

HIGH-PRECISION WEAPONS

12+

Special edition for Middle East

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EXHIBITIONS 2019

The largest world defensive exhibitions in which the enterprises of High-Precision Weapons Holding participate in 2019

IDEX-2019

February 17–21
United Arab Emirates

LIMA-2019

March 26–30
Malaysia

MILEX-2019

May 15–18
Belarus

SITDEF-2019

May 16–19
Peru

ARMY-2019

June 25–30
Russia

IMDS-2019

July 10–14
Russia

MAKS-2019

27 August – 01 September
Russia

INTERPOLITEX-2019

October 22–25
Russia

JSC 'High Precision Weapons' the leading Russian designer and manufacturer of wide variety state-of-the-art military and special equipment, including but not limited to land systems, small arms, air close and short range defense systems, is now opening new business opportunities for partners.

Moscow-based and ranked among top 50 global producers of military equipment by SIPRI chart, JSC 'High Precision Weapons' is legally authorized since November 2016 to provide full spectrum of maintenance and overhaul, modernization and upgrade works and services worldwide.

Global success

Russian High-Precision Weapons Holding

In February of this year, the High-Precision Weapons Holding (a part of the Rostec Corporation) was celebrated the 10th anniversary of its work on the global market. Years by years Holding plays an increasingly important role on the world arms market. The holding is the Russian largest developer and manufacturer of the most modern and innovative high-precision weapons. The importance and potential of the Russian holding increase worldwide as well: On a scale of the top 100 weapons manufacturers in the world, the Stockholm International Peace Research Institute (SIPRI) rates the 'High-Precision Weapons Holding' from Russia at 39.

Also every year Holding is increasing deliveries both to the Armed Forces of the Russian Federation and to the foreign market. According to an SIPRI expert, 'the Russian companies ride the ground-swell of boosts in military spending and arms export. Eleven companies from the top 100 list are Russian ones. Their income has increased by a total of 48.4%'. It also can be noted that the 'High-Precision Weapons Holding' belongs to the top 10 world's defensive rankings by an overall production and supply increase rate.

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 Shipunov KBP Instrument Design Bureau, the Tula Arms Plant, The Tulatochmash, the Nudelman Precision Engineering Design Bureau, the Kovrov Electromechanical Plant, the V.A.Degtyaryov Plant, the VNII 'Signal' and others. 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/EM, Konkurs, Metis-M1, Igla-S, Arkan, Verba, Shmel, Kapustnik, and others as well as on training systems, armored vehicles upgrade, and so on.

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.

It is evident that the demand for high-precision weapons only increases around the world. They do not miss. They are mobile, fast, maintenance-friendly, reliable, and the most modern.

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BRIEFLY

RECORD LEVELS IN 2018

On November last year, Rosoboronexport (part of the Rostec State Corporation), celebrated the 18th anniversary of its founding. The Company was established in 2000 by decree of the President of the Russian Federation.

‘For 18 years, Rosoboronexport has become a world leader in the supply of weapons and military equipment and reached record levels. Today, Russia assuredly ranks second in the world in terms of the scope of military-technical cooperation. The Company’s order book stands well above \$50 billion, while the total value of deliveries has exceeded \$150 billion over the years. We continuously improve and offer foreign customers more and more new models of military equipment, often the best in the world in performance and competitive in terms of price and quality. More than 200 Rosoboronexport employees have been awarded state and departmental awards for their great contribution to the development of military-technical cooperation with foreign countries,’ said Rostec’s Director General Sergey Chemezov.

In 2018, the Company was actively engaged in efforts to promote and exhibit their products. Rosoboronexport took part in 24 international exhibitions and forums. The Eurasian Air Show in Antalya, Turkey, the International Far Eastern Maritime Show in Vladivostok, ADAS 2018 in the Philippines and EDEX 2018 in Egypt were debut exhibitions for the Company.

‘Despite unprecedented competition, Rosoboronexport continues to strengthen its position in the global market. Just recently, we signed the biggest-ever contract in company history to supply India with the S-400 Triumph anti-aircraft missile systems. In 2018, we delivered weapons and military equipment to more than 40 countries of the world. At the same time, over 1,100 contract documents worth about \$19 billion were signed, almost a quarter more in the whole last year. That statistics suggest that the quality of Russian weapons and their proven performance are a determining factor for our partners,’ said Rosoboronexport’s Director General Alexander Mikheev.

Rosoboronexport has expanded its catalog of military products over the year and is actively promoting a number of new pieces of military hardware on the world arms market, including the Buk-M3 Viking and Tor-E2 SAM systems, the Sprut-SDM1 light amphibious tank, the ships Karakurt and Sarsar, Il-78MK-90A tanker aircraft, and Il-76MD-90A(E) military transport aircraft.



Global success

Russian High-Precision Weapons Holding



(See page 1)

The newest technological solutions are used. 20 years ago, the proportion of high-precision weapons used in local conflicts amounted to up to 7%. In recent years, this share has increased by up to 90-95%. The most designs of the ‘High-Precision Weapons Holding’ are the best in the world and determine the technological vectors of development in their segments.

There is no doubt that the main task of the ‘High-Precision Weapons Holding’ is to strengthen the defense capability of Russia

and to supply the Russian Army with the most modern and the most reliable high-precision weapons. Within the scope of the contract, the holding regularly transmits to the Russian Ministry of Defense the corresponding quantity of planned weapons. Due to the holding, the Russian Army is armed with the best weapons in the world. At the same time, it is important that the holding itself also supplies the same

weapon to the world market, where it enjoys consistent success.

Middle East states are always been and remains the most important strategic partner of the High-Precision Weapons Holding. The participation of the holding’s enterprises in IDEX-2019 is an important stage of friendly and mutually beneficial cooperation in defence area.



Khrizantema-S

The Best All-Weather Antitank Missile System

Anti-tank missile system ‘Khrizantema-S’ can change the tactics of armored warfare: a small group of combat vehicles anti-tank systems have the power to change the outcome of the battle. Only three cars are able to conduct actions against 14 tanks and damage a minimum of 60 percent of the equipment. This missile system can also fight with low-speed air targets, helicopters and aircraft. Russian ‘Khrizantema-S’ is the most powerful anti-tank missile system of distant action that the world has ever known.

‘Khrizantema-S’ is designed to provide a very important combat missions.

Destruction of fielded and future main battle tanks, including those protected with explosive reactive armour (ERA), small-displacement surface vessels, low-flying aerial targets, fortifications, manpower under cover and in the open in the day- and night-time, under easy and difficult weather conditions, in the presence of dust and smoke.

The ‘Khrizantema-S’ ATGW self-propelled system fielded by the Russian Army since 2005 remains the only weapon system of this category in the world capable of defeating main battle tanks and other armoured combat vehicles when the threat is not optically seen. No company in the world was able to implement an mm-wave radar detection and homing system controlling and guiding the missile through any battlefield obscuring factors be it dust, smoke, haze, rain or snow.

The developmental work according to Russia’s MoD design specifications had been carried



out from 2014 to improve performance of the system by enabling it to detect and recognize threats (including non-radiocontrast ones) and guide missiles in this environment as well as with the purpose of integrating the combat vehicle within the framework of an automated battlefield management system for antitank forces. AO NPK KBM was nominated the main contractor for the work.

In addition to the radar channel, the initially fielded combat vehicle was outfitted with the second, laser-beam riding, con-

trol and guidance channel coupled with a daytime optical sight.

The upgraded version replaced the daytime sight with a more advanced imaging infrared and television (IIR/TV) sight featuring enhanced capabilities in terms of target detection and recognition ranges. The new sight ensures

ATGW self-propelled system was introduction of an automated battlefield management equipment set (ABMES) for antitank forces. Thus upgraded 9P157 combat vehicle is provided with advanced communications means, a combined — inertial and satellite-based — navigation and orientation system, a terminal for receiving targeting data from the battery commander’s vehicle, their automatic processing, displaying tactical data on a digital map, receiving combat orders and instructions. The ABMES was developed by AO NTTS Rubin JSC (city of Penza).

The upgrading of the 9P157 combat vehicle entailed development of a new test equipment for the IIR/TV sight (developed and manufactured by OAO Peleng JSC), a modified 1L32 radar control system (manufactured by PAO NPO Strela public company, city of Tula); modification of 9M123 and 9M123F missiles (manufactured by FGUP FNPTS PO Start) in terms of replacement of the former Ukrainian photodetector and installation of a more powerful warhead in the 9M123 missile, the 9V981 test equipment for 9P157 CV checks, the 9V945 test equipment (developed and manufactured by Kalashnikov concern, city of Izhevsk) and 9F852 simulator (developed and manufactured by AO TSKBA, city of Tula) for training CV operators.

Vehicle of Three Elements: Land, Water and Air



Kurganmashzavod PJSC will present the upgraded 125-mm 2S25 self-propelled antitank gun (SPATG 2S25M) designed and manufactured by Volgograd Machinery Building Company VgTZ LLC.

The SPATG is a tracked armored amphibious fighting vehicle with a powerful artillery and missile weapons system. The vehicle can make marches over a distance of 500 kilometers without refueling, it can be transported by military transport aircraft and by landing ships, be air-landed and paradropped and with the crew inside the vehicle.

With its high power-to-weight ratio, the 2S25M can conduct combat operations in conditions of highlands or mountains and hot tropical climate against highly armored vehicles, fortified strong points, and enemy troops, it can cross water barriers without preparation at sea state 3 with the delivery of gun fire when afloat. The installation of highway shoes or snow-riding tracks will expand the vehicle capabilities.

In the 2S25M SPATG is implemented the increase in firepower. This is ensured by the installation of a modern digital fire control system, including commander's panoramic sight with optical, thermal-imaging and range finding channels; gunner-operator's combined sight with optical, thermal-imaging

and range finding channels and a laser missile guidance channel; gunner's back-up sight with a TV channel; automatic target tracker; ballistic computer; commander's and gunner-operator's automated workstations. Also, to combat manpower and low-flying helicopters, installed on the vehicle's turret is a remote machine gun mount, enabling the commander to conduct fire by 360 degrees around him, without leaving the workstation.

The increased mobility in the upgraded version is achieved by borrowing the engine, transmission, units of track-and-suspension system, chassis information and control system from the BMD-4M and BMP-3 vehicles. Improvement of performance of the crew life support system and functioning in the independent mode is provided by the heater and diesel generator plant.

The firepower of the 2S25M self-propelled antitank gun is on a par with that of the T-80 and T-90 main battle tanks and its mobility on land and in water is on a par with that of the BMD-4M airborne assault vehicle and BMP-3 infantry fighting vehicle. These and other qualities, together with the turret revolution and armament stabilization in two planes allow using the SPATG as a light amphibious tank. There are no analogues of such a vehicle in the world, and the upgraded version will only once again confirm this statement.

Tulsky Oruzheiny Zavod

Anti-tank guided missile 9M113M



The guided missile is a part of the anti-tank missile complex Konkurs-M 9K111M4 which is intended to engage modern vehicles equipped with the mounted reactive armor, fortified fire emplacements, both moving or stationary surface and afloat targets, low flying helicopters at any time and weather conditions. The 9M113M missile is launched from a portable launching unit 9P135M-1. Main technical characteristics of the guided missile are indicated in the table.

9mm special assault rifle AS



The 9mm assault rifle AS (index 6P30) is an automatic firearm, its automatic operation is based on the work of the energy of powder gases, which leak out of the barrel bore to the gas chamber, barrel bore locking is provided with the bolt turning round its longitudinal axis at 6 locking lugs. The assault rifle AS is designed to use a special 9-mm cartridge (SP6). It is intended for a noiseless and flameless shooting at a distance of 400 m. The assault rifle is intended to engage the enemy manpower protected with fragmentation bulletproof vests and the non-armored vehicles.

9mm Special Sniper Rifle VSS

The 9mm Special sniper rifle VSS (index 6P29-1) is an automatic firearm, its automatic operation is based on the work of the energy of powder gases which leak out of the barrel bore to the gas chamber, barrel bore locking is provided with the bolt turning round its longitudinal axis at 6 locking lugs. The rifle VSS is designed to shoot a special 9-mm sniper cartridge (SP5) and is intended for a noiseless shooting at a distance of 400 m. The main type of assault rifle shooting is automatic. A cartridge feeding is provided out of a detachable double-column sector magazine with the cartridges located in a chess-board order. The magazines are interchangeable. The rifle is equipped with a sniper optical sight.

9mm small-size assault rifle AM



The 9mm small-size assault rifle AM (index SR3) is an automatic firearm, its automatic operation is based on the work of the energy of powder gases, which leak out of the barrel bore to the gas chamber, barrel bore locking is provided with the bolt turning round its longitudinal axis at 6 locking lugs. The assault rifle AM is designed to shoot a special 9-mm cartridge (SP6) and is intended to engage the enemy manpower wearing fragmentation bulletproof vests as well as the non-armored vehicles at a distance of 200 m.

The design features of the assault rifle are: a magazine quick 'ejection' mechanism; a metal folding buttstock reduces the overall dimensions during carrying and allows to deliver aimed fire with a folded or non-folded stock; secret carrying is allowed due to the absence of projections on the assault rifle surface; assault rifle dimensions are the same as a submachine gun but the firing range and hitting effect of the assault rifle are considerably better; the safety presence assures a safe treatment of the assault rifle.

Control of Artillery Fire

Artillery fire control automation is one of the principal business areas of All-Russian Scientific Research Institute Signal (VNII Signal, member of High-Precision Weapons Holding, Rostec Corporation). Application of Automated Fire Control Systems (AFCS) for self-propelled artillery guns (SPAG) and combat vehicles of multiple launch rocket systems (CV MLRS) drastically improves their performance, time of response and firing accuracy. The Mashina-M and Kapustnik-B Automated Fire Control Systems developed by the company for artillery units have gained an international reputation.

Realities of the modern world raise a demand for an alternative approach to the design of Control Automation Equipment Systems (CAES) for artillery units. There is a need to reduce system weight and size, enhance combat flexibility and manoeuvrability of command and control posts, standardize the systems components, simplify and shorten the training period for artillery unit executives, and to make the systems substantially more cost-efficient. At the same time, the combat characteristics of such systems



must enable fulfilment of next to all artillery unit control tasks. This requirement has special relevance in design of the fire control systems for fire weapons that are not originally equipped with integrated automation equipment (mortar launchers, towed guns, CV MLRS).

VNII Signal extended the AFCS range by designing a portable CAES to control artillery and mortar units.

The portable control automation equipment system for artillery units has been developed by VNII Signal JSC on the basis of the Strelets reconnaissance, command, control and communication system approved for delivery to the Armed Forces of the Russian Federation. As an improvement to the original system, VNII Signal JSC incorporated its inhouse software and mathware to meet the special application and computing needs of control of artillery units.

Use of such systems will enable automated control of artillery and mortar units not equipped with integrated automation equipment. In the meantime, the new systems are cost-efficient, low-maintenance and easy to master (the training time is short).

The portable control automation equipment system for artillery units comprises indi-

vidual standardized equipment sets for officers, equipment for communication, reconnaissance, navigation, meteorological and ballistic support.

The portable CAES improves combat performance of artillery, mortar and MLRS units through:

- system cost reduction without effect on the basic combat characteristics, significant standardization of equipment sets for officers;
- use of portable systems to control all kinds of artillery units;
- compatibility with a wide range of communication, reconnaissance, navigation, meteorological and ballistic support equipment, both domestically produced and imported;
- simplified process and shortened time of battalion/battery officers basic training;
- rapid combat deployment of the equipment sets;
- uninterrupted control of the units even if any of control items fails to operate;
- substantial reduction of time for preparation and performance of firing tasks;
- simplified maintenance and repair of the systems in both stationary and field conditions.

Unified B8YA01

Bakhcha-u combat module for light-weight class combat vehicles



Throughout its history KBP Instrument Design Bureau has been developing small-arms and gun armament as well as guided weapons for Land Forces, Air Forces and Navy. A large scope R&D work in respect of armament structure and its efficiency has been carried out. All that provided for development in 1980-s the unique weapon system for the new IFV. In 1987 the new BMP-3 IFV was put in service with the Soviet Army. Exactly the original armament package of high fire power (2A70 gun-launcher, 2A72 automatic gun and 7.62 machine-gun integrated in a single module and an automated fire control system) developed for BMP-3 by KBP Instrument Design Bureau (Tula city) predetermined popularity of BMP-3 vehicle in the world market and nowadays it is in service with many Armies worldwide.

The significant enhancement power foreseen in the course of the design of BMP-3 combat vehicle was implemented by KBP during the development of BAKHCHA-U combat module.

BAKHCHA-U combat module is designed for the engagement stationary and on the move of the whole range of targets: tanks, lightly-armoured vehicles, ATGWs, sheltered and unsheltered manpower, air threats including helicopter- and low-flying aircraft- type targets. During the designing of the combat module R&D work was carried out in the following critical directions:

- enhancement of firing range and power of guided and unguided projectiles;
- providing efficient operation by day and night in adverse weather conditions and conditions of smoke interference;
- automation of combat operation, decreasing the exertion of the crew in the battle;
- enhancement of detection capabilities of the crew due to modification of the surveillance and sighting system;
- providing for efficient repelling the assault of helicopter- and low-flying aircraft- type air threats, as well as efficient engagement of drones.
- Providing autonomous combat operation in the whole range of combat situations and separate stages of the battle – during fire preparation before attack, assault, repelling the counter-attack, including firing from enclosed positions;
- Enhancement of the armament system performance parameters.

The set tasks were solved under the conditions of severe restrictions, since it was critical not to increase the weight and size specifications of the vehicles.

Weaponry composition of BMD-4 airborne assault vehicle.

- Armament: 100-mm 2A70 gun-launcher, 30-mm 2A72 autocan-

non, 7.62-mm PKTM machine-gun installed in one module;

- Unified automated round-the-clock fire control system integrated with guided weaponry, comprising;
- Combined day and night gunner's sight with independent two-plane stabilization of the field of view with visual, IR, range-finding channels and a missile guidance channel;
- Panoramic commander's sight with independent two-plane stabilization of the field of view with IR and range-finding channels;
- New weaponry stabilizer with increased aiming speed and accuracy;
- Digital ballistic computer with system of sensors;
- Control unit;
- TV/IR-autotracker;
- Electric automatics system;
- Ammo load: 464 pcs of 30-mm APDS, AP tracers, HEF incinerating projectiles, 2000 pcs of 7,62 mm rounds, single autoloader for HEF and guided projectiles contains 4 pcs of 100-mm guided missiles 3UBK23-3 'Arkan', 34 100-mm HEF rounds 3UOF19-1 with high-power HEF projectiles of enhanced firing range.

The new armament system is an integrated combat module. The solution of the set tasks with the implementation of new design solutions has enabled to create the module design of the armament system: the armament can be used as one integrated system in 'BAKHCHA-U' combat module for equipping lightly-armoured combat vehicles BMP-3, BMD-3, BMD-4, BTR-90, or as separate sub-systems.

In 'BAKHCHA-U' combat module the following technical solutions have been implemented regarding the FCS, guided and artillery weaponry:

Fire control system

- Due to the introduction of the head mirror unit into the sight the range-finding, IR, visual channel and guidance channel were united

in one module and highly-precise two-plane stabilization of the LOS was introduced.

Highly-precise two-plane stabilizing system of the head mirror enables to detect the target at distant ranges on the move and to reliably track the target automatically or manually.

- The rangefinding channel of the sight is integrated with the range-finder in one module enables to measure the range to the target with frequency 4-5 Hz, which enhances the efficiency of engagement land, and, especially, aerial targets.



The angle of divergence of the rangefinding channel has been decreased by two times and the integrated design of the unit provided for the misalignment value between the optical axes of the rangefinding and visual channel not exceeding 0.1 mrad throughout its whole lifespan without the implementation of any adjustment assets, which provides for accurate rangefinding and jamming-proof operation of the range-finder.

Better specifications of the visual channel and lesser LOS stabilizing errors have enhanced the accuracy of target tracking, especially of those moving.

- The issue of limited capabilities of the commander regarding target search and identification and taking over for the gunner was resolved by introduction of the panoramic commander's sight with two-plane independent stabilization of the FOV into the FCS. This has enabled the commander to carry out all-around search and detection of ground and aerial targets on the move at elevation angles of up to 60 degrees, with maximal angular velocity of the LOS increased up to 26 degrees per second, providing for the increase the amount of targets detected by the combat vehicle by 2.5 times,

increase the accuracy of the target designation to the gunner by 10 times, providing for accurate target designation (up to 1 mrad.) not only in traversal channel, but also in elevation channel, to completely take over for the gunner and to engage aerial targets in automatic mode.

The FCS provides for complete taking over of the firing process with all arms by the commander by day and at night, including guided weapon using the thermal image of the target, shaped by the IR channel of the gunner's sight, on the commander's screen.

- Autotracker united with the IR channel of the gunner and TV channel of the commander enables to increase the firing efficiency due to high precision (0.05-0.1 Russian mils) of aerial and ground targets tracking, as well as to rule out the influence of the psychophysical state of the operator and his skills on the firing results. The tracking precision became a technical specification not depending on the qualification of the operator and stress conditions in the combat environment. Autotracker provides for enhancement of accuracy of target tracking when compared to manual tracking.

non accuracy with all tip[es of projectiles is provided due to original firing algorithm, which optimally takes into account all the factors of firing: range to the target (either taken by the rangefinder or fed manually), speed and direction of the combat vehicle and target movement, wind speed, temperature and air pressure, charge temperature, deviation of the projectile muzzle velocity from normal value, target elevation, roll and pitch angles, projectile angle of jump.

- Efficient range of firing with 30-mm projectile of the autocannons increased from 1100-1400 m to 1800-2000 m.
- Significant increase of the AD firing efficiency of BMD-4: the kill probability of typical helicopter-type and low-flying aircraft-type targets increases drastically and approaches the value of such specifications of SHORAD ADMS with significant decrease of the ammo load spent on the engagement. Thus the AD capabilities of the IFV are added without additional expenditures, making the IFV a versatile weapon.
- The control of the FCS specifications is carried out by means of built-in test system.

Armament

- The 3UBK23-3 round and new 9M117M Arkan GM were designed, which, as compared to a standard round, provided the following:
 - engagement of ERA-protected targets;
 - increase of armour penetration from 550 up to 750 mm;
 - increase of firing range from 4000 up to 5500 m.

The fighting compartment ensures firing from a stationary position, on the move, afloat, by day and night, killing contemporary ERA-equipped tanks.

- In order to expand artillery capabilities of a fighting compartment the new 100 mm HEF round with enhanced fragmentation action was designed and taken into service with the Russian army. The new round, as against a standard shell, provided the following:
 - firing range increase from 4000 up to 7000 m;
 - enlarged fragmentation effect area up to 360 m² (by two times) at impact burst and up to more than 600 m² – with proximity action;
 - precision ballistics due to increase of muzzle velocity stability and projectile weight stability: projectile weight variation is within one weight zone mark (BMP-3's projectile has 9 weight zone marks).

Installation of the new Bakhcha-U fighting compartment boosts fire power as compared to standard fighting module and preserves weight-and-size properties of vehicles and their propulsion performance: speed of movement on the ground and water, cruising range, buoyancy reserve.

A CV with FC becomes high-efficient multi-mission mean fulfilling tasks assigned not only to an IFV, but to light tanks, artillery, an ATGW and an AA gun.

Thus, the upgraded Bakhcha-U B8Ya01 fighting compartment enables BMD-4 to outperform standard BMP-3 in combat efficiency by 3-4 times.

The fighting compartment mounted on BTR-90, BMP-2 and BMP-3 successfully passed firing trials. It can be mounted onto other carriers with corresponding dimensions and carrying capacity and was taken into service with the Russian Federation Armed Forces as a self-contained weapon
KBP JSC is serially producing B8Ya01 fighting compartment as component of BMD-4 airborne assault vehicle.

IDEX-2019



Best ships protection

From Kashtan and Kashtan-M – to Pantsir-ME

The only systems in the world that combine within a single turret mount a powerful artillery armament, efficient multi-mode missile weapon and an integrated radar-optical weapon control system are the Russian Kashtan, Kashtan-M and Pantsir-ME developed at KBP, Tula. With two types of weapons within the systems that give them significant advantage these systems possess better performances of each weapon separately as compared to counterparts. Target handling capability and killing potential of one channel of these systems with missile-gun weapon is 2-4 fold higher than the same of the systems with only artillery armament. The difference in efficiency has increased with the advent of advanced targets (increase of their velocity at decrease of lateral dimensions).



The specified systems have passed a big number of trials at shore positions as well as comprehensive ship tests.

At present, the systems are mass produced and used on a number of ships in Russian Navy as well as supplied abroad.

High efficiency of killing anti-ship missiles is ensured owing to the following peculiarities:

- modular design (1 command module and up to 6 fighting modules depending on the ship type) allows flexible arrangement of its protection;
- combination within a single turret mount of missile and artillery weapons and a radar-optical weapon control system allows for increase of firing accuracy due to elimination of errors related to deformations of the ship's hull when the weapons and weapon control system are installed at different places aboard a ship as well as it provides assured destruction of anti-ship missiles by firing missiles at them at different ranges, and at close range – by artillery armament. Successive fire at a target with two missiles decreases ammunition consumption rate and ensures its destruction probability at 0.96 – 0.98, and when firing in the close zone with artillery armament the kill probability is close to 1;
- designing of high-precision integrated guidance systems with radar mm-band channels and optronic channels with automatic target tracking;
- ultra-precise optronic channels with automatic target and SAM tracking capable of aiming a SAM at a target with at 1 meter precision at any flight altitude;
- radar guidance system of the fighting module owing to the use of mm waveband and having acceptable antennas dimensions allows for aiming a SAM at a low-flying anti-ship missile with no limitations on flight altitude at 2-3 meters precision owing to implementation of two factors – a

narrow beam and diffusion scattering of waves against water surface within millimeter band;

- co-processing of signals from the radar and optical channels of target and SAM tracking with automatic selection of an optimum mode ensures high jamming immunity of the system as compared to systems having only radar or only optical guidance systems;
- exploitation of correlation-contrast processing of signals from the optronic system with capability to memorize the target pattern ensures reliable tracking in different target environments;
- use of two super high rate AA automatic guns with the total fire rate of 10000 rounds per minute as compared to the GAU-8/A gun of the Goalkeeper system allows reducing of burst duration required to kill a target by a factor of 3 (down to 1.2 sec) and reducing of mean range of target engagement by a factor of 1.5 to the 300-500 meters target line which increases the kill probability by 1.5-2 times.
- implementation of fully automatic operation mode;
- use of agile small-size SAMs with the fragmentation-rod warhead.

All combat operation processes – target detection, friend-or-foe identification, high threat target selection, assignment of a target designation for tracking assets, firing by missiles and guns, estimation of firing results and transfer of fire to another target, are carried out without crew participation.

Combination within a single turret mount of missile and artillery weapons allowed for 2-2.5 fold reduction of required space and volumes for its installation. For instance, the typical arrangement of missile and artillery systems on a ship requires space and underdeck rooms for placement of an artillery mount, SAM launchers with vertical launch and an outer post with a guidance system; the named systems

occupy space and volume that are required to allocate on a ship only one artillery mount.

On small surface ships (displacement 500-3000 t) any of the given systems within the command module and one – two fighting modules is a sufficient air-defense asset for efficient ship protection without assistance of other air-defense means. On large surface ships (displacement over 4000 t) the given systems with up to 6 fighting modules fulfill the functions of a short-range AD system capable of killing air threats that passed through long-range AD systems.

For instance, the Kashtan system surpasses 1.5-2 fold the Crotaire Naval system, and 2.5-3 fold the Goalkeeper system in terms of target handling capability.

Air threats to ships are ever-improving: flight velocity increases, maneuverability and application tactics improve, radar observability decreases, wherefore KBP jointly with co-contractors upgraded the Kashtan (code name Kashtan-M) and Kashtan-M (code name Pantsir-ME) systems.

Basic line of modernization:

- use of a command module with its own 3D search radar (SR), which allowed for decrease of final targeting time by 2 times;
- expansion of engagement envelope in range and in altitude of SAM;
- capability of salvo firing at high threat targets by two SAMs allows for destruction of high threat targets with 0.96-0.99 probability;
- use of a thermal-imaging system along with a TV-optical system of target tracking allows for increase of system application rate;
- use of the artillery weapon based on the GSh-6-30KD AA automatic guns with increased muzzle velocity up to 960 m/s for the HEF round and up to 1100 m/s for the APDS round enhances firing accuracy and target kill probability owing to reduction to

300 m of the minimum permissible safe kill range of the anti-ship missile. The aforesaid is ensured owing to detonation of the anti-ship missile warhead when fired by the APDS round. Reduction of the anti-ship missile minimum permissible safe kill range down to 300 m allows the artillery system with the 10000 rds/min rate of fire engage in the automatic mode up to 5-7 anti-ship missiles (before ammunition is expended) that approach from the same direction at 3-4 sec. intervals (e.g. the Goalkeeper system can fire targets at over 6 sec. intervals);

- reduction of the response time owing to the increase of speeds and accelerations of the missile-gun mount laying;
- improvement of the system reliability by 2 to 3 times as well as enhancement of the operating specifications of the system components through reduction of number of the control post instruments and use of modern hardware components.

The results of the modernization:

- the killing potential of the Kashtan-M system per time unit increased by 4 – 5 times as compared to the Kashtan system;
- the killing potential of the Pantsir-ME system increased by 2.5 – 3 times as compared to the Kashtan-M system.

Use of the target tracking radar with the phased-antenna array and the SAM with 20 km range within the Pantsir-ME system fighting module ensure simultaneous engagement of 4 targets as well as killing new types of upgraded anti-ship missiles and small-size surface targets.

All that ensure combat readiness of protected ships against all modern air threats including low-altitude high-precision weapons.

The Pantsir-ME, Kashtan-M and Kashtan single-post air defense missile-gun systems are the most advanced systems of such type and have no counterparts worldwide.

BRIEFLY

RPG-7V



The year of 2019 marked the 58th anniversary of the RPG-7, but the weapon is still among the best AT systems in close combat. 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 capabilities. 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.

3UBK14F1 with 9M119F1



Russian modern tanks, including those going for export, have that indisputable advantage over other countries' tanks of having a guided weapons system. Thanks to it, the effective range of fire of the T-90S, T-72B, T-72S, and T-80U tanks equaled the aimed fire range of 5,000 m. The guided weapons system fire 3UBK20, 3UBK14F, 3UBK14F1, and 3UBK20F1 missiles armed with tandem shaped and fragmentation warheads. All of them are produced at the Degtyaryov Plant in Kovrov. In pursuit of a solution the Degtyaryov Plant in a concerted effort with GosNII Mash (State Scientific and Research Institute of Machine-Building, Dzerzhinsk, Nizhny Novgorod Region) developed the 3UBK20F1 projectile carrying the 9M119MF1 high power HE missile.

Its substantial increase in damaging effects is accounted for by the fact that the 9M119M has a modular warhead of an HE unit at the bottom and additional fragmentation unit in front, both arranged along the axis of the missile. Large-yield explosive compounds in the warhead made the charge 2-3 times superior to any existing projectiles of the same caliber. The 3UBK20F1 possesses far greater power than the 3UBK20F. While the maximum range has dropped from 5,000 m to 3,500 m, it still corresponds to the range of starting a fire combat on a flat terrain and is as far as most of foreign AT assets reach today.

New-generation Russian armoured fighting vehicle

The success in military operations in today's conflicts often depends on the mobility of military formations, in some cases, this eliminates the possibility of the battle. High manoeuvrability of small units, especially when moving across broken country with water barriers, could be provided by an armoured fighting vehicle that negotiates the obstacles on the fly, without advance preparation. And it was the vehicle that was developed by the designers of the Special Design Bureau of Machine Building OJSC (Kurgan) and specialists of the Kurgan Machine Building Plant (Kurganmashzavod JSC) having created the developmental prototype of BT-3F armoured fighting vehicle on of the BMP-3 infantry fighting vehicle chassis.

In the first instance, Kurgan designers sought to lay high level of protection into the new vehicle. Great attention was paid to qualitative improvement of the characteristics of habitability and ergonomics. The basic parameters of mobility and unification with the base vehicle were kept.

The BT-3F armoured personnel carrier inherited high protection from the BMP-3 against both conventional weapons and effects from a nuclear explosion, which makes it possible to use these vehicles together in combat missions.

The 5ETS16U remote-controlled weapon station mounted on the BT-3F with the 12.7 mm 'Kord' machine gun is equipped with the TV-thermal imaging sight with the laser rangefinder. It is indispensable for combating light armored targets and weapons, the destruction of the enemy's manpower. It is essential for fighting soft targets and fire units for destruction of enemy fighters. By the way, the video surveillance system provides the all-round view of the area, while the image is displayed on the driver's and mounted troopers' video and vision devices.

The accommodation of the mounted troops has options: as well as crew members the vehicle can accommodate also up to 10 mounted troops, in addition, it is possible to accommodate 5 more people. It is important that the BT-3F can be used for transportation of a large volume of goods, ammunition, and stationing of the devices and equipment. In fact, the new-generation armored personnel carrier is offered as a base chassis for the creation of vehicles of wide application.

The 450 hp engine allows keeping the BT-3F mobility characteristics at the level of the BMP-3 IFV: speed on highway up to 70 km/h, swim capability at sea state three.

Another undoubted advantage of the vehicle is its transportability. The BT-3F can be transported by motor, by air, by sea, and by rail. The BT-3F can also be transported on the external suspension of the MI-26 helicopter.

Due to the use of units and assemblies of serial production



of the BMP-3 IFV, being in service for a long time, in the design of the armored personnel carrier being in service with the, the new BT-3F can be introduced into the serial production at the Kurganmashzavod in short time, without actually carrying out preparatory work. And there will be no problem to train the crew having experience of the BMP-3 and BMP-3F operation.

This circumstance makes it possible to name those states as the most promising foreign markets of BT-3F vehicles which already have the BMP-3 IFVs in service. Of course, the BT-3F amphibious armored personnel carrier manufactured by 'Kurganmashzavod' JSC will occupy its niche in the global arms market, where the Russian offer is traditionally strong.

Verba: Best of the Best

The Russian man-portable air-defense system (MANPADS) 'Verba' – is weapons 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 engage-

ment 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.

BUR small-size system

The rocket-assisted grenade launchers earned a reputation of convenient, efficient and popular close range engagement asset. Further, the introduction of various types of warheads has considerably broadened their application range.

KBP Instrument Design Bureau have been over a long time involved in the searches aimed to extend the firing range and enhance accuracy of grenade-launching (flamethrower) system rounds, as well as increase the payload relative to the total weight of the weapon.

The R&D resulted in rocket-assisted infantry flame-thrower of increased range and power with thermobaric warhead (RPO PDMA), adopted for service with Russian Army in late 2003. Further, based on the design of RPO PDM-A, KBP developed a small-size grenade-launcher system (SGLS) 'BUR'.

The small-size grenade-launching BUR is intended for:

- engagement of manpower in urban environment, inside buildings, fortifications, as well as exposed on various terrain (including mountainous areas);
- inactivation of soft-skinned and lightly armoured vehicles.

The system allows firing from limited space rooms. The system ensures reliable firing within the whole operational temperature range: from minus 40°C to plus 60°C and in adverse conditions.

While developing the SGLS the designers managed to create a highly accurate rocket assisted grenade launcher allowing effective engagement of wide range of targets depending on the mission scenario at ranges up to 650 m. To guarantee high accuracy of firing a 'reactive-active' grenade propulsion principle was introduced, since standard methods, e.g. increase of the booster motor power or employment of sustainer motor running during the flight, lead to increased size and weight of the weapon or higher dispersion respectively.

The 'reactive-active' propulsion principle implies jet thrust acceleration of the grenade placed in a barrel fixed to the jet engine and simultaneous active acceleration in the moving barrel due to gas bleeding from the engine chamber. Further, the barrel and engine stop, inducing additional acceleration to the grenade.

Thus, the energy induced to the grenade is increased (doubled) and accordingly grows the muzzle velocity compared to that of the conventional design grenade launchers with similar container length. However, high grouping of shots is maintained.



IDEX-2019



Kornet-E/EM

New capabilities of antitank guided weapons

Development and manufacture of antitank guided weapons have been carried out for half a century all over the world. Within this period these guided missile systems have turned out to be in the demand and most popular type of high precision weapons due to combination of such advances as simple operation, reliability, pin-point guidance and affordability. High popularity of antitank guided weapons is easily explained by its capability to cause damage to the enemy that shall be crucially higher than friendly force expenditures. In fact one-two antitank guided missiles shall be enough to kill the enemy tank, missiles prices being by ten or even hundred times lower than that of MBT.



Initially antitank guided missile systems were developed to fight tanks. However modern battlefield scenario has greatly changed – large-scale hostilities between tank armadas have given way to scattered fights in local conflicts. And on this new battlefield ATGW have appeared to be attractively effective not only against MBT but also against other small-size targets including lightly armoured and soft vehicles, cars, fortifications, manpower, enemy infrastructure, fire points and snipers.

The Kornet-E weapon system developed by JSC 'KBP named after Academician A. Shipunov' in the early XXI century remains to be one of the mostly demanded antitank missile systems in the world military market.

Due to availability of a shaped-charge warhead primarily designed to engage heavy armour contributed by a thermobaric high explosive warhead of blast effect Kornet-E ATGW has become an effective defence and attack weapon capable to destroy a wide range of targets on the modern battlefield.

Open media read that the Kornet-E system, including self-propelled home-made versions, is being used intensively and effectively in the current local warfare in the Middle East against all and any military armaments, equipments and manpower. The contract values with the same Customer for equal quantities of Kornet-E and Spike ATGW to equip the same units are \$25 mln and \$48 mln, respectively.

With a financial factor in mind and to solve the above tasks, JSC 'KBP named after Academician A. Shipunov' has created the Kornet-EM multi-purpose missile system which realizes state-of-the-art capabilities using breakthrough engineering solutions which allowed to obtain advanced ATGW with quite a number of new attractive features.

Advancement of science and technology at the beginning of the XXI century gave birth to innovative technologies and new materials and thus allowed to realize 'fire

and forget' or 'fire, see and adjust' principles without using a seeker onboard the missile due to alternative solution to have a target autotracker added to the ground-based equipment installed on board the vehicle. This approach allowed to transfer seeker functions from an 'expendable' part of the weapon system into its 'constant' multiple-use part.

Machine vision plus the target autotracker increases target tracking accuracy by 5 times compared to the previous ATGW generation and thus provides for high fire accuracy at ranges up to 10 km.



Availability of an automatic target engagement mode shall reduce the Operator's psychophysical problems, simplify requirements to his skills and thus shall cut the time required for training.

The crucial part of the new weapon system is its automated launching unit (ALU) designed on the principle of modular approach which have been always traditional for the Kornet family.

The main part of ALU is its sighting and guidance module (SGM) with televiewer and thermal imager channels (TV/IIR sight), four missile launching guides and independent elevation and azimuth drives. SGM is fixed on a special frame which together with a sliding roof is installed in the opening on the carrier roof. The frame has a lifting mechanism provided to put SGM up for firing and to return it back for travelling. This frame also houses various electronic components which control SGM and ALU operation in general.

On the move ALU has its travelling configuration with SGM located horizontally inside the vehicle and thus being invisible from outside. To fire, SGM shall be raised outside with the help of the lifting mechanism, put vertically and fixed to provide a firing position.

In the combat process the Operator shall detect a target on the monitor display, aim SGM at this target so as to put a target image inside a target autotracker gate, produce a target acquisition command to the target autotracker, select a missile type to be fired, and launch a missile when the autotracker is ready. When these steps are done the Operator's job is finished: SGM shall be tracking a target and guide a missile to the target automatically by target autotracker commands. But if the Operator detects a more vital target he can stop automatic guidance and send the missile to a new target. Thus the Kornet-EM system offers 'fire and forget' and 'fire, see and adjust' principles realization.

New missiles have been developed to be used with this weapon system: the 9M133M-2 antitank guided missile with a flight range up to 8 km and the 9M133FM-3 guided missile with a flight range up to 10 km. Moreover this weapon system has a 'long arm' advantage, i.e. capability to effectively fight the enemy remaining safe beyond the enemy return fire.

In general the 9M133M-2 antitank guided missile (ATGM) has

armour and the targets protected by ERA. Two missiles shall be launched from the same launching unit with a short time interval (less than 2 s), one missile shall initiate ERA and the second missile shall hit the target.

By now Kornet-EM ATGM has been proved in all required tests and is being serially manufactured and installed on the Tiger-M vehicle against the contract with the overseas Customer. Yet the ALU modular design allows to integrate the Kornet-E system with practically any vehicle, of foreign manufacture as well, provided the carrier load capacity and inside volume are enough to do it. In case a carrier load capacity is 1.0-2.0 tons single ALU shall be installed, if a load capacity is 1.7-1.9 tons it shall be possible to install two ALU.

The comparative analysis of the mobile Kornet-EM version and its foreign equivalents shows that in traditional missions Kornet-EM outperforms the weapon systems, which use ATGM with a seeker to provide homing, by 3-5 times estimated on the basis of cumulative factors, and yet the Kornet-EM is easier to use and to provide services to, has 2-3 times less price for its guided missiles being an expendable part of the weapon system and thus a crucial factor which determines weapon system service costs when it is in the army.

Moreover Kornet-EM is available as a tripod version with the 9P163M-2 launching unit. In this configuration Kornet-EM enjoys all the advantages of the Kornet-E system with the latter high capabilities that have been proved in the recent local conflicts.

The design of the Kornet-EM launching unit is practically identical to the one used with Kornet-E ATGW. Main upgrade efforts were undertaken towards modernization of the sighting and guidance unit (SGU) and the latter was developed to have a new sighting channel with adjustable magnification (12x and 20x) and thus to provide more convenient operation for the User at long target ranges. To ensure high guidance accuracy at 10 km range, the laser guidance channel has been also modernized.

Moreover, a new thermal sight – 1PN79M-3 – was designed to be of the third generation and configured for a closed-loop operation without cooling bottles as those used with the earlier Kornet-E thermal sight.

High design similarity between the Kornet-EM and Kornet-E launching units provides for minimized Customer's costs of old system replacement by the upgraded one – practically there is no need to provide fresh training for users and technicians.

Pioneering technical solutions together with high guidance accuracy, formidable warheads, operation reliability and simplicity shall ensure high market demand worldwide as for the self-propelled version so as for the tripod variant of Kornet-EM ATGW for the next 10-15 years.

BRIEFLY

KORD machinegun



Design of 6P57 machinegun KORD allows to conduct aiming firing from unprepared position. Compactness of the machine-gun and possibility to transfer it from 'travelling' position to the combat one allow to use it during landing of units of landing forces, stream crossing and to fulfil easily combat missions in the mountainous country.

The 12.7 mm KORD machinegun, is indeed a sniper weapon, relatively mobile too. The KORD is unique. It is the world's first general-purpose heavy machinegun. It will fire equally well from prepared and unprepared sites, buildings, vehicles – both stationary and moving – whenever the gunner can assume a comfortable firing position. The relatively small weight and fast deployment capability allow the crew to change positions and support advancing infantry staying with the combat order. If attached to the 6T19 mount with a bipod and the combat situation dictates that, the weapon can be handled by a single crewmember.

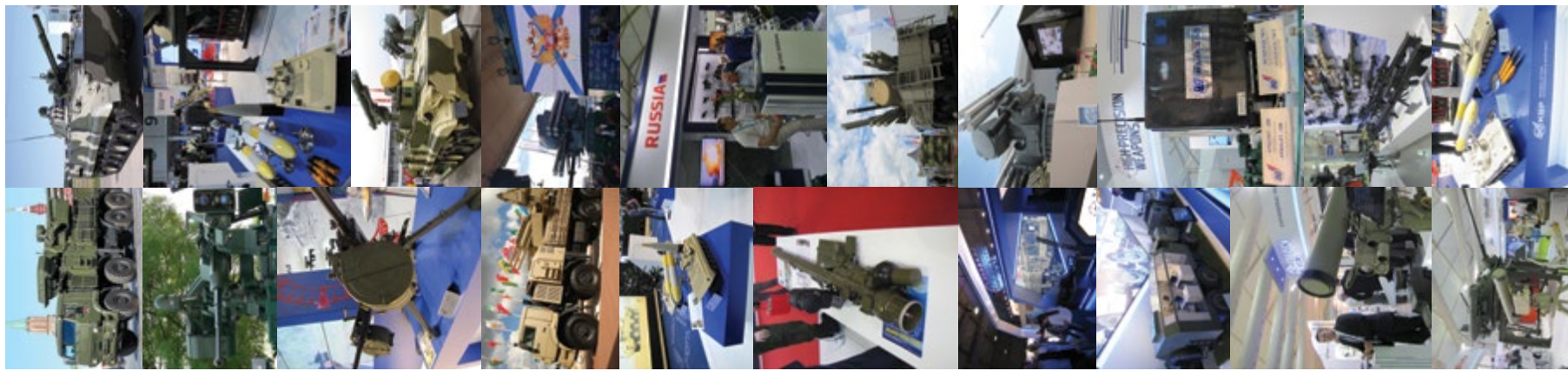
The quick-change barrel is based on a technology developed at the plant. It ensures even heating of the barrel and only minor heat distortion. Thanks to the steel grade, new production and bore chrome plating technologies the life approached 10,000 rounds. The barrel is fitted with a highly effective muzzle break. The weapon has inherited the gas-operated action with a long-travel rod, while locking is performed by rotating of a lengthwise sliding bolt, featuring two rows of lugs. The new barrel, upgraded locking assembly, as well as reduced impact of action operations on the barrel led to 1.5-2 times as good density of hits as that of the NSV using the same mounts.

7.62 mm Pecheneg



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.



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

