UKRAINIAN DEFENSE REVIEW

Defense Express

UDR

№2-3 [APRIL – SEPTEMBER 2020]

ATTACK FROM THE SKY
FURY & *THUNDER* – WHAT NEW UKRAINIAN UAVS ARE CAPABLE OF

MADE IN UKRAINE

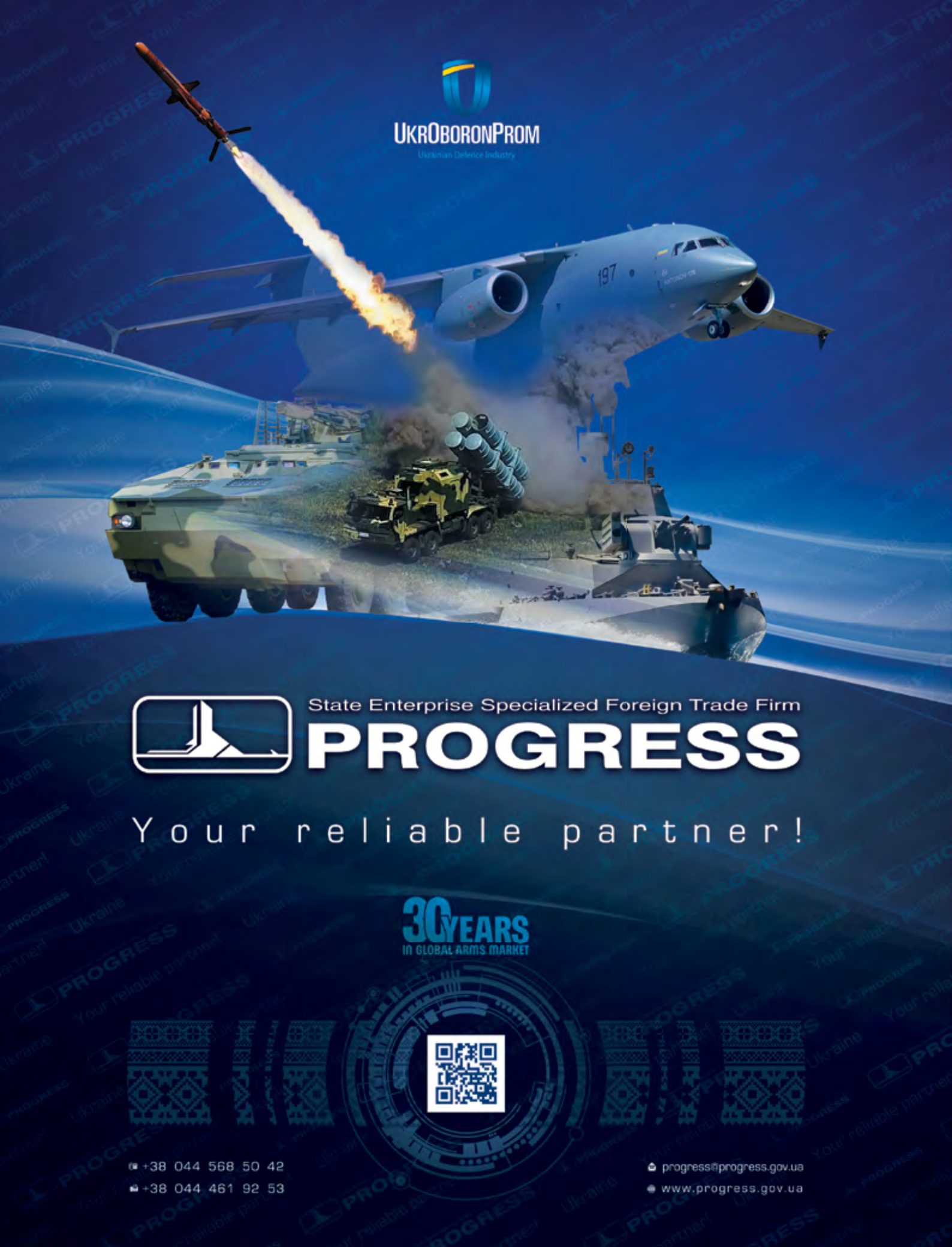
NOVATOR APC

PERFECTLY SUITED FOR OFF-ROAD MISSIONS

RIFF – COMPACT-SIZE COUNTERMEASURE AGAINST UAV THREATS

BARRIER-S: A COMPREHENSIVE UPGRADE TO RENOWNED ATGM VEHICLE

PIRAT **ATGM ATTACKS FROM THE TOP**
BILATERAL POLISH-UKRAINIAN PROJECT HAS REACHED ITS FINAL STAGE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UKRAINE'S AIR FORCE TO UNDERGO DRASTIC MODERNIZATION BY 2035

Ukraine's Air Force (UAF) fleet will, by 2035, be modernized with new aircraft, in a three-phase program worth UAH 200 billion (USD 7.2 billion).

Plans for modernization of the country's air force and air defense capabilities are set out in the Air Force's 2035 concept.

As part of the initial, preparatory phase (2021-25) Ukraine will hold a tender and struck a contract in 2022 to procure 6-12 new multirole fighters to achieve initial capability in 2025 so that the UAF could prepare infrastructure and train personnel.

During the second phase (2025-30), from 8 to 12 fighters will be acquired each year so that to enable the UAF to fully replace its aging fleet of MIG-29s and Su-27s by the end of the program.

At least two tactical aviation brigades will be fully re-equipped with new aircraft and full operational capability will be achieved by 2030.

On a parallel track, UAF's transport fleet has to be fully replaced, too, starting in 2030, at a rate of 1-2 aircraft a year.

The UAF also wants to deploy unmanned aviation brigades or regiments replacing fighter, bomber and spy airplanes currently in use.

During the third and final phase, the UAF's fleet will be fully modernized with new capabilities that will replace Soviet legacy fleets by 2035.

According to the concept, the UAF will be recreated into a brand new, modern air force branch; the command and control, logistics and personnel components should be prepared to act effectively and efficiently in all operational scenarios of modern warfare.

The currently operational tactical aviation, consisting of fighter, bomber, attack and reconnaissance branches fielded with varied models of MiG-29s, Su-27s, Su-24Ms, Su-25s, and Su-24MRs, has to be renovated and restructured to become a multi-role, mixed-capability force uniformly equipped with 4++ generation jets such as Swedish Saab JAS-39E/F Gripen or F-16 Block 70/72 to reduce inventory types and minimize logistics footprint and cost.

Overall, Ukraine needs to purchase and accept for service between 72 and 108 fighters deployed to at least 4 tactical aviation brigades by 2035. The lesser overall number of fighters (as compared to the present-time fleet) will be compensated by their modernity and technological superiority over the Soviet legacy fleet.

UKRAINE DEVELOPING NEW UCAV TO BE KNOWN AS SOKIL-200

Luch, a State-owned defense contractor, is working on development of a full-mission Unmanned Combat Aerial Vehicle (UCAV) known tentatively as Sokil-200 (Ukrainian for "Falcon").

With a wingspan of 14 meters and a payload capacity of 200-250 kg, Sokil-200 will surpass its Turkish rival Bayraktar by a margin of two meters and several times, respectively, whilst retaining the same air endurance of 24 hours.

This came from an interview given to Defense Express by Oleh Korostelev, Chief of Design and CEO at DKKB Luch.

"We are developing a full-mission UCAV equipped with capabilities for automatic takeoff and landing, autonomous preprogrammed inertial navigation flight and long-range live video streaming via an encrypted link", Mr Korostelev said.

Sokil-200 UCAV will feature some of the technology solutions that DKKB Luch has already tried out and implemented in its Anti-Ship Cruise Missile (ASCM) system Neptune and similar projects. Here we talk about the command and control station with associated communication facilities as well as the inertial guidance system and some other electronic systems fielded on the Neptune's R-360 missile.

The new UCAV will carry Luch's Barrier-V precision-guided anti-armor missiles capable of ranges up to 7.5 km. It will be equipped with the Ukrainian-designed optronic weapon aiming pod OPSN-1 that can pick up targets at ranges out to 14.5 km away.

Regarding the engine for the new UCAV, Luch is hesitating choosing between a turboprop and a piston engine. Defense Express estimates that an Ivchenko-Progress turboprop or a piston engine with specs similar to the Austrian Rotax 914 are best suited for this application. Here the talk is about Ivchenko-Progress AI-450 turboprop that delivers 450 horsepower at a weight of 130 kg. Just for record, Turkey had selected the AI-450 for its Akinci UCAV.

KYIV, ANKARA NEGOTIATING LOCALIZATION OF UCAV BAYRAKTAR PRODUCTION IN UKRAINE

Ankara and Kyiv are negotiating options for collaborative development and production of the Turkish-developed Bayraktar drone system in Ukraine.

This is according to a report by Interfax-Ukraine, citing the Ambassador of Turkey to Ukraine Mr Yagmur Ahmet Guldere.

The two countries have conducted several rounds of negotiations on varied aspects of bilateral cooperation, from co-development of high-end unmanned aerial systems up to local production of Bayraktar UCAVs in Ukraine, provided that appropriate conditions are in place, Mr Ambassador told Interfax-Ukraine.

"We had discussions on various topics, and this issue was also discussed by the two countries. Also under negotiation is collaborative development of more capable systems and even production of Bayraktar drones in Ukraine, provided there are appropriate conditions in place. I think that defense industry can become a new hallmark of the Turkey-Ukraine cooperation, including this specific area," the Turkish Ambassador said.

UDR note: Bayraktar drones are in production at the Turkish company Baykar Makina. The Bayraktar family of UAVs includes Mini Bayraktar, Bayraktar VTOL (vertical takeoff and landing), and (the best selling of them all) Bayraktar TB2. Ukraine purchased a shipment of Bayraktar TB2 drone systems under a contract signed by the then President Petro Poroshenko during his Turkish visit in November 2018. This was followed by the $70 million contract struck in January 2019 to purchase 6 Bayraktar UCAV systems in a package with three Ground Control Stations. The drones arrived and were flight tested in the Ukrainian skies in March 2019. In the following months till May 2020, the UAVs flew a series of operator training missions.

In July 2020, the Turkish Anadolu Agency cited Ukraine's Defense Minister, Andriy Taran as telling his Turkish counterpart Hulusi Akar that Ukraine is looking to purchase another shipment of UAV systems (presumably Bayraktar TB2) from Turkey.

CAMEROON AIR FORCE BUYS BARRIER-V ATGMS FROM UKRAINE

UkrSpecExport, an affiliate of the State-owned Ukroboronprom defense industries holding group, has shipped a batch of weaponry and equipment to the Cameroon Air Force, under a $2.411 million contract awarded in December 2019.

This is according to statistics from 52wmb.com, an export/import online platform.

The contract included two units of the 524-PE guided weapon system; two units of the electronic warfare system Quadros; 38 PK-2B "Barrier-V" anti-tank guided missiles; one unit of the KTK-1M training & status monitoring equipment kit for integrated guided missile systems.

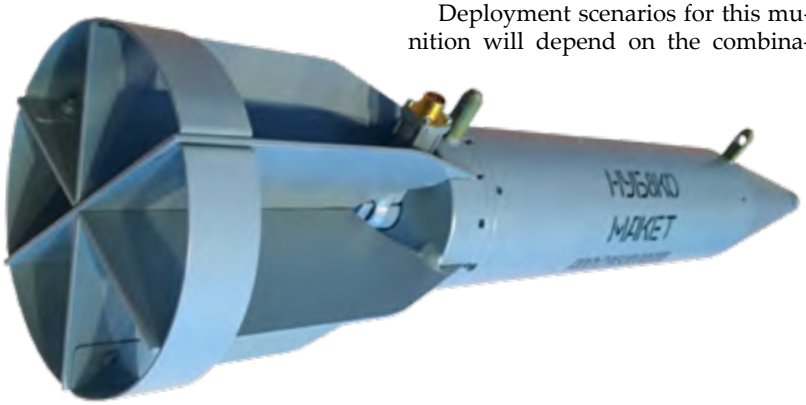
Reports are that this purchased equipment will be deployed on helicopter platforms, albeit without specifying the types or names of the platforms.

The Cameroon Air Force is currently fielding five Mi-8/17 multi-role helicopters in several configurations, in addition to two Mi-24V attack helicopters the service purchased in 2015 from Slovakia and got them overhauled and upgraded by Poland. In 2016, the service was reported to have purchased from Russia two Mi-24s, overhauled and upgraded.

UDR note: The Photoprylad's 524R is a missile fire-control kit that was designed as part of upgrade packages for the helicopters Mi-24, Mi-8 and Mi-2. The 524R has day-and-night capabilities for (1) battlefield surveillance; (2) search, detection, identification and automatic tracking of ground and aerial targets, moving or stationary, and (3) guidance and control of helicopter-launched, RK-2V missiles.

UKRAINE DEVELOPING A DRONE-DELIVERED BOMB

SpetsOboronMash is developing a lineup of dropped munitions optimized to be fired from UCAV platforms. One such, an unguided gravity bomb, has completed its prototyping phase and is now ready to enter initial trials beginning soon.



The munition is being designed with a mass of 4.2 kg and a length of about 45 cm. It will carry a high explosive anti-tank warhead of 80 mm in diameter which expands downward to 110 mm. The warhead can be fuzed to detonate in air, on impact or upon penetration.

Deployment scenarios for this munition will depend on the combination of factors such as the altitude and speed of the drone platform; weather conditions, etc. Algorithms for using the munition in specific mission scenarios will be set by a ballistic computer tailored for each specific drone platform.

While claiming that this compact-size gravity bomb is suitable to be fired from both fix-wing and rotary-wing aircraft, SpetsOboronMash doesn't disclose the company that has provided its drone platform for this project and acts as a major or potential partner in developing air-deliverable weapons for use from UAVs.

More details about the bomb's specs and capabilities will become available upon completion of factory-level tests when it will be delivered to field forces for user evaluation and further maturing.

SRI LANKA AIR FORCE TO GET ITS AN-32B AIRPLANES REFURBISHED IN UKRAINE

Plant 410 Civil Aviation (CA) and Antonov Company will collaboratively do full overall and lif e extension work on three An-32B airlifters operational with the Air Force of Sri Lanka, according to a press statement released by Plant 410 CA.

One An-32B airplane (serial number 3501, hull number SCM-860) and one An-32B (3504/SCM-869) flew and arrived in Ukraine on August 11, 2020. Ukrinmash, the licensed arms dealer who acts as the Contract compliance supervisor, provided technical aid to help prepare the airplanes for their technical flights from Sri Lanka to Ukraine.

UDR note: Overall, the Sri Lanka Air Force is fielding nine An-32B transports (five built in 1995 and four in 1996). Some were purchased newly built in Ukraine while others were bought in the early 2000s after a period of lease use by Colombia.

Plant 410 CA will do the lion's share of the work under this contract.

Plant 410 CA is a certified MRO provider for the airplanes Antonov An-24, An-26, An-30, An-32 as well as D-36 1/1A/2A engines deployed on Yak-42, An-72 and An-74 airplanes. The Company maintains self-sufficiency doing all the operations – from disassembly to testing – all by itself. The Plant has copyright over MRO manuals for the full range of aircraft and their associated systems it repairs and overhauls.

Plant 410 CA was, on July 15, 2020, certified by a NATO country to do maintenance and overhaul of An-26 airplanes, auxiliary propulsion systems RU19A-300 and airplane propellers AV-72. Issued by the State Department of Aviation at Hungary's Ministry of Defense, the certificate is valid till June 11, 2025.

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DKKB LUCH TO UNVEIL ITS STUGNA-P ATGM UPGRADE IN 2021

DKKB Luch, a state-owned defense contractor affiliated with the Ukroboronprom defense industries group, intends to unveil an improved and upgraded configuration of its Stugna anti-tank guided missile (ATGM) system, named Stugna-P, in 2021.

"We will release Stugna very soon. I hope that a whole new configuration of the Stugna will be ready next year," Oleh Korostelev, Chief of Design and CEO at DKKB Luch told Defense Express in an exclusive interview.

"Almost all of the key components and subsystems will undergo improvements and upgrades. Stugna-P has a whole different look with reduced size, improved ergonomy of use, enhanced quality of images and weapon guidance quality etc," he said.

UDR note: Stugna-P was officially inducted into Ukrainian Army service in 2011, but it was not until the outbreak of Russian military aggression in Ukraine that the ATGM and its associated launchers and training facilities began to be fielded to Ukrainian forces in 2014.

The ATGM systems Stugna-P and Korsar/Corsair were ceremonially handed over to the Armed Forces in August 2018.

The Armed Forces have over the past few years received hundreds of brand new Stugna-P and Korsar ATGM launchers and thousands of their associated missiles.

After having proved its effectiveness in real-world combat engagements in Eastern Ukraine, the Ukrainian ATGM system saw a substantial surge in demand on the international market.

Export-oriented version of the ATGM Stugna-P has been successfully marketed across the globe.

UKRAINE LOOKING TO DEVELOP, BRING INTO PRODUCTION AN UPGRADE TO RENOWNED PASSIVE SIGINT/COMINT SYSTEM KOLCHUGA

R&D and Production Corporation NVK Iskra is willing to develop and bring into production a new passive COMING/SIGINT system that will have higher capabilities than the world-renowned Kolchuga-M.

This came from an interview given to Defense Express by Iskra CEO, Yuri Pashchenko.

Asked about the probability that Iskra would open a production line for the Kolchuga-M as the Government envisioned, Mr Pashchenko said: "We don't believe it feasible or practicable to get engaged in production restart or modernization of that system. Instead, we suggest to develop and bring into production a new system that will retain the best features of the Kolchuga while adding some extra features. It is going to be a whole new system with a different look and a different equipment layout. The Defense Ministry has already drafted an operational requirements document on the new system. But, I think, this will change and gradually become more realistic in the course of research and development".

UDR note: Kolchuga-M, a passive electronic reconnaissance system, detects and tracks aerial threats by triangulation and multilateration of their radio-frequency emissions, while itself remaining "passive", i.e. imperceptible to other radars. Kolchuga-M can scan an envelope of 600 km in range, 150 km in width and 10 km in altitude, but its detection range may be up to 800 km for very high altitude, very powerful emitters.

UKRAINIAN COMPANY DEVELOPING NEW 40-MM GRENADE LAUNCHER

InterProInvest, a Private-Sector company, is developing a new hand-held grenade launcher derived from the Soviet legacy 40-mm single-shot under-barrel GP-25/Koster grenade launcher.

Pictures emerged on Facebook showing the new grenade launcher being tested.

Underneath the pictures, captions read that the compact-size, single-shot weapon is being developed for use by Ukraine's Special Operations Forces.

Beyond that, there is another new product the Company is working on.

Thus, videos emerged in the Internet showing InterpProInvest's automatic rifle Malyuk featuring an adjustable length butt-stock among several other new features.

UDR note: Malyuk automatic rifle, which is a bullpup conversion of the Soviet Kalashnikov rifle, entered Ukrainian Army service in 2017, in a version known in the domestic market as "Special Automatic Rifle Vulcan".

The bullpup design has created an overall more compact weapon maintaining the advantages of a long barrel such as accuracy while reducing the overall size and weight.

The 5.45/7.62 Malyuk rifles have been fielded to Ukraine's defense and public security forces, with thousands of the rifles deployed so far (most of them with Special Operations Forces), according to InterProInvest.

It should be added that, in a bullpup weapon, length adjustment of the butt-stock is the most difficult challenge to handle. As we can see from the preceding comments, engineers at InterProInvest are handling this challenge with great success, which will help make the Ukrainian automatic rifle more user convenient and appealing to the Soldier.

UKRAINIAN MARINES TO SWITCH OVER TO L3HARRIS RADIOS BEGINNING NEXT YEAR

Ukraine's Naval Infantry will be fully re-equipped with L3Harris radios as part of a major modernization effort planned for 2021.

"For next year we plan a number of major projects. One such is to fully equip Naval Infantry brigades and battalions with L3Harris Technologies digital radios (e.g. with funding from international aid programs)", Maj Gen Yevhen Stepanenko, Chief of Communication and Cyber Security for Ukraine's Armed Forces has said.

According to MG Stepanenko, the MoD is seeking to strike an offset barter deal with L3Harris containing provisions to promote efficient, broader range use of the radios across the Armed Forces user community.

What is meant here is to set up an authorized MRO service center for Lr3Harris radios in Ukraine. In addition to providing MRO services, the center will be focused to produce manuals on "installation of Harris radios onto vehicular platforms of the Armed forces", he said.

UDR note: Harris Falcone II HF radios and higher-end Falcon III HF/VHF radios have been fielded for several years to Ukraine's Armed Forces, National Guard and State Border Guard Service, this being enabled through funding from the U.S. Foreign Military Funding (FMF) program budgets. The Armed Forces have also fielded more capable, multi-band, multi-role radio systems supporting virtually all bandwidths and frequencies, including satellite frequencies.

As at early 2020, Ukraine had procured $230 million worth of communication equipment from L3Harris Technologies, with another procurement worth $70 million planned for this year.

ELBIT SYSTEMS WILL HELP UKRAINE TO UPGRADE MIG-29 FIGHTER JETS

The news agency Defense Express, quoting Ukraine's Ministry of Defense officials, reported that Israeli defense electronics company Elbit Systems can help the country to upgrade Ukrainian MiG-29 fighter jet into a next-generation, powerful tactical fighter aircraft.

Elbit has been currently negotiating its possible participation in modernization of Ukrainian Air Force's aging fleet of MiG-29 fighters.

The potential agreement will cover the MiG-29 aircraft avionics upgrade program, advanced cockpit, radars, weapon delivery and navigation systems.

The upgrade offered by Elbit for the MiG-29 will provide the Soviet legacy jet with capabilities far exceeding those of the Ukrainian MiG-29MU2 upgrade.

Interestingly, the Ministry of Defense plans that Elbit Systems will take part in the modernization of 11 MiG-29 fighters of the Ukrainian Air Force. At the same time, according to preliminary estimates, the cost of modernizing each aircraft will be about $40 million.

Elbit Systems Ltd. is an international high technology company engaged in a wide range of defense, homeland security and commercial programs throughout the world. The company's portfolio already includes projects to modernize F-5 and MiG-29 fighters for a number of other countries.

UNITED STATES CLEARS SALE OF 16 MARK VI PATROL BOATS TO UKRAINE

These latest generation patrol boats will be procured for the Ukrainian Navy under U.S. foreign military assistance programs.

Ukraine's Foreign Minister Dmytro Kuleba said in a tweet: "The United States has approved the sale of up to 16 Mark VI patrol boats & related equipment to Ukraine. This will help the Ukrainian Navy meet current and future threats in the Black Sea & the Sea of Azov".

According to the Foreign Minister, "Six boats are currently being prepared for Ukraine using U.S. security assistance funds. The remaining vessels will be available for Ukraine to purchase using its military budget".

UDR note: Plans to procure the U.S. patrol boats Mark VI were first made public in late 2019 and confirmed by the Ambassador of Ukraine to the United States, Volodymyr Yelchenko in May 2020.

In June, U.S. Defense Security Cooperation Agency notified Congress of the possible Foreign Military Sale of up to 16 Mark VI patrol boats and associated equipment to Ukraine.

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GENUINE THREAT

RUSSIAN FEDERATION BUILDING UP MILITARY POWER IN ITS OCCUPIED CRIMEA AND ON UKRAINE'S EASTERN BORDER

In early July 2020, an online meeting of the OSCE Forum for Security Co-operation took place, at which the Ukrainian military presented its views regarding the current security situation in and around Ukraine, more specifically in the context of Russia's military aggression. Here UDR introduces its readers to contents of the speech delivered at the gathering by Leonid Holopatiuk, Lieutenant General, Head of the Main Directorate of Military Cooperation and Verification of the Armed Forces of Ukraine.

Ladies and Gentlemen! In my speech to the "Security Dialogues" of the OSCE Forum for Security Co-operation, I would like to take this opportunity to inform you in detail about the implementation of the Vienna Document 2011 (VD-2011) by Ukraine and, at the same time, to familiarize you with the situation where my country has found itself due to the occupation of a part of its territory and illegal annexation of the Autonomous Republic of Crimea and Sevastopol by a foreign country, as well as foreign military build-up in eastern Ukraine.

We live in difficult times. The modern world has run into another period of turbulence, which is characterized by the presence of both traditional and a number of emerging threats and challenges. The international security crisis is assuming systemic proportions.

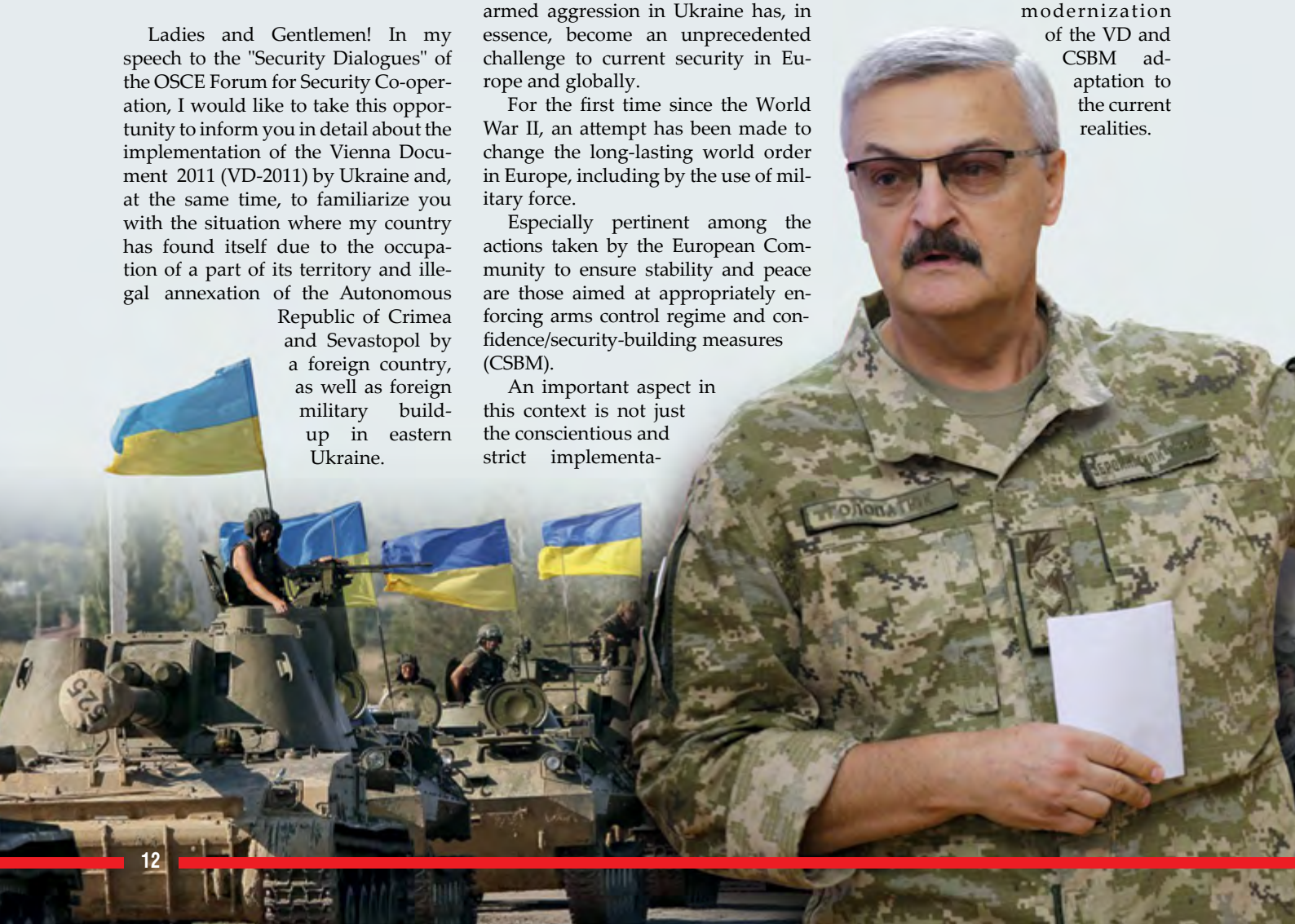
In this context, it is indisputable that the armed conflict launched by the Russian Federation in the Donbas and Russia's occupation of a part of Ukraine's territory has resulted in the significant deterioration of the security situation in the OSCE area. Russia's armed aggression in Ukraine has, in essence, become an unprecedented challenge to current security in Europe and globally.

For the first time since the World War II, an attempt has been made to change the long-lasting world order in Europe, including by the use of military force.

Especially pertinent among the actions taken by the European Community to ensure stability and peace are those aimed at appropriately enforcing arms control regime and confidence/security-building measures (CSBM).

An important aspect in this context is not just the conscientious and strict implementation of the Vienna Document by all participating Parties, but also updating the document to current realities to take into account emerging challenges to the European security system.

Being aware of the importance of these processes Ukraine, being one of 34 OSCE participating States, takes the appropriate steps in this direction. However, we face the reluctance of some of the participating States to support these changes. We also face blocking, by the Russian Federation, of the modernization of the VD and CSBM adaptation to the current realities.



Moreover, the Russian Federation's activities have already dealt a blow to Ukraine's territorial integrity and resulted in the creation of the so called "grey zones" in our territory. At the same time, military build-up in close proximity to our State border continues to foster more destabilizing factors.

DONETSK AND LUHANSK REGIONS

As has been repeatedly noted, deployment of the Russian-occupying force to temporarily occupied areas of Donetsk and Luhansk regions, consisting of the 1st and the 2nd Army Corps, has brought a lot of weapons and military equipment to the east of our country. By the way, the strength of these formations exceeds that of some of European countries.

About 650 Russian career servicemen occupy command and staff posts, requiring critical skills, in the 1st and 2nd ACs. In addition to this, Russia has deployed operational/combat support units as well as logistics units, military advisers and instructors to temporarily occupied areas in Donetsk and Luhansk Regions, bringing its military presence up to 2,100 troops.

In order to sustain the operation of its 1st and 2nd ACs, the Russian Federation continues supplying ammunition and POL (petroleum, oil and lubricants) from its territory.

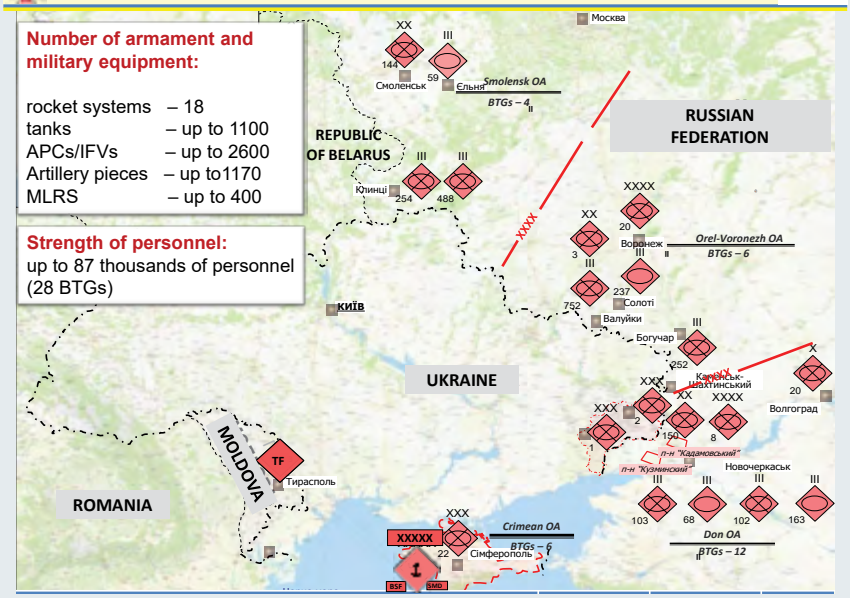
CRIMEA

Militarization of Crimea remains another destabilizing factor. Today, a powerful joint task force has been established in Crimea, comprised of ground, air and sea components with a combined strength of about 32,500 servicemen. Add to that, units of Russian Coast Defense Forces, National Guard (up to two brigades) as well as the FSB Border Guard Service have been deployed.

This indicates an active increase in strike power of the Russian Armed Forces units illegally deployed to the peninsula, achieved by means of increasing the number of deployed troops (forces) equipped with latest weapons and military technologies.

I would like to draw your attention to the fact that the Russian Federation has over the past six years substantially increased the amount of weapons and military equipment deployed in the Autonomous Republic of Crimea. By the way, we are still missing information about the Su-30SM, Su-30M2, Su-34 combat aircraft as well as the Mi-28 and Ka-52 helicopters that Russia has deployed to Crimea. →

Russian formations along the Ukraine's borders



FOR YOUR INFORMATION: *the 22nd Army Corps and the 810th detached Naval Infantry Brigade comprise the core of the ground component, which is planned to be organized into a new combined arms army. Currently, 6 battalion tactical groups are ready for deployment. The air component has been reinforced by deployment to the peninsula of units of bomber, assault, fighter and army aviation. By the way, the aircraft Su–30SM, Su–30M2, Su–34 and helicopters Mi–28, Ka–52 that Russia has deployed to the peninsula are not found in the country's annual Military Information Exchanges.*

Belbek and Hvardiyske airfields have been rebuilt to allow Russian long–range bombers to be deployed to the peninsula, and Crimea's infrastructure has been prepared for nuclear weapons deployment.

The combat capabilities of the naval component have been increased by adding the latest warships and submarines armed with Kalibr cruise missiles (up to 70 surface ships/gunboats, 6 submarines with a combined salvo of 84 missiles).

LEONID HOLOPATIUK,
Lieutenant General, Armed Force of Ukraine: *"The Russian Federation deployed 28 battalion tactical groups along Ukraine's border"*

FOR YOUR INFORMATION: *tactical elements of the 1st AC include:5 brigades (1st, 3rd, 5th dmbde, 100th dmbde, dartbde); 3 detached regiments (11th dmreg, 9th dmreg, detached commandant reg.); 10 detached battalions (divisions).*
Tactical elements of the 2nd AC include: 4 brigades (2, 4, 7 dmbde, dartbde); 2 regiments (6 dmreg, detached commandant reg); 6 detached battalions (artillery battalions).
The 1st and 2nd ACs have a combined strength of some 35,000 military personnel and possess a complement of equipment that includes 481 battle tanks, 914 armored fighting vehicles, 720 artillery gun systems, and 202 MLRS deployed in the Donbas areas outside government control.

Guided by the provisions of the Global Exchange of Military Information, specifically paragraph 4.4, which states that a State Party must report up-to-date information on troops (forces) stationed in a foreign state, Ukraine insists that the Russian Federation has to report, within the Global Exchange of Military Information, data on the number of troops and weapons it had deployed to Ukraine.

In addition to the situation in occupied Crimea, the tense security situation in the Azov-Black Sea region also raises concerns.

This region, given the geopolitical and economic factors, is of particular interest to the Russian Federation. To achieve its own goals in the Azov-Black Sea region, Moscow is implementing a strategy, the main elements of which are:

- increasing the deployment of warships and gunboats in the Black and Azov Seas;
- conducting "show of force" exercises involving the imposition of restricted access to certain areas in the Black and Azov Seas;
- restriction of freedom of navigation in the Sea of Azov in order to cause economic damage to our state;
- denying the passage of Ukrainian Navy ships and boats through the Kerch Strait.

Under the guise of fighting "terrorist" threats, Russia has been tightening control over navigation in the Sea of Azov and displayed its ability to place our country under a blockade.

In fact, the airspace and waters of the Sea of Azov have been patrolled on a regular basis by maritime patrol aircraft of the Black Sea Fleet. The practice of closing areas in the Sea of Azov is being introduced, ostensibly under the pretext of conducting combat training activities. Under the "anti-terrorist" pretext, Ukrainian and foreign civilian vessels bound for/from Ukrainian ports are detained and searched by the FSB Coast Defense Forces.

EASTERN BORDER

The Russian Federation continues its military build-up along Ukraine's border. In particular, new military units have been set up and existing military formations reorganized in order to enhance their ability to fight. Currently, 28 battalion tactical groups are deployed along Ukraine's border.

Today, work is being completed to set up three new formations – two Armies and an Army Corps, which are envisioned to reach full operational capability in 2020-2021.

In Russia's Western strategic area, the 20th Combined Arms Army consisting of the 3rd Motorized Division and the 144th Motorized Division has been organized to empower the Ground Component.

The 448th Missile Brigade of the 20th Army has been equipped with mobile short-range ballistic missile systems "Iskander".

In the South-Western strategic area, the 8th Combined Arms Army consisting of the 150th Motorized Division, the 20th detached Motorized Rifle Brigade, and the 1st and 2nd ACs has been organized.

The "Iskander" missile brigades will be established within the military district and the Army. Overall, the strength of Russia's ground task force deployed along Ukraine's border amounts to about 87,000 military personnel, up to 1,100 tanks; up to 2,600 armored fighting vehicles; up to 1,100 artillery gun systems; up to 360 MLRS, and 8 mobile short-range ballistic missile systems.

The Air Component continues to be modernized with newly-built and upgraded aircraft (Su-30SM, Su-35S, Su-34, Su-25SM3, MiG-31K with hypersonic "Kinzhal" system as well as helicopters of various modifications). In total, about 330 combat airplanes and 230 helicopters are deployed at base airfields near the Ukrainian border.

The formation of mobilization deployment support centers continues, which can allow for the establishment of up to 4 combined arms divisions (Boguchar, Kamensk-Shakhtinsky, Novoozerne/temporary occupied territory of AR Crimea).

Thus, as of today, in the vicinity of the Ukrainian border there have been set up three joint task forces capable

of carrying out surprise offensives in Ukraine's territory, pursuing limited goals without declaring a state of mobilization and with minimum preparations being made.

MISCELLANEOUS SECURITY ASPECTS

Over the past 6 years, we have witnessed the Russian Armed Forces increase the intensity and extent of its operational and combat training, which does not imply any additional security guarantees to neighboring states.

Special attention should be devoted to issues such as unforeseen military activities involving snap (unannounced) exercises and exercises held at lower than threshold level.

The possibility is not excluded that, during these exercises, Russia hides the actual number of personnel and weapons involved, including the number of airplane and helicopter sorties and the use of so called "fragmentation".

The non-transparent nature of unscheduled (snap) exercises increases distrust and military-political tensions in the OSCE area of responsibility.

Meanwhile Ukraine is forced to fight, repelling military aggression; it strictly adheres to the requirements of international treaties and agreements and fulfills all its international commitments while showing a high degree of openness and transparency. Ukraine has currently been one of the Member States that have been most active in implementing VD-2011. Out of a total of 199 activities conducted by the participating States, Ukraine has done 29 (or 15 percent) of all the activities conducted in the territory of participating States, including 19 inspections and 10 evaluations, and hosted 18 activities (12 inspections and 6 evaluations) in its own territory, which is equal to almost 10 percent of all the activities done.

Beyond that, in order to improve regional confidence and security, Ukraine has consistently abided by its obligations under bilateral agreements with neighboring countries (Hungary, Slovak Republic, Republics of Poland, Belarus and Romania), established under Chapter X "Regional Measures" of the Vienna Document.

CONCLUSION NOTES

Firstly, I would like to assure you that Ukraine is consistent in its policy of strict compliance with its obligations under international treaties and agreements in the field of conventional arms control.

Secondly, Ukraine will continue its contribution to the process of the VD-2011 modernization regarding confidence- and security-building measures and other tools for OSCE influence for promoting military stability, transparency and predictability in all participating States, and calls on all participating States to join this process.

Thirdly and finally, I would like to draw your attention to the need for developing effective mechanisms of international supervision over military activities conducted by Russian-occupying forces in temporarily occupied areas of eastern Ukraine and in the Autonomous Republic of Crimea. UDR

MAJOR WEAPON & EQUIPMENT SYSTEMS (MW&ES) DEPLOYED BY THE RUSSIAN FEDERATION TO CRIMEA, AS REPORTED BY THE ANNUAL EXCHANGE OF MILITARY INFORMATION UNDER THE VIENNA DOCUMENT 2011

Major Weapon & Equipment Systems	01.01.2014	01.01.2020	Difference
Battle tanks	0	31	+31
Armored combat vehicles	117	305	+188
Armored combat vehicles look-alikes	53	62	+9
Artillery gun systems	30	128	+98
Combat aircrafts	22	85	+63
Helicopters	0	34	+34
Anti-tank guided missile launchers permanently/ integrally mounted on armored vehicles	9	39	+30
TOTAL	**231**	**684**	**+453**

HYBRID WAR AT SEA: UKRAINIAN EXPERIENCE

The Ukrainian Navy is an important actor in conditions of the ongoing hybrid war at sea that Russia is waging against Ukraine. Over the years of confrontation, Ukrainian Navy sailors and commanders alike have learned and gained much experience in how to counter hybrid adversary tactics and to use available resources and capabilities to best effect. But it's crucial that hybrid tactics be identified and neutralized in advance in order to prevent negative effects from such adversary actions.

BACKGROUND FOR RUSSIA'S HYBRID WARFARE

Hybrid warfare at sea being waged by Russia in Ukraine's Crimea and other Black Sea littoral areas began in 1991 and assumed its current character in 2014-2019, i.e. the years of Russia's military intervention in Ukraine.

Between 1991 and 2014, the Russian Federation was taking the following hybrid warfare actions in Ukraine's Crimea and other Black Sea littoral areas:

- An expanded information campaign aimed to discredit Ukraine in the eyes of leaders of European countries, especially members of EU and NATO; damage the credibility of the government of Ukraine; undermine the morale and psychological fitness of the military, security, and law enforcement services personnel.
- Continuous economic pressure and manipulation against Ukraine, dating back from the unfair partition of the Soviet Black Sea Fleet between Ukraine (18.3%) and Russia (81.7%), allegedly in partial compensation for Ukraine's debt for natural gas deliveries from Russia (while Russia itself systematically failed to honor its obligations under a payment treaty regarding the basing of its Black Sea Fleet in Crimea).
- Continuous political pressure brought to bear, especially on political/military policy and decision makers in Ukraine.
- Russia's neglect of international law, especially international maritime and humanitarian law, and of Ukraine's national legislation at the time of basing of Russia's Black Sea Fleet in Crimea (in particular, the illegitimate use of forces, the so called "little green men", who weren't members of the BSF personnel and were illegally deployed with arms to the sovereign territory of Ukraine); the blockading of Ukrainian Navy deploy-

ment sites using BSF ships and mixed tactical groups.
- Russia's failure to comply with diplomatic obligations under international law and bilateral agreements at the start of Russian military incursion in Ukraine and in follow on periods, in particular, as it regards responding to diplomatic notes from Ukraine, etc.

Thus, Russia had created conditions that made it impossible for the Ukrainian side to adequately respond to Russian threats and actions. As a result, the Russian Federation has been able to partially achieve its strategic objectives - to destabilize Ukraine and create conditions for getting it back under Moscow's political control. However, the goal of full-scale destabilization hasn't been achieved other than in Crimea and in some areas of Donetsk and Luhansk provinces.

MILITARY PHASE OF CONFRONTATION, 2014-2019

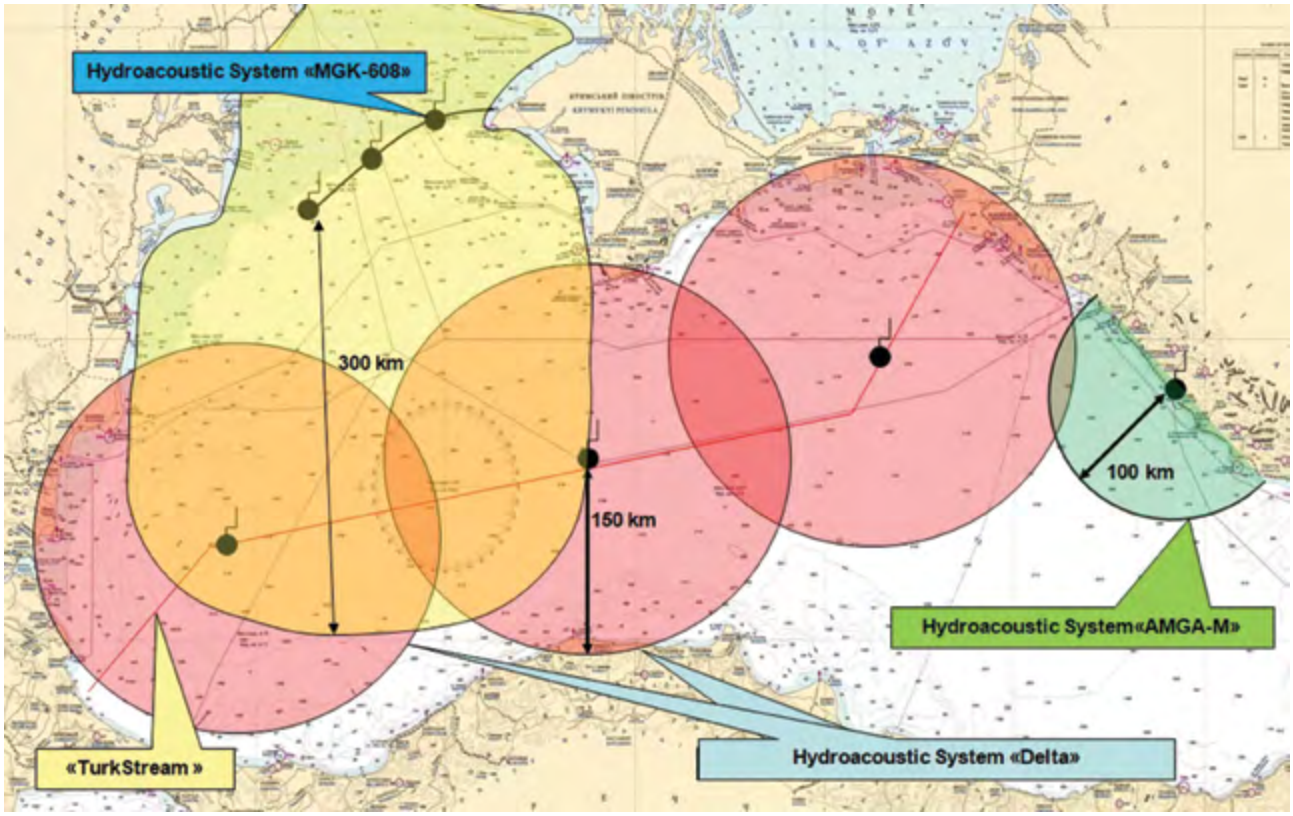
From the onset of Russian military incursion in Ukraine in February 2014, the Russian Federation has progressively expanded the hybrid influence it wielded on the security situation, especially in the Azov/Black Sea region.

In 2014, Russian forces, dressed in unmarked uniforms and using means of hybrid warfare, illegitimately occupied the Ukrainian peninsula of Crimea. While claiming "they were not there", they performed strikes against government forces deployed in Eastern Ukraine, and in particular they attacked and destroyed two Ukrainian border guard boats, one in August 2014 and another one in June 2015. In the time afterward, Russian Navy ships and boats staged "shows of force" maneuvers off Ukraine's coast near the city of Mariupol.

At sea, the Adversary is currently conducting hybrid warfare activities that combine information attacks, cyber attacks, and misinformation of both Ukrainian and international public with intimidating shows of force, measures of economic pressure, as well as actions aimed to worsen social tensions in Ukraine and to frustrate daily activities of the Ukrainian Navy.

Result of a Russian attack against a Ukrainian Navy vessel bound for the Strait of Kerch, November 2018

A large cargo vessel anchored by Russia under the central arc of the Kerch Strait Bridge in order to physically block access to the Strait, November 2018



Russia employs special hydroacoustic systems for subsurface monitoring in the Black Sea

In order to ensure continued influence over Ukraine, Russia makes an extensive use of a "hybrid warfare" technique aimed to disrupt Ukraine's economic activity at sea while simultaneously boosting own presence in the Sea of Azov:

- in May 2018, Russia completed the construction of the Kerch (more commonly known as Crimean) Bridge, whose fairway arch is too low for big, Panamax-class bulkers;
- indiscriminate stoppages and temporary detentions of merchant ships heading to the Azov Sea ports, resulting in a 20-30% reduction in freight turnover at the Ukrainian ports of Mariupol and Berdyansk;
- in 2018, the Adversary country completed formation of an interagency task force "to protect the Kerch (Crimean) Bridge and seize control of the traffic in the Sea of Azov and through the Kerch Strait";
- the Russian task force in the Sea of Azov was, in 2018, reinforced to include artillery boats transferred from the Caspian Fleet.

After having allowed two Ukrainian military vessels to pass through the Kerch Strait and into the Sea of Azov in September 2018, the Adversary yet again showed off its "strategy of limited actions" on November 25, when it attacked and seized three Ukrainian Navy vessels, including two latest gunboats and a tugboat with crews.

This operation saw the following developments: (1) A Russian border guard ship intentionally stroke and rammed into the Ukrainian tugboat several times in an attempt to block its course toward the Strait. The tug sustained numerous damages to its hull as a result of the ram attacks. (2) The Russians then anchored a large cargo vessel under the Kerch Strait Bridge to physically block access to the strait. (3) The Ukrainian Navy vessels lose communication with their headquarters as a result of Russian electronic warfare attacks. (4) One of the gunboats, the Berdyansk, sustained a damage to its pilothouse when it had taken fire from a Russian vessel while outside of the 12 nautical mile limit area. (5) The vessels came under attack from Russian combat choppers. (6) FSB Special Forces soldiers assaulted and seized the Ukrainian vessels, which were then towed to the Kerch harbor.

In 2019, the Adversary expanded its hybrid warfare operations in the Black Sea. Particularly in August, Russia closed for shipping over 25 percent of the Black Sea's area, thus severely disrupting international navigation and frustrating the Ukrainian Navy's daily operational activities.

In general terms, a review of recent developments in the Black Sea and the Sea of Azov allow the following conclusions to be reached:

- the Russian Federation is expanding the use of hybrid warfare means and techniques in order to wield pressure over Ukraine militarily, in particular by making a hybrid use of newly deployed force groupings;
- when conducting hybrid warfare, the Adversary employs interagency task forces formed specifically for that purpose;
- by waging hybrid warfare at sea the Adversely is seeking to dis-

rupt normal economic activity in Ukraine and to cause a frustration of international sea shipping in Ukraine's area of responsibility, and hence to achieve a worsening of social and economic tensions in littoral provinces and in Ukraine overall and to undermine the international reputation of Ukraine insofar as it relates to its ability to secure compliance with international maritime law.

WHAT TO EXPECT FROM RUSSIA IN THE FUTURE?

At present, the situation in the temporarily occupied Autonomous Republic of Crimea, the city of Sevastopol, Ukraine's territorial waters around Crimea and exclusive (maritime) economic zone in the Black Sea, the Sea of Azov, as well as the Strait of Kerch involves Russia's continued action as part of its "strategy of limited actions", based on coordinated interagency collaboration. Russia, as before, will maintain permanent military and naval presence in areas adjoining Ukraine, including the territorial waters of Ukraine, and will maintain control of maritime economic facilities it has seized from Ukraine.

Moreover, in the Black and Azov Seas, the Russian Federation will continue a restrictive posture to frustrate the daily operations of the Ukrainian Navy, disrupt normal international traffic in the Ukrainian waters; attain a reduction in the level of international shipping and in freight turnover at Ukrainian seaports, and hence to achieve a worsening of social and economic tensions in littoral provinces and in Ukraine overall. An important factor will be Russia's effort to foster a negative attitude toward Ukraine among the international public, foreign country leaders and large international businesses, by portraying it as "being unable to ensure the safety of international shipping in its waters".

It is clear that Russia will seek to militarize Crimea further and to obstruct the armed forces and other institutions of Black Sea members of NATO from activities for ensuring and enhancing international security, supporting the objectives of NATO-Ukraine and NATO-Georgia partnerships, and bolstering NATO's defense capabilities in the region.

An FSB patrol boat performing course blocking maneuvers against a Ukrainian Navy vessel

Expert reviews suggest that the Russian Federation is beefing up the capabilities of its newly organized interagency/joint task forces deployed in Crimea and the Black/Azov Seas, by fielding the forces with the latest military weapons and equipment systems tested in real-world combat deployments in Syria.

Thus, expert reviews of the situation in the region suggest that, in the short to medium term, the Russian Federation will continue its military intervention in Ukraine. This intervention will be in the form of hybrid warfare influence in order to undermine Ukraine's ability to secure and defend itself, to bring Ukraine back under Russia's political control, and to prevent its Euro-Atlantic integration. UDR

Stepan YAKYMIAK,
1st Rank Captain,
PhD in Defense Studies,
Assistant Professor,
Head of the Naval Chair at the
National Defense University of Ukraine

A Black Sea Fleet vessel guarding the security of an offshore drilling rig that Russia illegally seized from Ukraine during its Crimea annexation campaign

UKRSPETSTECHNIKA

JSC "Holding company "Ukrspetstechnika" operates in the market of telecommunications and electronic technologies since 1989. Experience professionals, creative success and talent have allowed to win a leading position in Ukraine in the design, creation and delivery of a wide range of sophisticated electronic and other equipment for military and special purpose.

ANTI-UAV GUN

Radio-electronic gun is designed mainly for counteraction against commercially available UAVs which may be used to perform acts of sabotage or terrorist attacks, or simply to intrude into a private life. As well, this equipment may be used for protecting air fields, stadiums and places of mass events for ensuring their security against drones activities. The employment of the gun is based on radio jamming of UAV's navigation channels (GPS and GLONASS). The effective range of the signal generated by the gun's antenna is up to 5 km. Additionally, the whole field of interferences to UAV's navigation channels up to 2 km in radius may be setup due to application of omnidirectional antennas of the system. The low weight of the system enables using it in the portable version or transporting it on an ATV, in a vehicle or any other mobile carrier.

MUZZLE VELOCITY RADAR SYSTEM

Muzzle velocity radar system is designed to measure the initial speed of any caliber shell. The device can be placed in two ways, both on a tripod and on self-propelled guns or tanks. It can be integrated into artillery firing systems.

frequency band.....Ka-Band
transmitted power.....≤ 50 mW
velocity range.....10 - 2000 m/s
measurement error.....≤ 0,1%
shell caliber.....from 4,5mm
power source.....12V
overall dimensions.....250x170x130 mm
weight.....up to 10 kg

RADAR «MALACHITE»

Digital, Interference-proof radar reconnaissance aircraft and surface targets provides detection, identification of the origin and transmission of radar data to consumers automatically.

Targets' detection range: 400 km.

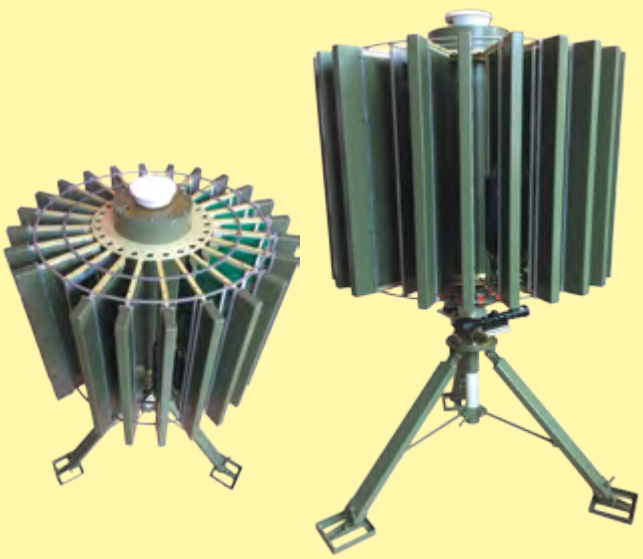
COMPLEX «POLONEZ»

Anti-UAV defence mobile complex.
Detection and identification of moving aerial objects and UAVs, radio spectrum monitoring, identification of UAV's frequency band and control commands structure, archiving data base, automatic transmission of radar data to Control Center, firing complexes, combat modules, spot and barrier jamming of control commands and telemetry, jamming of GPS\GLONASS navigation receivers of UAV.
Complex «Polonez» includes: reconnaissance complex «Jab» and jammer complex «Anklav» combined by common algorithm of tasks handling with the help of specially developed software protocols.

RADAR «BISKVIT - KB»

Developed jointly with JRC «POLITECHNOLOGY», «Biskvit-KB» is meant for radar reconnaissance of positions of mortars, multiple-launch rocket systems, high-caliber weaponry and automatized transmission of radar data via communication channels to perspective automated systems. The radar is performed on the base of digital active antenna array and can be installed on vehicles or trailer.

frequency band.....L-Band
detection range.....up to 20 km
azimuth range.....360°
elevation range.....ap to 40°
weight.....80 kg



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LIVE IN A NEW WAY

UKRAINE'S DEFENSE-INDUSTRIAL SECTOR IS FACING DRAMATIC REFORMS IN HOW THE DEFENSE INDUSTRY IS MANAGED AND HOW ARMS PRODUCTION IS STRUCTURED AND ORGANIZED

Summer 2020 saw a start to dramatic transformations facing Ukraine's national defense-industrial sector. In the country, there has been established a Ministry for Strategic Industries and a long overdue legislation on public defense procurement has been passed. The newly hatched minister has announced radical changes planned for the national defense industry within a few years to come. But only time will tell how profound, fast and successful the changes will be.

Matters relating to the defense-industrial sector and Government Defense Procurement Contract (GDPC) had, until now, been the responsibility of a small department at the Ministry for Economic Development, Commerce and Agriculture, headed by a deputy Minister. But in a country where there are as many as 16 defense and security customers, the head of a small department is very limited in his ability to exert influence on how things are run and done, and especially so when it comes to implementation of national defense-industrial policy priorities.

But the fact is that there is much to manage in the defense-industrial realm. The State-owned defense industries group Ukroboronprom alone has under its administration 137 companies (including 21 located in Russia-occupied areas in eastern Ukraine) and the State Space Agency of Ukraine (SSAU) has managing authority over 21 companies. There are several more companies administered by other Government agencies, including the ministries for internal affairs and for education and science. In Ukraine, more than a half (or over two hundred) military production companies are in the Private Sector.

That being said, however, the situation in Ukraine's defense industry, especially its public segment, has been changing for the worse, this despite the fact that the GDPC has been increasing year by year. Ukroboronprom's figures suggest that only 27 out of 116 companies currently under its management are actually operating producing 90 percent of the Company's output. Regarding the SSAU, the situation is no better with only seven of 21 companies being alive and working. In the Private Sector the situation is reversed, with production booming, albeit this happening without due attention or support from the Government.

Thus, with the purpose in mind to change this sad situation, the National Security and Defense Council (NSDC) decided at its session held in June 2020 to set up a Government authority to address defense-industrial policy issues. One month later, the Ministry for Strategic Industries was established pursuant to a Government Decree, with Deputy Prime Minister Oleh Urusky placed in charge of the new ministry on July 16.

Established as a successor to the Department of Defense Industry at the Ministry of Economy, the new ministry is to integrate within itself SC Ukroboronprom, SSAU, State Research Institute of Informatization and Economy Modeling, as well as State-owned Pavlohrad Chemical

Plant, a manufacturer of rocket fuel.

A new configuration for the country's defense industrial sector was outlined in detail by Oleh Urusky, in a speech to August 12 round table conference hosted by Ukrinform news agency.

Thus, according to Mr Urusky, there will be established two state-owned holding groups to bring together companies that are currently administratively subordinated to the Ukroboronprom and SSAU, respectively. Before this happens, there will be identified companies across industries to lead industry clusters in their respective areas of expertise. This will be followed by company corporization process, with the Government initially holding 100 percent ownership of the companies.

In the future, Ukroboronprom will be re-organized into a state-owned holding company with whole different functions and responsibilities. The company will be renamed, tentatively "Ukrainian Defense Systems". The new holding will manage equities in its constituent companies. There is talk about five to eight business associations – holding companies to be set up based on specific areas of industrial expertise and competencies: precision-guided weapons, radar systems, shipbuilding, specialty chemicals, ammunition, and armored combat vehicles.

In addition to Ukrainian Defense Systems, there will be established a holding group that will bring together SSAU-run companies and public businesses engaged in the aircraft building industry. This second group, to be known as Ukrainian Aerospace Systems, will be comprised of two holding-type entities, one of them Antonov Company and the other the holdings group "Space Rocket Center Pivdenny".

Ukrainian Defense Systems and Ukrainian Aerospace Systems will be both placed under the administration of the Ministry for Strategic Industries, excepting licensed arms dealers who will be removed from under the administration of SC Ukrobonroprom and will operate within the functions and purposes defined in their respective founding charters.

It is also on plan to encourage the Government to establish an Export Credit Agency to provide trade financing to domestic arms manufacturing companies for their export market activities. It is assumed that this will facilitate the export market for Ukraine's arms manufacturers and allied industries.

Another area of reform is the creation of a defense technology agency akin to the U.S. DARPA. This new Research & Development entity could be created centered around organizations such as the Central Scientific Research Institute of Weaponry and Equipment Systems, the National Academy of Sciences' Division of Applied Sciences and the State Research Institute of Informatization and Economy Modeling. This would be helpful to formulate a new vision of future development priorities for Ukraine's defense industry.

Beyond that, incentives to facilitate defense industry growth and development are contained in the recently adopted legislation on "Public Defense Procurement" that President Volodymyr Zelensky enacted on August 12. The legislation includes measures that are long overdue. Thus, it introduces the term "life cycle" for use in the context of weaponry and military equipment systems, and makes provisions that new defense and military technologies be officially tested and qualified by the same procedures as used by NATO nations. On top of that, the legislation fosters transparent and competitive market for defense-related products, works and services, and allows domestic customers to source products directly from import markets.

In addition, the legislation introduces a three-year cycle in planning for arms procurement programs and provides for Government support measures for the domestic defense industries, both public and private.

The law allows international defense technology suppliers to be invited to bid for contracts, provided that there is a higher priority given to (1) bidders who offer products localized for production in Ukraine's customs territory and to (2) bidders with more favorable bids in terms of MRO servicing of the equipment supplied.

So, we can see from the preceding comments that Ukraine's defense industry is on the verge of major reforms that the newly founded Ministry for Strategic Industries expects will be brought to fruition within a few years' timeframe. That being said, there is an ambition that the reforms be carried out quickly enough so that to yield their expected results before the next presidential election. But this will depend on a fusion of multiple factors, the most important being the concerted effort by the legislative and executive branches and SDCU; timely adoption of requisite regulatory legal acts, such as a law on corporatization in the defense industry; and the need for company managers and executives to be really willing and interested in innovations, game-changing practices, and learning how to compromise with each other. UDR

Anton MIKHNENKO,
UDR

NEPTUNE ASCM PROJECT

APPROACHING ITS FINAL LAP

Despite the COVID-19 Quarantine and restriction measures in Q1 and Q2 2020, the RK-360MTs mobile Anti-Ship Cruise Missile (ASCM) System Neptune has succeeded through the final round of its Official Qualification Trails (OQT) process, potentially leading to formal Approval for Service Use.

DKKB Luch, a State-owned Design & Development Company, is the Prime Contractor for the Neptune ASCM system Neptune.

The Neptune is a domestic collaboration involving both state-owned and private-sector defense contractors. The project is aimed to provide Ukraine with a cost-effective 300-km-range ACSM capability.

FINAL TRIALS

The closing round of the OQT program for the Mobile ASCM System Neptune took place at Ali Bay marine testing range, outside Odesa, in the period from April to June 2020.

Thus, on April 2 there was conducted a test firing against a surface target using a non-explosive warhead. The missile, after being fired from Neptune launcher vehicle, flew to the target area by following a pre-programmed path formed by predefined waypoints. Navigation was performed by fusing inertial and GPS measurements with radio altimeter data. In midcourse, the missile was skimming over the sea at the lowest height possible. At this low sea-skimming height the missile will be less detectable by enemy sensors and less vulnerable to air defense countermeasures.

A lighter ship of 38 m in length and 11 m in width, located about 100 km off the shore was used as the test target.

The missile successfully hit its target with high accuracy.

This was followed by test firings conducted from 25 to 29 April in realistic mission scenarios that involved the use of naval warships and aircraft and saw actual jamming attacks being launched to frustrate and disrupt the missile guidance systems. It was reported that two successful launches

had been made against a lighter ship used as a simulated target.

The tests continued on May 26-29, with several R-360 missiles fired simultaneously at different targets. As explained by the Chief of Design at DKKB Luch, Oleh Korostelev, "Parameters of the targets regarding flying trajectory, distance and lock-on time were preloaded into the memory of each of the seeker heads...".

"At a distance of about 10 to 15 kilometers from two assumed points of impact the missiles descended to 5 meters above the Black Sea surface, then calculated the most probable point of impact, flew the remaining path and hit two ship targets," Mr Korostelev said.

June 17, 2020 saw the first ever live test-firings of the Neptune ASCM. As claimed by DKKB Luch, Russia attempted to interfere and frustrate the testing process by taking electronic countermeasures, but failed to succeed: the two missiles launched successfully reached and destroyed their assigned targets. Moreover, the flight plan for the second missile was promptly updated from the Ground Control Center to incorporate relevant data from the first missile launch.

The sea-skimming height of the second missile was decreased to three meters. This second missile successfully hit and destroyed a sea-floating platform loaded with several sea cargo containers of a test-specific mass.

Now that the missile test firing program has been successfully completed, it can be hoped that the Neptune ASCM system will be officially accepted into service and fielded by Ukraine's military as early as in 2020.

NEPTUNE ASCM SYSTEM IN ALL ITS GLORY

The RK-360MTs "Neptune" is a shore-based ASCM system optimized to fire the cruise missile R-360. The Neptune missile is intended to be used against surface combatants like cruisers, torpedo boat destroyers, frigates, and corvettes, as well as amphibious landing ships and transport vessels sailing in strike groups (convoys) or individually, and it would be effective also against radar-detectable targets on the shore.

The Neptune is being designed as a day/night all-weather weapon system capable of operating in severe ECM environments and under heavy enemy counterfire. It would be able to engage targets at ranges from 7 to 280 km.

The Neptune would be able to achieve its full capability if deployed no farther than 25 km from the coastline.

- Full salvo – 24 missiles.
- The time lag between missiles launched in a salvo – 3…5 s.
- Time from the end of mission to ready-to-fire time for the next mission – ≤15 min.
- ASCM Neptune vehicle range – ≤1,000 km.

The Neptune ASCM Battery includes:

1. Command-and-control post vehicle equipped (1) for automatic control of the System's operation, (2) to ensure sustainable communication (over HF, UHF and satellite) with higher echelons and other Neptune vehicles. The five-member crew can emplace the command-and-control post and have it ready for mission in no longer than 10 minutes.
2. R-360 missile in the TPK-360 storage/transport/launch canister. Armed with a 150-kg warhead, the 870-kg, 380-mm diameter missile would skim over the sea at a height of 3…10 m. It will have a maximum range of 280 km.
3. Unified launcher system USPU-36 is equipped for temporary storage, transport, pre-launch preparation and launch of R-360 missiles.
4. Transporter/transloader vehicle T3M-360 carries TPK-360 canisters with R-360 rockets.
5. Ground support equipment kit KMO. →

Neptune missile test results, June 2020, Black Sea

The composition of the Neptune Battery can be configured to meet specific Customer needs. A Neptune battalion would typically consist of: (1) mobile command and control post, (2) three launcher batteries consisting of two SPU-360 launchers each, (3) operational support battery consisting of six transporter/transloader vehicles each carrying one storage/transport/launch canister TPK-360, (4) logistical units. Each Neptune battalion will have a standard missile establishment of 72.

The State Enterprise DKKB Luch, Kyiv, is the primary contractor for the Neptune ASCM System. The Neptune Project is a collaboration involving domestic entities only, including but not limited to: Orizon-Navigation, Impulse, Visar, Arsenal TsKB, Radionix, Telecart-Prybor, Ukrainian Armor, Motor-Sich, and KrAZ.

The Neptune ASCM System technology offers a number of important competitive advantages in the following ways:

1. In terms of capabilities versus cost trade-offs, the R-360 missile, while being cheaper to buy, exhibits performance capabilities roughly comparable to those of best international brands from the U.S., Sweden, PRC, and Russia. Being fully indigenous it eliminates reliance on foreign sources of components and subsystems.
2. The Neptune can be integrated with any of the existing foreign-produced ISTAR assets by networking the Neptune command-and-control post vehicle with Customer's systems. It can also operate autonomously by using targeting data obtained externally from reconnaissance missions and aerial surveillance from manned/unmanned aircraft.
3. The System can be located for production in the Customer's home country. In particular, it can be

Neptune ASCM operator workstation

mounted on any wheeled chassis brand with off-road performance as required by Customer need.

4. The ASCM Neptune is unified for launch from land, sea and air platforms. In Ukraine, it was test launched from missile boats and is being adapted for launch from the Su-24M-type strike aircraft (Su-27 objective). The configuration optimized for air launches will be designed without a canister, enabling the missile to be delivered from standard aircraft rocket launchers like APU-78 or AKU-58.

MOVING FORWARD TO NEW FRONTIERS

The family of Neptune ASCMs is currently being expanded to include configurations optimized for sea and air launches in addition to the ground-launched baseline.

From the economic perspective, the baseline configuration of the missile has optimum parameters in terms of full-rate series production, requirements on the materials used, production processes, machinery and other manufacturing technology.

The Neptune ASCM rates relatively high among rival technologies worldwide in comparisons of cost and effectiveness.

The experience gained so far with developing this new ASCM capability reveals much room for modernization of both the unified subsonic missile and other System components.

DKKB Luch is already working on some of the upgrades to improve the tactical, technical and operational parameters of the Neptune ASCM system. But, of course, it is the feedback from the military customer that will matter most in this respect.

Military weapons designers are stressing that advances in microelectronics, computer technology and artificial intelligence, combined with the automation of military command and control will be the key drivers behind quality based transformation of ASCM weapons and related doctrine, organization, capabilities, training, tactics and procedures.

So, future history for the Neptune is already in writing. UDR

Serhiy ZGHURETS,
Defense Express

Unified launcher system USPU-36

Command-and-control post vehicle

Transporter/transloader vehicle T3M-360

Storage/transport/launch canister TPK-360 deployed on a T3M-360 transporter/transloader vehicle

PIRAT ATGM ATTACKS FROM THE TOP

The Polish company Polska Grupa Zbrojeniowa, on July 15, 2020, conducted successful testing of the anti-tank guided missile (ATGM) system "Pirat". The Pirat ATGM – a binational project involving MESKO S.A., the Military University of Technology, and CRW Telesystem Mesko of Poland and DKKB Luch of Ukraine – has now reached its final stage of development.

The tests conducted at Nowa Deba testing range intended to validate the main conceptual assumptions of the Pirat ATGM program.

The scope of the tests conducted included guided launches assisted via the LPC-1 laser target illumination device. Besides that, the tests checked and verified the operation of the Polish-developed thruster and cruising engine and the accuracy of missile guidance at distances from 500 m to 2,400 m.

"The tests were completed successfully. The results achieved verified both the full functionality of the indigenously developed engines and the accuracy of guidance under field conditions. Pirat meets the requirements announced by the Polish Armed Forces, especially in the context of the Pustelnik program, to which it remains the core solution. We are now completing this project in preparation for the launch of production due next year," said Gabriel Nowina-Konopka, the Mesko S.A. Board Vice-Chair.

The light Pirat ATGM is being developed and offered to the Polish Ministry of Defense as part of the Pustelnik program that provides funding for the purchase of up to 5,000 Pirat ATGMs and 500 associated launchers.

CAPABILITIES AND FEATURES

The contract award to develop and manufacture the Pirat ATGM system for the Polish Armed Forces was signed on July 23, 2014. On a parallel track, Mesko S.A. agreed a collaboration with the Ukrainian state-owned defense contractor DKKB Luch who at that time was privately developing the ATGM RK-3 Korsar (aka Corsair) that was later introduced into the Ukrainian Armed Forces inventory.

DKKB Luch is attached to the Pirat ATGM project as developer of the missile airframe as well as the aerodynamic system and the autopilot system (in collaboration with CRW Telesystem-Mesko). CRW Telesystem-Mesko, for its part, is responsible for development of the guidance system, the autopilot system (in collaboration with DKKB Luch) and all the optoelectronics components, while MESKO undertook to provide the warhead, engines and miscellaneous systems, including the control console.

The Pirat has notable differences from the RK-3 Korsar missile. The RK-3 Korsar is guided by a semi-automatic laser homing seeker, with the laser beam focused on the tail of the missile with the gunner having to keep the sight's crosshairs on the target until impact.

The Pirat, alternatively, homes in a target illuminated by a laser illuminator, this being attached to the launcher tube or an external platform such as UAV.

For that purpose, a forward-mounted auxiliary detection device has been developed to facilitate the Pirat missile to keep to the trajectory of the target-reflected laser beam.

Especially for use with the Pirat missile, CRW Telesystem-Mesko has developed a laser designator, the LPC-1 that featured in the Pirat missile test launches carried out on July 15. Alongside the short-range ATGM Pirat, the LPC-1 is claimed to be suitable for use also with guided projectiles fired from 120-mm mortars and 155-mm artillery guns.

The LPC-1 laser target illuminator uses a semiconductor diode laser emitting radiation at a wavelength of 1.064 nm.and frequency of <25 Hz, with an impulse power of >80 mJ and length of 15 +/- 5 ns, and beam width of <0.35 mRad and length of ≤5,000 m.

The LPC-1 allows for programming of PRT impulse sequences (Pulse Repetition Time) in line with the NATO STANAG 3733 standard, making it compatible for use with laser-guided projectiles of NATO armies other than Poland's. Operating at 1.064 nm, the device can measure distances in the range of 0.2-20 km, with an accuracy better than 5 m. The detection of targets is facilitated by the use of a 10X magnification sight.

At around 10 kg of its own weight, the LPC-1 goes up with the attachable scopes (1.5 kg), cables (0.5 kg), and batteries (2-4 kg), to around 17 kg. While the Poles have a newer laser target designator that is lighter weight and smaller, nonetheless it weighs in the range of 8-10 kg.

The Pirat ATGM employs the integrated sighting system consisting of a daytime sight, thermal imaging sight for day/night use, laser target illumination device, electronic compass and GPS receiver.

MISSILE'S CAPABILITIES AND POTENTIAL

In its version intended for dismounted infantry use, Pirat has the range of 2,500 meters, missile weight of 10.1 kilograms (inclusive of 2.5 kg for the HEAT warhead) and diameter of the missile body of 107 mm. In its final form, Pirat would be capable of penetrating up to 550 mm of rolled homogenous armor (RHA) behind explosive reactive armor (ERA). It is also assumed that fuel-air explosive and high-explosive fragmentation warheads would also be available for the new weapon.

The missile is delivered from a 1,180-mm long transport/launch canister that weighs 15 kg when loaded. Time to target is 12 seconds, which exceeds the time needed by the crew of a target vehicle to respond to the threat by setting up protective countermeasures.

To address this issue, Polish engineers developed a backup mode of guidance complementing the conventional mode where a target vehicle is attacked head-on. This is about the top-attack mode that allows a target to be hit from above in its most vulnerable, upper section.

As claimed by Mesko S.A., "This system can focus not just on the reflected laser beam as was the case with older generations of ATGMs. We can conduct an attack in a pre-defined, pre-programmed manner where the missile attacks its target from the top of its trajectory "arc" at the height of 100 meters. The ability to implement and further improve these guidance algorithms would make the Pirate missile significantly more resilient to enemy countermeasures, and it also offers many flexible options for deploying the new ATGM system in combat".

It is yet to be seen, however, whether this top-attack mode will be sufficiently effective against targets that are on the move.

This "top attack" mode has nothing in common with the top-attack capability of the Israeli missile "Spike" (the operator controls the missile by viewing the feed from the missile optical seeker), not to mention the TOW-2B (the missile flies over the target; employs plunging warheads and IR/magnetic sensors that command the warhead to detonate when flying over the target tank; and this eliminates the need for distance measuring) or the Javelin missile with its pre-launch lock-on capability.

ENDNOTES

1. The Pirat ATGM, even though it has been developed based on the aerodynamic measurements made for the RK-3 Korsar missile, is inferior to the latter in firepower and lethality.

2. The use of the guidance method, where the missile is self guided after launch following the target-reflected laser beam trajectory can give away the position of the missile operators and thus put them at risk of counterfire.

In contrast, the Ukrainian alternatives Korsar and Stugna – where the reflected laser beam receiver is located in the aft section of the missile – are kept stealthy from launch till impact to avoid being detected in due time by enemy sensors.

3. The top-attack mode that is one of conceptual assumptions of the Pirat program is a solution that experts are warning does not take due account of the rapidly changing dynamics of the modern battlefield.

4. The Pirat ATGM has lost part of its armor piercing ability due to the auxiliary detection device being mounted in the missile forebody in place of the precursor warhead that is needed to detonate explosive reactive armor installed on modern tanks and lighter armored combat vehicles.

While the RK-3 Korsar is armed with a tandem-charge HEAT warhead fitted with two charges: a precursor warhead to detonate any ERA protection and a primary warhead to penetrate base armor, the Pirat, in contrast, has a single-charge warhead.

The Korsar ATGM can penetrate 550 mm RHA behind ERA protection.

It is assumed that the Pirat will be capable of defeating up to 500-550mm RHA behind ERA. But given the simplified, single-charge design of its warhead, it will certainly be powerless to defeat even the old-generation ERA system such as the one seen on the T-72 MBT.

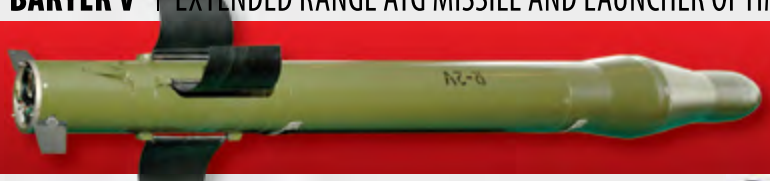
But this is not all that critical, given that counter-tank warfare is not the only use assigned to this light ATGM system by the Pustelnik program. To ensure a 100 percent effective capability against hostile tanks, the Polish military is acquiring more potent and capable ATGM weapons. As regards the Pirat ATGM, this capability will certainly find its utility in defeating targets such as lighter armored combat vehicles, helicopters, or unmanned aerial vehicles and in performing various important missions in combat both in urban and countryside battlefields. UDR

Volodymyr TKACH,
Defense Express

State Kyiv Design Bureau "LUCH"

STATE KYIV DESIGN BUREAU «LUCH» – THE LEADING

BARYER V | EXTENDED RANGE ATG MISSILE AND LAUNCHER OPTIMIZED FOR USE FROM AERIAL PLATFORMS



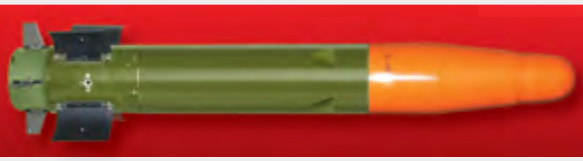
BARYER | VEHICLE-CARRIED LOG-RANGE ATG MISSILE SYSTEM

15,7 kg | 1091 mm | 130 mm ∅

KOMBAT | GUIDED MISSILE ROUND

24,7 kg | 1013 mm | 125 mm ∅

KONUS | GUIDED MISSILE ROUND



22,3 kg | 923 mm | 120 mm ∅

FALARICK 105 | 105 MM GUIDED MISSILE ROUND

25,2 kg | 1015 mm | 105 mm ∅

STUGNA | GUIDED MISSILE ROUND

19,3 kg | 1136 mm | 100 mm ∅

FALARICK 90 | 90 MM GUIDED MISSILE ROUND

20,5 kg | 977 mm | 90 mm ∅

KORSAR | MAN-PORTABLE ATG MISSILE AND LAUNCHER

13,5 kg | 1000 mm | 107 mm ∅

Type of carrier platform
Missile mass
Missile diameter
Missile length

DEVELOPER OF ANTI-TANK SYSTEMS IN UKRAINE

UKROBORONPROM
Ukrainian Defence Industry

25 kg | 1609 mm | 130 mm ⌀

7,5 km — 800 mm

5 km — 800 mm

5 km — 750 mm

5 km — 700 mm

5 km — 550 mm

5 km — 550 mm

4 km — 550 mm

2,5 km — 550 mm

Armor penetration capability

Light portable missile system Corsar

Man-portable rocket grenade launcher

Man-portable ATGW system Skif

Antonov AN-178

TRADE FIRM PROGRESS

THE OLDEST EXPORTING COMPANY IN UKRAINE

Progress is a strong stakeholder in the development, sponsorship and funding of promising technology projects being pursued by domestic companies for the benefit of Ukrainian defense forces and an international customer.

State Enterprise "Specialized Export/Import Trade Firm Progress" was the first in Ukraine to be officially certified as exporter/importer of goods and services.

Since its establishment in 1990, Progress has arranged export deliveries of military and special equipment to more than 50 countries in Europe, the Middle East, Hispanic America and Africa. The deliveries included not only off-the-shelf military products like main battle tanks, armored personnel carriers, maritime vessels, communication systems etc, but, also, advanced technology, know-how and R&D services relating to future-generation armament systems.

Progress is currently focusing its business on own entrepreneurial projects. The company is a full-fledged affiliate of the Ukroboronprom Concern, a State-owned defense industries group that incorporates over 100 armaments manufacturing companies in Ukraine. Progress is committed to translating its experience and investing revenues obtained from export sales into industrial partnerships for development of future-generation armament systems for marketing in-country and abroad. We are pleased to offer mutually advantageous cooperation in export marketing and import procurement of defense/special-purpose equipment and defense MRO services.

Here we offer to your attention short descriptions of the Company's areas of focus:

EXPORT MARKETING AND IMPORT PROCUREMENT OF DEFENSE/SPECIAL-PURPOSE PRODUCTS AND SERVICES: armaments, munitions, military and special-mission equipment; replacement parts, explosives, and other products suitable for design, development or production of defense/special-purpose equipment.

We have been involved in the export domain since 1990. Thus we are currently executing a contract to deliver anti-tank guided (ATG) missiles and launchers to Saudi Arabia. In May 2019, we shipped 40 launchers with "Skif" ATG missiles and 100 man-portable launchers with "Corsair" ATG missiles equipped with thermal-imaging sensors. The 130-mm caliber Skif and 107mm caliber Corsair are the most advanced and capable ATGM systems ever developed in Ukraine thus far. The Skif, for instance, can be launched and guided from defilade or shelters on land. The Corsair, being of low mass and compact size, features semi-automatic laser-beam guidance along with a strong counter-jamming capability.

EXPORT MARKETING OF NEW KNOW-HOW, TECHNOLOGY, BLUEPRINTS and other sci-tech products for defense and civilian applications.

We follow trends and aid our partners in Ukraine with design development and production of innovative technologies and promoting them for marketing. Thus, we partnered with Microin, Kharkiv, to develop and produce a set of innovative, magnetic surgical instruments. With the help of these instruments, military surgeons can swiftly and easily remove ferromagnetic fragments of mines, grenades, shells and bullets, and it takes five-fold less time to remove a foreign body with this new instrument than with a conventional one. The proportion between the number of foreign bodies removed from and retained in the wound is 30 per cent to 70 percent with conventional instruments, and reverses to 70 percent and 30 percent with magnetic instruments. These instruments help surgeries become less

invasive as they involve much smaller incisions, in full conformity to the minimally invasive surgery concept that means less operative trauma, other complications and adverse effects than a traditional open surgery. The use of these instruments have additional benefits in terms of sooner wound healing, shorter hospital stay, and a faster recovery time, allowing soldiers to quickly return to service.

MRO OF ARMORED MILITARY VEHICLES: battle tanks, armored personnel carriers, other vehicles on wheeled or tracked platforms, as well as their related engines and subsystems. We carry out overhaul/upgrading of BTR-3/4 APCs; comprehensive, heavy upgrading and overhaul of the T-72 tank and its family members etc.

MRO OF AIRCRAFT AND RELATED SYSTEMS: airplanes, helicopters, propulsion systems, components and subassemblies as well as flight mission simulators etc. We are working successfully in this field with different customer countries. Thus we provide MRO and technical support for the legacy fleets of MiG-29 and Su-22 fighter jets operational with Poland's air force, under a long-term contract signed in 2005. We also partner in development of trainer aircraft, monitor the progress of R&D projects, and develop technical programs for aircraft industries.

REPAIR AND UPGRADING/REDESIGN OF SMALL ARMS AND ARTILLERY SYSTEMS along with related optical and electro-optical devices. In the small arms domain, we, among other things, sell and provide follow-on support for the marksman/sniper rifles UBR-008 and UAR-10 produced by [Ukrainian company] "Zbroyar".

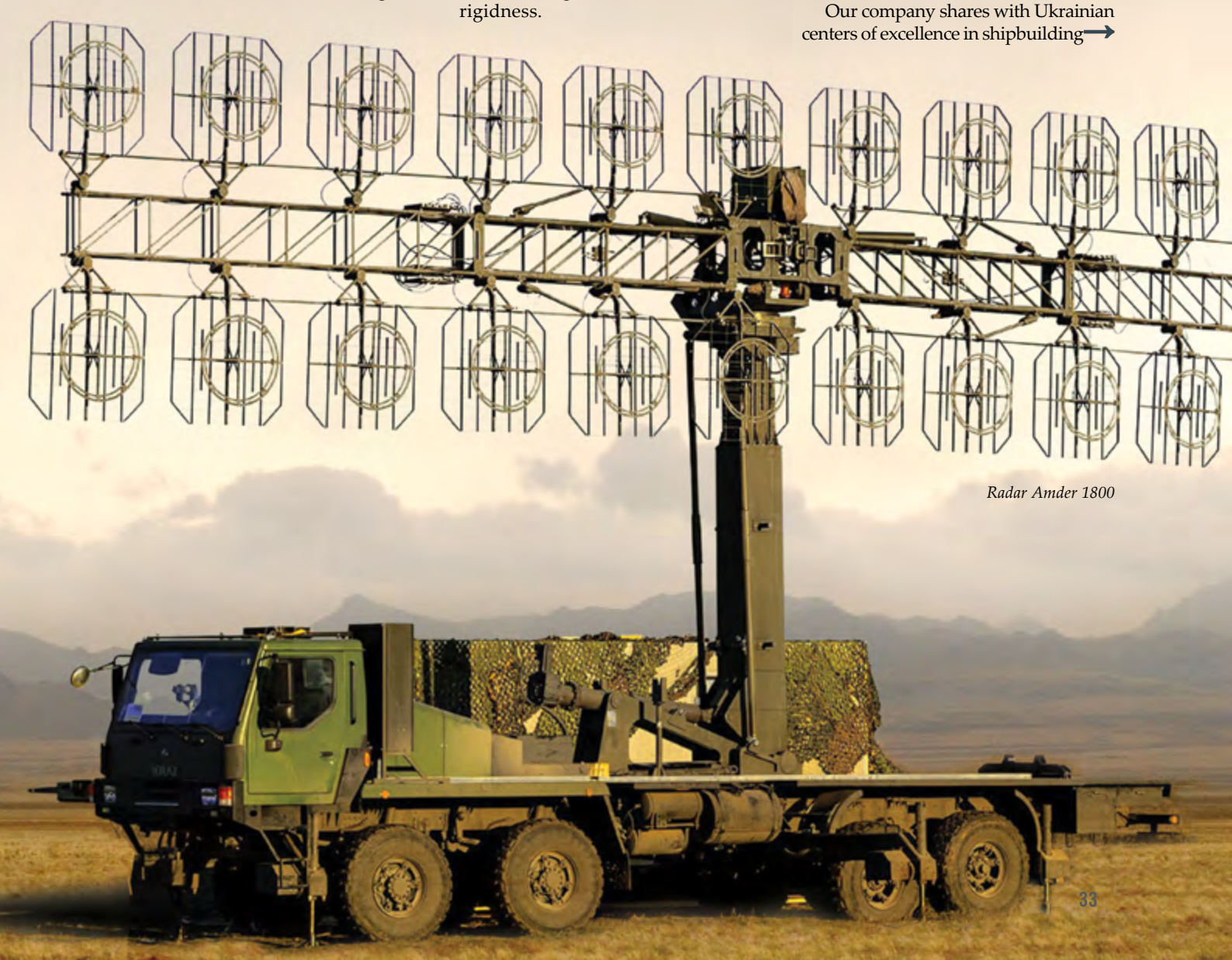
The UBR-008 is distinguishable by its bolt carrier group where each and all components are manufactured with a precision not exceeding 0.0076 mm. The breach casing, made from thermally processed stainless steel, is designed such as to facilitate rigidness.

The sniper rifle UAR-10 has its cocking handle permanently attached to the bolt carrier to allow a stuck bullet to be easily removed or rammed down by hand. The stainless steel barrel has a chrome-plated inside for durability, giving a guaranteed barrel life of 7,000 rounds. Simple and convenient in design, the weapon can be disassembled into two parts for storage and transportation. The barrel is cantilever to facilitate more stable firing.

For manufacturing its rifle products, Zbroyar relies on components sourced from domestic manufacturers, excepting the barrels, which are bought semi-finished from top leading manufacturers in U.S. and Western Europe.

Shipbuilding sector: design, development and construction of warships and commercial vessels; MRO and upgrading of shipborne systems, related subsystems, as well as sonobuoy systems and integrated sonar suites.

Our company shares with Ukrainian centers of excellence in shipbuilding→



Radar Amder 1800

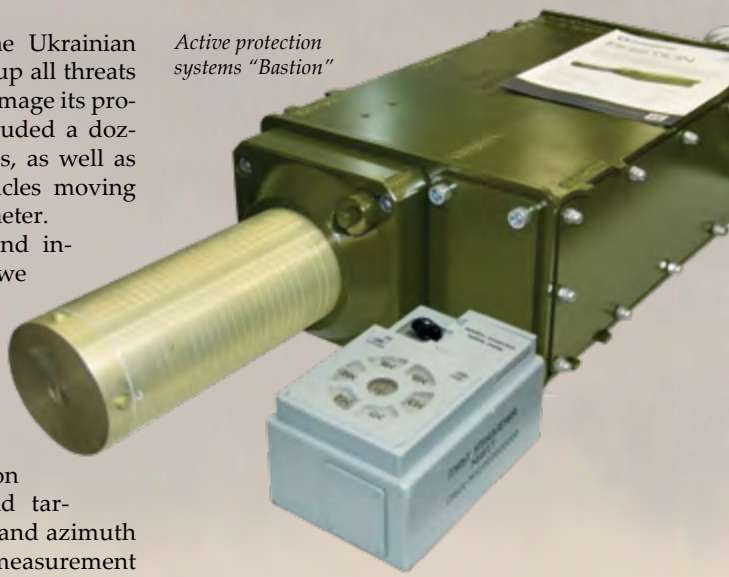
a great experience in design and construction of vessels of different displacement capacity and for different uses. The products range that we offer our clients includes coast guard ships, patrol boats, and assault craft among others, which all are suitable also for roles such as guarding and patrolling of sea borders and poaching interdiction/deterrence. Ship repair and maintenance industry in Ukraine has the capabilities to overhaul and refurbish some of Soviet-built naval ships, as well as modern ships built in Ukraine.

MRO AND UPGRADING OF RADAR SYSTEMS, AIR DEFENSE AND COMMUNICATION SYSTEMS: radar equipment, air defense systems and equipment, electric assemblies, and technical support equipment. We partnered with the Ukrainian Academy of Sciences' Institute of Radio Astronomy to develop the Radar System Kh-1M "Oko" and the integrated radar suites designated "Taira" and "Kharza".

The Kh-1M has performed well while operationally deployed in the Donbas conflict area, and proved itself in capability demonstrations held in foreign countries. Thus, in a series of demonstration trials held in a Baltic Sea country, the Kh-1M outperformed the other five rivals bidding for a potential contract from that country's defense department. The Ukrainian system was able to pick up all threats that might potentially damage its protected object, which included a dozen UAVs of various sizes, as well as human beings and vehicles moving within its assigned perimeter.

The radar systems and integrated solutions that we offer are designed for a broad range of missions, from the neutralization of low-RCS surveillance drones and UCAVs; through to the search and detection of slow moving ground targets; down to the range and azimuth location of targets, and measurement of RCS, radial velocity and Doppler spectrum width. They are all designed with capabilities for automated target detection, classification and tracking with EO sensors; providing situational awareness updates to electronic maps; alerting operators about moving targets detected; and library search by time period, class of target or operator's comment.

FILLING, REFINEMENT AND DISPOSAL OF MUNITIONS: recycling, recovery and reuse of munition and missile components; life extension of artillery and MLR munitions; refilling of munitions of various types.



Active protection systems "Bastion"

MISCELLANEOUS SERVICES: We arrange for training of foreign-country military personnel at military colleges in Ukraine, and provide training programs to be conducted in a customer's home country. We do design of specialized facilities for production of chemical mixtures, industrial explosives, and munitions; investigate explosives, chemical materials, and pyrotechnic mixtures for physical and chemical properties; demilitarize armored military vehicles for museum display.

We invite potential partners to dialogue on future opportunities and collaboration. UDR

State Enterprise Specialized Foreign Trade Firm
PROGRESS

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Ukrainian man-portable anti-tank guided weapon

NEW PYROTECHNIC MUNITIONS DEVELOPED IN UKRAINE

System for remotely managing the rate of smoke release

The ongoing fight against Russian military aggression and the need for domestic manufacture of pyrotechnic ammunition to comply with the import replacement program have forced SPPE Sparing-Vist Center, a world-renowned manufacturer of radiation detector devices (ECOTEST™) to branch out into development and production of pyrotechnic munitions. As the result, the Ukrainian army has received new, indigenously developed hand thrown smoke grenades, smoke candles and signal mines that are more reliable, more effective and more operationally convenient compared to their Soviet-era predecessors.

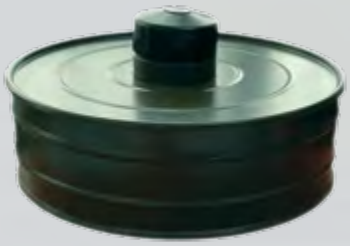
HAND THROWN SMOKE GRENADES

RDG-55 and RDG-55M are hand-thrown smoke grenades that create black or white smoke screens to mask the location of firing positions or small tactical groups; to blind the enemy, or to simulate a fire in a combat vehicle. Beyond that, these may have utility to mark landing points and indicate the direction and strength of wind for helicopters.

The RDG-55 was developed to replace the Soviet-era RDG-2 grenade that is still operational with several armed forces worldwide.

Ukrainian-developed smoke grenades are more convenient to use. Thus, they are available in two sizes. The larger size RDG-55 is a complete analogue to its Soviet predecessor RDG-2 in terms of size, performance characteristics, duration of smoke screen and area of obscuring smoke. The RDG-55M, a reduced size version of the RDG-55 grenade, is substantially more compact in size and more convenient in use, while only marginally sacrificing the smoke screen time. This makes it suitable to be carried in a standard tactical vest.

Unlike the Soviet-produced RDG-2, which used a "match-strike" styled mechanism to ignite, the Ukrainian grenade uses a simple, ring-pull ignition mechanism allowing smoke to be produced immediately upon ignition, which makes it easy to use in multiple difficult situations.



SMOKE CANDLE

The smoke candle UDSh-U, developed as a Ukrainian replacement for the Soviet-designed UDSh original, begins producing smoke within 30 seconds upon ignition. The munition creates a dense smoke screen of at least 100 meters in length that lasts for up to ten minutes.

It can be set off manually or remotely via a remote control. With that purpose in mind, the Company has developed and offers a system for remotely managing the rate of smoke release.

This remote control system is an integration of a modern, military-grade computer, a digital weather station and a local network of remote control stations that use dual channels for networked data exchange and can support simultaneous control of up to 1,920 smoke candles.

This system may have utility on the battlefield, specifically when used to obscure the location of river crossings, checkpoints, relocable warehouses, or air defense batteries during offensive operations. It is also suited to camouflage large infrastructural assets such as airports, airfields, and strategic depots among other critical objects.

SIGNAL MINES

Sparing-Vist Center has, since 2015, supplied military customers in Ukraine with SM-U signal mines. This munition has been developed to replace the Soviet-designed signal mine known as SM.

The SM-U is meant to alert troops when an enemy intrusion into protected area is detected. Once actuated, it emits a bright light – white (SM-UB), red (SM-UCh) or green (SM-UZ) – and a loud whistling noise until it burns out.

It is contained within a thin casing of metal that accommodates 10 stars alongside a whistle with its associated powder charge, and comes equipped with P-shaped firing pin safety and trip wire.

The SM-U mine can be used during military exercises to mark the location and simulate explosions of tripwire operated landmines. UDR

BARRIER-S

COMPREHENSIVE UPGRADE TO SOVIET-DEVELOPED ATGM VEHICLE

UkrInMash Corporation, DKKB Luch and Izyum Instrument Factory have forged a collaboration to modernize the Soviet-era self-propelled ATGM system Shturm-S (meaning "Storm") into a configuration meeting the needs of Ukraine's Armed Forces.

Ukraine keeps a fleet of around four hundred Shturm-S ATGM vehicles left behind after the demise of the USSR. Some of them have been operationally deployed in the Donbas Theater in Eastern Ukraine while others are facing retirement as the 9M114 missiles are rapidly approaching the end of their shelf lives.

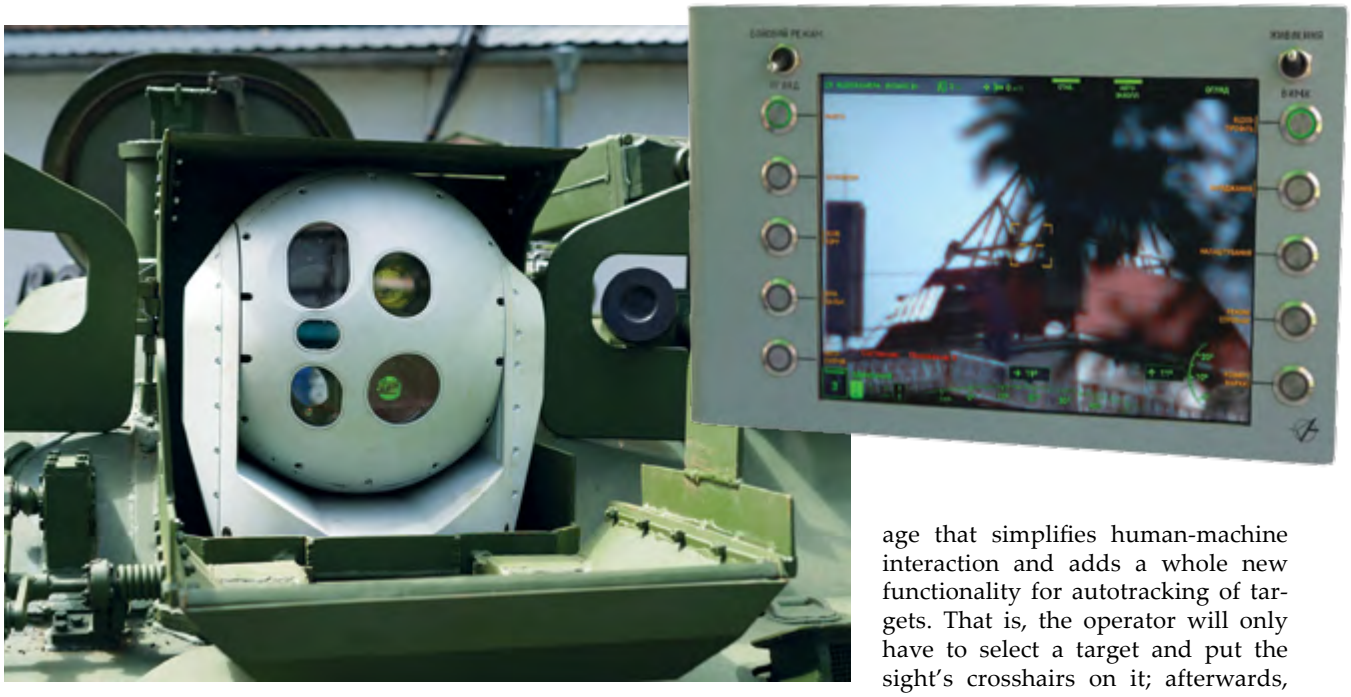
The Shturm-S was adopted into Soviet Army service in 1979. A two seat-vehicle based on the MT-LB chassis, it was meant to engage and destroy armored vehicle targets with its anti-tank guided missile armament.

What made the Sturm-S especially effective ATGM vehicle at the time was its 9M114 Kokon/Cocoon SACLOS radio guided missile capability. Whilst the missile had a stated range of six kilometers, it actually could reach targets at ranges not exceeding four kilometers.

The 9M114 missile was well suited to be launched from defilade or camouflaged positions, and this was easy to do due to low silhouette of the MT-LB platform. With its high mobility performance and the ammunition allowance of 12 ready to fire missiles, the Shturm-S was considered a pretty highly effective combat vehicle.

That being said, the Shturm-S has several significant shortcomings. Firstly, the 9M114 Kokon does not have the power to destroy modern tank targets with its single-charge warhead, and, secondly, the vehicle, with its daytime-only sight, has little if any utility in night operations.

The Barrier-S upgrade eliminates these shortcomings. It is effectively a new design (excepting the chassis) with newly developed key capa-



bilities – the missile, command and control circuit and targeting/sighting system.

The Barrier-S upgrade includes the DKKB Luch's RK-2P missile replacing the 9M114 Kokon. This new missile was developed as a derivate of the Barrier ATGM technology that has been fielded in the Donbas conflict area.

The RK-2P has a longer range of 7 km, and it is substantially more reliable and resilient to enemy jamming attempts. The developer claims that the RK-2P is able to penetrate armor protection on any of the battle tanks currently in use.

In the upgraded vehicle, the missile loading system has had to be redesigned to accommodate the larger RK-2P missile housed in a 12-cell loader.

Interestingly enough, the Armed Forces required a range of six kilometers, but DKKB Luch exceeded this, looking ahead into the future.

The RK-2P works interfaced with the Izyum Instrument Factory's optronic sight system OPSN-I that was unveiled for the first time in 2019. Combining television, thermal imaging and laser sensors with a laser range finding capability and supported by 20X optics, it Is able to pick up targets from more than 11 kilometers away, and its laser can reach targets out to 7 km away.

The OPSN-1 is noteworthy also for its use of a two-axis gyrostabilized platform developed by DKKB Luch. For this technology the developer opted for direct-drive torque motors to ensure smooth movement without jerks, hence to enable easy and accurate aiming.

Beyond that, Luch contributed to the project by developing a software package that simplifies human-machine interaction and adds a whole new functionality for autotracking of targets. That is, the operator will only have to select a target and put the sight's crosshairs on it; afterwards, the target will be tracked automatically without human intervention until impact.

The Sturm-SM features a laser warning receiver that gives warning of hostile laser threats aiming on the platform and is fielded on modern Ukrainian tanks. Other improvements include GPS-aided navigation; digital, encrypted communications; and an air conditioner for better comfort of the crew.

What is particularly important with respect to the Barrier-S project is that it integrates a new longer-range missile and a highly capable weapon aiming system with a state-of-the-art software package supporting the target autotracking functionality. These are readily available solutions that can be adopted for use on other weaponry and equipment systems deploying DKKB Luch guided missiUDR.

VLADYSLAV BELBAS,
Director General at Ukrainain Armor

"WE ARE CURRENTLY MORE THAN JUST A MANUFACTURER OF ARMORED VEHICLES"

As a military confrontation broken out between Ukraine and Russia in 2014, there arose an urgent need for equipping Ukrainian military and security forces with current-generation weaponry and equipment systems. R&D and Production Company "Ukrainian Armor Design and Manufacturing Company", the renowned developer of Varta and Novator APCs, was among the privately-owned defense technology companies who rushed into that market along with state-owned defense contractors. The following is an interview conducted with Vladyslav BELBAS, CEO of Ukrainian Armor Design and Manufacturing Company, LLC, by Defense Express on the Company's latest achievements and vision for the future.

- Your Company is renowned for the production of two special-purpose armored vehicles – "Varta" and "Novator" that have been fielded to Ukraine's military and security forces since 2015. What's the situation now with this equipment?

Our vehicles were specifically developed to meet the operational needs of defense and security agencies. In Ukraine's Defense Ministry parlance, Varta and Novator are armored personnel carrier (APC) intended primarily for personnel transport roles. Whilst the Varta, being bigger in size, is more apt to transport personnel to battlefield locations at times of conflicts or terrorist events, the Novator, a far smaller vehicle with fewer crew members, is meant to provide off-road transportation to special operations squads.

The APC's have both successfully completed Agency-level tests conducted in accordance with the technology testing and evaluation procedures adopted by the Ministry of Defense, National Guard and State Border Guard Service; and have been introduced, pursuant to legally prescribed procedures, into the inventories of Ukraine's defense and public security services.

Varta is currently completing its official qualification trials (OQT) program and has logged over 32,000 kilometers out of 35,000 kilometers required. Next, we will have to test the vehicle for resistance to blast effects.

According to our assumptions, the testing and qualification process for Varta will be finalized and completed in September 2020. Novator, too, has logged more than 30,000 km and so it only has a few thousand kilometers left to run. In this case, too, we hope the testing and qualification process will be completed in September.

At a weight of 8.8 tons, Novator shows good performance in terms of lightweight, maneuverability and speed. There have been no systemic problems found with the vehicle over its three years in operation. But, you know, any vehicle certainly has to be subjected to improvements and fine-tunings in order to become perfect.

Overall, over two hundred Varta APC's and more than five dozen Novator APC's have been fielded to the Armed Forces and National Guard so far.

- What's like the user feedback?

I have to note that Ukrainian defense and public security services previously did not have vehicles of this category in their respective inventories. So some troubles do occur, which we fix as part of warranty servicing. But still, there have been none of global, systemic problems found in our vehicles. The troubles that occurred were caused mainly by the operation of the equipment. So this is more of a question of user training. We are currently negotiating a collaboration with domestic industries regarding the creation of simulator trainer systems for the two vehicles.

As regards the feedback from military users, it is largely positive. Let me cite an example regarding the Novator APC. Our reconnaissance men, who were looking at offers from world renowned APC vehicle suppliers, including Sandcat of Israel, compared the vehicles to find out that Novator is as well equipped as the Israeli rival and even surpasses it in quality of the interior design. We well realize that a soldier is not a machine. So we challenged ourselves to create a most comfortable environment in our vehicles and devoted much attention to important details. Thus, for each crew member there is a connector for charging communication devices of all kinds, and there are even miscellaneous items such as tea cup holders.

- Have the Varta and Novator APC's received their baptism in combat already?

There were situations where Varta vehicles came under live fire, but with no fatalities or penetrative impacts as the armor of the vehicle was able to withstand enemy attacks. As for the Novator, I cannot say for sure whether it is deployed in downrange or not. But reports reached us that a Novator APC was used to evacuate out of range personnel of military unit # 3066, National Guard. For the record, it's Novator that had been selected to provide security for the Ambassador Extraordinary and Plenipotentiary of the Kingdom of Sweden to Ukraine, Mr. Tobias Tiberg and the Minister for Foreign Affairs of the Kingdom of Sweden, Mrs. Ann Linde during their working visit to Stanytsia Luhanska in early March 2020.

- What new configurations are being considered for the Varta and Novator APC's?

Regarding the Varta, there have been two configurations developed and implemented: a mobile platform for the strike UAS Sokil and a communication command/staff vehicle. Beyond that, work is in process to reconfigure the vehicle, under a MoD contract, into a carrier platform for 120 mm mortar fitted out with an automated fire control capability. In addition, there has been a collaboration forged with domestic Radar industries to make it into a radar vehicle and an anti-drone warfare vehicle.

As far as the Novator is concerned, we, jointly with the 93rd Brigade, offered the Ministry of Defense that the vehicle be reconfigured for transport of the Stugna-P ATGM system crew. This configuration is much the same as the baseline, excepting that it adds mission-specific sections equipped for anti-tank missiles and provides room for the ATGM launcher and equipment. These additions are easily removable allowing the vehicle to be reconfigured back into the baseline as needed. On top of that, there has been considered a configuration outfitted with Amulet weapon station. →

APC "Novator"

APC "Varta"

I would add to this that the technological and design solutions regarding armor protection of rolling vehicles that we implemented for both the Varta and Novator APC's have been adopted for the indigenously-developed mobile anti-ship cruise missile (ASCM) system "Neptune". We are attached to the Neptune project to develop and manufacture armored cabins and to design exterior layout of the Neptune ASCM vehicles.

- What are the key technological solutions that make your APC's stand out among similar vehicles offered by the Ukrainian market?

Overall, we have implemented a complete range of technological solutions, among them a central tire pressure regulation system, NATO-compatible blast attenuating seats, and a highly effective, user-safe fire suppression system that has a response time counted in milliseconds. Next is armor protection. In the Varta and Novator APC vehicles we use Swedish-supplied armor steel with hardness equal to 560 HB, while other manufacturers use primarily 500 HB armor. Finally, we have patented a technology for welding this armor steel. With assistance from the E.O. Paton Institute of Electric Welding, there has been developed a proprietary technology for welding armor steel joints. We have made the welding joint strengthened – it was never shot through during live firing trials. This technology is featured on both the Varta and Novator vehicles.

- Your Company is known to be dealing in the field of mortar weapons alongside armored carrier vehicles. What the situation is like in this regard?

We are currently much more than just a manufacturer of armored vehicles. We have launched several new business activities, including the development and production of mortars. We are currently working on three mortars in calibers 60 mm, 82 mm and 120 mm, designated, respectively, MP-60, UPIK-82 and MP-120.

The UPIK-82 successfully passed through the OQT process and was introduced into the Armed Forces inventory in 2018. Developed as a derivative of original Soviet technology, it was matured with improved features in terms of sighting and ranging, design and structure of the mortar base plate, as well as optics just to name a few. There has been no negative feedback received from users across all of its years of deployment. Overall, more than 300 units of the UPIK-82 mortar have been operationally deployed so far.

The MP-60 was adopted for military use pursuant to Cabinet Decree No 345, with around ten dozen units fielded so far. This is a unique mortar for Ukraine; it was never produced or operationally deployed in Soviet days. The MP-60 is suited for special operations missions and can be fired with or without a bipod mount. In this mortar product we have implemented a range of technical solutions that make it advantageous over competing technologies. Our plan now is to bring the product soon into the OQT process that would include test firing of 5,000 rounds of ammunition. As part of ultimate, Agency-level testing program we have successfully put it through the full range of tests required by the OQT program. The only OQT test left to be done will be aimed to verify and validate the Mortar fatigue life. Given the experience we have with the 82 mm mortar (with barrel life expectancy confirmed at 10,000 rounds), I am confident there will be no difficulties passing the test.

Regarding the MP-120, we are currently at the final stage of the OQT process, with only a handful of rounds left to be test fired. We hope all the required actions will be completed soon. Here, I would like to emphasize that we are making the mortars compliant with the operational requirements set out by the Ministry of Defense. The MP-120 will therefore have characteristics similar to the Soviet-designed 2B11, this being necessitated by the need to employ the firing charts available for the currently existing types of mor-

The UPIK-82 successfully passed through the OQT process and was introduced into the Armed Forces inventory in 2018

tar rounds. That is, the MP-120 retains the same barrel geometry as the 2B11, but has other components, such as base plate, bipod, sighting and aiming mechanism, wheelbase, etc. developed by our engineers. Moreover, the MP-120 features an improved fuse mechanism and uses higher-grade steel. Basically, the mortar came out to be really good.

- What about mortar rounds? Your Company announced it has launched production lines for mortar rounds of 60mm, 82mm and 120mm calibers. Could you give a few details about this?

Our 60 mm round passed through a full range of tests and was adopted for operational use in 2019. We are currently working on 82mm and 120mm rounds. The 120 mm is currently under development, but progress depends on financing. If the Ministry of Defense continues with orders for 60 mm rounds, we will be able to move faster in this area. Mortar rounds, especially in the 60mm caliber are in demand indeed.

- What are other projects your Company is working on in addition to those you've mentioned above?

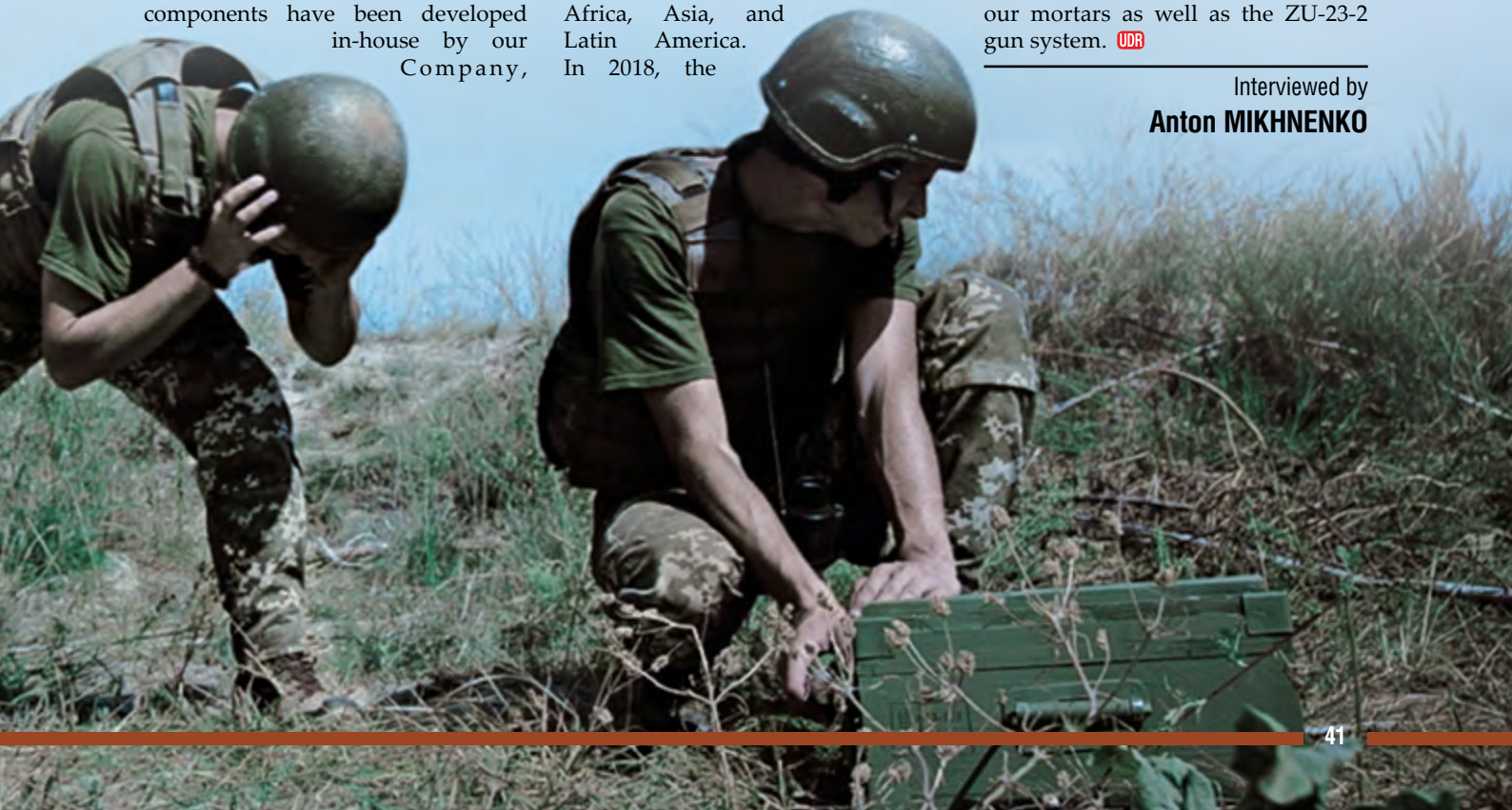
Yes, indeed, we are setting up a production line for the world market renowned air defense gun system ZU-23-2. Whilst most of the System components have been developed in-house by our Company, still there are components that need to be sourced from foreign countries. I am talking, above all, about the barrel, with which the weapon comes equipped for testing. It is assumed that the barrels will soon begin to be manufactured in-house as well. This is a highly promising business, and especially so knowing that the ZU-23-2 has been extensively deployed both in an outside of Ukraine, with over five hundred ordered for export.

There is another project that we would like to continue into the future, and it is about the development of an infantry fighting vehicle in the 25-ton class. In 2017, we forged a written agreement with the Ministry of Defense to develop an armored fighting vehicle for infantry use, to be known as "Guardian", which will be similar in to the Soviet-era AFVs BMP-1 and BMP-2. We developed a preliminary design and submitted it to the Ministry of Defense for consideration and possible approval, but for some reason have been never given any positive response. Still, we hope that this situation will change soon.

- My last question is about military technology collaboration with international customers. Does your Company have any ambitions to develop its export capabilities?

Since 2016, we have been proactively promoting our equipment in Africa, Asia, and Latin America. In 2018, the company concluded its first and, according to available information, Ukraine's first international trade contract for the delivery of combat vehicles produced by a private enterprise. The contracted consignment of APC Varta was adapted to the end-user requirements (with the ins and outs of operating in countries with hot and humid climate taken into account) while retaining key features of MRAP vehicles. In August 2019, we were licensed by the Government to sell own-label defense-related products in export markets and to buy defense products from international suppliers directly wherein it's needed for our production programs (license valid till March 1, 2024). At the same time, we closely cooperate with government-licensed arms dealers. Prior to COVID-19 quarantine, we participated in several international trade fairs held in Ukraine, Turkey, Peru, the UK, the UAE, and France. Every time our mount caught the great interest of potential customers, partners, and international competitors. Currently, there is a great amount of negotiations held. While the arms export market is a conservative market, we have around 10 international cooperation projects regarding both the Varta and Novator vehicles. Geographically these are countries in South America, Africa and Asia, and there has been an interest shown in our mortars as well as the ZU-23-2 gun system. UDR

Interviewed by
Anton MIKHNENKO



UkrOboronProm
Ukrainian Defence Industry

36D6M – NEW LIFE FOR

36D6M UPGRADE ENABLES THE ADVANTAGES AS FOLLOWS

- extended Radar range;
- improved and enhanced processing of target trajectory data;
- improved working environment for the Radar operating crew;
- introduction of NATO IFF equipment (MK-X, MK-XII);
- expanded functionality;
- reduced operational costs;
- service life extended by 10-15 years
- implementation of varied interfaces; data exchange via communication lines and using Customer-selectable formats.

OTHER ELEMENTS OF THE 36D6M UPGRADE PACKAGE

The upgrade package also includes replacement of out-of-date and worn-out components with current alternatives, as well as the application of new protective coating systems to the external surfaces to enable appropriate ingress protection under specified weather conditions.

The capabilities to be improved as a result of modernization include longer Radar range and improved accuracy of target location measurement and trajectory data processing, achieved by implementing modern software solutions, expanding functionality and reducing operational costs.

The Radar cooling system will be upgraded to enable a longer life for klystrons.

The 36D6M upgrade adds the capability for displaying data on the geo-location and intensity of meteorological conditions, which is essential for flying safety.

The upgrade would improve the working environment for the Radar operating crew by modernizing workplaces with new displaying screens and adding HVAC facilities among other improvements.

The upgrade provides the four remote workstations to allow the Radar to be controlled remotely from up to 300 meters away. On top of that, the Radar can be optionally equipped with a direct interface to air defense missile batteries.

FAMOUS "ISKRA'S" RADAR

SCIENTIFIC AND PRODUCTION COMPLEX «ISKRA»

PERFORMANCE CAPABILITY	PRE-UPGRADE VALUE	POST-UPGRADE VALUE
Max Radar range (km) - frequent activation mode - rare activation mode - ultra rare activation mode	 90 180	 90 180 360
Radar envelope in unobstructed terrain		Increased by 25 to 30 percent
Generation of target data for integration into modern automated C2 systems using the ASTERIX data format or a Customer-selectable format	Unavailable	Available
Rejection bandwidth management in Operator-defined gates	Unavailable	Available
Identification of targets equipped with NATO IFF transponders	Unavailable	Available
Tracking of target by IFF response received	Unavailable	Tracking is available, using IFF response received regarding identification number and barometric altitude
Automatic measurement of Radar self-location	Unavailable	Available via GPS
Operator training	Available with external training equipment	Available with built-in training capability
Radar output data recording	Recording available in the form of radar images	Data is recorded on electronic media, allowing it to be reviewed by an operator at his workstation or transferred to an archive media
Recording of operator commands and Radar performance data	Available	Done simultaneously with radar output data recording
Mean time between failures	400 hr	800 hr

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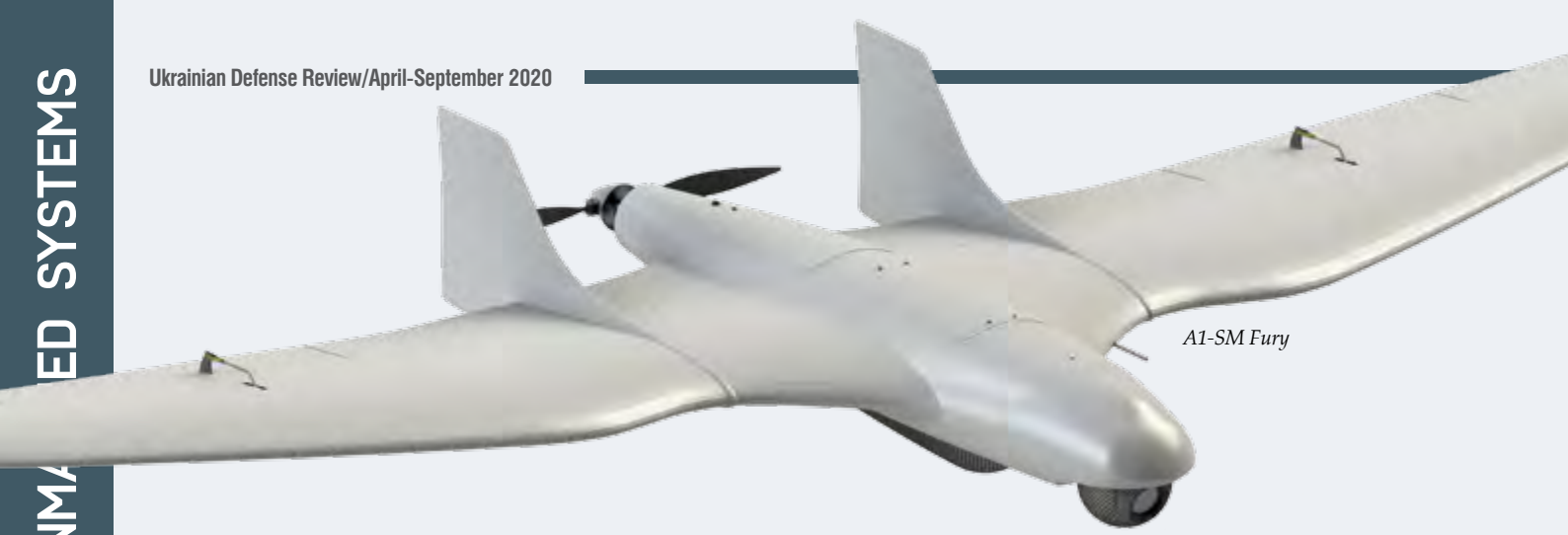

A1-SM Fury

"FURY" AND "THUNDER" DRONES MADE IN UKRAINE

WHAT NEW UKRAINIAN UAVS ARE CAPABLE OF

Since almost the earliest days of military hostilities in Eastern Ukraine, the unmanned aircraft system (UAS) A1-SM Fury (a product by Athlone Avia, a privately-run defense technology firm based in Kyiv) helped the Ukrainian military defeat and destroy over a dozen hundred important targets. The A1-SM Fury is currently operational with the National Guard and the Armed Forces of Ukraine. The use of Fury UAVs in real-world combat scenarios has driven Athlone Avia toward developing a loitering munition drone "Thunder" for destroying targets hidden in defilade positions located deep in hostile territory.

"Donbas" Battalion – an irregular pro-government unit deployed in the Anti-Terror Operation against Russian-sponsored insurgents in Eastern Ukraine – was among the first to receive the Fury UAS in June 2014. The "Fury" capability had come as a welcome response to the acute need for military drones by forces on the frontline.

In 2015, Athlone Avia developed the Fury technology further to create the new A1-SM evolution using the feedback from real-world combat operators. The A1-SM Fury has now become the core UAV in combat/military use in Ukraine. In July the same year, the new Fury was officially adopted for use by the National Guard of Ukraine.

The A1-SM Furia, after having passed governmental trials and user evaluation during gunmen's drills, was demonstrated to potential customers from the Armed Forces in 2016 and won high praises from top military officers at the General Staff and Headquarters of the Rocket and Artillery Forces. Moreover, the Armed Forces' Central Scientific Research Institute had rated the A1-SM Furia the highest among the other UAS technologies developed indigenously in Ukraine.

Those high appraisals are well substantiated; the "Fury" system is able to adjust artillery fire without any compromises and in full compliance to the demands and requirements of modern warfare, and it as good in terms of performance as world-renowned brands. The Ukrainian drone offers the capabilities for automatic calculation of the target's coordinates and autotracking of targets, of which none of the Ukrainian counterparts was capable at that time. The drone's command and control links for both main and backup use verified their reliability during two years of operational deployment in the Donbas theater.

The A1-SM "Fury" received a new, forward mounted optical system offering 360-degree freedom of use in the longitudinal axis to allow for more user-friendly operation for the pilot and gunfire spotter. There is a snapshot camera integrated into the wing, which would capture images at a preset frequency rate.

The A1-SM Furia uses Athlone's proprietary software on Linux platform. The software facilitates and speeds up the work of gunfire spotters, ensures more effective and →

The "Fury" system is able to adjust artillery fire without any compromises and in full compliance to the requirements of modern warfare

efficient engagement of targets and helps improve sustainability among gunman crews. The A1-SM Fury is operated by two people – one for the drone itself, and the other to run the gunfire spotting missions.

The A1-SM "Fury" is fitted with two duplicated digital encrypted data and telemetry links and one analogue video link capable of ranges exceeding 50 km.

C2 and telemetry links are subdivided into sublinks for enhanced security. To prevent the possible disclosure of friendly positions, the video data transmitter is turned on/off remotely from the ground control station (GCS). Therefore, in practice, enemy interception of a video data link while over the enemy territory will have little if any effect on the progress of the combat operation.

In addition, the Fury can switch over to GPS independent navigation when it detects a GPS spoofing attack.

In this unmanned aircraft system, there has been implemented a data transmission capability projected into the integration with the Rocket Artillery Forces' future gun-fire control technologies. The capabilities of modern radio systems already operational with the Ukrainian army, such as Aselsan or L3Harris, support the transmission of data from the "Fury" drone to the "Obolon" system.

Fury's functionality includes automatic calculation of the target's coordinates by designating the target to the ground control station. The target's coordinates can be determined also by means of object orientation and geographically referenced video footage; this method is almost as effective as automatic calculation, and even surpasses it in some cases when it comes to accuracy.

The drone's datalinks are fully encrypted for highest security. In particular, the A1-SM "Fury" has a capability allowing for data from each preceding mission, including logs and photo/video contents to be deleted by GCS operator. Beyond that, the logs are encoded such as to be unreadable by software other than Athlone's.

The Company has continued expanding the functionality of its unmanned systems by adding new capabilities, especially for radiation detection, SIGINT/COMINT, etc. Thus, Athlone Avia accepted an offer from Sparring-Vist Center, Lviv, to equip the Fury UAV with a radiation detector sensor.

The A1-SM is the first UAV system developed privately in Ukraine which has been adopted by the Ukrainian military (relevant directive by the Minister of Defense was issued as number 115 on April 9, 2020).

Operational experience gained by Ukrainian government forces with "Fury" UAVs motivated Athlone Avia to draw up a draft design and operational requirement document on a loitering munition drone. Named "Thunder", the drone was designed with a mission to defeat and destroy targets located in close vicinity to residential buildings, with minimum risk to nearby civilians or civil infrastructures.

As regards flying performance capabilities, they are fairly competitive with a cruising speed of ~120 km/h, which is sufficient for the drone to cover a 30km distance to a target area within 15 minutes under normal weather conditions. The drone can stay aloft for up to 60 minutes, which had been validated during test flight missions. The first-evolution configuration of the drone is designed with a take-off weight of 10 kg, including its 3.5kg warhead payload. The munition will be available with warheads of several different types. Work is now underway on a Fuel Air Explosive (FAE) warhead weighing 10 kg, but other warhead types, including inter alia HEAT and HEF are also under consideration for this application.

The munition will be guided semi-automatically by optical, television or IR guidance heads, which will be swappable as needed depending on the visibility and weather conditions. Guidance to the target would be carried out by way of on-board processing of video signal within the carrier drone, its flight path being updated automatically till impact. The Thun-

"Thunder" loitering munition drone design by Athlone Avia

der would use a human operator to locate targets, then operate autonomously till the mission is accomplished. It would be able to operate autonomously while assessing the weather conditions in the target area, approaching the aiming point (with minimum cross-wind component), and diving at the target.

The Thunder drone has a biplane design with two sets of X-shaped control surfaces on a front fuselage extension mounting an EO guidance system. The selection of said design enabled achieving an optimum between the controllability performances of the drone while in horizontal flight and diving at the target. The aforementioned aerodynamic design is perhaps the only one suitable for this application.

A multirotor aerial vehicle will be used as launch platform for the "Thunder" munition drone. This enables the launch to be carried out from any suitable site, be it even a household's yard. The multirotor vehicle would lift the drone up to 500 m altitude from where the latter would separate and begin flying to the target area. The multirotor would then ascend to ~1,000 m and stay there to act as a transmission relay. This altitude is high enough to support sustained video streaming from the drone at ranges of 30-40 km.

The Thunder drone features several solutions adopted from the A1-SM Fury technology. This is above all an automatic target tracking system that allows a ground operator to automatically keep the target within his field of view by just pressing a single button while assisting to adjust counter-battery fire. A similar algorithm will be used also for aiming the loitering munition at a target.

Athlone Avia is looking at two configurations for its loitering munition drone. One is a man-portable configuration fitting into three transport backpacks weighing 15 kg each, rated collectively for carrying three drones with a full set of miscellaneous equipment by a crew of three. The other is a vehicle-mounted configuration, but this will be implemented if Ukrainian armed forces or other customers require or wish so. UDR

Serhiy ZGHURETS,
Defense Express

UNMANNED AERIAL VEHICLES VS AIR DEFENSES

SOME LESSONS LEARNT FROM COMBAT CONFRONTATIONS BETWEEN HIGH-TECH ARMAMENTS

Recent wars and conflicts in various regions of the world, especially Ukraine, Syria and Libya, have become a testing ground not just for the latest weaponry and equipment, but, also, innovative methods and techniques of warfare. In this context, most remarkable is the contest between unmanned aerial vehicles (UAVs) vs air defense technologies. Duels between the two are most revealing of the changes occurring in the nature of modern warfare, determining future directions in technology development in relevant fields.

Some lessons learnt from recent confrontations between UAVs and air defenses are detailed in this article, courtesy of Defense Express.

The expert community has long watched the confrontation between the Turkish Baykar Makina's Bayraktar TB2 and TAI's Anka-S Unmanned Combat Air Vehicles (UCAVs) and Russian Pantsir-S1 air defense missile systems which all have been extensively deployed in the Syrian and Libyan theaters. The two UCAVs and the air defense missile system exemplify most recent, high-tech developments by the defense industries of Turkey and Russia, respectively. While the UCAVs have been designed with a focus on recon-strike missions against a variety of military targets on the ground, the Pantsir-S1 has been used precisely for defeating targets such as UAVs.

According to official statistics available for early June 2020, over two dozen Russian Pantsir-S1 surface-to-air missile (SAM) systems had been destroyed by drone attacks in the Syrian and Libyan theaters (8 and at least 16, respectively). Most of the Pantsir-S1 vehicles were destroyed by Roketsan MAM-L laser guided munitions delivered from the UCAVs Bayraktar TB2 and Anka-S.

However, there have been reported losses of Turkish drones in both countries, but figures differ significantly from report to report. Defense Express, for example, has reported figures that are by far lower than those found in the Syrian and Libyan media which reported the shooting down of "dozens" if not "hundreds" of the Turkish drones there.

Whatever the figures, however, it is worth looking at the value of a surface-to-air missile vs a drone. The difference is huge, amounting, in some cases, to several magnitudes. On top of that, drones proved so effective in air-to-ground attack roles that they were "game-changers" in favor of those who used them.

What made Turkish drones so much successful in the battlefields in Syria and Libya, and what made them capable of defeating air defense missile systems, let alone armored vehicles and personnel targets?

Based on preliminary assessment of the nature and character of military confrontations in those countries, the following key aspects can be singled out for further consideration in a single context.

1. **Extensive pre-use preparations made by the Turkish side**. Thus, at the time prior to and in the course of the operation in Idlib, Syria, Turkey set up a network of radio relay stations in its regions adjacent to the Syrian border to ensure the most effective and efficient use of its UCAV capabilities deployed at different bases along the country's southern border.

There has been set up a single command and control center to coordinate deployments of all UAV capabilities in the area of operations, and there was held a comprehensive review of available intelligence regarding the types, numbers and deployment locations of Syrian forces in the

region, as well as the specifics of their operational deployment. On top of that, the Turkish side identified most likely positions for forces and equipment locations and for major weapons emplacements, and reviewed its Air Defense and Electronic Warfare (EW) capabilities with respect to potential flaws and weaknesses.

2. **Turkey's comprehensive use of Bayraktar TB2 UCAVs and Koral EW systems** that supported almost all TB2 sorties by conducting electronic surveillance of the battlefield, identifying the capabilities and characteristics of hostile air defense radars and communications, and frustrating their operation during combat. This allowed air attacks to be made against targets on the ground, inclusive of SAM batteries such as Pantsir-S1.

3. **The use of drones under cover of artillery fire**. Recon-strike drone missions were often flown to coincide in time with artillery fire attacks, performing a dual task of damage assessment and enemy distraction.

4. **The use of swarms of at least 5-6 drones** for surveillance and possible engagement and destruction of, primarily, Pantsir-S1 SAM vehicles in a selected area. In these conditions, the vehicle crews were unable to simultaneously handle each and all of the drones attacking from different directions.

5. **Effective and efficient use of intelligence on the position of Pantsir-S1 vehicle locations and possible routes for their removal from one location to another.**

6. **Familiarity with the weaknesses of Russia's air defense systems (weapons maximum ranges, radar dead zones, etc.) that faced up to the Turkish UCAVs in Syria; the maximum use of own drone capabilities and weapons.**

Beyond that, the success of Turkish UCAV missions was facilitated by the fact that Syrian and Libyan forces lacked experience and training in fighting UAV threats, resulting in late or inadequate responses. The Turkish forces, in contrast, entered the hostilities armed with a solid experience of using UAVs against Kurdish Workers Party insurgents in one of Turkey's remote mountainous areas.

Haftar's army in Libya, like Syrian forces in Syria followed recommendations by Russian experts to take actions as listed below for minimizing losses in manpower and materiel:

- close the airspace with all the air defense assets available to provide a no-fly zone over the area of operations, and therefore minimize the effectiveness of potential drone attacks; maximize the use of own SAM capabilities for destroying first-priority targets, including unmanned aerial vehicles;
- when SAM vehicles move from one firing position to another, two vehicles are moved simultaneously in pairs so that one could provide security coverage to the other, and vice versa;
- creation of special teams at medium-range Air Defense batteries and within Electronic Warfare units; creation of MANPAD sniper couples for securing selected areas. For this purpose, MANPAD operators would be deployed in a forward position to prevent hostile drone intrusions. Intruder drones, if any, will be handled by air defenses. At the same time, air defenses would provide security coverage to the EW systems that interfere and frustrate control of approaching drone threats;
- neutralizing drone swarms using electronic countermeasures such as noise screens, followed by Pantsir-S1 missile shelling where needed;
- concealing air defense battery emplacements; misinforming the enemy about battery relocation routes, etc.

It's important to note, however, that success of air defense missions and UAV missions alike depends in no small part on the amount of operator training and real-world combat experience. Beyond that, air defense weapons and drones both are sufficiently effective assets in their own right, but come with flaws and weaknesses due to the specifics of their tactical deployment and physical characteristics.

The success of a military operation depends to a large measure on the level of proficiency in knowing and understanding these weaknesses and operating skills. It's also worthy of note that the Turkish side had taken a careful, professional approach to deploying its warfighing capabilities in Syria and Libya, with a resulting benefit that its forces have been highly successful in confronting Russian air defenses, especially Pantsir-S1.

The Ukrainian military, who has recently received a quantity of Bayraktar TB2 UCAVs from Turkey, will only benefit from getting to know the experience of the drones' deployments in the Syrian and Libyan conflicts. But one needs to be aware that their successful use depends, among other factors, on the level of operator skills and experience. UDR

Anton MIKHNENKO,
UDR

EUGEN GUZEI, Chief Operations Officer
Radio Satcom Group LLC, authorized Training and Service Center of HARRIS GLOBAL COMMUNICATIONS, INC., L3Harris Technologies, INC. in Ukraine

USAI PROGRAM AND UKRAINIAN ARMY: ADVANCED TACTICAL COMMUNICATIONS CHANGES RULES OF THE GAME ON THE FRONT LINE

International assistance programs for Ukraine financed by US Government provided equipment of Ukrainian Army, National Guard and Border Guard of Ukraine with modern tactical communication systems and technologies. Owing to US aid, for the last 6 years of military activities on the East of Ukraine prompt and systematic saturation of Ukrainian Army with most advanced radios manufactured by L3Harris Technologies, USA took place. FMF programs (before 2014), ERI and USAI programs (after 2014 till now) have provided delivery of the newest world-beating communication equipment that is a de-facto standard of tactical communications in NATO countries from long ago. By the end of 2020 total cost of communications equipment, personnel training and installation services delivered to Ukrainian law-enforcement agencies will have amounted to $300 mln. According to our information Ministry of Defense of Ukraine also plans to purchase a significant batch of L3Harris radios using budget financing. For the purposes of the foregoing we would like to outline the position of our company which performs a considerable volume of services aimed to ensure the effective use of L3Harris technologies, L3Harris reputation enhancement as well as to allow establishing L3Harris equipment and technologies to be the basic tactical communication platform. Naturally, this will work towards increase of equipment sales in Ukraine which is our task.

As of today, amount of equipment (thousands of radios of different types and sets) used by the Army, National Guard and Border Guard has cleared the way to qualitative leap and made full-scale saturation of separate units possible. This will lead to systemic impact of L3Harris technologies use, especially in battle management systems. War at the East of Ukraine advances high demands to communication and management systems and enemy doesn't undercharge Ukrainian Army for being not combat-ready in 2014. But Army succeeded, hardened in combats and is now a real force which is undergoing serious reforms. Newly created Signal Troops and Cybersecurity Command as well as J6 Department of General Staff make efforts to develop the concept of communication system and combat management, coordinate units' equipment with our radios.

L3Harris communication equipment passed decades-long tests in dozens of armed conflicts and needs no advertising. Encryption system, ECCM (Electronic Counter-Counter Measures) functions and wide spectrum of work modes provide stable and resilient communication system, which excludes reading and suppression by enemy's electronic warfare equipment. Thus, communication system reliably counters enemy's electronic warfare systems and combat use shows this in a complete way.

Pool of many thousands of L3Harris radios in the army and their absolute matching to NATO requirements and standards has established the basis for making this equipment the primary tactical communication platform in Armed Forces of Ukraine. And we work in this direction constantly. Our company does its best to utilize L3Harris equipment and technologies in the most proficient way. Path to this goal is long but we move forward confidently and are happy to be the active member of this process. During the years of war, we have performed the role of L3Harris training and service center in Ukraine. Many hundreds of radios were installed on combat vehicles, ships and navy vessels, thousands of communications specialists were trained to exploit our radios. We permanently and systematically help army men to upgrade firmware of the radios. Through our efforts hard core of specialists is created in the Army, Navy and National Guard. These specialists are not only able to use our radios in combat environment but also train their colleagues and share their experience. Permanent work in the army gives us a good understanding of Ukrainian army requirements. Knowledge of these aspects allows us to prepare "proper" lists of equipment delivered to Ukraine.

Our company actively supports L3Harris radios implementation into Ukrainian legal environment. For example, we have received State Service of Special Communication and Information Protection of Ukraine certificates which allow to use L3Harris radios' crypto modules to transfer the restricted information. This opens gates for the legal use of our technologies in tactical combat management systems.

Translation of VHF and VHF/UHF radios' interface into Ukrainian language is an important part of our collaboration with Corporation's specialists. Navy, Marines and SOF specialists as well as qualified tactical network administrators work professionally with English interface but it is vital that mass users (combat vehicles commanders, squad, platoon and company commanders), whose English and IT knowledge are not always on a high level, can efficiently use our equipment. Now we work on proposals for the army concerning development of personnel training system, in which specialists of our company will occupy one of the key positions.

Training and permanent re-skilling of personnel is impossible without educational materials adjusted for users with different training levels. These materials include manuals for radio network administrator, operator and combat vehicle commander. Based on materials provided by Corporation we prepared thousands of pages of different manuals, best practices and short field guidelines. Due to Corporation's continuous work on radios' firmware enhancement, these papers are constantly updated and transferred to MoD. UDR

RIFF ON GUARD AGAINST DRONE THREATS

Anti-drone Jamming Gun System RIFF by InterProInvest

INTERPROINVEST OFFERS A COMPACT COUNTERMEASURE AGAINST UAV ATTACKS

Experience of recent conflicts, both initiated and sponsored by Russia in Ukraine and currently ongoing in Syria, Iraq, Libya and many other locations, reveals the extensive presence and use of unmanned aerial vehicles (UAVs) of various types and uses in local and hybrid wars in modern warfare. To counter the use of some of hostile UAV capabilities, the Ukrainian company "InterProInvest", which gained renown for developing the special-purpose automatic rifle Vulcan (otherwise known as "Malyuk" in the commercial and export markets), has developed and offers a reliable, small-dimension, and ergonomic countermeasure, the RIFF.

COUNTERING THE THREAT FROM THE AIR

Despite the significant progress reached in development of high-tech UAV technologies for special uses, inclusive of battlefield reconnaissance and air-to-ground attacks, few militaries can actually afford having high-end UAVs in their inventories. This holds true especially for various paramilitary forces involved in armed conflicts. That being said, parties to military conflicts often have to use the simplest mass produced, cheap models of UAVs. In battlefields, UAVs are usually limited to roles such as intelligence/surveillance/reconnaissance, target identification/position location, adjustment of artillery fire, and air-to-ground attacks.

In the civilian domain, such devices, in addition to the risk of being used for terrorist attacks on civilian infrastructures and individuals, can potentially pose a significant threat to

society due to their affordability and unpredictability of use.

All of this highlights the need for guaranteed detection and neutralization of these devices. Military and law enforcement customers are requiring simple, reliable and easy-to-use means in order to be able to counter current threats from the air effectively and efficiently.

In addition to this, however, there is a need for cost-effectiveness, meaning anti-UAV technologies should be designed such as to offer the optimum in terms of performance versus cost. This is important especially in light of the need to avoid occurrences of million-dollar missiles being used against low-end targets valued at several dozen thousand dollars or less, which could have been struck by far less sophisticated and less costly weapons.

For example, according to statistics by the Russian Ministry of Defense for 2018 to 2019, Russian forces in Syria shot down 120 hostile drones (53 in 2019 and about 70 in 2018) that were bound to attack the Russian airbase Hmeimim. While few details have been made public, information leaked to the media suggests that Russia's Pantsir-S air defense missiles were used to engage and destroy most of these targets, such as an "unidentified UAV" that was reported shot down while bound from the Mediterranean Sea to the Russian airbase Hmeimim in early February 2020.

If we take into account that 'cottage-industry made" loitering munition drones or cheap Chinese-produced drones costing (with weapons payload) a maximum of several dozen thousand dollars are most frequently used against Russian targets in Syria, and these drones are engaged and destroyed primarily with missiles valued at hundred thousand dollars (and this not inclusive of million-dollar launcher systems), this method of countering drone threats is less than efficient.

When it comes to countering mass-produced (primarily multi-rotor) drones employed for military or criminal activities, modern man-portable countermeasures – the so-called anti-drone jamming guns – are most effective, both in terms of cost and performance. These are electronic countermeasures designed to immobilize a target drone by jamming its remote control and GPS datalinks. In terms of cost, anti-drone jamming guns compare well with the targets they are designed to defeat. In some cases, anti-drone shotguns can be employed with great effect against low-end military drones of glider-type, as exemplified by InterProInvest's RIFF-P anti-drone gun system.

ANTI-DRONE COUNTERMEASURE SYSTEM RIFF-M (FOR MOBILE USE)

ACOUSTIC AND LIGHT INDICATION OF THE APPROACHING THREAT

Max jamming range	3 km
Max detection range	5 km
RF jamming power	1 kW (8 bandwidths)
Max continuous operating time	24 hr
Antenna	360-degree omnidirectional

RIFF-S SYSTEM (FIX MOUNTED)

Max jamming range	3 km
Max detection range	5 km
RF jamming power	1 kW (8 bandwidths)
Max continuous operating time	24 hr
Antenna	360-degree omnidirectional

Optional extra capabilities:

- monitoring of adjacent frequency bandwidths;
- maintaining a library of intrusion events at the installation being protected;
- mapping incidents of drone intrusion.

RIFF PROVIDES A SAFETY UMBRELLA AGAINST DRONE ATTACKS

As a result of close cooperation with users of the special-purpose automatic rifle Vulcan – especially Intelligence/surveillance/reconnaissance and special operations units operationally deployed in eastern Ukraine, InterProInvest reached the conclusion that, in the Donbas Theater, one of the most dangerous threats facing warfighters at the tactical edge comes from unmanned aerial vehicles.

These are Russian-produced UAVs such as Aileron, Zastava, Orlan, and Forpost, just to name a few, which have supported the operations of Russia's 1st and 2nd Army Corpses, the 8th Army, in this part of Ukraine, as well as less expensive, mass-produced commercial vehicles such as DJI Mavic, Inspire, and Phantom among others, or makeshift rotorcraft assembled from COTS components.

So the Company reviewed its available competencies and resources, and recruited the necessary staff. At the 2019 Arms & Security Trade Show held in Kyiv, InterProInvest unveiled the first release of its anti-drone jamming gun system RIFF-P. It's worth of note that the exhibited specimen was a working prototype that the Company used for purposes of technology maturation and for investigating potential customer demand. By late spring 2020, the RIFF technology had been sufficiently matured to meet the requirements of military and security customers, to →

The Anti-drone Jamming Gun System RIFF is related to the automatic rifle Vulcan (otherwise known as Malyuk in the export market)

have its planned specifications tested and verified and to be introduced into the Ukrainian army inventory. The electrical and electronic components of the gun have ingress protection certified to IP67.

The RIFF-P is specifically designed to defeat rotary-wing drones and flying/fixed-wing UAVs. A one-button-press-system enabling easy and rapid deployment, the RIFF-P jammer works by disrupting the connection between the target drone and its pilot's controls and by jamming GNSS (GPS/GLONASS/Galileo/Beidou) signals.

The system is a shoulder mounted jammer with a directional antenna that covers a 20-degree sector, emitting 100-W RF jamming power on four bandwidths. It can disrupt GNSS signals and jam UAV remote control signals and video signals at ranges over 1.5 km or longer.

The weapon has enough power to run continuously for 1 hour (or longer with additional rechargeable batteries).

Weighing just 4.8 kg, which is less than its closest rivals, the RIFF-P is portable and usable by one person without assistance and can be carried along with soldier's personal firearms. In the battlefield, the RIFF-P is a perfect pair to the automatic rifle Vulcan.

Some special operations units have already evaluated technical and combat capabilities of the RIFF-P shotgun in actual battlefield situations. InterProInvest claims that with such assets at hand (at the rate of one RIFF-P shotgun per platoon-size team), forces deployed downrange on the battlefield in eastern Ukraine could be far more effective and efficient in countering hostile drone attacks, and, more importantly, this would help reduce soldier casualties. The weapon could also be of use to checkpoint personnel securing critical military infrastructure, military bases, and materials/ammunition depots among many more other targets.

The Company, also, points to the RIFF-P technology being effectively employed in the prevention of smuggling from and to Ukraine. With this technology available to border security guards, this could facilitate them in fulfilling their mandated tasks regarding the protection of border security and interdiction of border violations involving the use of unmanned aerial vehicles.

The RIFF-M can be integrated aboard lightweight utility vehicles or passenger cars. It is able to detect drone threats at substantially long ranges from the object being protected and offers acoustic and light indication of the approaching threat

Fix-mounted system RIFF-S has similar specs to the RIFF-M, but offers room for additional capabilities to meet specific customer needs

The shoulder-mounted anti-drone jammer RIFF-P could also have utility for maintaining public order and security and for VIP security protection. It, therefore, can be used by law enforcement and private security personnel in missions involving a high risk of aerial attacks.

SECURITY, SECURITY AND STILL MORE SECURITY

Encouraged by the success of its portable anti-drone jamming technology, InterProInvest has expanded its RIFF family of anti-drone jammers by adding the RIFF-S and RIFF-M systems optimized for fixed and mobile uses, respectively, and these technologies boast broader-range and higher specifications and capabilities.

The mobile variant, RIFF-M has a compact size and can be integrated aboard lightweight utility and special-purpose vehicles. It can detect hostile UAVs at substantially long ranges from the object being protected and offers acoustic and light indication of the approaching threat. Equipped with an omnidirectional antenna, the RIFF-M can detect low-RCS UAV targets at distances up to 5 km while simultaneously calculating the launch trajectory of the target. It can interfere and frustrate control of a drone threat at ranges up to 3 km, using either directional (RF jamming power of 1 kW emitted over one of eight bandwidths) or omnidirectional (360 degree jamming) mode of operation. The RIFF-M can work continuously for 24 hours, which makes it a perfect solution both for securing vital facilities at times as needed and providing security coverage for individual persons and vehicle convoys on the move. In the latter case, the system can detect and disable a drone threat while travelling at speeds up to 100 km/h.

The drone countermeasure system RIFF-M, which is optimized for fixed uses, has similar specs to the RIFF-S, but comes with optional extras to adapt for specific needs such as:

- monitoring of adjacent frequency bandwidths;
- maintaining a library of intrusion events at the installation being protected;
- mapping incidents of drone intrusion.

More capabilities can be added to meet specific customer needs.

ENDNOTE

Despite all of the suffering and losses inflicted to Ukraine as a result of Russia's military incursion, the country has received a benefit in the form of knowledge and skills on fighting potential Russian threats and saw the rapid development of the capabilities that are so urgently required in the modern battlefield. One of the domains where Ukrainian industries have been particularly successful is anti-drone warfare, and the Ukrainian company InterProInvest is already here to help those facing threats from hostile drones by offering technology solutions based on its RIFF family of anti-drone countermeasures. If, of course, those are friends, not enemies… UDR

Valeriy RIABYKH,
Defense Express

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