UKRAINIAN DEFENSE REVIEW

№2 [APRIL-JUNE 2016]

UDR

Defense express

POTION OF YOUTH FOR "MI" HELICOPTERS

BTR-4

CERTIFIED BY BATTLE

MADE IN UKRAINE

UKRAINIAN 4X4 LAVS

NEW WEAPON TURRETS FROM UKRAINE

EXACTLY ON TARGET

Precision-guided weapons by Kyiv SE "Luch"

UKROBORONPROM

Ukrainian Defence Industry

DOZOR-B

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UKRAINE'S MOD TO SPEND UAH 7 BLN ON WEAPONS MODERNIZATION PROGRAMS IN 2016

The MoD has budgeted UAH 7 billion until the end of FY2016 to pay for armaments and military equipment modernization programs, which is four times and almost 8 times the amounts budgeted respectively in 2014 and 2013, a MoD official said.

«State-owned companies are continuing deliveries of new and upgraded armaments and military equipments to the Armed Forces of Ukraine. The Ministry of Defense has awarded 54 contracts and supplementing contracts worth a total of almost UAH 2 Bln to state-owned companies, under the Government Defense Procurement and Acquisition Program 2016, Lt. Col. Oksana Havryliuk, head of communications at the Ministry of Defense has said.

NATIONAL SECURITY AND DEFENSE SECTOR MODERNIZATION CONCEPT ENACTED BY PRESIDENT POROSHENKO

President of Ukraine Petro Poroshenko has enacted the decision of the National Security and Defense Council (NSDC) as of March 4 «On the Modernization Concept for the National Security and Defense Sector of Ukraine».

The main purpose of the national security and defense sector modernization is to build up and further maintain capabilities ensuring adequate and flexible response to the complete range of national security threats, and to ensure at that there is effective and efficient use of the limited means and resources available to the government.

According to the document, modernization of the national security and defense sector involves the implementation of complex tasks to implement the principles and standards adopted in the states - members of the EU and NATO; the respect for the rule of law, patriotism, competence and departyzation principles; enhance coordination and cooperation; effective implementation of unified planning and resource management using modern European and Euro-Atlantic approaches; creation of a national cyber security system; professionalization of the defense forces and create the necessary military reserve; strengthening cooperation with partner intelligence services of states - members of NATO, including implementing specific measures of mutual trust.

The most relevant threat in the medium term will be Russia's aggressive actions aimed at the atrition of the Ukrainian economy by undermining social and political stability in order to destroy Ukraine and seize its territory, the use of military force, as well as a hybrid war technology; temporary occupation of Crimea by the Russian Federation, and further actions aimed at destabilizing the Baltic-Black-Caspian Sea Region.

Among other threats to Ukraine there are the intelligence-subversive and sabotage activities of Russia and other states, as well as the actions aimed at inciting inter-ethnic, inter-confessional, social discord and hatred, separatism and terrorism; setting up and comprehensive support of puppet quasi-state formations in the temporarily occupied areas of Donetsk and Luhansk regions; Russian military build-up near the state border of Ukraine and in Ukraine's temporarily occupied territory, including deployment in Crimea of tactical nuclear weapons; activities on the territory of Ukraine of criminal extremist armed groups aimed at destabilizing the internal socio-political situation in Ukraine, disruption of normal functioning of state authorities, local authorities, and blocking of important industrial and infrastructure sites. Another security challenge is the possible use of the Ukrainian territory for combat operations in the event of a military conflict between NATO Member States and Russia.

INITIAL QUANTITY OF M-120-15 "HAMMER" MORTARS DELIVERED TO UKRAINIAN ARMY

Kiev-based Mayak Factory, a company incorporated with Ukroboronprom state defense industries holding group, has delivered an initial quantity of its new 120-mm M-120-15 "Hammer" mortars to the Ukrainian Army.

The M-120-15 features the MUM 706M sighting system and a double load prevention device in its front barrel. It can fire 12 rounds per minute, to ranges over 7,000 meters. The M-120-15 "Hammer" can fire any of the HE rounds used in 120mm mortars.

KHARKIV MALYSHEV PLANT TO LAUNCH PRODUCTION OF MODIFIED BTR-4 APC VEHICLE WITH REDUCED ACOUSTIC SIGNATURE

Kharkiv Malyshev Plant (KMP) is set to launch production of a modified version of the BTR-4 APC vehicle powered by a Mercedes-Benz diesel engine with reduced acoustic output, achieved thanks to the engine being enclosed in a soundproof box among other things.

The lower-noise upgrade of the BTR-4 APC was developed by Morozov Machine Design Bureau in response to requests from Ukrainian government forces fighting separatist insurgents in the east of the country, Uryadoviy Kurier (Government Courier) newspaper reported on 2 March 2016, quoting CEO of Ukroboronprom defense industries holding, Roman Romanov as saying.

Alongside reduced acoustic signature, the modification includes changes to undercarriage and vehicle systems as well as improved, field-replaceable armor panels.

On 23 March 2016, President of Ukraine Petro Poroshenko handed over another 16 BTR-4 APC vehicles to a Ukrainian Army unit, in a ceremony hosted by Morozov Machine Design Bureau in Kharkiv.

UKRAINE'S NEW AFV "AZOVETS" BEGINS ITS TRIALS

The Ukrainian military has begun trials of its innovative armored fighting vehicle (AFV) designated «Azovets». Approval for Service Use decision will be made subject to satisfactory completion of the trials.

Designed initially as an "urban tank" and a "heavy universal tracked platform", the «Azovets» eventually will likely end up as a tank support fighting vehicle.

The Azovets features two weapons turrets, each rotating in a 360-degree circle and outfitted with a double barreled 23-mm GSh-23 air cannon, a PKT machine gun and Stugna/Corsaire ATGM launchers.

The «Azovets» is well protected against anti-tank threats. Protection is provided with the indigenous ERA system "Nizh" (or 'Knife'), comprised of about five hundred KhSChKV-34 ERA tiles mounted exteriorly all around the vehicle's hull. Most vulnerable areas of the hull are protected with two layers of ERA tiling – one add-on layer and the other layer being integral with side screens.

The Azovets has a crew of four, consisting of the commander, the driver and two gunners/operators.

The vehicle is built at ATEK manufacturing plant in Kiev.

UKRAINE, INDIA TO JOINTLY BUILD MILITARY TRANSPORT AIRCRAFT AS INDO-RUSSIAN MTA PROGRAM STALLED

Reliance Group of India and State Corporation Antonov of Ukraine have agreed to cooperate on dual version transport aircraft for military, paramilitary and commercial use in India.
The partnership between Reliance Group and Antonov envisages the design of medium-lift dual use turbofan aircraft configured for use in tactical as well as strategic roles. It would address various requirements, including 50-80 seat passenger aircraft in their basic configurations and in transport, maritime patrol and other military variants, Reliance Group said in a statement.
Powered by two turbofan high fuel-efficiency jet engines, the medium lift aircraft will be suitable to operate on short runways at remote airfields with unpaved surfaces.
Low level tactical missions by this aircraft will be aided by current-generation avionics and navigation systems powered by fly-by-wire systems in all weather round the clock operations.
India has a requirement for 500 such aircraft in different roles, and the market size is expected to exceed USD 5.3 billion in the next 15 years.
The JV agreement between Defence Group and Antonov was signed in March 2016, on the sidelines of Defexpo India in Goa. The agreement comes in the backdrop of the previously stalled joint deal between India and Russia on the development of a Multi-role Transport Aircraft (MTA) transport warplane.
The planes will be built at India's first integrated Aerospace Park at Mihan, Nagpur.

UKRAINE, IRAN AGREE ON JOINT PRODUCTION OF AN-140 AIRPLANES

Ukraine and Iran signed a Memorandum of Understanding in the aftermath of the 5th session of the Intergovernmental Ukrainian-Iranian Joint Commission for Economic and Trade Cooperation held on 9 March 2016.
The MoU provides for an expansion of bilateral cooperation in the aircraft industry, Ukraine's Deputy Prime Minister, and Minister for Regional Development, Construction, Housing and Utilities, Hennadiy Zubko has said.
"Companies from our two countries will work together in upgrading and production of the An-140-100 regional jet airliner and in the development of its new variants; marketing and selling of An-158 airplanes in Iran and the Region; and toward the delivery of commercial An-178 cargo airplanes," the official said.

UKRAINE, POLAND LOOKING TO COOPERATE ON SPACE TECHNOLOGY INITIATIVES

Ukraine and Poland have signed a Memorandum of Understanding on cooperation in space technology development, public broadcaster Polish Radio reported.
The Chairman of the State Space Agency of Ukraine, Lubomyr Sabadosh and the Deputy President of the Polish Armaments Group (PGZ), Radosław Obolewski, have signed the relevant document concerning cooperation.
On 3 March 2016, a joint working group was established, with the primary aim to seek opportunities to execute joint projects.
Joint projects will be executed, among others, in the field of optical and radar instrument technologies for observation satellites as well as technologies for launching satellites to the Earth orbit.
"We are very interested in cooperation with the Ukrainian space industry in the field of modern technologies. We are also glad that also the State Space Agency of Ukraine is ready to execute specific projects together with PGZ. We are going to seek opportunities together to cooperate in the development of technologies used in satellite Earth observation systems," said Radosław Obolewski, Deputy President of the Polish Armaments Group.

ZORYA-MASHPROEKT TO SUPPLY MARINE GAS TURBINES TO THE INDIAN NAVY

State Company Zorya-Mashproekt, based in Mykolayiv, has signed two deals to supply naval equipment to the Ministry of Defense of India.
Both deals were signed in March 2016, on the sidelines of Defexpo India in Goa, Zorya-Mashproekt reported through its official website.
The two parties also agreed to cooperate on a naval engine overhaul program as part of already ongoing contracts. An initial quantity of engines will arrive in Ukraine for overhaul and refurbishment as early as in Q1 2016.
The Indian Navy is the largest export customer for Zorya-Mashproekt marine engine products, and maintenance, repair and overhaul (MRO) services.

UKRAINE TO TEST ITS NEW ANTI-SHIP CRUISE MISSILE "NEPTUNE"

Design Bureau Luch is set to start testing in mid-2016 its new anti-ship cruise missile to be known under designator "Neptune", military-informant website reported on 9 March 2016.

No data on the time or location of the testing has been revealed at this point.
Preliminary reports have it that a few flying prototypes of the missile are now ready to be tested.
The prototypes have been manufactured in a collaborative effort with domestic partners, including Kharkiv Aircraft Plant and Zaporizhia-based Motor Sich among others.
Being similar in design to the Russian anti-ship Kh-35 missile fired from the Bal-E launcher, the cruise missile Neptune could cope with surface warships and cargo ships of up to 5,000 d.w.t, travelling in convoys or independently.
It is expected that the missile will be available in configurations for sea, land and air attacks.
Being a cruciform-winged missile having a full length of 5,050 mm, the Neptune will be launched from a transport/launch canister (TLC) measuring 5,300 x 600 x 600 mm.

[armor]

THE MIGHTY «BUCEPHALUS»

Anton Mikhnenko, UDR

THE BTR-4 FULLY AMPHIBIOUS WHEELED ARMORED PERSONNEL CARRIER

The BTR-4 armored personnel carrier (APC) is one of the best known military vehicle designs developed in Ukraine since independence. Developed from scratch by the "Kharkiv Morozov Machine-Building Design Bureau" (KhKBM) and named "Bucephalus" – after the Macedonian commander's Alexander horse – the BTR-4 symbolizes the power and reliability. Manufacturers claim: from the previous soviet models there's only armor. The layout of the BTR-4 is the same as in Western analogues and meets the NATO standards. Today "Bucephalus" is the faithful servant of Ukrainian military, especially in the area of antiterrorist operation (ATO) in eastern Ukraine.

The BTR-4 is designed for battlefield troops transport and to provide fire support to dismounted troops. It is intended to support Army units operating in various battlefield environments and conditions, including NBC environments. The BTR-4 could form the basis of armored vehicle fleets of special operations/rapid reaction forces and marine forces. It has been designed to operate on road and cross country in extreme climates and adverse weathers, at day and at night.

The layout of the vehicle represents a dramatic change compared to the older BTR family of vehicles, including the BTR-60/70/80/90. The BTR-4 hull is divided into three compartments, with the driving compartment in the front hull, the power pack compartment in the mid-center left hull and the fighting and personnel compartments at the rear of the hull. The power pack compartment is located immediately behind the driver's seat on its left, and it is linked to the troop compartment via a right-side passageway. The troop compartment in the rear hull has a two-part door (upper and lower parts which open outwards) for troop mount/dismount. The commander and driver can enter and exit the vehicle by side doors fitted with integral bullet-resistant windows. The windscreen is likewise of bulletproof glass-block construction, and it can be additionally protected with back folding armor screens.

The BTR-4 is the faithful servant of Ukrainian military in the area of antiterrorist operation in eastern Ukraine

The "Bucephalus» took an active part in the Ukrainian Armed forces' operation near Sloviansk

The BTR-4 layout design – which allows its fighting and troop compartments to be easily reconfigured without the need of rearranging the engine-transmission block – could be used as baseline configuration for a comprehensive family of armored fighting vehicles. The baseline BTR-4 design can form a basis for a family of specialist vehicles, including fire support vehicle, command/staff vehicle, armored medical evacuation vehicle, self-propelled anti-aircraft gun system, reconnaissance and observation vehicle and repair/recovery vehicle.

The APC's chassis has load carrying capability which not only allows for a broad variety of spinoff variants and AFV families to be designed on its basis, but also enables installation of appliqu armor protecting against automatic small-caliber gun fire. Anti-mine protection level of the BTR-4E was given as Level 3 according to STANAG 4569, which means the ability to withstand under-wheel detonation of 8 kg HE mines (the level of anti-mine survivability in case of an explosion under the hull has not been disclosed by the designer). An additional anti-mine floor protection is optional.

This armored troop carrier can mount multipurpose above-hull weapons stations of various types, particularly the ones designed for lightweight armored fighting vehicles. The proposed selection of weapons modules includes the Ukrainian-designed BAU-23, SHTURM, GROM and PARUS. The installation of foreign-supplied counterparts is also possible if the customer demands so.

The BTR-4 entered service in the Ukrainian Armed Forces in July 2012 and after two years the APC has passed its baptism of fire in the war in eastern Ukraine. Thus, in June 2014, the manufacturers released the official information regarding BTR-4 use during the operation near Sloviansk. The APC's armor withstood a square hit of heavy machine guns, the slat armor protected the crew and troops against anti-tank grenades attacks and armored glass stood the direct hits of sniper rifles. In confirmation of these words here's the statistics: after a year of the BTR-4 use in the ATO area, only one person was killed within this APC.

The BTR-4 entered service in the Ukrainian Armed Forces in July 2012 and after two years the APC has passed its baptism of fire in the war in eastern Ukraine

In March 2016 the following batch of BTR-4 in an amount of 16 vehicles, was transferred to the army

The participation of BTR-4 in warfare gives developers the opportunity for its constant improvement. In particular, after the first vehicle's experience in the ATO, its construction has undergone more than 50 changes. The latest updates concern the chassis design and onboard systems. The off-the-shelf variant of the BTR-4 has got the improved armor, which can be replaced in the field. In addition, the APC is planed to be equipped with a new Mercedes-Benz diesel engine, which will significantly reduce the level of the vehicle's noise.

At the same time, it should be noted that in March 2016 in Kharkiv on the territory of KhKBM with participation of the President of Ukraine, the following batch of BTR-4 in an amount of 16 vehicles equipped with Deutz engines, was transferred to the army.

As we can see, Ukraine – despite the need to deal with a whole tangle of scientific, technological, production and organizational issues – has been successful in creating new types of armored equipment which ensures the fulfillment of tasks by the troops in the most difficult combat conditions. UDR

TECHIMPEX

TECHIMPEX EXPANDS CAPABILITIES

The Scientific-Production Company "TECHIMPEX Ltd" is a Ukrainian private-sector company that performs contracts under Ukraine's Government Defense Procurement programs and enjoys an extensive experience in repairing and upgrading of military equipment and selling it in the domestic and foreign markets.

TECHIMPEX Ltd has over the past few years supplied and performed contracts for defense and security sector institutions of Ukraine involving major overhauls and upgrades on dozens of BTR-70T, BTR-80, BMP-1, MT-LB-23-2, MT-LB-23-2, BRDM-2T, BRDM-2RH and PZM-2 armored military vehicles as well as deliveries of mobile workshops and a wide assortment of spare parts, assemblies and units.
The Company offers unique packages for upgrading Soviet/Warsaw-Pact military equipment to meet Modern Warfare standards. Particularly it offers solutions for upgrading the BRDM-2 and BTR-70 vehicles to the BRDM-2T and BTR-70T configurations respectively. The upgrade allows for of improvement of repairability as well as ergonomic and mobile characteristics.
TECHIMPEX offers upgrade packages for the MTLB and MTLBU vehicles that include integration of ZU-23-2 AD cannon. The Company's new fire control system (which is currently at the final stage of development) equipped with an automatic target tracking capability, enabling the weapon to be controlled and fired from within the armored hull of the vehicle.
TECHIMPEX is developing an innovative sighting system for application on machineguns and air defense guns of various calibers. The system is fitted with optical and thermal imaging camera sensors to provide precision fire capability both in day and night operations.
The Company is designing a new weapon station easily installable on all types of combat vehicles and enables for weapon of different calibers.
TECHIMPEX, leveraging its extensive expertise in the upgrade of combat equipment, has developed and built a concept prototype of the VARAN APC unveiled at Kyiv Arms and Security Expo - 2015. The VARAN APC is built to the same layout as modern wheeled armored personnel carriers such as Patria/Rosomak AFVs, Otocar ARMA 8x8 or FNSS PARS 8x8. The VARAN APC, due to its layout design, offers a highly capable platform for conversion into a self-propelled mortar system, a fire support vehicle (armed with a domestically manufactured weapons turret accommodating 30-mm ZTM-2 autocannon, coaxial 23-mm cannon, 7.62-mm PKT machinegun, 12.7-mm NSVT machinegun and Barrier ATGM in various combinations) and other configurations.

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We work for the army – for strong state!

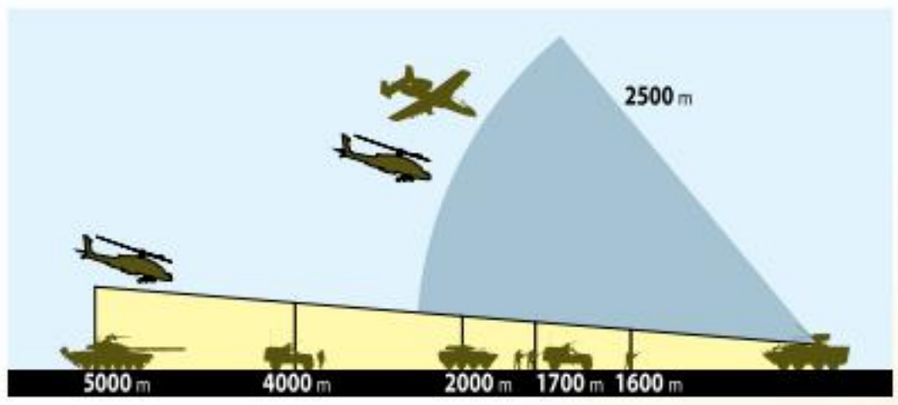
BTR-4
fully amphibious wheeled armored personnel carrier

Designed and developed by the "Kharkiv Morozov Machne-Building Design Bureau"

The BTR-4 was designed to conform to the Ukraine Ministry of Defense specification for armored military vehicles in this category

The BTR-4 APC is designed for battlefield troops transport and to provide fire support to dismounted troops. It is intended to support mounted and dismounted infantry operations in various battlefield environments and conditions, including NBC environments.

ARMAMENTS



The BTR-4 armored troop carrier can mount multi-target weapons stations of various types, including the BAU-23 (1), PARUS (2), SHTURM (3), GROM (4) and similar types of above-hull combat modules. The BAU-23, SHTURM, GROM and PARUS – the most potent combat modules in firepower terms – integrate identical weapons kits comprised of:

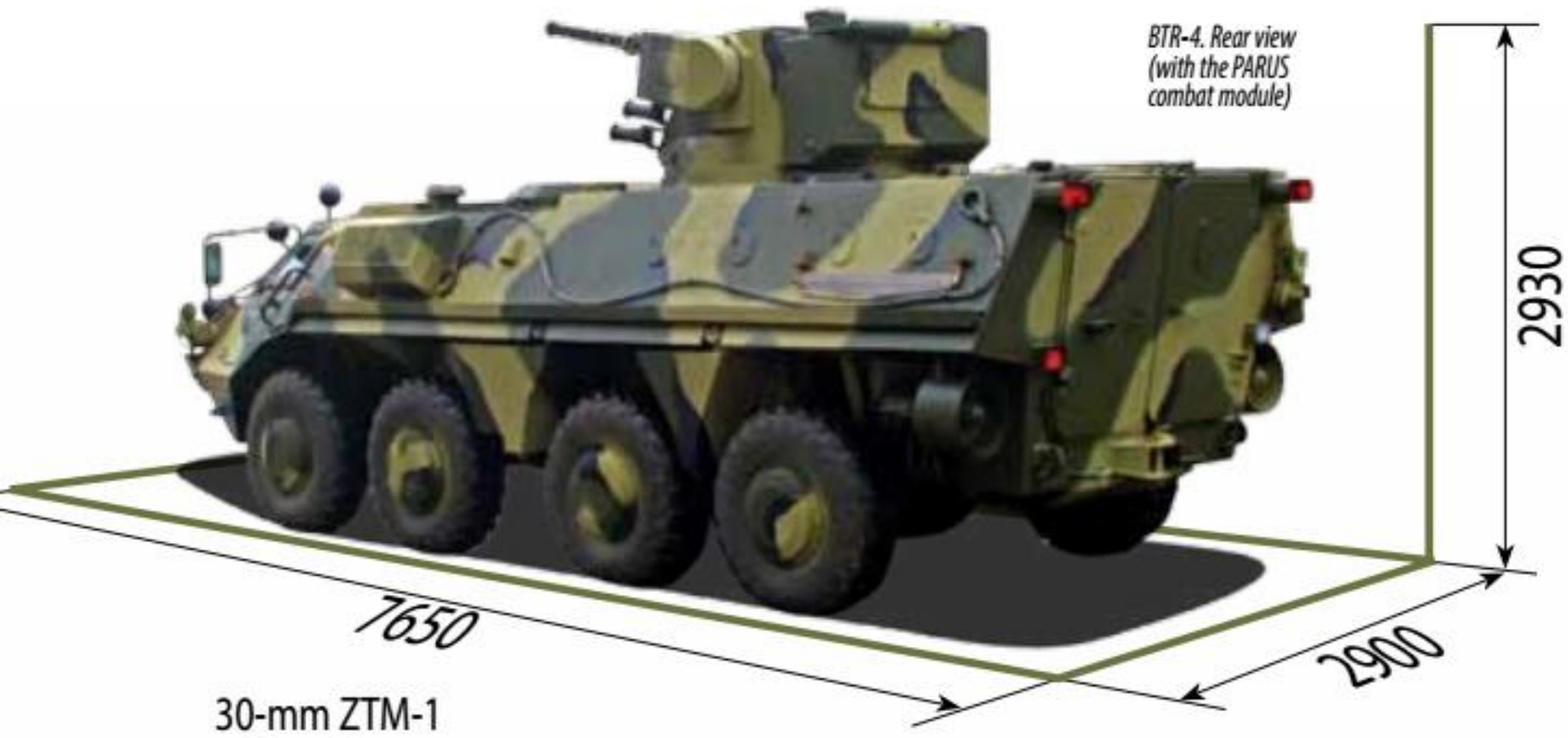
- 30-mm ZTM-1 automatic gun defeating ground targets out to 4,000 meters;
- 7.62-mm coaxial machinegun;
- 30-mm AG-17 automatic grenade launcher capable of effective ranges of up to 1,700 meters;
- antitank guided missile (ATGM) system BARYER with maximum launch range of 5,000 meters.

STRATEGIC MOBILITY

18t + 3%

The BTR-4 with additional armor protection may weigh up to 27 tons

The BTR-4 is air-deployable on the Antonov AN-70-class military transports or similar types of aircraft; transport configuration would depend on specific configuration of the vehicle being transported



BTR-4. Rear view (with the PARUS combat module)

30-mm ZTM-1 automatic gun

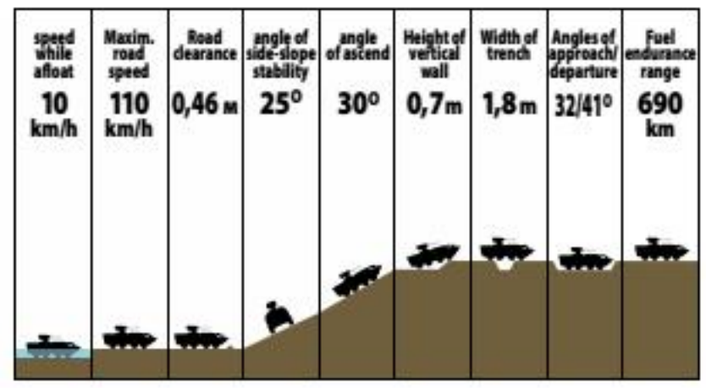
The all-welded steel hull is divided into three compartments, with the driving compartment in the front hull, the power pack compartment in the mid-center and the fighting & personnel compartment at the rear of the hull

The commander and driver can enter and exit the vehicle by side doors fitted with integral bullet-resistant windows

Bullet-resistant windows can be additionally protected with backfolding armor screens

Hydraulically-driven water guard is brought up in preparation for negotiating a river-line obstacle

RIDE CHARACTERISTICS



POTENTIAL CONFIGURATIONS:

- **BTR-4 armed with the GROM remote weapons station**

- **Armored command and control vehicle**

- **armored medical evacuation vehicle**

- **fire support vehicle**

- **reconnaissance and observation vehicle**

- **armored recovery vehicle**

CARRYING CAPACITY

[made in ukraine]

PROTECTED MOBILITY

UKRAINIAN 4X4 LIGHT ARMORED VEHICLES

In Ukraine, the Armed Forces and other national security sector services have a critical requirement for armored vehicles of various types. This has driven domestic companies to launch R&D projects on new armored vehicles to meet this requirement. This effort resulted in the development of a whole range of new indigenous armored cars that include Dozor-B (developed by Kharkiv Morozov Machine Design Bureau), Kozak-1 and Kozak-2 (Practika R&D and Production Company), Bars-6 and Bars-8 (Bogdan Motors), Cougar and Spartan (AvtoKrAZ), Triton (Leninska Kuznya) and Varta-2 (Ukrainian Armored Vehicles). UDR brings its readers forward to Ukrainian achievements in the segment of 4x4 light armored vehicles.

DOZOR-B

The Dozor-B 4x4 light armored vehicle was developed by the Morozov Machinery Design Bureau and is being produced at Lviv Armor Plant.

The vehicle is designed to protect the crew, passengers and internal equipment from NRBC attacks, the effects of small arms fire, shell fragments and mine threats, precisely 7.62-mm AP bullets fired from 30 meters, and fragments of 150-mm HE shells detonated 50 meters away.

The baseline Dozor-B design can form a basis for a family of specialist vehicles, including command vehicle, scout car and medical evacuation vehicle, as well as a mobile platform for antitank weapons or a fire support squad armed with 120-mm mortar.

The vehicle is powered by DEUTZ BF 4M1013FC four stroke four cylinder turbocharged 190hp diesel engine mated to Allison LCT-1000 automatic transmission. Suspension is of independent type with A-type control arms, with torsion springs integrated with hydraulic buffers on each of the four wheels.

Baseline equipment set includes HVAC, communications equipment, a GNSS receiver, a 6.8t self-recovery winch and a smoke grenade dispenser system.

The design of the hull allows the installation of slat armor to protect against larger caliber munitions and heavier mines. The level of additional protection will be defined by specific customer requirements.

The Dozor-B is armed with BPU-12.7 machine gun turret. The targets that can be engaged with this machine gun turret are hostile armored vehicles as well as aerial targets (helicopters) at ranges up to 2,000 meters, at day or night. A non-stabilized turret that can run autonomously, the BPU-12.7 is controlled remotely from operator's station. Related fire control system is comprised of a color TV camera, thermal imaging camera and laser rangefinder.

In early December 2015 press office of SC Ukroboronprom stated that Dozor-B has passed state tests and was recommended for adoption by the Armed Forces of Ukraine. Later it was also reported that the Ministry of Defense of Ukraine signed a contract with the Lviv armored plant for production of these armored vehicles in the interests of Ukrainian army.

KOZAK-2

Unveiled in 2014, the armored car Kozak-2 was developed by the R&D and Production Company Practika as a second-generation improvement to its Kozak armored car developed in 2009.

Kozak-2 during the tests on mine resistance

Built on the Iveco Eurocargo 4x4 chassis allowing for gross vehicle weights of up to 15 tons, payloads of up to 4 tons and a towing capacity of up to 6 tons, the Kozak-2 is powered by Iveco 279 hp 5.9L diesel engine (the first prototype Kozak-2 vehicle featured a 250 hp engine) mated to a 6-speed manual transmission.

The level of ballistic protection on the Kozak-2 vehicle has been improved to Stanag-4569 Level 2.

The vehicle was designed with a comprehensive range of anti-mine blast protection measures to provide the crew and passengers with an enhanced level of protection and overall survivability. First, the Kozak-2, like its older sibling, has modular layout where individual modules are not connected rigidly to each other, meaning the engine protection module affected by a mine blast under a front wheel, for example, will be thrown aside and away from the vehicle without transferring the energy of the blast wave to the crew module, as would be the case with rigid-

ly connected modules. The vehicle has a V-shaped hull bottom designed to absorb and deflect part of the force of explosions away from passengers inside the armored hull. This is complemented by a multilayer floor that absorbs part of the detonation energy and additionally reduces the secondary effects of fragments being projected inside the vehicle. The vehicle has blast attenuating seats fitted to the ceiling rather than the floor of the vehicle.

On a roof hatch, there is a gun mount that can accommodate a 7.62 mm/12.7 mm machinegun or a grenade launcher (AGS-17 or UAG-40).

The baseline equipment set includes a GPS/GLONASS receiver system, a radiation analysis system, a situational awareness system incorporating a thermal imaging camera, and a battlefield surveillance radar on a telescopic arm.

Practika intends to use the Kozak as the basis for a line-up of other armored vehicles to include inter alia reconnaissance, command, medevac and mortar vehicles.

In early June 2015, Practika won a contract to supply 22 Kozak-2 armored vehicles to National Guard of Ukraine. The first ten vehicles were delivered on June 6, 2015.

Alongside National Guard, a quantity of Kozak-2 vehicles was fielded with Ukraine's border guard units fighting separatist rebels in Eastern Ukraine.

SPARTAN AND COUGAR

PSJC AvtoKrAZ offers Spartan and Cougar, new MRAP armored vehicles it manufactures under license from Canadian-UAE Streit Group.

Developed in 2012, the Spartan 4x4 APC is based on Ford F550 chassis. The first prototype Spartan APC was built at Streit Group's Canadian Manufacturing Facility based in Ontario, Canada, and unveiled at IAV armored vehicles show in February 2013. In August 2014, a Spartan vehicle was seen at Ukraine's Independence Day military display in Kiev.

The vehicle incorporates a conventional layout with engine in the front, driver's station in the middle and troop compartment in the rear. It has seats for several soldiers, in addition to its crew of two.

The welded hull is made of steel armor plates inclined at an angle, offering CEN Level BR6 (7.62x51 mm NATO caliber at a range of 10 m) protection for the crew and passengers. The roof of the vehicle can be fitted with weapons stations and turrets of different types armed with a 7.62 mm/12.7 mm machinegun or an automatic 40 mm grenade launcher. Three firing ports are fitted to both sides of the troop compartment. Passengers enter and exit the vehicle via rear door.

Weighing almost 8t, the Spartan 4x4 APC is motorized by FORD TD V8 400 hp 6.7L turbo diesel engine coupled to a five-speed automatic trans-

mission. With a 257L fuel tank, the vehicle is capable of speeds up to 110 km/h (68.4 mph).

Spartan APC vehicles have been used by Ukrainian government forces deployed in rebel-held East Ukraine.

In early August 2014, 22 Spartan vehicles were ordered for production and delivery to National Guard of Ukraine. The first ten vehicles, equipped with Luch State Design Bureau's Sarmat turrets, were delivered on 22 October 2014.

On 30 December 2014, 15 Spartan vehicles armed with 12.7mm machineguns were ceremonially handed over to a Ukrainian Army unit by the President of Ukraine.

Spartan vehicles have been exported to Libya, Nigeria and Iraq.

Alongside Spartan, AvtoKrAZ manufactures the Spartan, a multi-role light armored vehicle (LAV) built on the Toyota Land Cruiser 79 and optimized for operation in urban warfare.

The first prototype Cougar vehicle was demonstrated at IAV armored vehicles expo in February 2013.

Being smaller than the Spartan APC, Cougar LAV offers similar performances in terms of ballistic armor protection and weapons load. Options for engine include inline 6 cyl Toyota engines developing 218, 228 or 240 hp.

The first 20 Cougar LAVs were ordered for production and delivery to National Guard of Ukraine in August 2014. Two Cougar vehicles were fielded with Ukrainian Army's Poltava territorial defense battalion, and 47 vehicles were delivered to State Border Guard Service of Ukraine in November 2014.

The Cougar has already received its baptism in combat. Particularly in December 2014, a Cougar vehicle carrying Border Guard Service personnel came under fire in an ambush-style attack. Having received 76 hits in its hull, the vehicle was able to withdraw under its own power from the area of fire exposure.

BARS-8

Developed by Bogdan Motors, the tactical armored vehicle Bars-8 made debut in April 2015, during a demonstration of new indigenous military vehicles to the country's leadership at the National Guard's test and training facility in Novi Petrivtsi outside Kiev.

Available with a 6-speed manual or automatic transmission, the all-wheel drive vehicle features a body-on-frame construction, reinforced suspension and axles, a 6.7 liter Cummins turbocharged diesel engine developing 385hp, and thickened-wall exterior body panels. The Bars-8 is designed to support tactical and special operations of military forces and other national security sector services, by providing transportation of personnel and supplies over rough terrain. Being in the 8t gross vehicle weight (GVW) category, the armored car can carry a full squad of 10 personnel, under the protection of its STANAG 4569 Level 2 compliant armor. The body-on-frame vehicle, it is built on the chassis of the Dodge Ram truck.

Designed to have a combat weight of 10 tons, the Triton is built with a water fording capability.

The welded hull is made of steel armor plates inclined at an angle, offering NATO STANAG 4569 Level 2 ballistic protection. The hull has a five door design, with two front side doors for the driver and commander, and one rearward and two middle side doors for troop mount/dismount.

The doors have bullet-proof windows in the upper panels. The windshield is of two-part construction consisting of two bullet-proof windows. Over the troop compartment, there is a roof hatch for observation, firing and emergency exit.

The vehicle can be optionally equipped with a winch for self-recovery or assisting other vehicles of the same or lighter mass. Other optional extras include HVAC equipment, a situational awareness system with rear-view and 360-degrees cameras, a GPS navigation device, thermal imaging cameras and night vision devices, NRBC filters and air filtering system.

The Bars-8 can accommodate different types of weapons sta-

tions and turrets armed with a 7.62 mm/12.7 mm machinegun or an automatic 40 mm grenade launcher, or an indigenous AT-GM launcher system.

Aimed at possible Ukrainian Army requirement, as well as other security sector institutions, the vehicle is now undergoing the State Trials process that is potentially leading to Approval for Service Use.

TRITON

Developed and built by Leninska Kuznya, the first prototype of the Triton 4x4 APC vehicle was revealed at Kiev Arms and Security trade fair in late September 2015.

Designed to have a combat weight of 10 tons, the vehicle is built with a water fording capability.

It features a remote control turret developed in-house by Leninska Kuznya, integrating a 12.7-mm machine gun and an UAG-40 grenade launcher. The turret is controlled remotely from within the armored hull using a computer interface. Turret weapons allow targets to be hit and destroyed with great accuracy at ranges of 1,500-2.000 meters. The machinegun can be fired simultaneously with the grenade launcher or independently.

Now that the project has just reached the prototyping stage, it's too early at this point to talk about performances of the vehicle or its market potential. But what can be said even now is that the Triton APC vehicle has a water fording capability, and this distinguishes it favorably from its indigenously developed counterparts.

VARTA-2

In December 2015, Ukrainian Armored Vehicles unveiled its Varta-2 armored car aimed at Ukraine's National Guard requirement. The car has seats for nine troops, plus the driver. It is fitted out with the necessary accommodations for crew and passenger comfort, including HVAC equipment. The vehicle is provided with the Level Five ballistic armor protection by the Ukraini-

UKRAINIAN 4X4 LIGHT ARMORED VEHICLES

Specifications	DOZOR-B	KOZAK-2	BARS-8
Dimensions, mm	5600 x 2400 x 2700	7050 x 2500 x 2650	5500 x 2200 x 2400
Crew	3+6	3+8	3+8
Engine	DEUTZ BF 4M1013FC4.76L, V4, turbocharged 190 hp diesel	IVECO 5.9L, V 6, turbocharged 251 hp diesel	CUMMINS 6.7L, V8, turbocharged 385 hp diesel
Weight, kg	8450±250	15000	9000
Maximum speed, km/h	120	120	110
Mobility range, km	700	700	700
Armaments	Autonomous BPU-12.7 machine gun turret	PKMS 7.62 mm / NSVT 12.7 mm / KT 12.7 mm machine gun or AG-17 / AG-40 grenade launcher	PKMS 7.62 mm / NSVT 12.7 mm / KT 12.7 mm machine gun or AG-17 / AG-40 grenade launcher

an PZSA standard. It features a V-shaped armored hull and an internal roll cage to help protect against mines and roadside bombs.

The Interior Ministry of Ukraine has ordered the delivery of ten Varta-2 vehicles to equip its SWAT and National Guard units, according to the Interior Minister, Arsen Avakov.

At this point, the vehicle is motorized by a maintainable 270 hp engine, which is slated to be eventually replaced with a 300 hp Cummins motor.

The vehicle's hull armor provides ballistic protection against 7.62x39 mm armor piercing rounds. The vehicle has blast attenuating, shock-absorbing seats for the crew and passengers, similar to ones found on armored vehicles produced by BMC, FNSS, Otockar and others.

Rugged springs and shocks are used for improved speed performance and off-road agility.

Side walls and roof of the vehicle hull are so designed to accommodate a crown-type or machine-gun turret weighing up to 500…550 kg. The Varta-2 can accommodate different types of weapons stations and turrets armed with a 7.62 mm/12.7 mm machinegun, and it will also accept the BP-1 or a similar turret found on the BTR-70/80 and BRDM-2 armored vehicles. The Varta-2 vehicle is capable of speeds up to 120 km per hour.

In December 2015 and January 2016, a prototype Varta-2 vehicle was undergoing snow-covered off-road trials at a National Guard's proving ground.

With such a great variety of indigenously designed 4x4 armored cars on offers, domestic competition will increase, driving manufacturers to improve their products to attain bearable advantages. The adverse factor is that the vast majority of the armored vehicle designs are built using parts and assemblies that are not interchangeable, and some use commercial technologies that are not suitable for military applications. Ukraine's defense and security sector customers will therefore have to weigh all aspects of proposed solutions before making final choices. UDR

COUGAR/ SPARTAN	TRITON	VARTA-2
5352 x 2030 x 2114 / 6020 x 2438 x 2381	5650 x 2450 x 2300	7050 x 2600 x 2550
2+6 / 2+6	3+8	2+8
TOYOTA 1GR-FE 4.0L, 228 hp gasoline/ FORD 6,7 L, V8, turbocharged 400 hp diesel	VOLVO TAD620VE 5.7L, V6, 211 hp diesel	YaMZ-536 6.65L, L6, 270 hp diesel
5900/8800	8000	13500
105/ 110	110	120
900/ 800	700	700
PKMS 7.62 mm / NSVT 12.7 mm / KT 12.7 mm machine gun or AG-17 / AG-40 grenade launcher	Autonomous OBM machine gun turret	PKMS 7.62 mm / NSVT 12.7 mm / KT 12.7 mm machine gun

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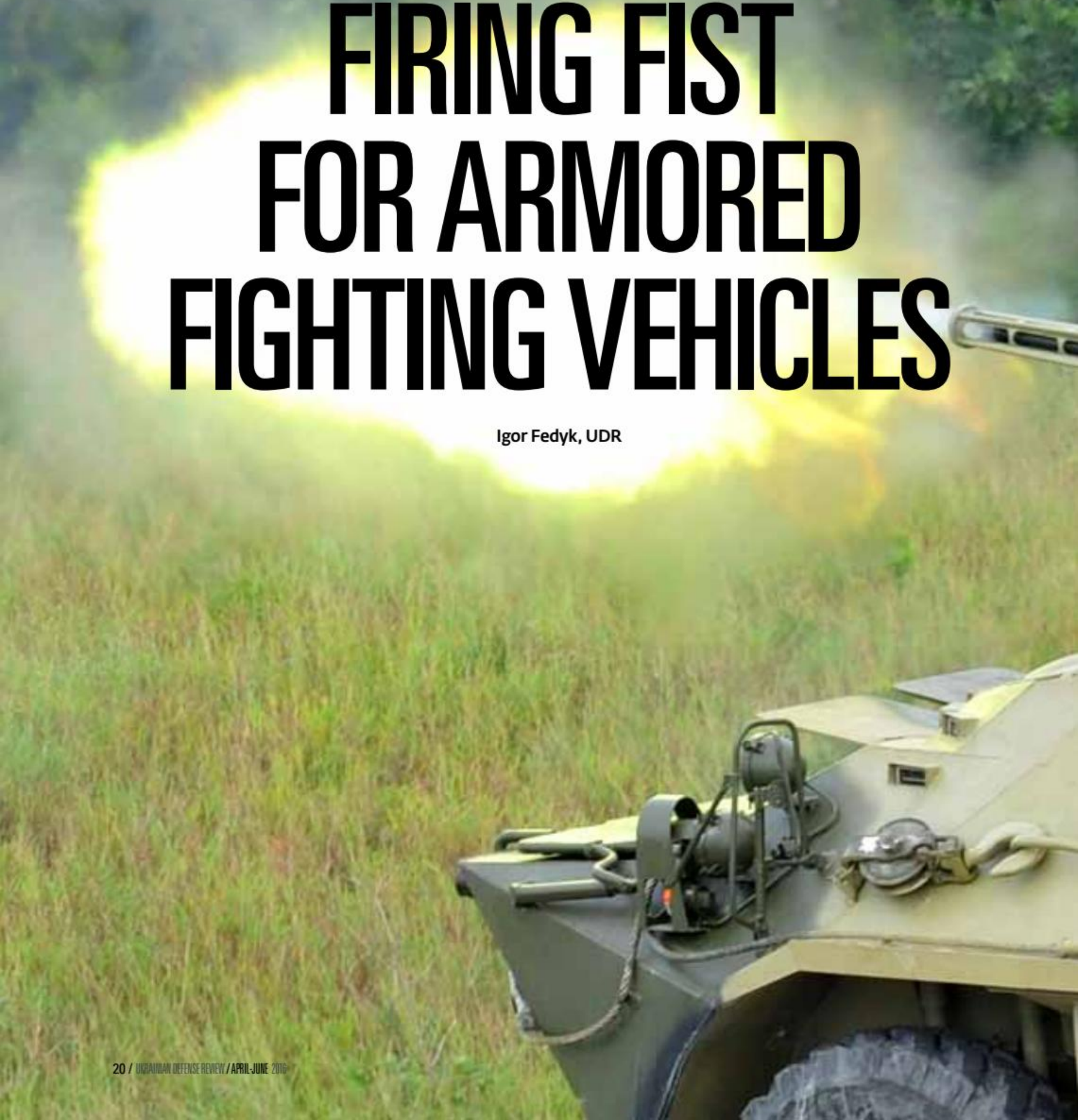
FIRING FIST FOR ARMORED FIGHTING VEHICLES

Igor Fedyk, UDR



Any current armored fighting vehicle (AFV) has a weapons turret mount as one of its main components that determines how well an AFV vehicle will do in combat. UDR offers its readers an overview of recent AFV turrets being proposed by Ukrainian arms producers.

INNOVATIONS FROM CHEZARA

The current state-of-the-art AFV weapons turret being offered by Chernihiv-based PJSC CheZaRa is the Desna turret. Intended to be used against armored vehicles, weapons emplacements, enemy forces and low-flying targets (such as hovering helicopters), this one-man turret includes a remote-controlled multi-role optronic suite performing targeting stabilization, target acquisition and weapons control functions.

The Desna turret accommodates a 30mm ZTM-1 (2A72) or ZTM-2 (2A42) autocannon, a Barrier ATGM launcher, a 7.62mm PKT-7.62 machine gun, a 30mm AGS-17 (KBA-117) grenade launcher and an 81mm 902V Tucha smoke grenade dispenser system. The targeting stabilization device includes a gyroscope developed by CheZaRa for this application.

Surveillance and target acquisition functions are performed using day sight cameras, a laser rangefinder and a color LCD display, enabling targets to be detected and recognized at ranges between 7 km to 160 km, and offering an automatic target tracking capability.

A noteworthy point is that the targeting stabilization, target acquisition and fire control suite is a proprietary development by CheZaRa. It is accessible as required by the tactical situation for both the gunner and the AFV commander from their respective workstations, and enables turret weapons to be controlled remotely via a wireless communication link.

The design of the Desna turret offers advantages in terms of convenience of ammunition stowage and feed, the turret layout, as well as the use of electronic equipment that is compact in size with minimum number of constituent units, thus saving valuable internal space.

Alongside the Desna, CheZaRa offers its lighter-weight weapons turret "Iva". Designed for engagement of light armored vehicles, weapon emplacements, enemy soldiers and low-flying slow targets (such as hovering helicopters), it is suitable for integration onto AFV vehicle and watercraft platforms and can also be used as a stand-alone firing point. Along with ground, sea and coastal situational awareness in day and night conditions, the "Iva" turret is equipped with capabilities for pre-launch measurement of target angular coordinates and range tracking.

The design of the Desna turret offers advantages in terms of convenience of ammunition stowage and feed, the turret layout, as well as the use of electronic equipment that is compact in size with minimum number of constituent units, thus saving valuable internal space.

The turret is proposed with three different weapons configurations which are a 12.7mm machine gun; a 12.7mm machine gun plus a 7.62mm machine gun; and a 12.7 mm machine gun plus a 40/30mm grenade launcher, provided with 200 12.7mm rounds, 300 7.62mm rounds and 32 ready-to-fire rounds for the 40/30mm grenade launcher.

The "Iva" turret carries a surveillance and target acquisition suite that includes a day sighting system with a dual FOV color TV camera, an eye-safe laser rangefinder and a color LCD display, and enables targets to be detected at ranges from 7 km to 160 km. Optionally, its modular design allows the integration of a night sighting system with an uncooled thermal imaging camera module of the Ukrainian manufacture. CheZaRa is close-

ly engaged in this area with Izyum-based Instrument Factory.

The turret can be controlled both remotely as well as manually. Targeting stabilization capability is not provided at this phase of the project, but the traverse and elevation stabilization functionality can be added optionally.

TWO IDEAS FROM KBTZ

Kiev Armor Plant (KBTZ) offers potential customers two of its recent products; one is a yet unnamed new turret and the other is the BM-3M "Shturm-M" (meaning "assault").

The former is an all-new design intended for integration onto light armored vehicles and configured for attacks on ground-based and low-flying targets. It can be detached from a vehicle and used as a static firing point for base protection, but it is also suitable for integration with naval turret mountings.

The turret hosts a 30mm ZTM-1 (2A72) autocannon with an allowance of 400 rounds of ammunition, a coaxial 7.62-KT or PKT machine gun with a 2,000 round ammunition allowance, a 30mm AG-17 automatic grenade launcher, as well as a 81mm 902V Tucha smoke grenade dispenser system. It should be noted that the weapons kit on this turret doesn't include an ATGM launcher, which makes it less expensive to buy and maintain (but an ATGM launcher can be installed as an optional extra to better meet specific customer needs).

This new KBTZ's turret features the fire control system "Kashtan" developed by Kiev-based AT-System R&D and Manufacturing Company. This is a dual-mode computer-aided system that can be operated both remotely and locally on the vehicle. It offers an operating range of 1,800-8,000 meters or 600-2,000 meters at daylight or night respectively, and can detect an APC-sized target within an envelope with a width of 150m and a length of from 500 to 4,000m in less than 15 seconds with a 90 percent probability of success.

The Kashtan is rather unique in that its optronic module is not located laterally but is rather positioned between the cannon and smoke grenade launchers. This makes it better protected against influences from the outside, and therefore contributes to the overall effectiveness of the weapons turret as a system.

Although a stabilization system for turret weapons is, for now, offered as an optional extra, the turret can be equipped with an electro-mechanically operated digital two-plane stabilization system SVU-500-10R produced by Kiev-based PJSC "Petrovsky R&D and Manufacturing Company".

The other turret, the BM-3M "Shturm-M" is being offered after some 700 improvements were made to its original design, including particularly a current-generation mission computer and a NATO-compatible fire control system. The latter was upgraded with an eye to integrating the system into a single device, this being complemented with a proprietary interface, enabling all the targeting data to be displayed on the screen of the mission computer.

Other improvements include changes to the overall layout of the turret mount. Particularly sighting equipment received additional protection, while the area between the turret and the vehicle's hull has been made almost impervious to the effects of round shots, thus reducing the probability of the turret ring being jammed as a result of damage.

The Shturm-M turret comes complete with a multi-spectrum camouflage net supplied by Lubawa S.A. of Poland, which makes both the turret and the host vehicle less visible in the infrared and radar spectrums.

The weapons kit on the upgraded Shturm-M turret was remained the same as it was prior to upgrade, consisting of a 30-mm ZTM-1 canon, a 7.62-mm KT 7.62 machine gun, a 30-mm KBA-117 automatic grenade launcher, a Barrier ATGM launcher and six 902V Tucha smoke grenade launchers. The turret weapons control system is comprised of an SVU-500 traverse and elevation stabilizer, a Trek day/night surveillance and acquisition system with TV and IR cameras and an integral laser rangefinder, as well as a Panorama-2B 360-degree television surveillance system.

The Iva turret is proposed with three different weapons configurations which are a 12.7mm machine gun; a 12.7mm machine gun plus a 7.62mm machine gun; and a 12.7 mm machine gun plus a 40/30mm grenade launcher.

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ZHBTZ'S UPGRADE OF THE SHKVAL TURRET

Zhytomyr-based Armor Plant (ZhBTZ) offers its BMP-1UM IFV vehicle upgraded with Shkval-A turret mount.

An upgraded version of the Shkval turret, the Shkval-A incorporates the Tandem-2 optronic surveillance and fire control system that provides several advantages over its counterpart seen on the Shkval turret prior to upgrade. Further improvements may include a day/night fire control capability enabled particularly by the use of the KLW-1 ASTERIA cooled thermal camera that was displayed by PCO S.A, Poland, at MSPO 2015 expo.

Traverse and elevation stabilization is ensured by the two-plane SVU-500-3Ts stabilization system produced by Kiev-based PJSC "Petrovsky R&D and Manufacturing Company".

The Shkval-A differs from the original Shkval in that is uses two Kompleks 212 ATGM launchers firing RK-2S missiles in place of as many Fagot ATGM launchers firing PU 9M113M missiles.

The Shkval-A accommodates the same weapons kit as found in the original Shkval prior to upgrade, comprised of a ZTM-1 autocannon, a coaxial 7.62mm PKT-7.62 machine gun, a 30mm AG-17 automatic grenade launcher and 6 smoke grenade launchers. It is noteworthy that the ZTM-1 cannon can be fired manually using a back-up mechanical trigger in the event of vehicle power supply failure.

An upgraded version of the Shkval turret, the Shkval-A incorporates the Tandem-2 optronic surveillance and fire control system that provides several advantages over its counterpart seen on the Shkval turret prior to upgrade.

FIREPOWER FOR DOZOR-B ARMORED VEHICLE

The Dozor-B armored vehicle (produced by Lviv Armor Plant) uses as its main armament the turret mount BPU-12.7 developed and produced by Kharkiv Morozov Engineering Design Bureau. The BPU-12.7 is a stand-alone, non-stabilized turret controlled remotely from operator's workstation. It is intended to engage lightly armored vehicles and low-flying aerial targets (helicopters) at ranges of up to 2,000 m during day and night operations.

The weapons turret, which weighs 350 kg and is 618-mm high, hosts a 12.7-mm remotely controlled machine gun (NSVT or its Ukrainian counterpart KT-12.7), a laser rangefinder, a color TV camera and a thermal imaging camera, as well as a remote control unit. It offers enough elevation to engage and defeat low-flying slow targets, and carries 150 12.7-mm ready-to-fire rounds fed from a cartridge box belt, the reserve ammunition being stowed inside the hull of the vehicle.

LONG ARM FOR THE ARMORED FIGHTING VEHICLE

Ukrainian companies are also working on concepts that include a 23-mm anti-aircraft can-

non used as the main armament of an AFV turret. One such design, designated BM-23, is being developed by Kiev-based Artillery Design Bureau (ADB).

The idea to use air-defense cannons on AFV turrets arose given the abundance of both 23-mm antiaircraft guns and related ammunition in Ukraine's military arsenal, designers say.

At this stage, the ADB offers a turret armed with a single 23-mm cannon in order the see what the market response will be, but the final idea is to develop a turret mount equipped with two antiaircraft cannons, more specifically those seen on the ZSU-23-4 "Shilka" self-propelled radar guided anti-aircraft weapon system and the twin-barreled ZU-23-2 towed gun.

In one potential configuration, the turret will be used as a stand-alone firing point -- controlled remotely as well as manually and fitted with capabilities for surveillance, threat warning, data transfer to higher air defense echelons etc, with potential addition of weapons for other roles, including particularly ATGM launchers.

Westan Group Associates LTD offers its "Viy" turret armed with the twin-barreled 23-mm autocannon GSh-23 that was developed in the Soviet Union primarily for military aircraft use.

The Viy is a remote turret weapons module suitable for integration onto light armored vehicles and designed to defeat medium-armored vehicles, firing points, enemy soldiers and low-flying slow targets (hovering helicopters). As noted above, the main armament used in this turret is the twin-barreled 23-mm autocannon GSh-23L that offers an effective range of about 2,000 m and a rate of fire of up to 3,400 rounds per minute.

The Shturm-M turret comes complete with a multi-spectrum camouflage net supplied by Lubawa S.A. of Poland, which makes both the turret and the host vehicle less visible in the infrared and radar spectrums.

Turret «Viy» armed with the twin-barreled 23- mm autocannon GSh-23 that was developed in the Soviet Union primarily for military aircraft use.

Fire control capability is enabled by the optical-television sighting system OTS-20.01 developed by Kiev-based NII Kvant, which offers day/night AFV-vehicle-sized target recognition ranges of 4,000 m and 900-1,100 m respectively. The turret also carries the anti-aircraft sight PZU-5, which can be used as a backup sighting and targeting capability, with optional extras including a rangefinder, a thermal imaging camera and a 7.62-mm KT-class machine gun.

Overall it could be said that R&D and production of weapons turrets for application on AFV platforms have seen a stable development in Ukraine. It should be noted that the domestic arms companies dealing with the development of new turrets and upgrading of existing designs to higher performance are not only seeking to exploit new trends and technologies, particularly in areas of fire control or weapons stabilization, but also to take into account budget restraints and make the new armaments more affordable to military customers in Ukraine. UDR

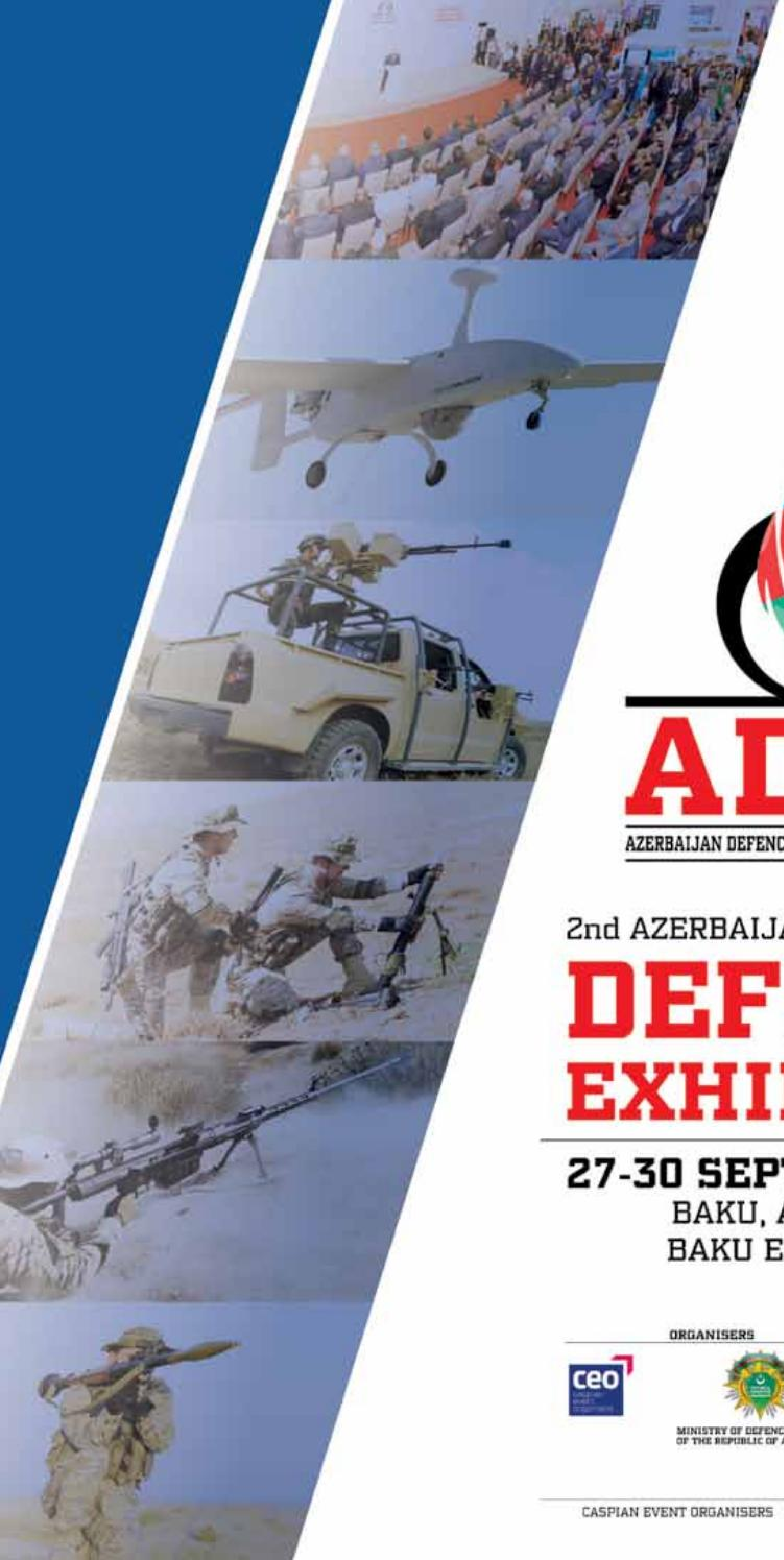
MORTAR FIRE

The ongoing military conflict in eastern Ukraine has seen large-scale use of artillery, mortar guns being particularly effective in engaging enemy forces and targets. Ukrainian companies have developed a lineup of mortar guns in various caliber sizes, leveraging the international experience and lessons learnt from Ukrainian army operations in eastern theater. In particular, Kiev-based Artillery Design Bureau (ADB), which is incorporated with Ukroboronprom State Company, developed and brought into production its 60-mm KBA-118 mortar and 82-mm KBA-48M mortar. In its turn, Mayak Factory, another company from Kiev incorporated with Ukroboronprom, has developed a 120-mm mortar, which is currently known by its designation as M-120-15 "Hammer".

Property	KBA-118
Caliber	60 mm
Max firing range	1,429 m
Rate of fire	20 rpm
Elevation	40° – 85°
Mass of the mortar	12.5 kg
Mass of HE round	1.33 kg
Crew	1-2

Property	KBA-48M
Caliber	82 mm
Max firing range	100-4,000 m
Rate of fire	10-15 rpm
Elevation	40° – 85°
Mass of the mortar	35 kg
Mass of HE round	3.0 kg
Crew	3

Property	M-120-15 «Hammer»
Caliber	120 mm
Max firing range	7,100 m
Rate of fire	12 rpm
Elevation	40° – 85°
Mass of the mortar	210 kg
Mass of HE round	15-16 kg
Crew	Up to 5



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As for today, Scientific and production association "AVIA", Ltd., is one of the world leaders in Mi-8, Mi-17, Mi-171 and Mi-24(35) helicopters training complexes manufacture and training for those helicopters types.

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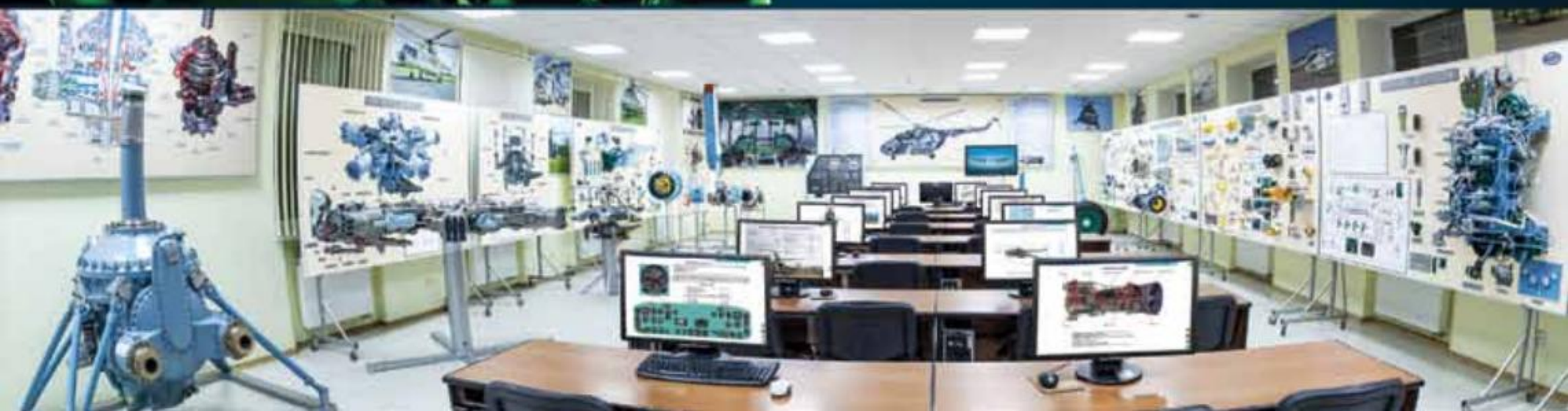

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RUSSIAN HYBRESSION

DISTINCTIVE FEATURES, PHASES AND THEIR SUCCESSION

Mykhailo Honchar, Centre for Global Studies "Strategy XXI", President

In the annals of history, Russia's hybrid aggression (hybression) in Ukraine will be strongly associated with the name of Russian president Vladimir Putin – its chief ideologue and author, along with Alexander Dugin, Vladislav Surkov and Valeriy Gerasimov to name the least. Dugin's role is the "chief designer" of the project on geopolitical re-engineering of the Eurasian expanse. Surkov is the chief technologist for rearrangement of the Eurasian expanse, while Gerasimov serves as the chief expert on military matters. The latter's role is absolutely necessary insofar we are talking about warfare, even if it's "hybrid" warfare.

The first distinctive feature of a hybrid war vs linear war is that a hybrid aggressor makes the conventional component of its aggression stealthy at the initial stage so the adversary remains unaware of being subject to an aggression. Creeping occupation of Crimea by the "little green men" is illustrative.

The second important feature is that military success is ensured with minimal use of conventional capabilities to mislead the adversary and third parties into believing that a low-intensity conflict posing no direct threat to uninvolved parties is taking place.

The third feature is that the aggressor, while initially using its conventional capabilities to the minimal extent only, is undertaking intensive subversive effort to undermine the adversary country "from within" by creating and making wider and deeper "cracks" and "fractures" in its information, political, military, economic and social environments.

The fourth feature is that the aggressor creates a tailored

"smart management injection" system to leverage the adversary's capabilities. The most conspicuous examples are State-owned Russian banks entering Ukraine's financial sector during the period of Russian aggression, as well as State-owned Ukrainian companies continuing their Ukrainian government-funded operations in rebel-occupied areas in the east of the country.

The fifth feature is that the hybrid aggressor is making third countries believe it has nothing to do with "internal conflict"; imposing itself for the peacekeeper role; encouraging third parties to stay away from the conflict in order not to allow the defending country to strengthen its capabilities to respond to the aggression. Examples are the US refusal to provide defensive military support to Ukraine and the rejection by Brussels of Kiev's request that the EU send a peacekeeping or police mission to Donbas.

That being said, hybrid warfare is not an invention of today. It is described by the Russian expert community as an instrument to enhance the capacity of conventional policy approaches, which meets famous definition of war by Clausewitz.

The Centre for Global Studies "Strategy XXI" defines hybrid aggression as a diverse and dynamic combination of forces adaptively employed against the adversary, whereas conventional military means have a secondary importance, their use being masqueraded and denied, and the act of aggression generates uncertainties making difficult its identification as such.

The end objective of a hybrid war is to defeat the adversary using a combination of military and non-military means (political, economic, military, humanitarian, etc.), to not only win militarily but also to destroy its stamina and balance "from within".

A hybrid war doesn't start with an overt military invasion but rather with the aggressor's subversive operations in an adversary country aimed to bring it to self-destruction.

The aggressor's propaganda machine masquerades this as civil conflict in the country, caused by "color revolution".

Media and propaganda support for a hybrid aggression has a strategic goal of generating semantic and attribution uncertainties in order to confound and confuse public opinion by imposing preferred interpretation of the events as a follow-up of internal conflict. This interpretation appeals especially to the outside world and the defending country's citizens influenced by the adversary propaganda. A notable example of this is the use by international institutions and the world's leading governments of terms "Ukrainian crisis" and "Ukraine conflict" in place of "Russian aggression".

The ways an aggressor deals with its adversary are diversified and adaptive to change. The diversity of means employed by an aggressor adaptively in pursuit of its goals is an aspect specific to 'new generation' warfare. Scenario for a hybrid war can be designed as the war unfolds, leveraging arising opportunities. So in a hybrid war, **the tactics prevails over strategy.**

The aforementioned definition deals with a distinctive feature of hybrid aggression, such as the generation of uncertainties. The following is a description of the fundamental 4-phase algorithm for nonlinear processes employed in a hybrid war technology:

1. False targeted programming of the adversary via a "cooperative model", under which disguise a program on the adversary's destruction is being implemented
2. Dispersion of certainties into the body of uncertainties; the creation of managed chaos
3. Management of uncertainties – managing the chaos
4. Turning chaos into order, achieving a new reality.

With this in mind, one should consider a certain sequence of phases in the preparation, conduct and completion of a hybrid war. Using the Russian hybrid aggression in Ukraine as an example, and keeping in mind the exploratory work done by the Russian Armed Forces General Staff, it can be schematically represented as follows:

1. The crypto-war (2003 – 14.08.2013)
2. Proxy phase (08.14.2013 – 20.02.2014)
3. The diffused invasion of the Russian Federation Armed Forces into the Crimean Peninsula and eastern Ukraine ("the little green men", "polite people") (20.02.2014– 12.04.2014)
4. The conventional military phase 12.04.2014-18.02.2015 – *Covert infiltration (12.04*

-11.07.2014, the start of Russia-based artillery shelling of Ukrainian troops);
– Managed escalation (11.07.2014-18.02.2015 till the Minsk-2 Agreement)
– Managed de-escalation (after the Minsk-2 Agreement, after the seizure of Debaltseve by Russia's proxy forces)

4. Intra-phase (+ proxy phase) 18.02.2015 (the Minsk-2 Agreement) till present time
5. "Peacekeeping" operation
6. Managed transformation of the occupied territory

Crypto-war is a separate stage of aggressive war that is waged implicitly and is not perceived as such but rather as a kind of "sub-war". It is the phase that always precedes the phases that follow it, but is not a phase of hybression per se. The crypto-war is a covert form of the aggressor's incremental, systemic and long-term effort aimed to inflict the maximum damage possible on the adversary in order to exhaust its capacities to a limit acceptable for a decision to launch a conventional or hybrid aggression.

Unlike the crypto-war, the proxy phase is a component part of a hybrid war. It is a kind of culmination of non-military operations preceding the hybrid invasion phase. The proxy phase typically has a duration of several months, being a transition phase from the crypto war to hybrid aggression. **This is a phase where the aggressor State makes an intensive use of non-military capabilities available to it, in order to achieve a combined effect of its destructive effort against the adversary State, resulting in dysfunction of its economy and the machine of government.**

If the proxy phase is not successful, it is then followed by the diffused invasion phase – an aggression "from within" fueled externally by the aggressor State. This and the conventional military phase that follows it are the main phases of a hybrid war. The two phases need to be sufficiently swift (Blitzkrieg) in scenarios where the defending country's conflict-evoking power is "warmed up" to a sufficient degree during the proxy phase, and the country has got exhausted by the crypto-war. Russia's Crimean campaign is an example of a success in a hybrid war achieved during the diffused invasion phase, while the "New Russia" project is illustrative of the collapse in a scenario where the Crimean campaign was mechanically applied as a blueprint to a region that has different specific features from those Crimea has.

The diffused invasion phase paves the way to the next phase of a hybrid war that includes a limited use of conventional military capabilities. Diffused invasion simultaneously generates and comes along with the emergence of internal tensions and conflicts prepared for in advance by agential efforts, the declaration of secessionist entities, the formation by those entities of "self-defense" groups, "people's militia" and "Cossack troops" operating under the covert leadership of foreign experts that had arrived under the disguise of "tourists", "volunteers" or "vacationers".

If diffused invasion and the use of conventional military capabilities are not successful, the "phase shifting" can be done. This happens in the event of a collapse of the blitzkrieg strategy as seen in the east of Ukraine. The intra-phase of war is turned on and, on a parallel track, the proxy phase is resumed. Moreover, kind of a "peace process" — in our case, the Minsk process — is launched. Meanwhile, the use of conventional military capabilities is reduced to the minimum, while the use of non-military means of the defending country's destruction, both from within and from outside, is maximized. The legally questionable Minsk agreements enabled Russia to launch an intra-phase, with a focus both on exacerbating the internal conflict in Ukraine due to Kiev's errors and Moscow's destabilizing efforts, and on a creative approach to dealing with the events as they unfold. In Ukraine's case, this approach is laid down in the Minsk accords, in which the aggressor sought to incorporate the following algorithm:

1. Federalization of Ukraine with a "special status" for the occupied territories
2. Legalization of pseudo-state entities in Ukraine's legal environment and, on a parallel track, limited economic integration of the occupied territories into the Russian economy
3. Snap parliamentary elections preferably resulting in at least a "blocking stake" for the pro-Russian forces
4. Pushing a pro-Russian figure into the prime minister's seat
5. The trimming of presidential powers
6. A foreign policy revision with focus shifted to Russia.

The goal of all this was to get Ukraine, stripped of parts of its territory, transformed into kind of a Ukrainian SSR with its capital in Kharkiv.

If this algorithm doesn't work, the next phase will follow through with a military escalation blamed on the defending country, and a regular military force will be deployed under the guise of "peacemaking". Keeping in mind the lengthy decision-making procedures to reach a consensus at the international level, the initiator of

the "peacekeeping operation" can act faster to achieve a speedy solution to the crisis, citing humanitarian considerations — such as the need to prevent civilian casualties — as a basis for action. As the Chief of the Russian General Staff Valeriy Gerasimov noted in his article "Drawing on the experience of Syria", "The overt use of force is the last resort option that is typically turned to under the guise of peacekeeping and crisis management".

The final phase is the stabilization and transformation phase. This is a transitional phase where the goals of hybrid aggression have been achieved, and the challenge being dealt with here is to completely stabilize the situation in the occupied territory and to transform it into the most optimal form of existence, which is a dependent territory or several territories with different statuses and the degree of integration with the occupier. The above described phases have no strict lines between them, and each following phase can overlap to a degree with the preceding phase.

In conclusion, it is worth noting that the exploratory work done by the Russian Armed Forces General Staff drawing on lessons learnt from Russia's first Middle East campaign in Syria puts an emphasis on "the remote contactless engagement of the adversary by the massive use of long-range, precision-guided weapons delivered from the air, sea or from space". Thus, we can conclude that the set of the means and methods of hybrid aggression can be supplemented by a component such as a high-tech contactless war that transforms a hybrid aggression into a new generation classical warfare. It is also noteworthy that Russia, fearing a retribution for its hybrid aggression, is preparing for active defense. According to V. Gerasimov, *"An additional set of coordinated statewide military and non-force measures has been adopted with a view to neutralizing military dangers and threats, inclusive of countering hybrid methods of exerting pressure. Chief among these are measures aimed at strengthening international positions and maintaining and expanding a Russian presence in regions that involve the country's national interests."* It is therefore obvious that the hybrid Russian activity in its contiguous geopolitical expanse will continue to increase despite growing internal challenges. That said, the developments that are being witnessed in Moldova and the South Caucasus, and will likely manifest in Central Asia and the Baltic countries fit well into the Russian global hybression technology. UDR

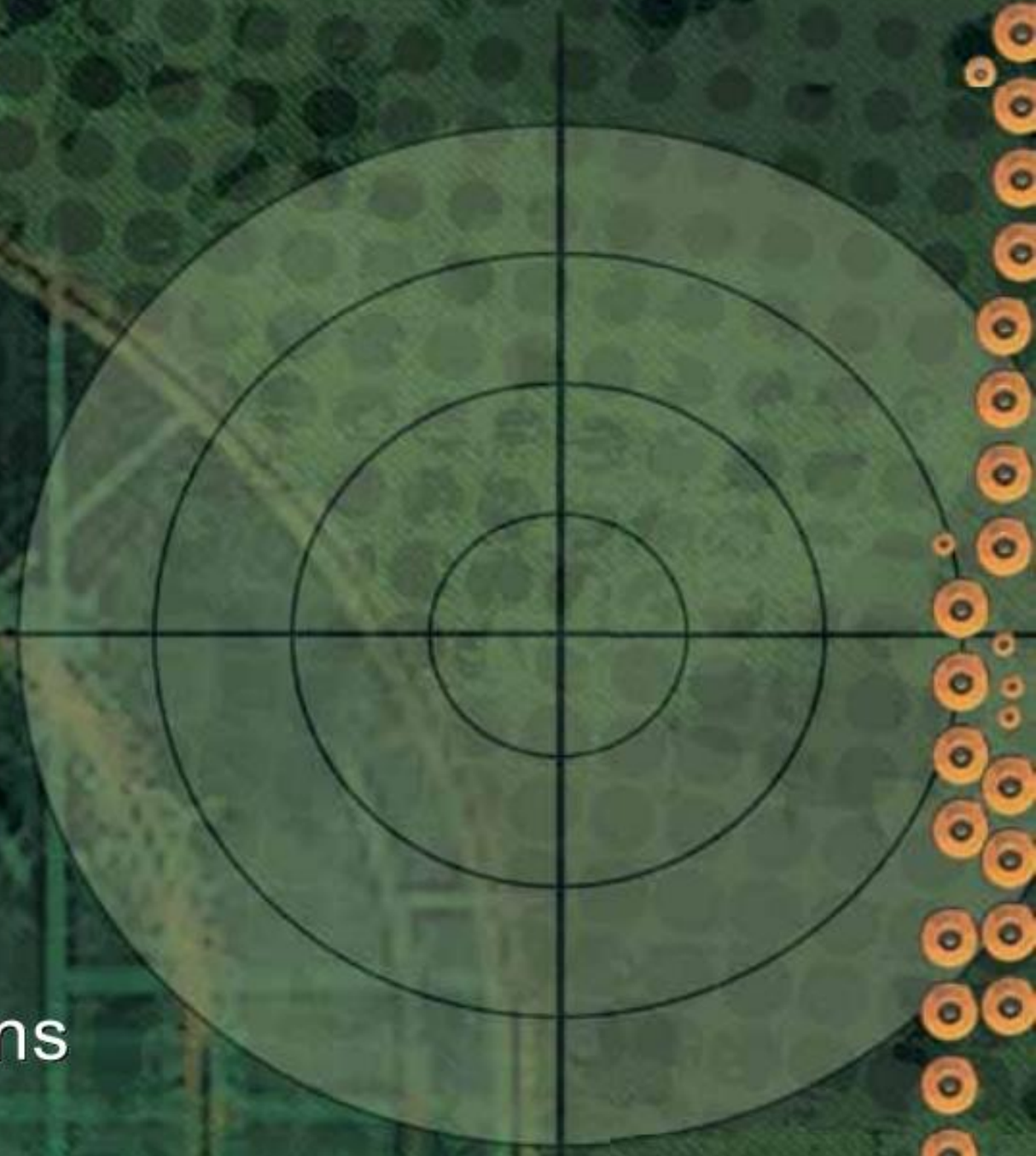
XIV INTERNATIONAL EXHIBITION

ARMS AND SECURITY

10–13 OCTOBER 2017 / KYIV, UKRAINE

MAIN SUBJECTS:

- Weapons and military equipment for army and law enforcement
- Police equipment
- Military aviation
- Border security
- Military clothing, shoes, protection means
- Hunting and sporting arms, self-defense weapons



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Science-industrial association «Fort» is leading enterprise in Ukraine which develops and serially produces different types of firearms. For the moment company manufactures modern weapon with high ballistic characteristics that is confirmed by the results of numerous tests including state tests. In 2014 products of SIA «Fort» were introduced into service by the Ukrainian Army. The enterprise is also the main supplier of the weapon for divisions of National police and the National Guard of Ukraine.

Pistols «Fort-14PP» cal. 9 mm Luger and «Fort-19» cal. 9 mm Luger are the advanced developments of the enterprise and currently are produced serially. Besides, the special attention is deserved by the single shot grenade launcher «Fort-600» cal. 40 46 mm which due to it's technical characteristics can be used both for protection of a public order, and carrying out special operations.

The enterprise has experience of products export to the countries of the Asia-Pacific Region, Europe, and Latin America. The special attention is deserved by the fact that at the enterprise the Control system of Quality is introduced thanks to what the certificate of ISO 9001:2009 confirming compliance of the enterprise t o the international standards is received.

FORT

Fort-12

Fort-19

Fort-28

Fort-17

Fort-600A

Fort-14PP

Fort-14TP

Fort-500MS

Fort-500M1S

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SECOND YOUTH OF "MI" HELICOPTERS

PJSC Motor-Sich is expanding its business related to the design and development, production, maintenance and upgrading of military helicopters as part of the national helicopter program. At the recent Arms and Security 2015 exhibition, Motor Sich demonstrated two of its most recent products – the Mi-8MSB-V and Mi-2MSB combat helicopters.

The Mi-8MSB-V, a combat-capable upgrade from the Mi-8T (HIP C) transport helicopter, is powered by new Motor-Sich TV3-117VMA-SBM-1V-4E powerplant that provides advantages in terms of increased maximum take-off weight (to 12.5 tons), higher airfield altitude (up to 4,200 meters) and practical ceiling (7,300 meters), as well as extended flight range with two fuel tanks (1,210 km).

The Mi-8MSB-V upgrade allows for expanded functionality to include fire support for dismounted troops and air-to-ground attacks on hostile troops, armored vehicles and weapons emplacements, in addition to its traditional missions of airlifting of equipment

and supplies, dropping of paratroopers and SAR.

The Mi-8MSB-VB upgrade is equipped with a weapons control system and unguided rocket pods B8V20MSB and B8V8MSB developed by Motor-Sich, and can carry a load of unguided gravity bombs of up to 500kg weight. Further improvements will include upgrades to enable the integration of guided missiles (Barrier-V) and NATO-compliant aircraft guns.

At Arms and Security 2015 exhibition, the Mi-8MSB was demonstrated alongside a gimbaled optronic sensor turret PM LKT Spectrum which can identify tank-size targets at ranges of up to 8 kilometers. Adopted from the missile control kit 524-R, the PM LKT Spectrum turret can be integrated on the Mi-8MSB helicopter alongside Barrier-V ATGW and other equipment.

Motor-Sich, R&D firm, Luch, R&D and Production Company Photoprybor and Radionix LCC are assisting in the Mi-8MSB project.

Depending on the mission to be flown, weapons package can include B8V20MSB unguided rocket pods carrying 20 rockets each on external hardpoints, UPK-23-250 gun, a load of unguided gravity bombs, GUV-1 machine gun, GUV-2 grenade launcher, Barrier-V ATGW, Igla SAM system and VSM-1 mine-scattering system.

Self-protection package includes Adron Adros KT-01AV IR jammer and Adros KUV-26-50 IR decoy flare dispenser, and work is underway to enhance self-protection by adding the Adros Ash-01V exhaust infrared suppression system and an Adron's laser warning system.

The Mi-8MSB upgrade package also includes EASA and ICAO-compliant navigation aids.

MI-8MSB-V

MILITARY TRANSPORT HELICOPTER

Helicopter Mi-8MSB-V is intended for landing and evacuation of troops, fire support of troops, target bombing, as well as transport of paratroopers and cargo inside the cabin and on the external sling.

maximum take-off weight

12,5 t

Payload in the cabin / on the sling

4/3 t

crew

passengers - 24

Flight range	**550 km**
With 2 external fuel tanks	**1210 km**
operating ceiling	**7300 m**
Static ceiling	**4200 m**
Cruising speed	**230 km/h**
Maximum speed	**280 km/h**

Turning optoelectronic unit PM-LKT «Spectr»

Recognition range of the «tank-type» target:
by the monitoring imaging channel: ..... **not less than 8000 m.**
by the monitoring thermal imaging channel: ..... **not less than 6000 m.**

Guidance range of the guided weapons
by laser channel: ..... **50-7500 m**
Error at all firing ranges: ..... **not greater than 0.8 m**

Equalized line pointing angles:
at route ..... **+-80 degrees**
at pitch: ..... **from+ 15 to -20 degrees**

HELICOPTER ARSENAL

The upgraded helicopter can be equipped with different models of bombing, shooting or missile munition, as well as mine-laying system VSM-1 (1). Bombs (2) of caliber from 50 to 50 kg or incendiary tanks can be suspended on the frameworks with beamed holders. Shooting munition includes unified gun pods UGP-23-250 with guns GSh-23L for firing at ground and air targets. Four machine guns YakB of 12.7 mm caliber, eight guns GShG of 7.62 mm caliber and four grenade launchers AG-18A (3) are placed in the pods. Missile munition consists of missile units B8V8MSB or B8V20MSB (4) for unguided air missiles S-8. It is possible to install portable SAM «Igla». A special «highlight» of Mi-8MSB-V is missile munition control complex 524-R with ATMS «Barrier-V» (5).

The upgraded Mi-8MSB combat-capable transport helicopter was officially approved for service use in the Ukrainian Armed Forces in April 2014, by a decree issued by Col. Gen. Mykhailo Koval, the then Interim Minister of Defense.

During a demonstration flight session in August 2013, the Mi-8MSB helicopter set a number of world records, including the absolute world record (FAI's class E-1 for helicopters) for altitude in horizontal flight (9,150 meters – 300 meters higher than Everest).

Motor-Sich also offers the MSB-2 life-extension package for the Mi-2 helicopter. The upgrade will include more powerful Motor Sich AI-450M turboshaft engine for improved flight performance, new external fuel tanks allowing for bigger internal payloads, a more ergonomic passenger cabin, and an advanced avionics suite.

The MSB-2 upgrade provides a number of advantages over the baseline Mi-2 configuration, which include hourly fuel consumption reduced by more than 30%; service ceiling raised by 15% (from 4,000 to 4,400 meters), WTOW increased by 10% (from 3,550 to 4,100 kg); and flight range with two fuel tanks extended to 800 km.

The Mi-2MSB completed its factory flight trials program in December 2014.

Also demonstrated at Arms and Security 2015 exhibition was Mi-2MSB-V, a planned combat-capable transport helicopter armed with guided munitions and equipped with outer hardpoints carrying B8V8MSB unguided rocket pods. Adaptations are being done to allow the installation of Barrier-V ATGW, UAG-40 automatic grenade launcher as well as NATO-compliant aircraft guns.

Self-protection package for the Mi-2MSB-B includes Adron Adros KT-01AV IR jammer and Adros AV-26V IR decoy flare dispenser, and work is underway to enhance self-protection by adding the Adros ASh-02V exhaust infrared suppression system and an Adron's laser warning system. Provisions are also made for additional fuel tanks on external fuselage to enable a flight range extension and bigger internal payloads to be carried.

It is yet to be seen what the final configuration of the Mi-2MSB-V helicopter will be, but given that the Ukrainian military has a considerable requirement for helicopters in this category, high expectations Motor-Sich has with respect to this initiative will be materialized. UDR

MI-2MSB-V

LIGHT MULTIPURPOSE HELICOPTER

The helicopter is intended for pilot and weapon operators training, transporting the wounded, cargo in the cabin and on the external sling, search and rescue operations, destroying armoured vehicles, gun emplacements and enemy

Propulsion system
Two engines
Ai-450M

maximum take-off weight
4,1 t

«ADROS» KT-01AV
optoelectronic suppression station

«ADROS» AV-26V
combined noise emission device

ARMED AND DANGEROUS

On the upgraded helicopter on the frameworks with beamed holders the following items can be mounted: multi-barrelled heavy machine gun WLKM, grenade launchers UAG-40 1 , surface-to-air missile system, anti-tank missile system, units B8V8MSB 2 for unguided air missiles S-8. The machine guns for firing at ground targets are mounted in the cabin 3 .

Flight range with external fuel tanks **800 km**

Operating ceiling **4500 m**

Static ceiling **1480 m**

Cruising speed **200 km/h**

Maximum speed **220 km/h**

PERFECTION OF VIRTUAL FLIGHT

HELITRAINING® UKRAINE

Helitraining Ukraine LLC (Kremenchuk, Poltava region) is a modern simulator training complex and innovative research and manufacture company. Our activity is aimed at development of simulator systems and aircrafts training compleses for civil and military aviation, as well as at the introduction of modern forms and methods of helicopters Mi -8/17, Ka-32 flight personnel training in its own, certified by aviation authorities of Ukraine, Simulator Training Center (Kremenchuk, Poltava region).

Company consists of the following departments:

- Simulator Training Centre: includes helicopter simulators of qualification level "Flight Training Device" (FTD) (according to CS FSTD), namely FTD Mi-8MTV-1 and FTD Mi-8A, and interactive classrooms for each of the above mentioned types of helicopters in the form of self-developed and self-manufactured electrified educational stands and computer based training system (CBTS);
- Design Bureau: develops and designs simulator hardware systems, interactive classrooms and other specialized equipment;
- Programming and Systems Engineering Department: develops modern software samples for simulators special software and CBTS, as well as forms programming architecture and computer equipment structure;
- Department for design and manufacture of instrument and other cockpit equipment simulators;
- Manufacture and technical department: manufactures simulators components, as well as performs the final assembly, commissioning and subsequent support of simulators produced with the assistance of other company departments;
- Department for the development and production of teaching aids and other means of education and training: develops and manufactures electrified educational stands, educational models of aircraft systems main units, produces up-to-date educational materials by means of its own printing equipment.

The company has all necessary: specialized computer equipment, advanced machines and devices for the implementation of innovative design and technological tasks that allow to create modern innovational products.

Совершенство полета на земле!

ООО «Хелитрейнинг Украина» (г. Кременчуг) – это современный учебно-тренажерный комплекс и инновационная научно-производственная компания, деятельность которой направлена на создание тренажерных систем и учебных комплексов летательных аппаратов для гражданской и военной авиации, а также на внедрение современных форм и методов подготовки летного персонала для вертолетов типа Ми-8/17, Ка-32 в собственном, сертифицированном авиационными властями Украины, Учебно-тренажерном центре в г. Кременчуг, Полтавская область.

Структурно компания состоит из следующих подразделений:

- учебно-тренажерный центр, включающий в своем составе КТВ Ми-8МТВ-1 и КТВ Ми-8АМТ (Ми-171) квалификационного уровня FTD (согласно CS FSTD), интерактивные учебные классы для каждого из указанных выше типов вертолетов в виде электрифицированных учебных стендов и автоматизированной обучающей системы (CBTS) собственной разработки и производства;
- конструкторское бюро, занимающееся разработкой и проектированием аппаратного комплекса тренажеров, интерактивных учебных классов и другого специализированного оборудования;
- отдел программирования и системотехники, осуществляющий разработку современных программных продуктов для специального программного обеспечения тренажеров и CBTS, а также формирующий архитектуру и состав компьютерного оборудования;
- отдел по разработке и изготовлению приборов-имитаторов и другого кабинного оборудования;
- производственно-технический отдел, занимающийся изготовлением составных частей тренажерных комплексов, а также осуществляющий окончательную сборку, наладку и последующее сопровождение производимых тренажеров с привлечением других подразделений компании;
- отдел по разработке и изготовлению учебно-методических пособий и других средств обучения и подготовки, занимающийся разработкой и изготовлением электрифицированных учебных стендов, разрезных макетов узлов и агрегатов систем летательных аппаратов, созданием современных образцов учебно-методической литературы, с применением собственного печатного оборудования.

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[exactly on target]

AERIAL BOMBS' INTELLECT

Ukrainian companies offer indigenous solutions to converting unguided gravity bombs into guided bombs.

The private defense electronics firm Adron has developed a new retrofit bomb kit that can convert several classes of 'dumb' Soviet/Russian or Warsaw Pact-designed bombs into precision-guided munitions. The unit, designated as Aerodynamic Trajectory Control Module Adros BAU-01K, is

currently at the final stage of testing and evaluation.

The BAU-01K kit is intended to be integrated on bombs weighing 500, 250 and 100 kilograms to provide a precision attack capability against static (primarily pinpoint) targets as well as hard ground targets. High precision attack capability is achieved by correcting for the initial sighting errors and other errors due to factors that are not corrected for during sighting process.

Bomb trajectory control is performed by deflecting aerodynamic control surfaces (canards) on the guidance unit's assemblies. The main BAU-01K assembly equipped with a set of aerodynamic control surfaces is fitted to the front end of a 'dumb' bomb. A second, add-on set of canards are installed at the aft section of the bomb.

The kit utilizes GLONASS global positioning system for its guidance. Co-ordinates of expected point of impact are determined for any given moment in time using proprietary algorithms developed by Adron.

Bombs equipped with two (front and bottom) detonator plug assemblies are suitable for conversion with this guidance kit. Those particularly include high explosive (HE) bombs FAB-500 M-54 and FAB-250 M-54, as well as high-explosive fragmentation (HEF) bombs OFAB 250-270 and OFAB 100-120.

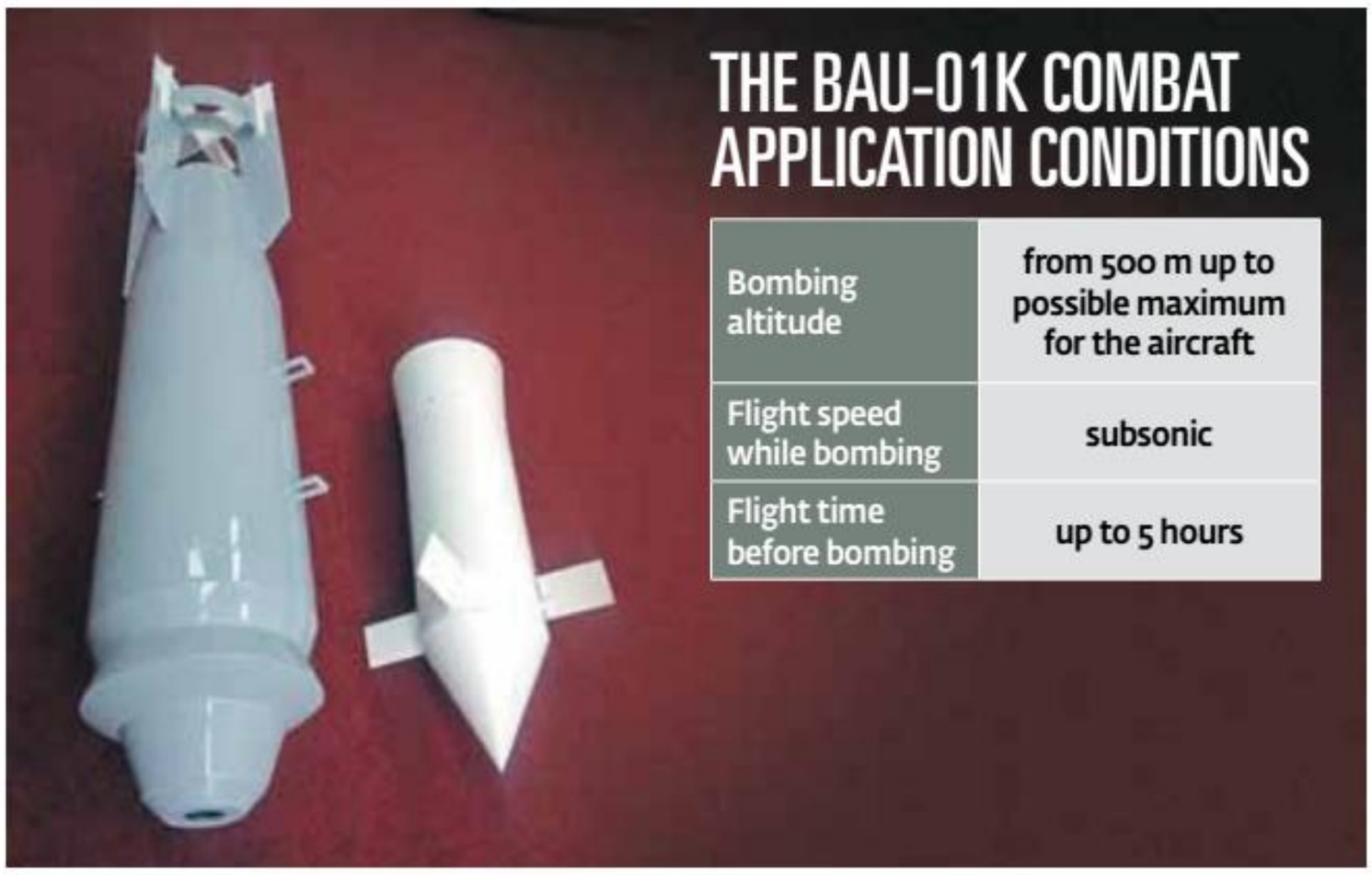
Bombs will be suspended externally from the aircraft by bomb racks, with guided flight mode activated immediately upon release from aircraft, by a signal from detonator fuses.

The BAU-01K provides several advantages over international counterparts, including those developed in the U.S.:

- versatility of use with respect to bomb calibers; but the size of aerodynamic control surfaces will increase with the weight of the bomb, and guidance software will need to be specific to a bomb of a given weight;
- The bomb will not have to be redesigned to accommodate the guidance kit;
- compatibility with standard bomb-detonator plugs, meaning there is no need to develop detonator systems specifically to different plug assemblies;
- since target co-ordinates are downloaded directly into the bomb's guidance unit, bomb guidance is performed without any involvement of on-board equipment on the launching aircraft, meaning it doesn't have to be modified;
- affordable price tag, which is 10-15 times less expensive than that of the JDAM kit, for example.

Retrofitting a legacy bomb with the Adros BAU-01K guidance kit provides advantages in terms of the probability of first-round-hit increased by a factor of 1.5 to 3, and the amount of ammunition needed to destroy a target of a given type reduced from 6 to 30 times.

The retrofit would put the Adros BAU-01K bomb roughly on a level with the 'smart' KAB-500L munition. UDR



THE BAU-01K COMBAT APPLICATION CONDITIONS

Bombing altitude	from 500 m up to possible maximum for the aircraft
Flight speed while bombing	subsonic
Flight time before bombing	up to 5 hours

The «ADROS» BAU-01K aerodynamic guidance kit for aerial bombs

[projectile]

A FOCUS ON

The antiterrorist operation ongoing in eastern Ukraine has clearly demonstrated the valuable role cannon artillery plays in a modern army's weapons arsenal. But today, when most of combat operations are conducted in urban areas, improving the precision of gunfire through the use of smart artillery projectiles assumes a special relevance, as not only does this enable a lethal payload to be delivered right to its intended target, but also to mitigate collateral damage. One of such solutions could be the use of a precision-guided round designated Kvitnyk, which was developed by R&D and Production Complex "Progress".

THE CONCEPTUALITY OF THE SUBJECT MATTER

The paramount significance of improving gunfire accuracy in a present-day operational environment has long been seen both by countries of the Western World and the Russian Federation. This is achieved precisely by employing precision-guided artillery projectiles to improve the effectiveness and efficiency of gunfire, to limit civilian deaths and to minimize damage to nonmilitary facilities.

The only two types of guided artillery projectiles to have seen service with the US Army are the M712 Copperhead semi-active laser-guided 155 mm artillery round and the M982 Excalibur GPS-guided 155mm trajectory-correctable munition.

Initially conceived in 1970, the Copperhead CLGP (Cannon-Launched Guided Projectile) began to be developed by Martin Marietta, now part of Lockheed Martin, in 1975. After various travails, produc¬tion was authorized in 1983 and continued till 1990, with the US Army and Marine Corps accumulating a limited stockpile of 20,000 rounds. Copperhead was used in Operation Desert Storm, with 90 rounds fired against hard point targets. In the US Army, the M712 Copperhead is being progressively supplanted by the new 155mm Excalibur trajectory-correctable GPS-guided shell. The Excalibur is designed to be effective against hardened command-and-control centers, infantry, weapons emplacements and air defense facilities among other targets. Excalibur has a range of approximately 40 to 57 km, with a Circular Error Probable (CEP) of around 5 m to 20 m. The extended range is achieved through the use of folding glide fins, which allow the projectile to glide from the top of a ballistic arc towards the selected target. The Excalibur was used by US Army units in Afghanistan.

The Krasnopol semi-active laser-guided round was the first guided artillery projectile to en-

ACCURACY

ter operational service with the Soviet Army. The baseline Krasnopol projectile, developed by KBP Instrument Design Bureau of Tula and variously designated 9K25 or 3OF39, was introduced into service in 1987. It is arguably a more successful design than the Copperhead is, having a longer range and greater production longevity. It has been produced in 152 mm and 155 mm calibers. The length and weight of the Krasnopol/KM-1, which is a two-piece design, renders it incompatible with autoloaders and stowage bins aboard self-propelled howitzers. Consequently KBP has introduced the shortened one-piece Krasnopol-M, which is again available in 152 mm and 155 mm (KM-2) calibers. In place of the Krasnopol's separate rocket booster, the Krasnopol-M incorporates a base-bleed device.

Russian engineers proceeded with the development of precision-guided munitions, having developed an extended-range version of the 152mm Krasnopol-M, the 155mm M2, which is designed to meet NATO compatibility requirements. The M2, which incorporates trajectory-correctable K155M semi-active laser guided HE payload, offers a 100 percent first-round hit capability against hardened and soft targets, both static and mobile, as well as engineer installations at ranges up to 25 km. The Krasnopol was exported to India and China, and licensed-produced in China.

In 2007, France was considering the purchase of 500 Russian Krasnopol-M projectiles at per unit price of some 50,000 (24.6M total). However, the contract has never been executed to full extent, as the French customer demanded a replacement of the pyrotechnic charge in the weapon's fuse assembly to make it Nato compatible. On a parallel track, France was pressing ahead with the development of long-range precision-guided artillery projectiles under its Pelican program. Initial concept studies into such long-range (LK - 60 km-plus) and very-long-range (85 km-plus) guided artillery projectiles under the Pelican pro¬gram were undertaken by Giat Industries.

China has been extensively demonstrating its extended range precision guided munition products at international exhibitions beginning in 2009. Previously, China, like India, met its own requirement for guided artillery weapons by purchasing production-standard Krasnopol shells from Russia. In the long run, China set up domestic production of precision-guided artillery projectiles of both howitzer and mortar calibers for its own military and for export markets. In January 2012, Iran unveiled its indigenous Basir artillery fired laser-guided explosive projectile, which is claimed to be able to destroy tanks, vehicles and other static and mobile targets with high precision. The Basir is outwardly very similar to some smart artillery rounds designed in the USSR and China.

A LITTLE ABOUT THE MOST IMPORTANT THING

Ukrainian Army's artillery units rely on the capabilities of the domestic arms industries. The Kvitnyk 152mm semi-active laser-guided HE projectile was developed by Progress Research-and-Production Complex joined with Central Research, Development and Technology Bureau Tochnist (which is incorporat-

TABLE 1

Specifications

	Kvitnyk	Krasnopol	Copperhead
Caliber, mm	152/155	152/155	155
Maximal range of shooting, km, not less than	20	17-20	16
Warhead type	fragmentation-high explosive	fragmentation-high explosive	cumulative
Explosive mass, kg, not less than	8	6,5	6,7
Projectile length, mm, not more than	1200	1300	1370
Projectile mass, kg, not more than	48	50	62

ed with Ukroboronprom State Holding Company). The Kvitnyk is designed to be deployed from artillery guns, with targets illuminated by laser designator rangefinder. Unlike HE rounds that are effective against area targets only, the Kvitnyk has the capability to effectively engage targets when fired from defilade positions, with first round accuracy and without adjusting fire. The projectile is available in 152mm and 155mm calibers. Guidance is by inertial navigation in the midcourse stage, followed by a semi-active laser for the terminal phase to increase the probability that the target will be hit in its most vulnerable, upper section. The Kvitnyk is effective against targets that include artillery, MLR and rocket launcher emplacements, self-propelled artillery mounts, tanks, infantry fighting vehicles and armored transporters (both static and moving), bunkers, bridges and ferries, assault landing and transport ships and boats. The Kvitnyk has 90% first-round hit probability if fired from a 152mm howitzer to ranges up to 20 km.

However, being as good as it is, and unveiled way back at IDEX exhibition in March 2001, the Kvitnyk project has yet to see completion. Ukraine's Ministry of Defense said on several occasions that the new artillery projectile would be introduced to the Armed Forces' inventory "in the nearest time". In 2009, it was announced that trials of the weapon are nearing completion, and the Ministry of Defense would annually buy 200-300 rounds at per unit price of Hr 200,000. However, Kvitnyk is still awaiting to take to the field with the Ukrainian Army artillery units.

Delays in the fielding of the Kvitnyk are attributed particularly to the fact that the projectile is yet to go through the final phase of the official trials program that includes live firing of several dozen rounds. However, the MoD has not the money to pay for the manufacture of the requisite quantity of rounds for live-fire trails because of its limited budget.

This despite, the 152mm projectile was taken to the stage of official trials in 2012. During a live-fire session, it showed excellent results when it hit a 40x40cm target distanced at 18 kilometers.

In September 2012, the Kvitnyk underwent live fire testing during Perspektiva-2012 military exercises and maneuvers. Later in the fall of the same year, another live-fire session took place at the training range of Sahaidachny Army Academy as part of the final stage of the official trials program. The live firing trials were conducted by officers and most experienced soldiers of the 55 independent artillery group, 72nd independent mechanized brigade of the Ukrainian Army.

After successful completion of the final, live-firing phase of the official trials program, the 152mm Kvitnyk precision-guided projectile was officially approved for service use on 6th December 2012. It will be fired from the self-propelled Akatzia 2S3 152mm divisional howitzer, although it is compatible also with cannon systems of other types.

In 2013, Progress launched a production line for the 152mm Kvitnyk. But developments in Crimea and Donbas, and the Russian aggression overall changed the course of things. However, Progress is continuing a supply market research that aims to find potential alternative suppliers for Kvitnyk's components.

Further development of indigenous precision-guided artillery munitions is especially pertinent with regard to the need to enhance the accuracy performance of the Ukrainian Army's cannon artillery in the ATO area and, also, in the light of present-day arms market realities and Ukraine's visible presence on that market. UDR

CM "Viy" SPECIFICATION:

GSh-23L specification:

CALIBER
23 mm

RATE OF FIRE
3..3400 rounds/min

MUZZLE VELOCITY
700 m/s

DESIGNED RESOURCE
4000 shots

FIRE CONTROL
electric, 27 V

WEIGHT	ANGLE OF ROTATION
50 kg	**Y:-5⁰ – 60⁰ X: 360⁰**

OVERALL DIMENSIONS (not more, mm)

Length	width	height
1387 (1537)	**165**	**168**

Tank hatch is equipped with vertical and horizontal targeting drives, bracket for mounting gun carrier and other mechanisms and electric equipment.

For storage and loading of ammunition CM "Viy" is quipped with box-type ammunition mechanism with capacity of 250 pcs of 23mm ammunition. It has a rigid welded construction and is attached to the back wall of the CM "Viy".

For collection of used cartridge belts CM "Viy" is equipped with a box type cartridge belts collector.

23 mm double-barreled aircraft gun "GSh-23L" designed for firing at air and ground targets with fragmentation high-explosive, armor-bursting and armor-piercing incendiary shells.
Automation work is based on usage of energy of powder gases. GSh-23L is equipped with a localizer, which are used for the directed removal of powder gases and reduce recoil force.

COMBAT MODULE "VIY"

Remotely controlled Combat Module

Can be mounted onlight armored vehicles (LAV) such as "DOZOR-B" and intended to destroy medium armored targets, firing points, manpower and enemy air targets. LAV with CM "Viy" are designed for patrol, reconnaissance and combat missions.

CM "Viy" has a simple steel constructions without stabilization, which significantly reduces its cost. The structure of CM "Viy" is based on commander hatch of the tank T-64, which ensures the reliability of the structure of CM "Viy", simplifies the manufacture and therefore reduces its cost

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[arsenal]

Precision-guided weapons is a key element in creating new and improving existing systems and weapons suites used by combat units of modern armed forces. State Enterprise "State Kyiv Design Bureau "Luch" (SE "Luch") has in its possession all the necessary R&D, technological and manufacturing capacities for the development and mass production of precision-guided weapons systems and suites.

Today, SE "Luch" provides Ukrainian Armed Forces with a comprehensive set of antitank guided weapons (ATGW) systems for short, medium and long-range engagements, and is actively marketing them for export. For improving the hitting power of armored combat vehicles and enabling the use from aerial and naval platforms, Ukrainian arms engineers developed a family of guided rocket weapons in 152, 130, 125, 120, 105, 100 and 90 mm calibers. The guided rocket is a modular technology that allows for proven design solutions to be incorporated in innovative weapons types with advanced performance capabilities. All the rockets are armed with a tandem shaped-charge warhead permitting first-round hit of targets protected with hybrid, rolled homogenous or spaced armor, including ERA protection.

PRECISION-GUIDED WEAPONS FROM UKRAINE

Guided by a laser beam and representing a relatively new type of precision-guided weapons for land warfare, the rockets can be launched either from ready-to-fire launch canisters or the bore of a gun. When used as part of weapons systems on tanks, armored personnel carriers or gun mounts, the rockets are adaptable to existing rounds racks, barreled systems, sighting and fire control systems, launch systems and other attributes typical of armored combat vehicles and artillery equipment.

Efforts to develop and manufacture ATGW weapons and guided rockets have led to the establishment in Ukraine of new industrial partnership links within a R&D and production cluster of nearly 30 companies from the ammunition, precision mechanics and electronics sectors of the defense industry. The weapons are 90% domestically produced.

Today company's products are used in the area of counter-terrorism operation in the east of Ukraine in Donbas region.

In February 2015 National Guard of Ukraine received the first six armored vehicles Spartan equipped by multi-target remote weapon station "Sarmat".

For the National Guard "Sarmat" comprises two (in base version – four) RK-3 missiles in transport-launch containers produced by SE "Luch" and 12,7 mm machine gun on rotating platform. Multi-target remote weapon station is used to hit static

and moving modern armoured targets that have combined, spaced or monolithic armour, including explosive reactive armour (ERA), as well as pinpoint targets like permanent fire positions, tank in a trench, lightly armoured objects, hovered helicopters, waterborne targets and manpower of enemy at any time of day or night. The missiles can be fitted with warheads of various types: tandem-charge high explosive, blast/fragmentation, thermo baric or inert. With tandem-charge warhead, the RK-2S missile is able to penetrate through 800 mm thick armor.

The "Sarmat" made debut at Eurosatory-2014 exhibition, mounted on Streit Group's Varan 6x6 armored personnel carrier.

Beside this State Concern "Ukroboronprom", according to the CEO "Ukroboronprom" Roman Romanov statement, in 2015 started the production of another SE "Luch" product – man portable antitank missile system "Stugna-P" (export variant – "Skif"). It is intended to destroy man power, stationary and moving modern armoured targets with combined, carried or monolithic armour, including ERA. The system's feature lies in its possibility to aim the missile on a target from closed emplacements and shelters that reduces the risk of the gunner destruction by reply fire attack of the enemy. The system is completed with 130mm and 152mm missiles in transport and launching containers with tandem hollow-charge (RK-2S, RK-2M-K) and high-explosive fragmentation (RK-2OF, RK–2M-OF) warheads. Guidance device consists of a TV channel, guidance laser channel, an electronic control unit. It is fitted with the thermal imager (at the Customer's request). The rocket is laser-guided in the range of 100 m to 5 km and its shaped charge can burn through armor thickness of 800 mm.

In February 2015 National Guard of Ukraine received the first six armored vehicles Spartan equipped by multi-target remote weapon station "Sarmat". For the National Guard "Sarmat" comprises two RK-3 missiles in transport-launch containers

The rockets for the Ukrainian version of the Javelin are about four times cheaper than the US counterpart, are wholly made in Ukraine, and do not have any component parts of the Russian Federation.

In 2014 SE "Luch" has successfully completed its test program of creating new anti-tank missile system and launcher "Corsar". In its mass and size, the "Corsar" is coming closer to hand-held anti-tank grenade launcher systems, being at the same time far superior in terms of effective range, first-round hit probability and lethality. With its 2.5-km rage (twice as longer as that of a handheld grenade launcher), the "Corsar" is designed to defeat hostile armored equipment, missile launchers, hostile guns operated from fortification works or urban buildings, enemy soldiers sheltered therein, and other types of small targets – under day and night conditions. Where appropriate, the "Corsar" can be used to engage hov-

In 2014 SE "Luch" has successfully completed its test program of creating new antitank missile system "Corsar"

ering helicopters and remotely piloted aircrafts.

Meanwhile, the Ukrainian party is seeking to diversify its international cooperation under global projects.

Examples are new ATGW rockets Falarick 90, Falarick 105 and Falarick 120 (in 90mm, 105mm and 120m calibers, respectively), which are designed to launch from guns by Belgium's CMI Defence (part of the CMI (Cockerill Maintenance & Ingenierie) international group).

Particularly the Gun Launched Anti Tank Guided Missile (GLATGM) Falarick 105 is configured for launch from the Cockerill CT-CV 105HP gun turret. The Cockerill 105 mm high pressure gun provides a wide choice of ammunition to suit the tactical situation; it fires all standard 105mm ammunition types in addition to the Falarick 105 GLATGM (ready– to-fire weight – 25.2 kg; the tandem shaped charge warhead provides armor piercing capability of 550mm of RHA behind ERA).

The 120mm high pressure Cockerill gun provides excellent lethality against a wide range of targets. The gun can fire all of the120-mm smooth-bore NATO standard types of ammunition, as well as the Falarick 120 armor piercing projectile which is fired from the bore of the gun to defeat heavy armored vehicles at ranges of up to five kilometers. Elevating to +42°, this weapon delivers exceptional engagement capability in complex terrain, an indirect-fire HE capability to 10km range, and the use of the Falarick 120 GLAT–GM permits heavy armor to be engaged at extended ranges. As a matter of fact, the Falarick 120 projectile currently being promoted on the export market is a spin-off version of the "Luch" 120mm ATGW missile "Konus" (ready-to-fire weight – 22.3 kg, armor piercing capability – 700mm of RHA behind ERA).

Both weapons are combat used employing a common high performance, digital, fully-stabilized, day/night weapon control system. Turret weight is kept low through the use of a bustle– mounted autoloader, which permits the turret crew to be reduced to two (commander and gunner). Due to the availability of current-generation target acquisition and tracking capabilities, targets can be effectively engaged both in favorable and difficult weather conditions. The stabilized gun, combined with a PC– based day/night fire control system delivers a high first-round hit probability on both stationary and vehicle targets.

"Luch" is also seeking to employ its precision-guided rounds in a Polish self-propelled mortar project. The Ukrainian company designed and developed a new 120mm semi-active laser-beam guided 16.8kg mortar projectile. This is armed with a shaped charge warhead offering 0.75-0.8 first-round hit capability against a comprehensive set of targets at launch distances of up to eight kilometers. With an additional rocket motor in place, effective engagement range can be extended to 12 kilometers. Huta Stalowa Wola (HSW) of Poland is reported to be working on the development and production of a 120mm mortar turret to be known as "Rak". The mortar turret will be distinguishable by the presence of mechanized rounds racks and an autoloader, and will be able to deliver 10 to 12 rounds per minute, according to the Designer. The turret can be elevated from -3 degrees to +85 degrees and traversed through +360 degrees. The Rak turret armed with a 120mm mortar system is compatible with armor protected chassis (including the Rosomak APC), both wheeled or tracked, providing shoot-and-scoot capability and allowing targets to be defeated with minimum time and ammunition budgets or – if armed with Ukrainian mor-

Man portable antitank missile system "Stugna-P" (export variant - "Skif") is intended to destroy man power, stationary and moving modern armoured targets with combined, carried or monolithic armour, including ERA

tar projectiles – even with first–round hit probability.

Beside that the Ukrainian enterprise offers its foreign partners solutions for naval platforms. For example, KB "Luch" participate in arming of the Kazakh Navy missile-and-gun ships with its most innovative weapon systems such as "Arbalet-K" and "Baryer-VK".

The short-range naval air defense missile system "Arbalet-K" uses Igla-series man-portable air-defense (MANPAD) missiles to engage jet-powered, turboprop and prop aircraft as well as helicopters on overtaking and lead-collision courses. A total of four ready to fire missiles are carried on a turntable type launcher assembly of a proprietary design. The system has a dedicated IR imaging sensor that can detect targets at ranges of from 8 to 12 kilometers, the output data being displayed on the fire control screen. The system comprises a platform with drives, a guidance unit with a thermal imager, and a turntable mounted launcher assembly.

The short-range naval air defense missile system "Arbalet-K" uses Igla-series man-portable air-defense (MANPAD) missiles to engage jet-powered, turboprop and prop aircraft as well as helicopters on overtaking and lead-collision courses.

The "Baryer-VK" naval guided missile system is designed for attacks against hostile ships, stationary ground targets, lightly armored targets as well as helicopters at ranges of up to 7 km. It fires the RK-2V missile with laser beam riding guidance, which makes it extremely difficult to jam. With tandem-charge warhead, the missile is able to penetrate through 800mm+ thick armor, making it suitable for defeating permanent fire emplacements and timber-and-sand fortifications. As well as "Arbalet-K", this system comprises a platform with drives, a guidance unit with a thermal imager, and a turntable mounted launcher assembly.

On the whole, at the present time SE "Luch" is one of the leading developers of aircraft and anti-tank armament systems component parts in Ukraine. Basing on powerful scientific and technical potential and it's own highly-qualified personnel the enterprise is able to solve the most sophisticated tasks on creation of modern military equipment as well as science-based, high-tech civil production. UDR

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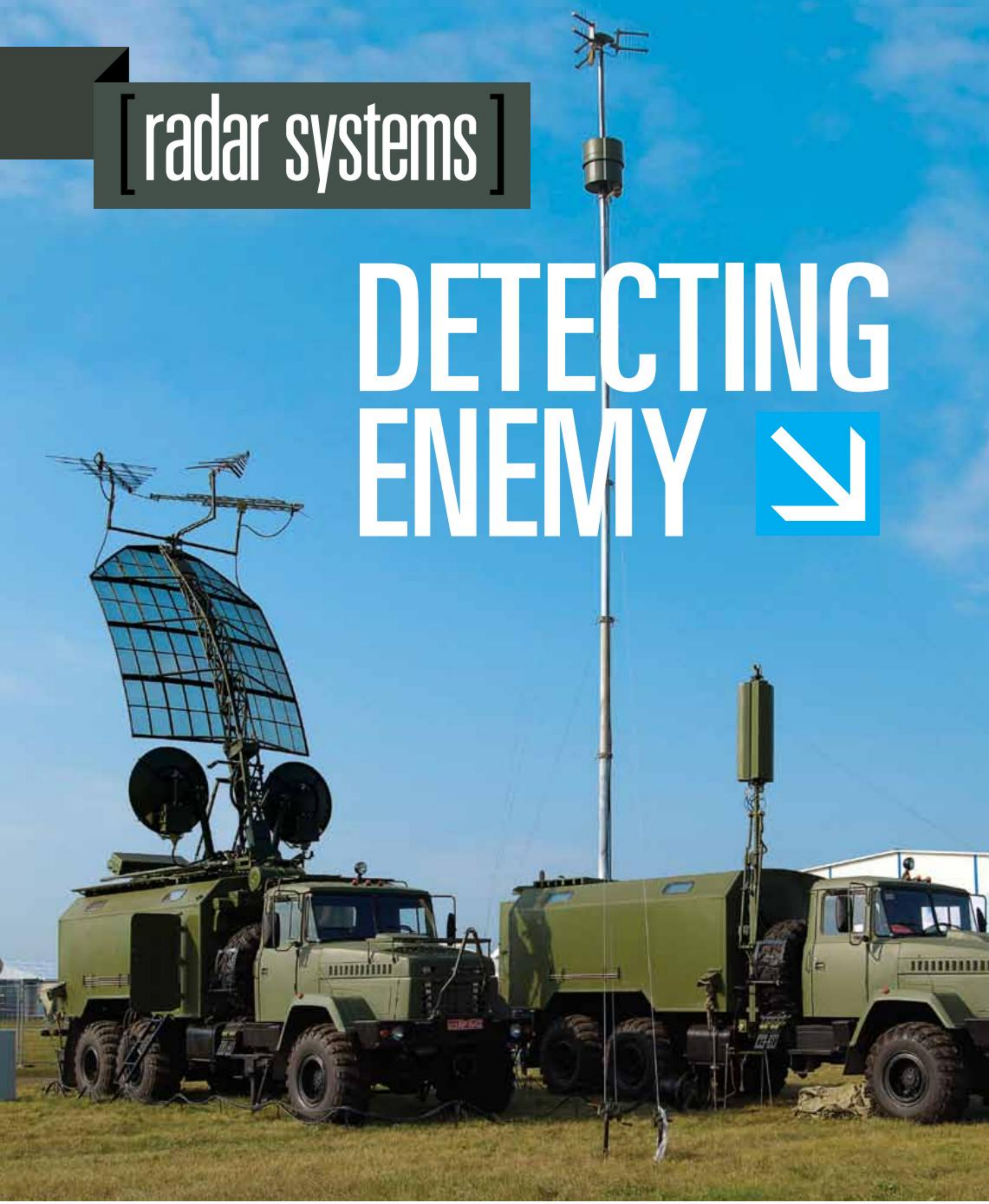

Electronic reconnaissance had always been of particular importance for the armed forces, providing information of interest to the country's top political leadership that was necessary for military operation planning and the conduct of war. The fine art of electronic reconnaissance was most sophisticated, and demanded involvement of highly qualified specialists.

Today JSC Topaz offers its potential customers passive electronic monitoring radar system Kolchuga, which was deeply upgraded and now is a completely new solution.

Original Kolchuga was developed in 1980s by Rostov military institute of GRU and Topaz radioelectronical factory in Donetsk. Serial production since 1987. 44 units were produced before 1 January 1992, 14 of them left in Ukraine.

After break up of Soviet Union, Kolchuga was modernized by the Special Radio Device Design Bureau public holding, the Topaz holding, the Donetsk National Technical University, the Ukrspetsexport state company, and the Investment and Technologies Company. It took then eight years (1993–2000) to conduct research, develops algorithms, test solutions on experimental specimens, and launch serial production. The relatively cheap Ukrainian Kolchuga-M passive radar station is able to detect and identify practically all known active radio devices mounted on ground, airborne, or marine objects.

The Kolchuga-M long-range electronic monitoring radar was at the time a truly last word in military technology. Kolchuga-M had provided far better detection capabilities for both ground and airborne radio emitters as compared to the radio detection assets available at the time. Priority attention in developing the radar was committed to reliability characteristics and maintainability. The item was intended in the first place for reconnaissance missions during military operations.

Despite of the Russian aggression in Donbas region, Ukraine has managed to save capabilities for developing and manufacturing Kolchuga passive electronic monitoring radar system. Some of the local enterprises in Donetsk and Luhansk regions were forced to move to another part of the country. According to the latest data, JSC Topaz (Donetsk) continues its work on one of the Ukrainian defense plants.

Enhancements included new software and a long-range electronic monitoring radar suite designated Assorti. In addition, Kolchuga itself had undergone comprehensive modernization to the configuration currently known as Kolchuga-M. SKB RTU had also rid Kolchuga of a disadvantage such as power source failures. The enhancements (which in fact advanced the design to a fundamentally new capability) made it possible to downsize significantly the military's obsolete radar fleet and enabled electronic environment monitoring out to 600 km, while data collection and processing both for the Land Forces and Air Defense Forces had been automated to the maximum possible degree.

The Ukrainian armed forces operated more than two dozen Kolchuga radar systems, which was enough to fully support the country's requirement for electronic monitoring out to 300-400 km. But as the system came into operation it turned out that the technology "stuffed" with electronics was highly sensitive to voltage drops, resulting in back-up power sources and sensitive subsystems getting out of order and adding to oper-

KOLCHUGA-M PASSIVE RADAR SPECIFICATIONS

Operating frequency range, MHz	130-470, 750-18000
Usable field sensitivity, minus dB/W	108-156
Instrument error of direction finding, deg	0.3-1.5
Instantaneous dynamic range, dB	±60
Pulse duration measuring range, mcs	0.07-999.0
Pulse time-of-flight measuring range, mcs	1.0-99999.0
Coordinate measuring methods used	triangulation-based range difference-based
Target coordinate measuring accuracy as a percentage of range - triangulation -range difference	 3% 1%
Satnav support	GPS NAVSTAR / GLONASS
Interface to an electronic map system	Available
Number of crew needed for round-the-clock operations	7
Power supply: - three-phase AC mains - built-in power unit	 50±2Hz, 380±10%V GEKO 15001ED-S/ MEDA/ KUBOTA EP183TDE

ators' headache. In a situation where underfunding of the Defense Ministry's needs took on chronic proportions, an effective asset such as Kolchuga was standing idle for months awaiting the arrival of maintenance teams from the manufacturer company. Ukrainian armed forces' intelligence de facto became hostage to economic situation and the monopolist company which overhead expenses grew to 1000 percent.

Kolchuga-M provides:

- the detection and analysis of impulse and continues wave signals; individual identification of practically all of the known electronic assets in various categories as well as mission systems installed on board ground, maritime or airborne carriers; long range detection of multipurpose radars, identification systems, air traffic control systems and navigation systems;
- re-targeting using rotating antennas, which allows it to identify the composition and operational mode, and to track movements of hostile radio emitters up to 150 km away in width in both far-field (up to 600 km) and near field (up to 200 km) zones – without radar silence zones and with continuous high-precision position location of targets in whatever spot of the area being monitored.

Today JSC Topaz offers its potential customers passive electronic monitoring radar system Kolchuga, which was deeply upgraded and now is a completely new solution.

Air defense capabilities include:

- take off detection of aircraft of various types and their identification by categories at ranges exceeding those of modern radar systems;
- tracking the movements of stand-alone and multiple targets;

A few such systems have already been exported to Ethiopia, China and Turkmenistan.

Recently JSC Topaz developed new version of Kolchuga for a foreign customer Kolchuga-5K

Each station of the complex «Kolchuga-5K» has separate systems for plotting flight tracks of different targets. Each station is equipped with a separate narrow beam detection system operating within a 0,13MHz-18GHz frequency range. The antenna system makes it possible to achieve maximum detection range of targets at the distance of up to 600 km via the effect of radio waves propagation through troposphere. Complex «Kolchuga-5K» comprises 4 autonomously operating PET/ELINT stations. There are 3 side (slave) units and 1 central (master) unit arranged in a triangle pattern. Being fully interchangeable each station can assume a role of the master one provided all units are equipped with an extra communication and data transfer equipment suite.

In case one or even two units go out of commission for whatever reason (enemy's hostile activity, act of sabotage, malfunction etc.) the overall level of functional capabilities of the system, though diminished, remains sufficient enough to meet basic operational requirements. Decentralization ability of the kind (Graceful degradation) vastly boosts the survivability level of the whole system.

Passive surveillance system «Kolchuga-5K» can easily be interfaced with either a Mobile Command Center or with an active radar or with an SAM system of S-300, S-400 etc. type via preselected data exchange and transfer protocol. There has been a growing tendency to make use of Active/Passive layered Air Defense where passive systems function as target acquisition, track and early warning radars.

Such factors as by far longer detection range as opposed to active conventional radar and absolute «no emission covertness» enable passive systems to serve as the first line of air defense by detecting and tracing targets up to the so called target engagement area where a SAM system's active engagement radar and illumination radar are briefly activated and a missile is launched. UDR

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