper functioning and launch of missiles.

- combat vehicle with twin-launcher ensures simultaneous salvo firing at two targets, thus significantly increasing the system's firing rate and number of targets handled and at the same time allowing two-fold reduction of combat assets required to complete a mission. Such performance specifications endow Kornet-EM with the highest target handling capability among similar existing and future systems - min. 3-4 targets per minute at ranges up to 5 km. Thus, in case the weapon systems are positioned at a stand-off range from enemy tanks (more than 4 km) a single Kornet-EM battery of 9 combat vehicles is able to repulse an attack (i.e. destroy min. 50% of targets) of enemy tank (M1A2 class) battalion (58 tanks). Actually, such mission may be accomplished by two battery salvos, destroying 32-34 tanks, i.e. 55-60% of the battalion. The time required to accomplish the mission will not exceed 1 minute, allowing to avoid casualties, since the enemy tanks will not be able to reach their effective firing distance.

- new capability for ATGW – effective engagement of small-size aerial targets - reconnaissance and reconnaissance-attack unmanned aerial vehicles being the enemy's crucial and mass combat support tool, as well as helicopters and assault aircrafts.

UAV on a reconnaissance mission lets enemy well in advance disclose defence, give accurate target designation for firing over-the-horizon munitions, record and transmit information on army relocations both during operations near the line of contact with enemy and in the rear. This results in significant increase in casualties and possible failures of combat mission performance. From the point of view of engagement, UAVs are difficult targets due to low altitude of flight. Moreover, in case of mass application they are a teaser for the air defence assets, causing high consumption of expensive surface-to-air missiles.

Attack helicopters and tactical aircrafts are by now the highest threat for land forces, as they can inflict maximum damage in minimum time. For example, a helicopter is able to destroy a company of armoured vehicles (10-14 armoured vehicles) with one ATGM load.

To efficiently counter the UAVs, attack helicopters and tactical aircrafts the air defence assets should be available right in the combat formations, because attack or reconnaissance flights are performed at low altitudes, impeding due-time detection with medium and short range air defence systems which are usually stationed deep in the home front. Kornet-EM is the system able to efficiently accomplish low-velocity aerial threats repulsion tasks.

Another distinctive feature of modern combat operations is deployment of sophisticated surveillance and networking technologies in the tactical units. Wide application of



integrated surveillance aids (various combinations of optical, radar, TV and IR systems), sophisticated automatic assets of tactical units operation control, communication and navigation allows continuous monitoring of the battlefield, real-time reception of reconnaissance data (both from peer and higher level units) overlaid on the digital maps and automatic or semiautomatic generation and transmission of target&firing data to the fire units, thus, determining the efficiency of high-precision tactical weapons and ATGW employment.

Availability of surveillance systems providing detection of wide range of targets and automatic battery operation control aids is a vital need for Kornet-EM with its versatility of combat applications and ability to effectively counter aerial targets. Timely submission of aerial targets data to the fire units (Line Kornet-EM combat vehicles) directly influences both the efficiency of ATGW counteraction to aerial threats, as well as casualties in the units under air raid.

To provide operational surveillance/data exchange and control of Kornet-EM battery combat operation, a battery commander's surveillance&control vehicle is designed based on standard line Kornet-EM CV.

The Surveillance&Control vehicle is special-purpose unit combining both reconnaissance/control and fire unit functions.

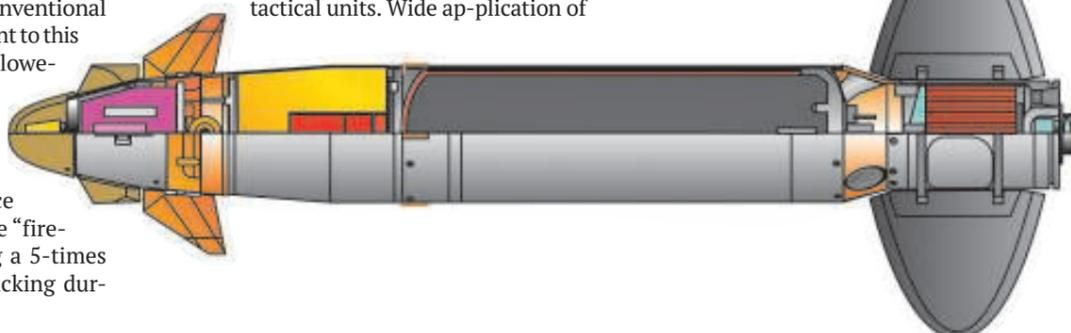
The control vehicle comprises:

- Integrated surveillance system featuring TV, IR and radar aids;
- navigation aids;
- communication and data exchange system;
- automated control suite;
- weapon system.

Employment of radar in the control vehicle allows target detection at ranges significantly exceeding the firing range of line combat vehicles weapon systems. This provides efficient control of Kornet-EM battery combat operation along with wide sector surveillance by Kornet-EM control vehicle.

Provided with such surveillance capabilities the task of the control vehicle limits to target detection, friend-or-foe identification and targeted distribution among the line vehicles in order to avoid multiple firing at a single target.

The battery commander's control vehicle capabilities by day/night time and under any weather conditions are the following:



- detection, identification and tracking of moving or stationary air and ground targets, automatic measurement, generation and processing of the detected targets' coordinates;
- friend-or-foe identification;
- generation and transmission of target designation data from the anti-tank battery commander to line combat vehicles;
- maintaining radio communication within the battery, as well as with higher-rank and peer unit commander's;
- real-time control of battery fire, relocation and firing pattern planning in case of changing deployment area with data overlaying on the digital map.

These capabilities allow:

- reduction of ground targets detection time for line combat vehicles – by 2-3 times at daytime and by 6-10 times at night (if compared to target search using IR sight), aerial targets – more than 10 times;
- automatic determination and firing primarily at the most threatening target;
- maintaining balanced target load on the combat vehicles to avoid multiple firing at a single targets by several vehicles;
- timely readjustment of battery firing pattern in case of casualties.

As a result, the Surveillance&Control Vehicle is able to double the combat effectiveness of Kornet-EM battery while countering enemy tanks attack in properly arranged defence formations, or increase it by 2.5 times in case of entering the combat (from march) without prior area survey and missing information about enemy forces.

In case of countering aerial threats (UAV, helicopters) the combat efficiency of ATGW battery will increase by 2.5-5.0 times due to reduction of target detection time and increase of detection probability.

MAIN PERFORMANCE SPECIFICATIONS OF THE SYSTEM

Firing range, m:	
• minimum	150
• maximum	10 000
Guidance system	automatic, beam riding guidance
Jamming immunity	high
Number of targets engaged simultaneously by a salvo	2
Armour penetration by shaped charge warhead, mm	1100-1300
TNT equivalent of high explosive war-head	7
Ammunition load, pcs including ready-to-fire missiles	16
Change-over from traveling to combat configuration, seconds	8
	7

BRIEFLY

9 MM SPECIAL SNIPER RIFLE VSS



The special sniper rifle is intended for noiseless and flameless shooting. The rifle is equipped with an optical sight also it is possible to install a night sight device. The automatic reloading is effected by the energy of powder gases. The firing and trigger mechanism of a striker type allows to deliver both single-shot and automatic fire. The sniper rifle features: the original design of the barrel allows to achieve high characteristics in the accuracy of fire and closely-grouped fire; the subsonic speed of a bullet and its high hitting effect; a silencer ensures noiseless and flameless shooting; a quick assembling into three parts makes it comfortable to carry the rifle secretly (in a special bag or case); the presence of safeties makes the rifle harmless in handling and prevents making any shots even if the trigger is accidentally pulled or the rifle is dropped or hit when the barrel bore is not locked. The advantage of the sniper rifle is the presence of a detachable double-column sector-type magazine with the cartridges located in a chess-board order and interchangeable with AS and AM magazines.

7,62 MM SPECIAL SELF-LOADING PISTOL PSS



The SSP is an individual weapon for the secret attack and defence also it is intended for noiseless and flameless shooting. It shoots CP4 cartridges at a range of up to 50 m. The reloading is carried out automatically with the aim of the blowback bolt recoil energy. The pistol has the firing and trigger mechanism that allows to fire with the full-cocking or self-cocking. The safety system prevents accidental shots even if the trigger has been accidentally pulled or the pistol has been dropped. The reliable work of the pistol is guaranteed in any climate conditions. The operating temperature range is from -50°C to $+50^{\circ}\text{C}$.

KALASHNIKOV 5,45 MM SHORT ASSAULT RIFLE

The Kalashnikov 5,45 mm short assault rifle with a folding stock is an exceptionally effective individual weapon for shooting in the conditions of limited space. The small size and high hitting capability make it possible to use the assault rifle in every extreme situation. The conventional (with a steel core), tracer and high-penetrating bullets are used for firing. The energy of powder gases is used to reload the assault rifle. The firing and trigger mechanism of a hammer type is capable of delivering both automatic and single-shot fire. The folding stock is very handy, the fire may be delivered from various positions. The assault rifle dimensions are considerably smaller with a folded stock. The magazine is detachable of sector type double-column with the location of cartridges in a chess-board order. The operating temperature range is from -50°C to $+50^{\circ}\text{C}$.

Optimal modernization of the Combat Module

Making in Russia BMP-2 can meet the latest modern requirements and military objectives

Many countries keep on upgrading the main fleet of their combat vehicles. In Russia, a BMP-2 mechanical module was selected as a basis for designing a uniform combat module weighing below 3 tons for upgrading Russian combat vehicles. Russian infantry fighting vehicle BMP-2, being the main combat vehicle of multiple countries' land forces, was adopted for service in 1980 and used to exceed most of its foreign counterparts in terms of combat capabilities. Nowa-days BMP-2 still basically meets the modern requirements.

Currently a huge fleet of such combat vehicles is in service both with the Russian army, as well as abroad. These vehicles have been produced for several decades and presently their weapon systems do not meet modern requirements. However, their life cycle is quite long and reaches 30-40 years. The light-weight category combat vehicles (IFV, air-borne assault vehicles, APC) are able to determine the combat potential of a country's armed forces due to their application versatility. Infantry fighting vehicles (BMP-1, BMP-2, BMP-3) and airborne assault vehicles (BMD-3, BMD-4) are the most common hardware of land forces and airborne troops.

The analysis of current state and development tendencies of weapons and fire control systems shows that BMP-2 weapon system is falling behind the modern level a number of parameters:

- guided weapon firing is possible from stationary position only due to wire command link of "Konkurs" anti-tank guided missile (ATGM);
- "Konkurs" ATGM has low penetration capability and is not effective against modern tanks like M1A2 "Abrams";
- "Konkurs" ATGM has low firing rate due to manual reloading of the launcher. Such reloading requires long time and besides that the loader may be injured by splinters or small arms fire;
- at night the system may fire only automatic cannon or PKT machine-gun at range not exceeding 800 m;
- the BMP-2 fire control system is not automated, i.e. it is lacking in onboard computer, modern sights, target auto-tracker, and does not allow for accurate firing, limiting the effective range of 30 mm cannon to 1100-1400 m. when firing on the move the system does not provide for required accuracy of line of sight stabilization due to BPK-2-42 sight rigidly bound to the weapon;
- 30 mm projectiles flat trajectory firing is not efficient against prone or entrenched manpower;
- firing at aerial targets carried out using center rings of 1PZ-3 sight, actually delivers only a psychological effect, since the typical aerial target hit probability is hardly one percent.

The firepower of a combat vehicle is determined by its weapon system, thus, the increase of combat efficiency may be achieved by weapon system modernization. BMP-2 has a high weapon system upgrade potential. The challenge of increasing the firepower of existing BMPs providing their superiority over other modern vehicles has been successfully met by KBP Instrument Design Bureau.

The upgrade was implemented on a serially produced BMP-2 turret with 2A42 automatic cannon (without changing the mechanical



module and turret internal layout). The design concept implies the following (Figure 1):

- mounting two "Kornet-E" ATGM launchers on the turret sides, each launcher equipped with independent electro-mechanical vertical drive and carrying two ready for fire missiles;
- replacement of standard BPK-2-42 sight with combined gunner's sight equipped with independent LOS stabilization system and incorporating optical, IR and laser rangefinding channels, as well as missile guidance channel;
- installation of onboard digital computer with sensors system;
- installation of TV-IR target auto-tracker;
- installation of 30 mm grenade launcher with independent electromechanical vertical laying drive and 300rds feed magazine;
- installation of commander's panoramic sight with independent LOS stabilization system and incorporating optical and laser rangefinding channels;
- installation of high-precision digital weapon stabilizer.

The weight of add-on equipment installed does not exceed 500 kg, including around 260 kg of extra ammunition: 30 mm grenades and ATGM.

The specifications of upgraded BMP-2 with new B05Ya01 combat module are given in Table: due to introduction of day/night FCS the system provides accurate firing with all types of weapons, including guided, at moving and stationary targets, round-the-clock engagement of all types of targets from stationary position, on the move and afloat at the range up to 4000 m with automatic cannon, up to 2100 m with automatic grenade launcher, up to 5500 m with 9M133-1 ATGM. Besides, 9M133M-2 ATGM with tandem shaped-charge warhead and 9M133FM ATGM with HE warhead and 9M133FM-3 ATGM with HE warhead and proximity fuse, recently designed by KBP, allow firing at range up to 8 km.

"Kornet-E" ATGM penetration capability, increased up to 1100-1300 mm, allows reliable engagement of modern advanced tanks fitted with add-on ERA («Leclerc», «Abrams», «Leopard»). Besides, HEF warhead of the missile is able to destroy concrete fortifications and strongpoints. Due to stand-off range targets engagement capability the upgraded BMP-2 are sure to prevail in combat with enemy tanks and IFVs.

The improvements implemented in "Kornet" ATGM (9M133M-2, 9M133FM-3) provide for considerable enhancement of its performance without increasing weight and dimensions. These improvements ensure: destruction of modern and advanced tanks taking into account their armour protection growth tendency; engagement of any armoured vehicle at stand-off range; engagement of low altitude assault and reconnaissance aircrafts (including drones);

- installation on two stabilized launchers of BMP-2 ICV of four ready-to-launch guided missiles significantly increase fire rate when firing ATGMs. This rules out the necessity to reload the guided missile launcher during the combat, which increases the survival potential of the crew and of the entire combat vehicle, since stopping of a CV for ATGM reloading during a combat makes it a perfect target;
- implementation of TV-IR-auto target tracker enables to increase the accuracy of target tracking 3-6 fold in comparison with manual tracking. The human is excluded from aiming circuit, the results of aiming become independent on psychophysical state of the gunner, which is dramatic in stressful battlefield environment. Accurate target tracking becomes a granted technical specification, which enable to decrease the requirements towards the gunner training level and reduces the training period of the gunners. Automatic target tracker adds the FCS a qualitatively new feature, putting to life the "fire-and-forget" principle when firing a guided missile. At the same time the missile cost is significantly lower than that of a missile with a seeker which fulfils the function of the auto-tracker;
- the possibility of KORNET ATGM launch in an elevated mode (above bore sighting line) almost excludes the possibility of detecting the missile by the enemy;
- laser guidance mode of the ATGM with orientation of the missile within the laser beam provides for high jamming-immunity against all types of active jamming, since the jammer cannot be behind the ICV and send the same encoded messages;
- to overcome systems of targets' active protection and to provide for guaranteed engagement of crucial targets salvo launch of 2 ATGMs riding on one laser beam is provided.

Robotization of the Army

VNII Signal JSC: UGV Research and Development

Over the last two decades the robotization of the arms and military equipment has become both the key issue of science and technology development, and one of the main ideas in the new approaches to military forces formation, their combat use, and the development of warfare techniques and support means. This is the case for other state power structures, because the development of their materiel is impossible without robotic techniques application.

Both Russian and foreign experience in R&D of the advanced arms and military equipment confirms that the successful development of military and special-purpose robotic equipment is provided by the availability of the well-timed groundwork, which is the basis of advanced design and manufacturing, and actually is a bundle of prospective innovations to support the development of advanced robotic systems. The implementation of such kind of innovations provides the solution of brand-new military and engineering, and special-purpose tasks and also a considerable improvement of performance characteristics of robotic systems. Scientific and engineering groundwork in the sphere of military and special-purpose robotic equipment may be treated as a bundle of potential innovations (or new developments) that can provide the design of advanced military and special-purpose robotic systems under certain conditions (the availability of certain approvals of the state and military agencies, manufacturing and economic opportunities both of the state as a whole and of the certain enterprises, etc.). The implementation of such kind of innovations provides the solution of brand-new military and engineering, and special-purpose tasks and the considerable improvement of performance characteristics of arms, military and special-purpose equipment.

VNII Signal JSC has great experience in the development of the following systems and articles for arms and military equipment: Automated fire and combat control systems for artillery units; Automated fire and laying control systems for firepower; Topographic precise positioning and navigation systems; Laying and stabilization systems.

UGV research and development is one of the newest fields of activities of VNII Signal JSC. Within this field of activities the following R&D topics are specified: Research on robotic system design; Design of robotic systems for health services; Design of remote-controlled mine clearing robotic systems; Design of remote-control station to control special-purpose heavy fire-fighting vehicles; Research on the development of robotic systems on the chassis of full-track armored vehicles; Design of mobile biomorphic robotic systems.

Within the research on the design of robotic systems, the research on the design of a mobile reconnaissance robot of artillery battalion to improve reconnaissance efficiency of land tactical units has been undertaken.

A robotic system to provide detection, recognition, and friend/foe identification, first aid treatment and medevac from the battlefield to the friendly lines was designed within the R&D of robotic systems for health services.

The robotic system provides: Remote control and unmanned operation mode of the armored medevac vehicle; Remote control of both external detachable and medical equipment; Remote monitoring of technical state of the main components and assemblies of the chassis; Day/

night operation; Maximum number of the wounded men to be shipped — 2 persons.

Within the R&D of a remote control station (RCS) for heavy special-purpose fire-fighting vehicles, a heavy multipurpose full-track armored robotic system on the chassis of a special-purpose fire-fighting vehicle (FFV) is under development.

The RCS is intended to perform remote control of a special-purpose FFV to: Provide search and location of fire hotbeds and fires in the day-time and at night, under adverse weather conditions, and also through smoke and dust; Clear passages through debris during terrain clearance; Make fire breaks during forest fire; Extinguish fire and perform recovery operations in arsenals and depots of missiles and ammunition.

The objectives of the research on the development of robotic systems on the chassis of full-track armored vehicles are as follows: The development of the proposals and scientific and engineering groundwork on the basis of the advanced engineering and information techniques; The development of the scientific and engineering groundwork and engineering solutions to design a medium range multipurpose robotic system for combat, reconnaissance, engineering and logistic support on the basis of advanced engineering and information techniques with the ability of its further transformation into other types of robotic systems; Design, manufacturing and testing of an experimental model of a medium-range multipurpose robotic system.

The tasks are as follows:

- To analyze the R&D status of combat and special-purpose UGV in Armed Forces of the Russian Federation, EMERCOM, FSS and MIA in Russia and abroad;
- To analyze the application areas of UGV for combat, reconnaissance, engineering and logistic support;
- To specify the list of main tasks for UGV for combat, reconnaissance, engineering and logistic support in armed forces and in unconventional units;
- To perform research on the design of basic intelligent, mathematical, information and program software;
- To perform research on several UGV for combat, reconnaissance, engineering and logistic support designed for armed forces and unconventional units;
- To provide design, manufacturing and testing of an experimental model of a multipurpose robotic system.
- To prepare drafts of requests for proposals for the design and development of mobile robotic systems.

UGV hardware versions are as follows:

- Reconnaissance robot;
- Fire support robot;
- Mine detection and demolition robot;
- Medevac robot;
- Munitions resupply robot;
- Engineer reconnaissance robot.

Within the design of mobile biomorphic robotic systems, medium and light UGV for defense and business activities in moderately rugged and tough terrain, and in a demolished city and industrial infrastructure, are under development.

The objective of the work is the development of medium and light mobile biomorphic robotic systems for defense and business activities in moderately rugged and tough terrain,

and in a demolished city and industrial infrastructure.

The advantages of walking robots are as follows:

- High mobility through rough terrain, mountains, forests, debris of city and industrial infrastructure;
- High maneuverability providing UGV movements in any direction and spot turn operations;
- Passing ability through soft ground;
- Small-size surface contact patch;
- UGV height adjustment capability / sinking to the ground;
- Hill climbing (up to 45 angular degrees);
- Capability to step over the obstacles.

Possible application areas are land forces, airborne troops, EMERCOM, Ministry of Internal Affairs, anti-terror special force units, industries with hazardous jobs.

Two UGV versions are offered in this work: 400 kg mobile biomorphic robot; 100 kg mobile biomorphic robot. UGV version depends

on its intended use, that is: Reconnaissance robot to provide fire defeat of adversary in the daytime, at night and under severe weather conditions, in the moderately rugged and tough terrain, and in a demolished city infrastructure; Reconnaissance robot, fire support of artillery units, laser target illumination when using high-precision munition; Munition resupply robot in moderately rugged and tough terrain, and in a demolished city infrastructure; Medevac robot; Robot for mine detection and minefield lane marking.

Nowadays there are two main trends in robotic automation development in Russia and abroad: The design of multipurpose remote control equipment kits (packages) to be installed on standard arms and military equipment to provide their unmanned combat, special-purpose and support operations; The design of robotic systems to provide combat, reconnaissance, and support operations on various chassis types.

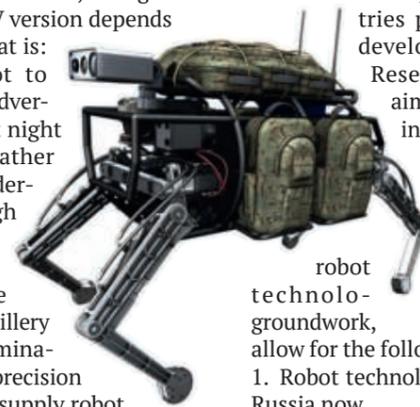
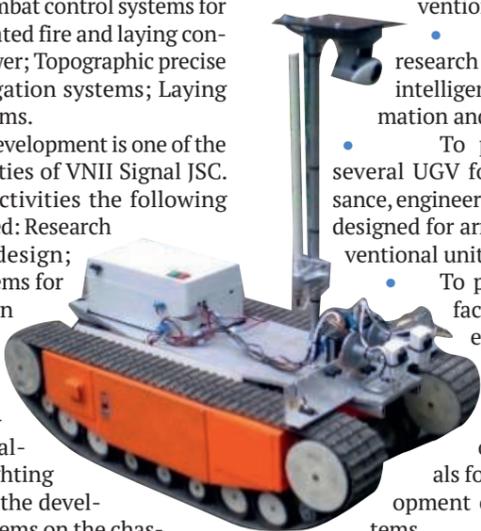
VNII Signal JSC supports the first approach as the most cost-effective and time-saving one. VNII Signal JSC has developed a multipurpose hardware/software system of remote control. This multipurpose hardware/software system of remote control comprises the following components: Central computing system; Communication and data transfer system; Power supply system; Motion control system; Computer vision system; Topographic precise positioning and navigation system; Payload, which can comprise weapon station, reconnaissance equipment, mining/demining equipment, medevac equipment.

The system can be used on-board combat and engineering vehicles on standard and advanced full-track chassis to provide remote- and programmed controlled operation with the ability to return to crew-controlled operation.

The analysis of the available information shows, that leading foreign countries pay great attention to the development of combat robots. Research work in this area is aimed at step-by-step improving of performances of remote-controlled vehicles and gradual elimination of the operator's control functions.

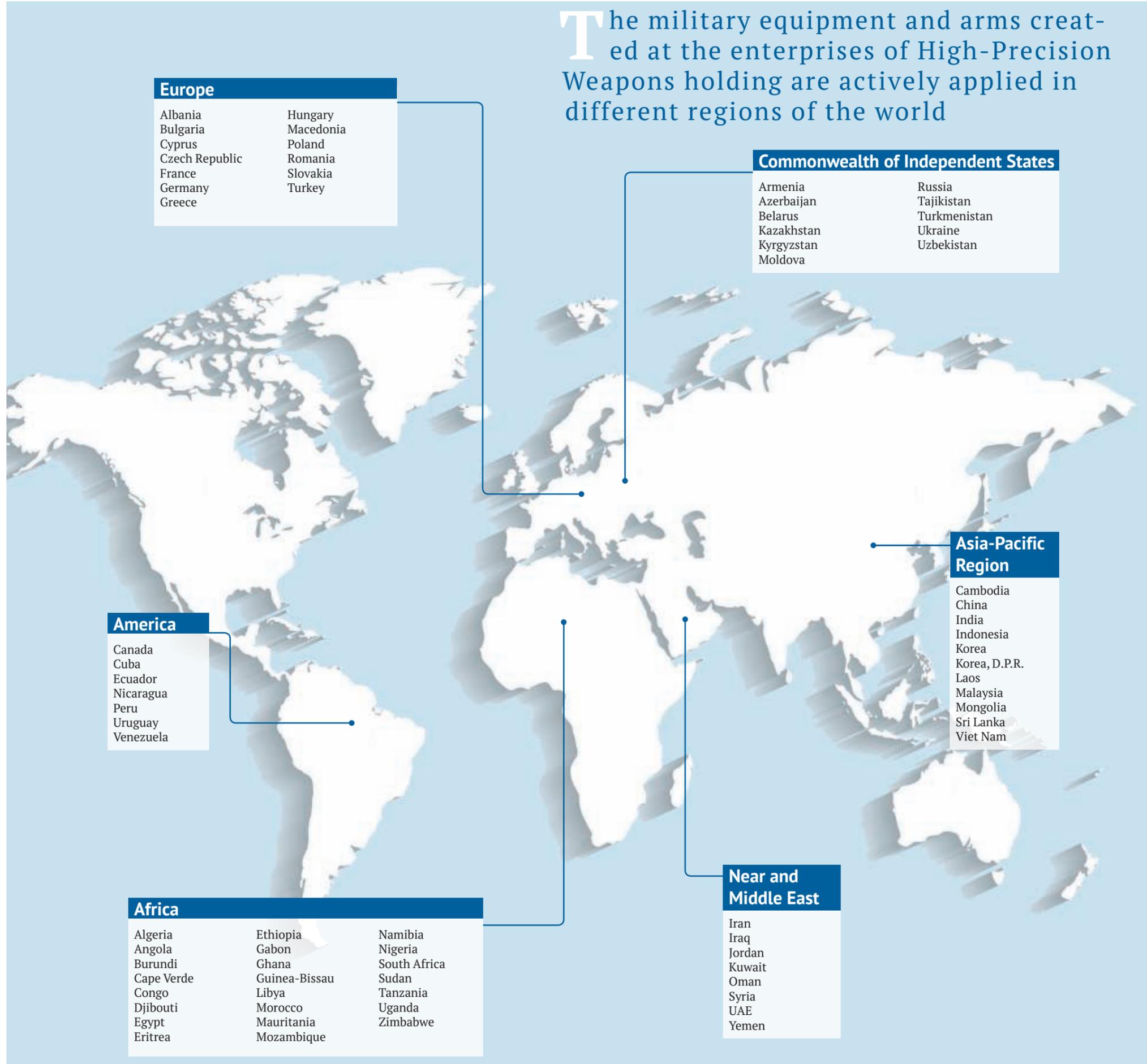
The current state of the market, state-of-the-art technologies and robot technologies acquired by VNII Signal, allow for the following conclusions:

1. Robot technology market is developing in Russia now.
2. The design of combat and special-purpose robots is the most promising sector of this market for VNII Signal JSC.
3. VNII Signal JSC has scientific and manufacturing background for research, development and production of robots.
4. To provide the efficient development of robot technologies, VNII Signal has chosen the approach of the development of multipurpose remote control equipment kits (packages) to be installed on standard arms and military equipment to provide their unmanned combat, special-purpose and support operations.





The military equipment and arms created at the enterprises of High-Precision Weapons holding are actively applied in different regions of the world



Europe

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| Albania | Hungary |
| Bulgaria | Macedonia |
| Cyprus | Poland |
| Czech Republic | Romania |
| France | Slovakia |
| Germany | Turkey |
| Greece | |

Commonwealth of Independent States

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| Armenia | Russia |
| Azerbaijan | Tajikistan |
| Belarus | Turkmenistan |
| Kazakhstan | Ukraine |
| Kyrgyzstan | Uzbekistan |
| Moldova | |

Asia-Pacific Region

- Cambodia
- China
- India
- Indonesia
- Korea
- Korea, D.P.R.
- Laos
- Malaysia
- Mongolia
- Sri Lanka
- Viet Nam

Near and Middle East

- Iran
- Iraq
- Jordan
- Kuwait
- Oman
- Syria
- UAE
- Yemen

America

- Canada
- Cuba
- Ecuador
- Nicaragua
- Peru
- Uruguay
- Venezuela

Africa

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| Algeria | Ethiopia | Namibia |
| Angola | Gabon | Nigeria |
| Burundi | Ghana | South Africa |
| Cape Verde | Guinea-Bissau | Sudan |
| Congo | Libya | Tanzania |
| Djibouti | Morocco | Uganda |
| Egypt | Mauritania | Zimbabwe |
| Eritrea | Mozambique | |

