Masterpieces Of Russian Arms
On The World Arms Market

The High-Precision Weapons Holding from Russia (a part of the Rostec State Corporation) 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.

Such a success (the holding did not belong to the world's top 100 weapons manufacturers before) can be explained by 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 JSC “Shipunov KBP Instrument Design Bureau”, the “Tula Arms Plant”, “Tulaotchmash”, 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”, “Komet-8M”, “Konkurs”, “Neto-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.

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. 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. There are “Iskander-M”, “Pantsir-S”, “Verba”, “Shtrim-SM” and other systems among the most critical supplies. Due to the holding, the Russian Army is armed with the best weapons in the world.

India has always been and remains the most important strategic partner of the High-Precision Weapons Holding. The participation of the holding’s enterprises in the DEFEXPO INDIA 2016 is an important stage of this friendly and mutually beneficial cooperation.
Weapon of the 21st century

Within the past twenty years a high experience of combat vehicles operation was gained. Scientific and technical achievements in the areas of sighting systems development, ammunition upgrade, computer engineering and new electronic components created the prerequisites for the development of the new fighting compartment with an armament package featuring high performance specifications that meet modern requirements. A great upgrade potential of the BMP-3 vehicle was realized in the course of Bakhcha combat module development.

The Best Shoulder-Launched Man-To-Air Missile The World

"Verba", the Russian man-portable air-defense system (MANPADS) of the new generation, is a unique and second-to-none defense. "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 "Iglia-S" system. Even though the new MANPADS looks similar to its predecessors, this is fundamentally different weapon with new performance. "Verba" can effectively 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 predecessors 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 broader 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 seeker head is increased eightfold. The track initiation and air engagement area increased respectively, namely, from 700 to 1000 meters in comparison to the "Iglia-S" MANPADS of the previous generation. The system is equipped with the "Maaji-2" night sight. The new engine of the missile enables the shooter to hit a target at a distance of 4 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 Valery Khashin, General Designer of KDM, 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 offline. The self-guidance system has been designed in such a way that the missile can deceive the missile protection system of the target. The shooter only has to pull the trigger. The missile will do the rest. The identification 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 "Iglia-1", "Iglia-3" but also to its foreign counterparts such as the American "Stinger-Block I" and the Chinese "HQ-22". "Verba" is superior to the American MANPADS in all indices.

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N owadays 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 exportable package 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;
- defensive 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 equipment 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 ADMGS system adapted for a wide range of Customers required solving a number of scientific and technical challenges.

Among them are:

- layout and structural challengens to ensure modular design of the system;
- development of the new multifunction control system for target and missile tracking;
- communication integration of the Pantsir-S1 into Customer’s Armed Forces;
- development and integration of IFF systems customized for the particular Customer;
- development of automated day/night all-weather control system common in terms of instrumenta- tion 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 allowing 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 provides 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 platforms, vital administrative, military, tactical and other objects), for installation of the system onto railway platforms, ensuring its integration into Customer’s existing main- tenance, training and logistics systems with minimum cost. The said approach also provides for development of the system variants taking into account particular geopto- graphical conditions in which the system is to be used by the Customer.

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

Outfitting Pantsir-S1 system with the multifunction tracking radar ensuring tracking of three targets and transmission of control com- mands 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 pilot- ed UAVs.

Thanks to development of a single multimode and multispectral radar-optical control system operating in dm, mm, and IR wavebands, featuring a multifunction track- ing radar as one of its components, high jamming immunity of the sys- tem was achieved and, as a conse- quence, 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 inte- gration into Customer’s existing AD system.

The said requirements are deter- mined by the following factors:

- mandatory availability of the same target environment at all lev- els and all components of a common air-defence system;
- complicated geoptographical conditions dictate the neces- sity of flexible target distribution both between combat vehicles (CVs) within a battery and within a com- mon air-defence system;
- continuous growth of high-pre- cision weapons and UAs among air threats imposes a specific require- ments to the use of anti-aircraft sys- tems consisting in capability of com- bat with targets without radar emission getting the required data from neighboring CVs and remote search radars.

Availability of mapping comput- er with digital maps ensures effi- cient automatic planning of combat actions taking into account partic- ular 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 cre- ation of a potential for AD system development basing on the com- bat actions control principle imple- mented in Pantsir-S1 ADMGS;
- implementation of various ways of SAMs destruction ensuring safety of their use according to Customer’s requirements:

a) air-blalt initiated by a command on climb trajectory;

b) airblast 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 mainte- nance system, supply of maximum unified individual, common, and base-stored SPTA kits, arrangement of service centers and crews train- ing 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 on a range of chas- six as well as to develop its station- ary 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.

Nowadays and in the near future Pantsir-S1 ADMGS fully satisfies all requirements for successful fighting modern air threats.

Appropriateness of the imple- mented 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, a battery of Pantsir-S1 CVs many times took part in a Parade on occasion of Republic of the Republic of Belarus Independence Day in the city of Minsk.

The Pantsir system was shown at a number of international defence exhibitions (IDEF, MAKS and others). In the near future and in the long-term outlook the Pantsir-S1 ADMGS will remain a reliable asset capable to ensure protection of airspace from all types of air threats.
**PALMA & SOSNA**

**PALMA** is a close defensive line naval automated air defense missile system designed for air attack missions, including anti-ship missile flights at low and extreme-low altitudes at close approaches to the warship. The missile is intended to engage the enemy manpower protected with bulletproof jackets and the non-armored personnel in vehicles equipped with the explosive reactive system. The weapon also poses a threat to the enemy's vessels. The weapon is intended to be used on the ships of the main design system area of responsibility. Main design features of PALMA system are: high precision unique multichannel automatic all-weather day/night optoelectronic control system, deployment of armament, target guidance, and aiming-down means directed by an artillery mount on "the same axis" in order to exclude the errors caused by ship motions; automatic, semi-automatic and inertial operating modes. PALMA firing module is comprised of an artillery mount with gear and optronic control systems. The armament of firing modules consists of: 2x10-18K rapid-fire cannon guns with link less feed system, with increased projectile muzzle velocity and with essentially increased service life, and 8 small size high effective SOSNA-R missiles.

**SOSNA-R** is a two-stage and consists of the launch stage and droppable solid-propellant low smoke booster that has short working time. The missile has canister configuration and two-channel aerodynamic guidance system 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 rolling during the flight. Initial rotation is receiving during its movement inside the container, during the flight the rotating is continuing due to a firing unit. Control of the rolling missile implements by means of gyroscopes, which measures missile attitude position towards its target. The combined control system is used for missile guidance. On launching trajectory — a radio command signal is used, which is functioning in radio-location mode. The guidance of missile trajectory is realized with high-precision in laser information field received by photo receiver installed in the back end by laser and non-contact target sensor with continuous emission. The optronic control system of PALMA 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, imaging thermal channel, 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.

**ZD-labeled weapons**

The Degtaryov 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 day thanks to the size and talent of Degtaryov’s team always hits the target.

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 fired by their enemies. Its specific feature is that it was the first among light anti-tank (LAWs) to adopt the rocket-propelled solution for grenade launching. When a 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-7, 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-7V, as well as iron sights received a new range dial.

7.62 mm Pecheneg machinegun

The major modernization of the PKM4 saw 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 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 surface of the barrel, ribbing, and ejector at the muzzle provide forced air-cooling evenly over the barrel part.

12.7 mm 658 sniper system

One of the products developed most recently at the Degtaryov Plant is the 12.7 mm 658 (658-7) 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 658 consists of the 6V7 sniper rifle, TN54 sniper rounds, 1P71 optical sight, and 1P111 night sight. The 658 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 15 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 heavier than the Russian 6V7.

**Main advantages of PALMA ADMS:**

1. Combination of high combat performance, jamming immunity, hiding operations, impossibility of the system destruction by anti-radar missiles.

2. High power, short flying time of the missile to the target and the ability of the gun mount to conduct rapid fire.

3. SOSNA-R air defense missile system is intended to protect army units in any form of combat including on the march against all types of air attacks and rockets fired at low and extreme-low altitudes.
The light-weight category combat vehicles (IFV, airborne 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. 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.

Many countries keep on upgrading the main fleet of their combat vehicles on 40–50 years old mechanical module was selected as a basis for designing a uniform combat vehicle design solution. The 30 mm projectiles flat trajectory fire control system is at night the system may fire only guided weapon firing is possible for armored vehicles upgrade vehicles have been produced onboard computer, modern sights, and fire control systems shows for armored vehicles upgrade, was adopted for service in 1980 and used to exceed most of its foreign counterparts in terms of combat capabilities. Nowadays BMP-2 still basically meets the modern requirements.

The analysis of current state and development tendencies of weapon 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 wide command link of “Kontuk” anti-tank guided missile (ATGM);
- “Kontuk” ATGM has low penetration and is effective against modern tanks like T-12, M1A2; “Abrams”;
- “Abrams” tanks 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 fire only automatic cannon or PKT machine-guns at range not exceeding 800 m; the 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 BKPK-2-42 sight stabilization system as well;
- 30 mm projectiles flat trajectory firing is not efficient against prone or entrenched manpower;
- firing at aerial targets carried out using 1PZ-3 angle 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 in-creating 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 equipped with independent elec-tromechanical vertical drive and carrying two ready for fire missiles;
- replacement of standard BKPK-2-42 sight with combined gunner’s sight equipped with independent LOS stabilization system and incorporating optical, IR and laser ranging channels, as well as missile guidance channel;
- installation of onboard digital computer with sensors system;
- installation of 3D/5 IR target autotracker;
- installation of 30 mm grenade launcher with independent electro-mechanical vertical laying drive and 500rds feed magazine;
- installation of commander’s panoramic sight with independent LOS stabilization system and incorporating optical and laser ranging finding channels;
- installation of high-precision dig-i tal 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 ATGMs. The specifications of upgraded BMP-2 with new BRUuy11 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 at stop 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 9M133M ATGM with HE warhead and proximity fuse, recently designed by KBP, al low-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", "Leopold"). Besides, HE 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 implement ed in "Kornet" ATGM (9M133M-2, 9M133M-4) 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 armed 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 re-loading during a combat makes it a perfect target;
- implementation of TV-IR-auto target tracker enables to increase the accuracy of target tracking 5–6 fold in com-parison with manual tracking. The human is excluded from aiming circuit, the results of aiming become independent on psychological state of the gunner, which is dramatic in stressful battlefield environ ment. Accurate target tracking be-comes a granted technical speci fication, 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 fulfills the function of the auto-tracker;
- the possibility of KORNET ATGM launch in an elevated mode (above bare 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 IGV 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;
- significant increase of automatic gun and grenade launcher firing accuracy with all types of ammunition is pro-vided due to the development of original firing algorithm, which most fully takes into consider-

ation all the factors: range to the target (measured by laser rangefinder or input manually) speeds and direction of the CV and the target, wind velocity, air pressure and temperature, charge tem perature velocity deviation from normal value, target elevation, pitch and roll angles, angle of jump. During this automatic generation of firing settings is carried out due to the fact, that ballistic computer is included into the firing circuit. Effective firing range of a 30-mm projectile increases from 1100–1400 m up to 1800–2000 m.

- air defense fire effectiveness increases significantly: kill probability by automatic gun when firing against "helicopter" and "low-flying attacking aircraft" type target increases dramatically and its value approaches that of specialized gun and missile air defense systems of closed ranges with much lesser expenditure of ammunition. Thus, the principle of IGV versatility is ful filled by adding air defense capaci ties without additional expenditures;
- effective engaging of enemy’s personnel at ranges up to 2100 m, including that behind the accidents of ground and air resistance (maximum detection of low ballistics armaments (AG-30M automatic grenade launcher) with new GPD-30 rounds;
- the opportunities of CV commander increase due to installation of night vision panoramic sight with technical view, implemented on IGVs for the first time. The commander has all-around vision picture and a systematic approach and leads not only to processing of aerial targets in automatic mode. BMP-2 upgrade meets the requirements towards combat engagement of aerial targets for the nearest 20–30 years, and upgraded BMP-5 ICV can be successfully used till year 2050.

The carried out upgrade features a systematic approach and leads not only to enhancing the combat effectiveness and modern technical specifications of the system, but has enabled to create a vehicle with qualitatively new features, which can successfully compete with foreign counterparts on the weapon market.

A modular design principle has been selected in the combat vehicle. Under the conditions of harsh up-expenditure limitations, the KBP carries set of equipment on his own either full or partial.

BMP-2 (combat module) is also meant for BMP-1 upgrade of (after the chassis is upgraded to up to the BMP-2 level) BJ, BTR-90 APC and has passed the trials on their chassis, see fig. 1–5. KBP carries out the lot production of upgraded BMP-2 combat compartment.
High-Precision Weapons Holding

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 presence of a detachable double-column sector-type cocking. The safety system prevents accidental fire. The folding stock is very handy, the fire may be delivered from various positions. The operating temperature range is from — 50°C to +50°C. The system is intended for:

- engagement of manpower in urban environment, inside buildings, fortifications, as well as on the various terrain (including mountainous areas);
- inactivation of soft-skinned and lightly-armoured targets concealed in shelters and low-vulnerable targets concealed in shelters or terrain and un-reachable for the small-arms.

...such missions take place in urban areas or counter-terrorist operations shows that in most cases such missions take place in urban areas or separate buildings. This eliminates the possibility to hamper the employment of combat vehicles for engagement lightly-armoured vehicles and low-vulnerable targets concealed in shelters or terrain and un-reachable for the small-arms. Under such circumstances the weapon should be extremely light-weight (to allow higher ammunition carrying capacity), highly maneuverable (small dimensions) and accurate, as well as possess long firing range and powerful warhead.

The R&D resulted in rocket-assisted infantry flame-thrower of increased range and power with thermobaric warhead (RPO PDM-A), adopted for service with Russian Army in late 2005, which proved the efficiency of the solutions implemented by KBP into the new method of grenade launcher (flare-missile) rounds propulsion.

Further, based on the design of RPO PDM-A, KBP developed a small size grenade-launcher system (SGLS) "BUR". The grenade-launcher rounds comprise a launch container, motor and grenade itself. The container and motor are uniform for all types of rounds, whereas a grenade pay-load varies. However, the warhead is designed in such a way that the payload variation does not affect the exterior ballistics, allowing employment of optical sights for firing all types of grenades.

The small-size grenade-launching system is intended for:
- engagement of manpower in urban envi-ronment, inside buildings, fortifications, as well as on the various terrain (including mountainous areas);
- inactivation of soft-skinned and lightly-armoured targets concealed in shelters and low-vulnerable targets concealed in shelters or terrain and un-reachable for the small-arms.

The system allows firing from limited space rooms. The system ensures reliable firing within the whole operational temper-ature 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 dis-paragraph 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 acceler-ation in the moving barrel due to gas bleed- ing 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.
An antitank guided missile system (ATGM) has been developed and produced globally for almost 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 de-fensive offensive guided weapon, whose portable and combat vehicle trans-portable modifications ensure a wide range of applications in close range tactic-cal zones in various combat environments.

As of today the IIIrd generation Kornet-E portable/transportable ATGM system developed by KBP and adopted in 1998 is the weapon definitively com-plying with the con-cept of advanced ATGW being state-of-the-art specimen of multi-purpose 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.

The weapon is designed as an automatic combat system, incorporating, besides the fir-ing unit itself, both reconnaissance and con-trol 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;
- surveillance and control vehicle, equipped with combined surve-illance 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 fire-range of up to 2 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 bat-teries, however, low cost technical solutions, Kornet-EM acquired a number of new features, allowing significant broadening-of its com-bat 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 track-ing 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 distri-bution, target designation commands genera-tion and processing result in virtual-ly fully automatic combat system, limiting the opera-tor’s task to supervision of its proper functioning and launch of missiles.

- combat vehicle with twin-launcher ensures simultaneous salvo firing at two tar-get points, thus significantly increasing the system’s firing rate and number of targets han-dled and at the same time allowing two-fold reduction of combat assets required to com-plete a mis-sion. Such performance specifications endow Kornet-EM with the highest target handling class of systems ability to engage low-velocity aerial targets.

Another distinctive feature of modern combat operations is deployment of so-phisticated surveillance and networking technolo-gies in the tactical units. Wide application of integrated surveillance aids (various com-binations of optical, radar, TV and IR sys-tems), sophisticated automatic assets of tactic-al units operation control, com-munica-tion and navigation allows continuous monitor-ing 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 gen-
The military equipment and arms created at the enterprises of High-Precision Weapons Holding are actively applied in different regions of the world.