

# UDR



**A NEW LEASE OF LIFE  
FOR THE 2K22  
TUNGUSKA**



**MADE IN  
UKRAINE**

# SILENT THUNDER

## UKRAINIAN LOITERING MUNITION

### NEW MISSILE SYSTEMS DEVELOPED BY UKRAINE

Neptune ASCM system  
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### BOGDAN MOTORS

Projects  
for the  
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UKRAINIAN DEFENSE REVIEW

**UDR**

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## DRAFT NEW EDITION OF UKRAINE'S NATIONAL SECURITY STRATEGY UNDER DEVELOPMENT



The updated draft new edition of Ukraine's National Security Strategy, which will outline the existing level of threats facing Ukraine, is due for completion by November 20, 2019.

This was announced during the first full meeting of the working group on drafting new edition of the National Security Strategy, held on the premises of the National Security and Defense Council (NSDC) on July 8.

This new edition of the national security strategy will be the first to be drawn on based on the recently adopted law on "National Security of Ukraine", which has set up a framework for structural reforms in this crucial area, commented Oleksandr Danylyuk, NSDC Secretary.

The new strategy "should be qualitatively different" [from previous editions] and it has to be "of special na-

ture". "The new legislation defines the National Security Strategy to be the base document for strategic planning processes addressing specific areas of national security", said Danylyuk.

He went on to note that since the National Security Law sets clear timelines for drafting the Strategy, that is within six months after the next presidential inauguration, all members of the working group must submit draft provisions at the early stages of the Strategy drafting process. "Although the time budget is limited, it's still possible to produce a high quality document that would enable Ukraine to adequately address and prevent the challenges [to its national security]," he said.

"The threat environment is changing and evolving. We want a modern strategy that would give an adequate assessment of existing security challenges and threats and would set up policy priorities in the area. In this case there should be no cliché constraints. Instead the drafting process should be from a clean sheet of paper, and the approaches used previously should be revised", said the NSDC Secretary.

## UKRAINE HAS ADOPTED AND IMPLEMENTED 16% OF NATO'S STANDARDS THUS FAR

According to statistics provided by the Ukrainian Ministry of Defense, 16 percent of NATO's standards have been adopted and implemented in Ukraine as of July 2019. This is contained in discussion report by the New Europe Center titled "Ukraine and NATO's Standards: How to Hit a "Moving" Target".

Overall, there are some 2,000 NATO standards and about 1,200 standardization agreements; these numbers are fluctuating as the standards are being continuously revised and updated.

The key purpose of NATO standards is to achieve the interoperability required by Allies. Provision for that purpose is inserted in the NATO-Ukraine Charter of Distinctive Partnership that was signed 22 years ago. But it was not before 2015-16 when Ukraine began implementing NATO standards after the goal of achieving NATO compliance had



been embedded in the country's strategic defense planning documents.

Some of the already implemented standards address areas such as military uniforms, equipment, and catering of soldiers, as well as the development of new military technologies.

One of Ukraine's Special Operations units has recently received NATO's certification that qualifies it for participation in NATO Response Force (NRF) operations. This is the first time in history where a military

unit from a non-NATO country has been able to pass NATO's certification for NRF missions.

The key impediments frustrating the implementation of NATO's standards in Ukraine are a lack of systemic approach in implementing and managing the implementation process, a shortage of properly trained and experienced personnel and a low level of their English language proficiency, as well as the complexity involved with the implementation of limited-access standards.



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# ARMS AND SECURITY

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## ANTONOV TO HELP CUBANA DE AVIACION BRING ITS FLEET OF AN-158 REGIONAL JETS BACK TO AIRWORTHINESS STATUS



State Enterprise Antonov, an aircraft manufacturing company incorporated with the State-owned Ukroboronprom defense industries group, will help Cubana de Aviacion airlines continue airworthiness status of its fleet of six An-158 regional jets, under a Full Fleet Support program suggested by Antonov.

This is according to a news report by Defense Express, citing Antonov press office.

Under the terms of a lease agreement with Panama-registered lessor SOUTH AMERICAN AIRCRAFT LEASING S.A. (SAAL), Antonov's expert team are now assessing technical status of Cubana's An-158 fleet to determine the amount of maintenance work necessary for each aircraft. This will be followed by work to bring all the six airplanes back to airworthiness status.

Based on the results received, Antonov will set up a spare parts stock that might be required to keep the fleet airworthy. The first two airplanes are due to be returned to service by Q2 2019.

UDR note: The first Antonov An-158 jet was delivered to Cubana in April 2013 and the sixth and last one in 2015. Warranty service agreement for the six airplanes expired in 2017.

## CABINET AWARDS EXPORT PERMITS TO THREE PRIVATELY-RUN ARMAMENT COMPANIES

The Cabinet of Ministers of Ukraine, at its session held on July 17, 2019, approved a decision to permit three Private-Sector armaments manufacturers – which are InterProInvest, UkrSpetsTechika, and UkrSpetsSystems – to sell own-label products in export markets, Defense Express reports.

TOV InterProInvest, a limited liability company, is the developer of the 5.45/7.62 Malyuk automatic rifle, which is a bullpup conversion of the Soviet Kalashnikov rifle. Malyuk entered Ukrainian Army service in 2017, in a version known in the domestic market as "Special Automatic Rifle "Volcano".

PAT "Holding Company UkrSpets-Technika", a leading company in the domestic radar industry, is famous for its products such as the radar system Malachite, integrated reconnaissance/electronic warfare system Jab, millimeter-wave radar systems Lis-2M and Borsuk/Borsuk-A, GPS/GLONASS satellite navigation jamming system Anclave, and counter-battery radar system Biscuit-KB.

TOV UkrSpetsSystems LLC focuses its business on developing and manufacturing UAV drones, copters, gyro-stabilized gimbals, and ground control stations. It is the supplier of PD-1 drones to the Ukrainian Armed Forces.





# MOTOR-SICH TO LAUNCH PRODUCTION OF ITS FULLY-COMPOSITE HELICOPTER IN 2020

PAT Motor-Sich is looking to complete the development and start production of its new, fully-composite helicopter in 2020, as well as to set up a production process for engines to power armed UAV drones.

This has become known from a news report published by Defense Express, quoting Motor-Sich President Vyacheslav Bohuslaev as saying at his meeting with the Company's young professional team.

Motor-Sich already has operational production lines for almost all parts for helicopters (presumably Mi-2/8 families – DE note); many of the parts surpass in quality and performance their Soviet/Russian equivalents, said Bohuslaev.

"We have created a new cabin, along with a new, fifth-generation engine that sets new records. We have created a new gear assembly which I've already demonstrated (to a visiting U.S. team – DE note), the one that would have a twice longer lifespan, compared to Russian-produced gear assemblies", he said.

"Our Company can now produce everything regarding helicopters, excepting rotor blades. Everything – I really mean it!", Bohulayev said and added that Motor-Sich is planning to

launch a U.S. technology-based production line to produce composite rotor blades by 2021.

"I'm certain that we would be able to maintain our supremacy in this field for 20 years or so. Over that time we will have to learn how to make good helicopters and we will do it. Next year we are launching [produc-

tion of] a fully composite helicopter".

Bohuslaev further said that his company is looking to expand its business focus to include engines for powering armed UAVs.

Motor-Sich currently focuses its business on development and production of helicopters and manned aircraft engines.



# UKRAINE TO SET UP AN MRO CENTER FOR AIRBUS HELICOPTERS AT NIZHYN

Airbus Helicopters and Ukraine's Ministry of Interior will establish a joint-venture Maintenance and Overhaul (MRO) center that will operate under the Ministry of Interior's new unified organization for Flight Safety and Civil Protection (FSCP).

As reported by Defense Express, citing the 'Emergency Situation' outlet, this was announced at a meeting July 17 between deputy Minister of Interior, Serhiy Honcharov and a visiting team of Airbus officials, attended also by a French diplomat accredited in Kyiv.

According to the report, the MRO Center will be located at the State Ser-

vice for Emergencies' Nizhyn airbase that already houses Airbus H225 helicopters.

UDR note: in May 2018, Ukraine and France signed a grand agreement regarding mutual support for establishing a unified FSCP organization within the Ukrainian Ministry of Interior.

The Ministry of Interior undertook to buy from Airbus Helicopters 55 helicopters for use by the State Service for Emergencies, State Border Guard Service, National Guard and National Police of Ukraine.

The first two H225 helicopters arrived in Ukraine in December 2018,

and the third came in January 2019 to enter operational service with the State Service for Emergencies. One of the Service's H225 helicopters has already performed SAR missions during a recent flooding crisis in the west of Ukraine. The State Service for Emergencies and National Guard are anticipating the arrival of three more H225s, and two H125 helicopters will be allocated to the Ministry of Interior's Kremenchuk Flight Academy for use in pilot training programs. Airbus will also deliver an H225 Full Mission Simulator to be based at Kremenchuk.



## KRAZ SELLS ANOTHER BATCH OF ITS "SHREK" MRAP VEHICLES TO AN EXPORT CUSTOMER



Kremenchuk Automobile Plant (KrAZ) has shipped another batch of its all-terrain, mine resistant ambush protected (MRAP) "Shrek" armored vehicles to a customer from an African country, Defense Express reports citing the Company's official website.

The design of the Shrek MRAP vehicle is based on the KrAZ-5233 4x4 all-terrain military truck. The Shrek features a V-shaped hull and provides

B6+/STANAG 4569 level 2 ballistic protection.

Other than disclosing the destination country, KRAZ reports on its website that an official team from the Customer country several times visited AutoKrAZ: first, they got familiar with the Company's lineup of current off-the-shelf and future vehicle models, their performance capabilities and technical specifications. The team

members then tested ready-for-shipment vehicles and found them to be compliant with the Customer specifications.

The Shrek is destined for use in missions that may involve route proving and the disposal of discovered mines, IEDs and other explosive hazards. The vehicle is fitted with an Italian-produced rake-type articulated robotic arm used to handle suspicious items from a distance. Crew can safely investigate anything the arm can reach out to 20 meters away, and can monitor the operation from a display unit inside the vehicle's armored hull. The mine detection and disposal system, which was sourced from a U.S. manufacturer, comprises a high-fidelity camera, specialist lighting equipment and a gripping device.

The vehicle armor protects against small-arms fire, shell splinters and grenade shrapnel. Ballistic protection is certified to STANAG 4569 Level 2 (7.62x39mm API BZ at 30 meters with 695 m/s). Anti-mine blast protection measures include STANAG-4569 Level I compliant protection of the wheels (hand grenades, unexploded artillery shells, small explosive devices of at least 0.35-kg TNT equivalent); and STANAG-4569 Level IIa/b protection of the bottom hull (6kg TNT under central hull).

---

## FIRST PRODUCTION UNIT OF PROTON'S COMMUNICATION JAMMING SYSTEM R-330KV1M SUCCEEDS THROUGH INITIAL TRIALS

Central Design Bureau Proton, Kharkiv, has successfully tested the first production unit of its R-330KV1M communication jamming system, at a military proving ground located outside Kharkiv. This is according to a press report released by Ukroboronprom, the firm's holding company, on June 16, 2019.

The R-330KV1M can automatically detect and jam signals from high-frequency transmitters to interfere with and frustrate the operation of hostile communication networks at ranges of

dozens of kilometers. It is capable of disrupting and disabling the operation of all existing high-frequency radio systems, even those designed with a strong counter-jamming capability. The performance and capabilities the R-330KV1M has are not unique to this Ukrainian technology, but are required by NATO as standard for all the existing and future technology products in this field.

The R-330KV1M would operate stand alone or as part of the R-330UM "Mandate" jamming suite, which in-

tegrates the capabilities for HF/UHF communication jamming, COMINT and C2. A production line for the R-330KV1M has been launched at NVK Iskra, Zaporizhia, also an affiliate of Ukroboronprom.

The R-330UM "Mandate" began to be developed by Topaz, a firm that used to be based in Donetsk, but had to move its R&D hub to NVK Iskra after Russian incursion into Donbas. Subsequent to this, development of the Mandate's high-frequency component was taken over by Proton.





Upgraded SAM System 2K12M1-2D «Kvadrat-2D» has service life of 15 years, increased target engagement envelope, increased efficiency and mobility, improved operation in conditions of heavy jamming. 2K12M1-2D «Kvadrat-2D» has increased reliability (achieved largely by replacement of 90% of original elements) and MTBF of 1500 hours.

## SAM 2K12M1-2D "Kvadrat-2D"

Key upgrade features:

- improved operation in jamming conditions, in presence of reflections from underlying surface;
- automation of control from command post, automation of detection and tracking, prelaunch preparation and launch of missiles;
- reduced response time and firing cycle;
- full crew training by simulation of air situation, jamming and action scenarios;
- notably simplified maintenance;
- replacement of gas turbine generator with diesel power plant;
- integrated climate control system;
- improved ergonomics.



- 👁 Max. detection range: 75 km
- 📏 Engagement slant range: 24 km
- 🕒 MTBF: 1500 h

## SAM S-125-2D "Pechora-2D"



- 👁 Max. detection range: 46 km
- 📏 Engagement range: 37 km
- 🕒 MTBF: 1500 h

Upgraded SAM System S-125-2D has service life of 15 years, increased target engagement envelope, increased efficiency and mobility, improved operation in conditions of heavy jamming. Upgraded S-125-2D also features automatic distribution of air situation and combat monitoring data to higher level Command Post.

S-125-2D has increased reliability (achieved largely by replacement of 90% of original elements) and MTBF of 1500 hours.

Latest generation of the system's Antenna Post UNV-2D is mounted on a semi-trailer, has built-in crane equipment and diesel generator to ensure transfer time from combat to travel position and vice-versa of 40 minutes. In emergency situations travel can be initiated after 18 minutes with the remainder of operations performed on the move. Upgrade of UNV-2D leads to much more mobility to S-125-2D operation.

The ground-based AMBER-1800 mobile VHF range surveillance radar performs automatic detection of aircraft, coordinates determination (azimuth and range) and radar data distribution to users.

Transmitter and receiver have solid state design.

AMBER-1800 radar uses multi-section antenna mast with rapid lift. It is capable of working in severe climatic conditions.

Time required for radar complete readiness, after installation at the position and completion of preparation for deployment, does not exceed 12 minutes.

Radar functions:

- automatic detection, azimuth and range finding and displaying of targets (aircraft);
- automatic tracking of aircraft and calculation of target motion parameters;
- automatic control of height finder (radar altimeter), equipped with A-1000H extractor. Altitude calculation and referencing with two – dimensional coordinates (option);
- automatic output of radar data via telephone channel;
- manual retrieving of radar data using digital data of aircraft labels in azimuth – range coordinates;
- radar data recording;
- technical control and diagnostics of the main radar units.

## "AMBER-1800" mobile VHF radar

- 📡 Transmitter: 8 or 30 kW
- 📡 Frequency band: 140 – 180 MHz
- 🕒 Deployment: 12 min







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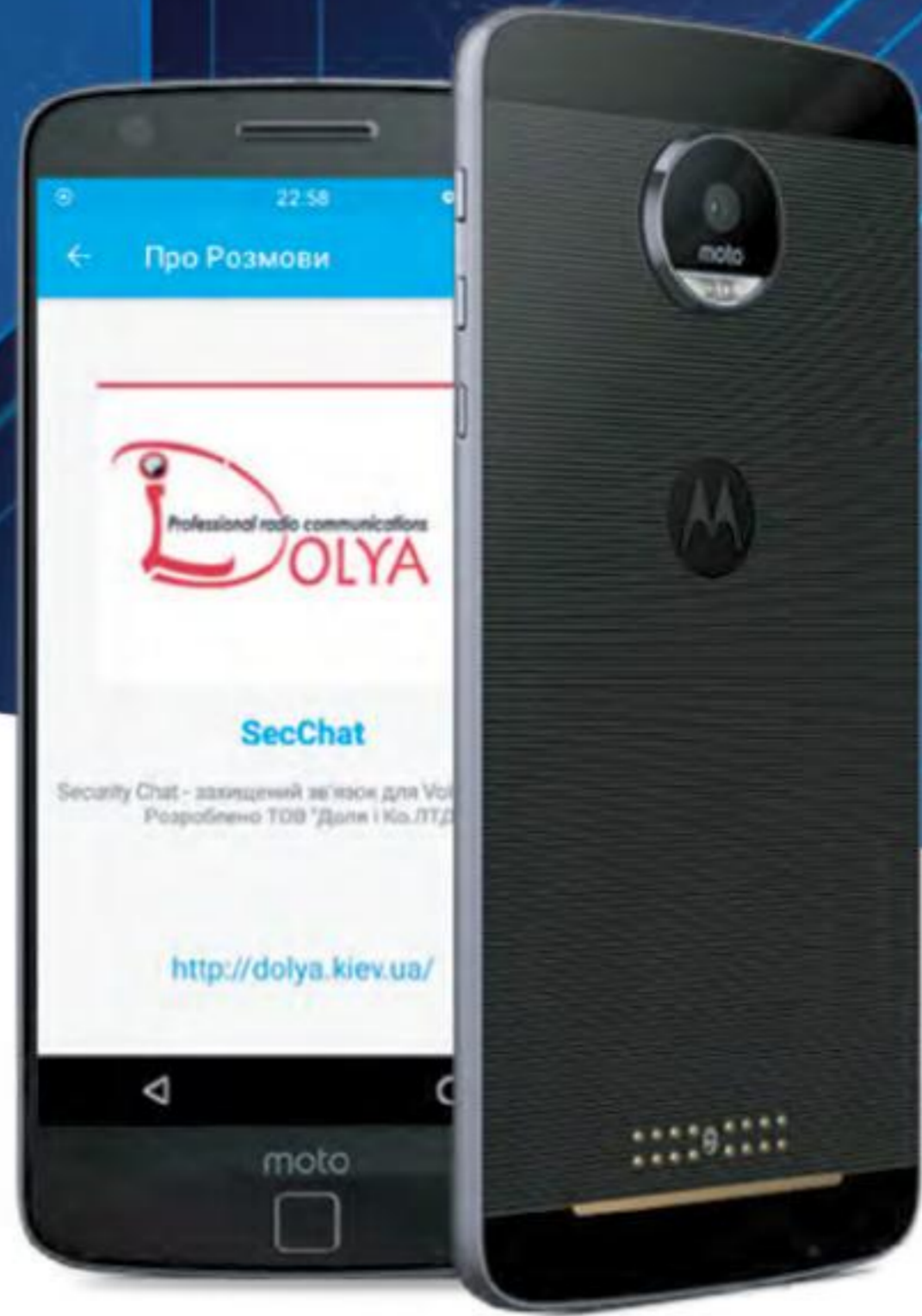
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## SECURE PHONE FEATURES



### HARDENED ANDROID

Hardened operating system with secure boot and device runtime integrity checks



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## BRAND-NEW "KOZAK-2M1" ARMORED OFF-ROAD VEHICLE SUCCEEDS THROUGH OFFICIAL QUALIFICATION TRIALS

Ukraine's brand-new tactical armored vehicle "Kozak-2M1", developed by NVO Praktika, Kyiv, has succeeded through its official trials and qualification process, ArmyInform reported July 10, 2019.

The trials, conducted and overseen by the Ministry of Defense' Armaments Testing and Certification Institute (ATCI), Chernihiv, included fording water obstacles, driving over swamp-land and difficult, snow/ice-covered terrains, as well as air-dropped deployment among other tests.

"The use of an independent suspension on the vehicle allows for increased payload capacity and improved smoothness of the ride. There is a locking device for all wheels. Developed with high off-road performance, the Kozak-2M1 has been tested over rough terrains that used to be only passable by tank-type tracked

vehicles", said Serhiy Kuzin, senior research fellow at ATCI.

The Kozak-2M1 has been able to ride 15,000 kilometers without any serious fault or breakdown. The tests also included firing from the 12.7-mm NSB machine gun turret on the vehicle's roof. Based on the results received from a series of test firing sessions, certain changes have been made to the design of the machine-gun mount.

The Kozak-2M1 technology incorporates major upgrades from its previous generation evolutions, most notably in terms of the range/endurance increased to 1,000+ km and water fording capability increased by 20%, to 1.2 m.

The Kozak-2M1, which essentially is a

compact-design armored personnel carrier, is categorized by its developer as "wheeled armored fighting vehicle", as opposed to its previous evolution, the Kozak-2M which is categorized as "special-purpose armored vehicle".



## UKRAINIAN ARMED FORCES TAKE DELIVERY OF COMINT SYSTEM "SECTOR R-677"

SE Central Design Bureau Proton, an affiliate firm of the State-owned Ukroboronprom defense industries group, has developed and produced a vehicular version of its state-of-the-art High-Frequency COMINT system "Sector R-677", Ukroboronprom reports, through its press office, on July 17, 2019.

Upon successful completion of commissioning trials, one unit of the Sector R-677 system has been delivered for deployment with Ukrainian Army field forces.

"The Sector R-677 would automatically detect and digitally process High-Frequency radio emissions, determine their direction, then find out and record parameters of received radio signals", the report says.

The Sector R-677 technology has been developed and produced by Proton in a close collaboration with Ukroboronprom's enterprises and Ukrainian Private-Sector entities. The technology incorporates modern solutions for signal analysis and digital processing, along with software al-

gorithms that have been purpose developed for this application based on real-world combat experience.

This enables the system to effectively detect high-frequency radio emissions from existing (as well as future) transmitters. Several such systems can be networked to locate a signal transmitter, thus facilitating accurate location of



adversary communication/C2 centers and force positions, as well as the obtaining of other important intelligence.

As a matter of fact, the Sector R-677 capability enables continuous monitoring of hostile HF radio communication in order to maintain awareness of the status, location and suspicious increased activity of adversary forces.

The Sector R-677, in its previous fixed configuration, has been in real-world combat use by Ukrainian forces since 2014. Its new, vehicle-mounted configuration succeeded through government trials and entered Ukrainian Army service in 2015.

The vehicular configuration has been developed by miniaturization of all subsystems and a broad application of modern digital technologies, thus making it compact enough to be mounted on an off-road chassis, with a substantially reduced space area needed to deploy the full system for operation. The Sector R-677 only takes a few hours to deploy and start using, compared to 24+ hours of deployment time needed with older-generation equivalents.



## FAST PATROL BOAT "SLOVYANSK" SUCCESSFULLY COMPLETES ITS SEA TRIALS

The going out into high sea from the Bay of Arundel, Maryland, in June 2019 marked the final milestone in a series of factory-level, mooring, and sea trials underwent by the Island-class Fast Patrol Boat "Slovyansk" (hull number R-191), Defense Express reported quoting a press statement by the Ukrainian Navy Headquarters.

Ukrainian crews for the Island-class craft, who are now on a ten-week long training course at the Maritime Institute of Technology and Graduate Studies (MITAGS), Linthicum, Maryland, were on board the R-191 while it was sailing during trials at sea.

For the Ukrainian crews, it was the first occasion where they could get a good feel for the workings of the vessel and how it performs at sea. They were able to watch it while being moored and performing maneuvers and speed tests. The Ukrainian sailors were also able to convince themselves that newly installed systems, weapons and main systems are performing as appropriate.

The Slovyansk patrol boat currently serves as the main platform for



training Ukrainian crews for two Island-class cutters, and will remain so till the other same-class boat, the Starobilsk (R-190) completes its re-equipment and sea trials program.

Defense Express note: Starobilsk and Slovyansk are both expected to reach Ukrainian shores sometime in the fall of 2019.

During an official ceremony on Sept. 27 in Baltimore, Ukraine's top naval commander, Ihor Voronchenko, and U.S. Coast Guard Vice Admiral Michael F. McAllister signed hand-

ing-over certificates paving the way for the transporting of the vessels to Ukraine.

The patrol boats, which both were built 40 years ago, can go out into very rough seas, perform their mission objectives in harsh tactical environments, and conduct firing missions. The handover was necessitated by the recent escalation of tension between Ukraine and Russia in the Sea of Azov. Kyiv and Washington are both accusing Moscow of interrupting Ukrainian maritime traffic in the region.

## DRONE TO BE BASED ON "GIURZA-M" - CLASS ARMORED GUNBOAT UNVEILED TO THE PUBLIC

The drone, designated F-2M and developed to specifications of Ukrainian naval forces, was unveiled to the public during Ukrainian Navy Day celebrations in Odesa, Defense Express reports citing the 'Breeze' TV/Radio Broadcasting Company of the Ministry of Defense.

"The F-2M drone is purpose built to be carried by Project 58155 Giurza-M-Class armored gunboats. Since the cramped platform deck area precludes accepting a landing drone, the latter would land on and be retrieved from water", Bohdan Ivanov, a Navy Headquarters officer in charge of issues related to operation of drone technologies commented and went on to say, "The F-2M, which is being developed specifically for Ukrainian Navy use, is currently undergoing government trials and being considered for entry into operational service".

Defense Express note: TOV "Unmanned Technologies", Berdyansk, completed development of the F-2M earlier this year. All transmissions to and from the drone are encrypted to AES-256 standard, while encryption of telemetry and video links is com-

pliant with STANAG-4586. The F-2M is designed with a maximum useable altitude of 5,000 m, air endurance of up to 12 hrs, speed of 70-150 km/h, max take-off mass of 18 kg, payload capacity of 4 kg, and operational radius of 80 km.







**INFOZAHYST**



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## ABOUT INFOZAHYST

Infozahyst R&D and Production Center has been successfully working in the field of security and defense systems since 2001.

The Company creates, using its own resources, software and hardware solutions tailored for the needs of Ukraine's military and other government services. It provides technical protection services to government and Private Sector customers in Ukraine, including the Ministry of Defense, General Directorate of the National Police, and State Property Management Department to name a few. Infozahyst is the Ukrainian leader in information security and holds leadership positions in the research, development and production of innovative technologies.

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# INSTABILITY BELT

**A** review of the causes and consequences of “frozen” conflicts in the former Soviet territories reveals their common root in Russia’s neo-imperial

policy. The implications of Moscow’s ambition to exert influence over neighboring countries have been observed in Moldova, Georgia, Azerbaijan and Armenia, and now in Ukraine’s Crimean peninsula and

the Donbas region. The conflicts in these territories have remained frozen for multiple years and show no signs indicating they are going to be resolved any time soon.



## HISTORICAL CONTEXT

The disintegration of the Soviet Union, despite being relatively peaceful, left behind territorial disputes between some of the newly independent states, inter-ethnic conflicts and other controversial issues.

In the case of the Moldova-Transnistria conflict, for instance, the opposition of the people in Transnistria to the domination of Chisinau was caused by concern over the status of the ethnic Russian and Russian-speaking population in Moldova. In a parliamentary vote held in 1989, the Popular Front of Moldova political movement in the Moldavian Soviet Socialist Republic won a landslide victory, which caused the conflict to escalate further. The Popular Front advocated for the Romanian as the official state language while its ultimate goal was to unify Moldova and Romania. In the end, Moldova had found itself destabilized, due in no small part to Russian involvement. Russia, under the pretext of protecting the Russian-speaking population, intervened in the armed conflict between Transnistria and Moldova, just to eventually cement its military presence in the region.

Factors similar to those observed in the Moldova-Transnistria conflict later manifested themselves in the conflict between Georgia and its breakaway regions of South Ossetia and Abkhazia. In the aftermath of the Soviet demise, both republics faced a dilemma of whether to join the newly created Georgian state or to fight for independence. South Ossetia, Abkhazia and Transnistria declared their willingness to remain part of the Soviet Union, attempting to retain considerable autonomy they enjoyed as former Soviet republics. As a result, this led to the emergence of pseudo-independent territories that relied for survival on the Kremlin's aid.

The Nagorno-Karabakh conflict, if compared to other post-Soviet conflicts, differs in that it is waged between two neighboring countries. Ethnically, Nagorno-Karabakh is a territorial enclave in Azerbaijan inhabited mostly by the Armenian population. This conflict involves Azerbaijan as seeking to recover full control over its territory and Armenia as standing behind the separatist "quasi-state",

also known as the Nagorno-Karabakh Republic. Here, Moscow is involved rather indirectly, since it supports Armenia militarily, although not without a selfish motive, aimed at building up its leverage with the authorities in Erevan.

The war in eastern Ukraine has not yet evolved into a frozen conflict, but it may well develop into what is now taking place in Transnistria, given a scarce reaction from European public opinion and the efforts being made by the Kremlin to legitimize the separatist authorities sitting in Luhansk and Donetsk.

## GEOPOLITICAL INTEREST

It is blindingly obvious that these conflicts all have arisen from common roots. It is open secret that Moscow

firmly secure them within its sphere of influence on the one hand and to prevent NATO and the European Union from expanding farther eastward into the former Soviet land on the other.

Frozen post-Soviet conflicts also pose a major challenge in terms of international relations development. Neither Georgia, nor Moldova, nor Ukraine can be fully independent in pursuing their respective international policies due to lacking in full control over parts of their sovereign territory. The authorities of the quasi-states that emerged within those countries have pursued policies imposed on them by Russia, who, for its part, helps them provide their security and economic needs. In these quasi-states, any important policy decision cannot be made unless endorsed by the Krem-



*Russian troops in Georgia in 2008*

has persistently intervened, directly or indirectly, into the internal affairs of its neighbors, using multiple different techniques making such intervention unnoticed by ordinary, uninformed people. In so doing the Kremlin pretends to be uninterested in any of the armed conflicts near the Russian borders - neither in the Republic of Moldova, nor in Georgia, nor in Ukraine, nor especially in Azerbaijan nor Armenia. The Kremlin is seeking to become a sovereign over the post-Soviet territories which it regards as belonging to its geopolitical sphere of influence, in fact seeking to materialize its ill-concealed neo-imperial ambitions.

With this robust instability belt surrounding it Russia has a strategic leverage over its former dominions, to

lin. This means that settlement plans for these conflicts should be negotiated directly with Moscow, or otherwise they would face the risk of fail, as was the case on numerous occasions before.

When exploring the motives behind Russia's policies vis-à-vis these frozen conflicts, one should be mindful that Russia, in pursuing its foreign policy agenda, not only seeks to stick to its status as a "grand power", but is also increasingly striving to remain a powerful actor in the transformation of the geopolitical landscape in Europe, especially in Eastern Europe and the Black Sea region. Russia regards Transnistria and the South Caucasus region to be important strategic military strongholds; Russia's presence in Transnistria enables it to exert →





*Burnt military technique in Tskhinvali*

influence over Southeastern Europe and the Balkans, while control over the Caucasus located at the intersection of Europe and Asia would allow for it to advance its interests deeper into the Near and Middle East, and into the Caspian Sea, Black Sea, and Mediterranean Sea regions.

### KEY TOOLS AND METHODS

Since Vladimir Putin's coming to Presidency in 2000, Russian international policy has been obsessed with keeping former Soviet-bloc states firmly secured in the Kremlin's orbit. All Russian pursuits towards former Soviet republics in Eastern Europe and the Caucasus were to prevent these states from integrating closer with Western political and military institutions. Proceeding on this track, Moscow employs a diversified range of mechanisms, one of most effective being the instigation of conflicts in those regions and keeping them frozen for as long as possible with aid of time proven leverages.

Russian military presence in conflict-torn regions is an important factor in keeping the conflicts frozen. As regards Moldova-Transnistria conflict, for example, the Istanbul 1999 OSCE Summit made Russia obliged to fully withdraw its forces, equipment and ammunition from Moldova till 2002. Moscow did so in part only, the result being that a major portion of Russian military arsenals and personnel has remained deployed in Eastern Moldova. Apart from the apparent unwillingness of

the Transnistrian authorities to be left without the military resources they need to feel secure against potential military pressure from Chisinau, another reason why this conflict remains in limbo is Russia's reluctance to withdraw from its last military outpost in the region, thus be short an effective tool to exert geopolitical influence, all the more so as Transnistria provides Russia with a leverage for influencing policies within Ukraine too.

Russia's military presence is also a factor standing in the way of even a hypothetical possibility of Tbilisi resuming reintegration talks with the governments of Abkhazia and South Ossetia. The conflict in Abkhazia – which, like other ethnic and political conflicts in former Soviet republics, has lasted from the time when the Bolshevik-led Soviet government, in conducting arbitrary national-territorial

delimitation, was guided not by historical reasoning, but, rather, by the striving to set neighboring ethnicities at odds with one another – concerns the interests of multiple ethnic and political factions. A permanent contingent of Russian forces has been deployed in the region since the developments of 1992-1994, and especially of 2008 when Russia decided to prove to the world it continues to be a geopolitical actor on the post-Soviet expanse, in particular in the Caucasus, by conducting what is refers to as "peace compelling" operation and stationing additional forces in the region. In Abkhazia, since 2009, Russia has had its 7th Military Base hosting around 4,000 personnel deployed at Bambour military airfield outside Gudauta, and has rented a military range along with a part of port and harbor facilities at Ochamchira and Kodori Gorge. In South Ossetia, the Russian 4th Military Base hosting, again, up to 4,000 personnel, is stationed at facilities based at Tskhinval, Dzartsemi Range, and a garrison and an airfield at Javi.

The military factor can also be observed in the Nagorno-Karabakh conflict. The conflict still remains unsettled, despite the efforts that have been made since 1994, including a protocol agreement signed in Moscow through the mediation of the then Russian Defense Minister, which obliged the conflicting parties to cease fire and halt violence; the signing of a force separation agreement; and the establishment of UN and OSCE missions to observe the cease-fire agreement. Moscow, while not being



*Tbilisi (Georgia), Summer 2019*



directly engaged in the dispute over Nagorno-Karabakh, provides military support to Armenia, its traditional regional partner who has its own vision as to the enclave's future and hosts on its land a permanent contingent of Russian forces, numbering at least 20,000 troops.

Another leverage the Kremlin has over those states is the issuance of Russian passports to people residing in Transdnistria, Abkhazia, South Ossetia, and now the separatist-controlled areas of Donbas, thus obtaining a formal pretext to intervene militarily in order to "protect the rights of compatriots".

For maintaining its geopolitical clout Russia also supports its sponsored separatist regimes with a tool such as referendum vote that serves to add legitimacy to policies pursued by its sponsored puppet governments. A number of fake referendums, held under a heavy Russian propaganda offence and a substantial pressure on voter opinions, have taken place in Transdnistria, Abkhazia, South Ossetia, as well as Russia-occupied areas in Donbas. It goes without saying that the votes all had predictable results that didn't entirely reflect actual voter preferences. The Kremlin dismisses the allegations, saying these referendums are manifesting the "democratic" nature of the policies being pursued by the authorities in the break-away entities.

The collection of the tools Moscow has exploited in pursuit of its political agenda also includes posing itself as being genuinely interested in having the frozen conflicts resolved. In so doing Moscow seeks to impose settlement plans that serve the interest of nobody but Russia and have no chances of being accepted by relevant host-country governments, while fully disregarding the wishes and opinions of the separatist authorities concerned.

Thus, for settlement of the Transnistrian conflict Moscow is placing preference on the so-called Kozak Memorandum. Under the plan, Moldova would become a federal state, along with Transnistria and Gagauzia (the latter of which is an autonomous territory recognizing Chişinău's domination) as two self-governing administrative entities enjoying a veto over



*The Russian 102nd Military Base is based in Gyumri, Armenia. It is a part of the Transcaucasian Group of RF Forces.*

federal legislation. Moreover, Chişinău would not be entitled to interfere in local legislation in these entities.

The recommendations listed out in the Kozak Memorandum proved unfavorable for Moldova's central authorities, meaning that pro-Russian autonomous entities within the federation could block all decisions on the country's Euro-Atlantic integration. Such a scenario would encourage Moscow to use its economic and political influence over Transnistria and Gagauzia to exert pressure on the government in Chişinău in order to incorporate Moldova into the Eurasian institutions. The Kremlin is seeking to impose a similar strategy to attain its political agenda for Ukraine, albeit without success yet.

In the Armenia-Azerbaijan conflict over Nagorno-Karabakh, Moscow is on Armenia's side while simultaneously pursuing coercive policy vis-à-vis Erevan. In 2012, the Kremlin forced Armenia to reject the Association Agreement with the European Union while alluring the country into the Eurasian Union. The current status-quo is satisfying the interest of Erevan in that it allows for it to remain in control of Nagorno-Karabakh on the one hand and to enjoy support from Moscow on the other. This situation, however, is absolutely unacceptable to Azerbaijan. The Kremlin nonetheless continues promoting and pushing for its "settlement" plan, albeit formally only and, as it usually is, in its trademark manner.

## ENDNOTES

Overall, the presented review of the Transnistrian, Russian-Georgian, Russian-Ukrainian and Armenian-Azerbaijani conflicts reveals an obvious fact that not only do these post-Soviet conflicts share a common historical background, but involve common circumstances, some of which have been exploited skillfully or directed from the outside, particularly by the Kremlin in pursuit of its neo-imperial agenda.

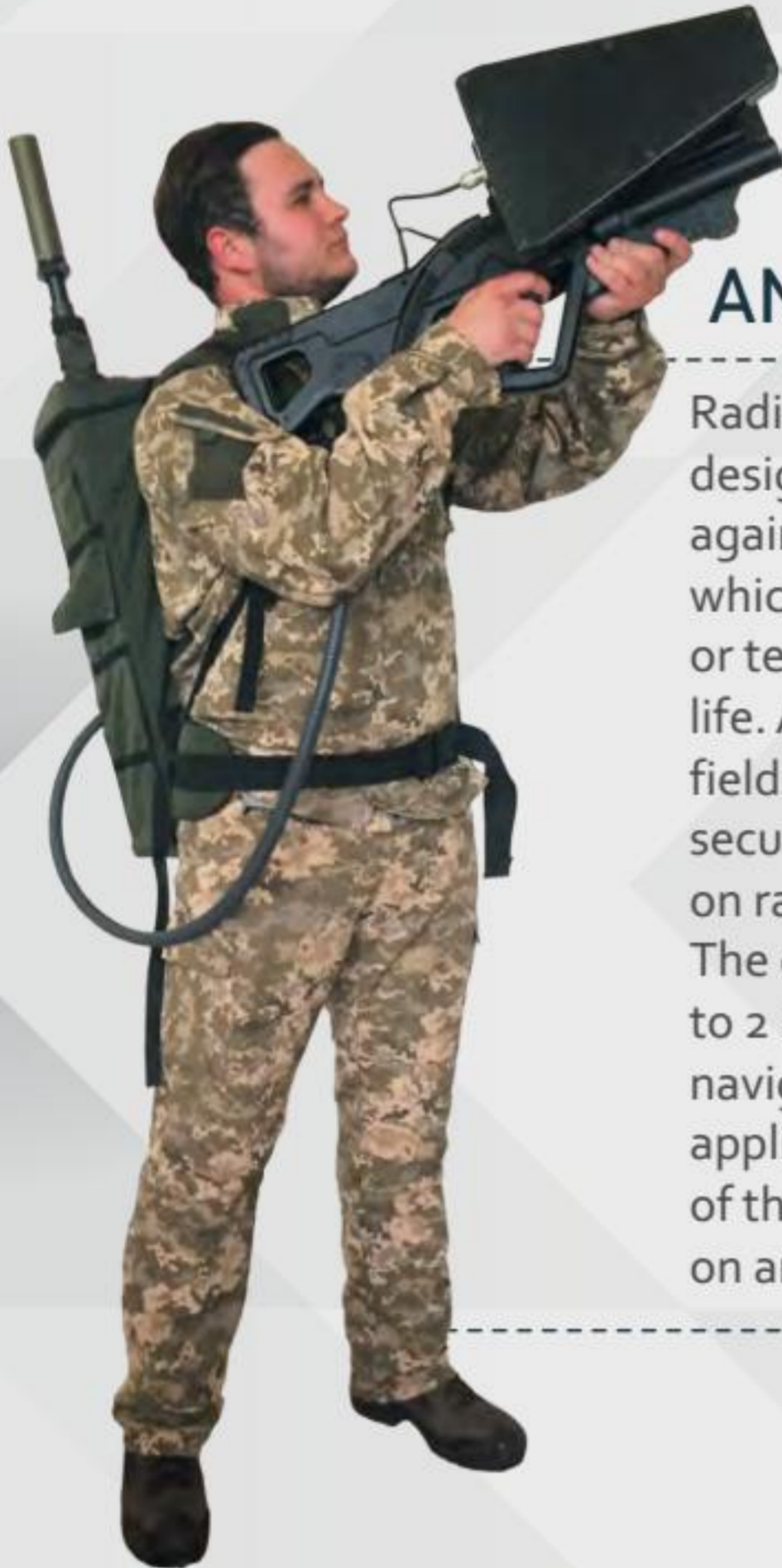
Russia is exploiting conflicts in the former Soviet Republics for consolidating its sphere of influence, because the Kremlin's integration offer is scarcely interesting for the countries in the region; the Moscow proposed integration options cannot compete with what is offered by the EU or NATO.

The Kremlin continues to regard Eastern Europe and the South Caucasus region as belonging to its exclusive sphere of interest. Moscow's continued control over the countries in this region poses a threat of a considerable delay for those countries' ambitions to achieve membership in European and Euroatlantic organizations. To Russia, the integration of the Eastern European and South Caucasus countries into Western institutions poses a threat of these countries becoming irreversibly cut off the "navel cord" that once bound them to the USSR, and of Russia's geopolitical influence being pushed out from this part of Europe. 

**Oleksiy SERDIUK,**  
For UDR



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 2 km. Additionally, the whole field of interferences to UAV's navigation channels up to 5 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	shell caliber.....from 4,5mm
transmitted power .....≤ 50 mW	power source.....12V
velocity range.....10 - 2000 m/s	overall dimensions.....250x170x130 mm
measurement error.....≤ 0,1%	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 км/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.

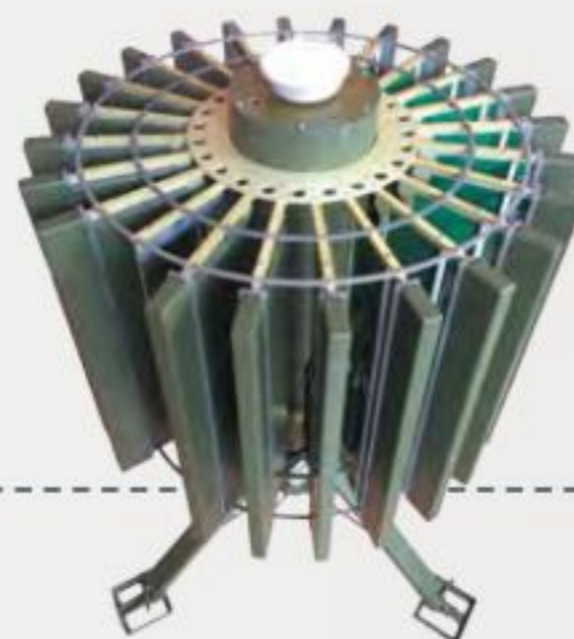
Complex «Polonez» includes: reconnaissance complex «Jab» and jammer complex «Anklav» combined by common algorithm of tasks handling with the help of specially developed software protocols.




## 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.....> 20 km  
azimuth range.....360°  
elevation range.....ap to 40°  
weight.....80 kg







70-year-old Viktor Frolov, whose property in the village of Novoluhanske was hit by a stray Russian rocket (laser-guided artillery round "Krasnopol") on February 14, 2019

# WHAT MILITARY TECHNOLOGIES RUSSIA IS TESTING IN UKRAINE

It's no secret that the 'hybrid' aggressive war being waged by Russia in Ukraine is exploited by the military clique in Moscow for purposes of performance and capability validation of their new military technologies and for updating and improving the tactics for

their use in battle. The results are then incorporated into personnel training programs of Russia's military and security forces, and also used in events for improving market potential of the weapons products that Russia offers for export markets. This policy by Russia will, sooner or later,

eventually bring members of the country's military and political establishment on trial at the International Criminal Court. Meanwhile, the Kremlin is building up evidence against itself thus nearing the day when Russia's senior most officials will be brought to justice.





Debris of a 152-mm artillery round 'Krasnopol' found at Ukrainian positions attacked by Russian artillery on April 5, 2019

## "HYBRID" FORCES AND EQUIPMENT

Russia has deployed enormous amounts of weaponry, including armored vehicles, artillery guns, air defense systems, ELINT/SIGINT systems, EW/ECM assets, UAV drones, small arms and sniper rifles, and other Soviet legacy and Russian military capabilities to Russia occupied areas in Ukraine's Donetsk and Luhansk regions. The weaponry is operated by the operational group of Russian forces deployed in areas of Donetsk and Luhansk oblasts illegally occupied

by Russia. The operational group is largely manned with personnel of the 1st and 2nd Army Corpses, the 8th Army, Southern Military District of the Russian Armed Forces.

According to estimates by Ukrainian intelligence sources and analysts, Russia has illegally deployed in Ukraine 475 battle tanks, some 1,000 armored fighting vehicles, over 600 heavy artillery guns and more than 200 multiple launch rocket systems.

While major Russian weapons deployed in Ukraine are mostly Soviet legacy technologies, a substantial portion of war waging assets that enable

dominance on the battlefield – communication facilities, ISTAR and EW/ECM assets etc – are all cutting-edge technologies developed and produced by Russian companies.

In the Donbas conflict area, Soviet legacy weapons are primarily deployed forward, while the post 1990s generation Russian armaments are deployed in rear areas and brought into action in critical situations only.

There are two reasons for this. One is that locals that have to join the ranks of the 1st and 2nd Army Corpses of the Russian Armed Forces enjoy little confidence from their commanding Russian officers. The other is that commanders of the intervention force and senior members of Russia's military and political establishment well understand that any registered presence of Russian weaponry in the Donbas areas uncontrolled by Ukrainian authorities, especially by OSCE observers, would add up to the evidence of Russian military presence, in contradiction to Russia's official statements regarding the situation in eastern Ukraine. For that reason Russian forces keep these weapons meticulously camouflaged and limit their use to exceptional circumstances.

That being said, the most recent military technologies the Kremlin deployed in those Ukrainian areas are exploited for testing and evaluating their capabilities in real-world combat scenarios as well as for reasons of intimidation and military strength display. Thus, four instances of Russia-sponsored forces launching 152-mm guided rockets Krasnopol from 2A65 "Msta" howitzers have been reported over the period since 30 April 2018.

On several occurrences, the rockets were launched against targets that are not intended to be defeated with this type of 'smart' munitions, which are designed specifically for engagement of important targets, which not always was the case. On one occasion, one such rocket was fired at a residential building. On 14 February 2019, a Krasnopol rocket was reported by Ukrainian soldiers to hit property owned by Viktor Frolov, on the outskirts of the village of Novoluhanske.

The smart round KM-8 "Gran" has also been reported to have been used for testing and evaluation purposes by the Russian forces. →





Russia's orbital communication jamming system Tirada-2 being tested in the Donbas conflict area. The presence of this modern electronic warfare capability in eastern Ukraine was documented in a report released by the OSCE Special Monitoring Mission (SMM) on 16 March 2019. As an interesting note, the Tirada-2 had not yet been officially adopted in Russia's armament at the time of this report. Image credit: OSCE

## NEW WEAPONS OF "HYBRID" WAR

The Russian army gives high priority to equipping its intervention forces with capabilities that enable dominance on the battlefield, like communications and battle command systems, ISTAR and ECM equipment, and UAV drones among other things. And these are all the most recent technologies developed and produced by Russia.

In particular, military command and control centers Russia deployed in its occupied areas in Ukraine are all equipped with cutting-edge communications capabilities and fully integrated into the C4I network of the Russian Armed Forces.

More specifically, the 1st and 2nd Army Corpses use the Russian-produced telecommunications capabilities as listed below:

- Command-and-staff vehicles R-149BMR "Kushetka-B" built on the chassis of the BTR-80 armored personnel carrier and the R-142N based on the GAZ-66 chassis;
- Wide-band radio communication systems R-161A2M "Equator-3M" based on the ZiL-131 chassis; brand new satellite phone system "Auriga"; KX-band radio communication systems R-129, R-130,

and R-131 (based on wheeled and armored tracked chassis), R-143 (man-portable);

- Brand new, jam-resistant secure VHF radio systems R-187P1 "Azart" and R-392ARK "Arakhis";
- Legacy VHF radio systems R-123/173 on armored vehicle chassis, R-159 (man portable), and China-produced Bao-Feng.

In Russia-occupied territories, there are also deployed radio-radar capabilities for various purposes:

- Engagement radar in the ZRK-9K33 "Osa" air defense missile system;
- Counter-battery radar 1L219M "Zoopark-1";
- Gunfire spotting/damage assessment radar 1L271 "Aistenok";
- Man-portable, ground surveillance radar systems 1RL133 "Monitor-M" (PSNR-5) and 1RL120 "Credo-MG" (PSNR-8);
- Man-portable, short-range ground surveillance radar systems 1RL-136 "Fara" (SBR-3) and 1L11 "Fara-G" (SBR-5).

The 1st Army Corps has recently fielded the radar system 1L22

"Soboliatnik" which is intended to be used for search and detection of mobile and static targets on land and at sea in zero-visibility conditions, as well as aerial targets flying at low altitudes, and it can be used also for gunfire spotting roles. Officially ac-

cepted into the Russian Armed Forces inventory in 2014, the Soboliatnik already has a history of deployment in the Donbas conflict area.

Radio-radar capabilities of various kinds and purpose also have seen an extensive use by Russian forces in the Donbas conflict area, two such being the air defense radar systems 51U6/35N6 "Kasta-2-G" and P-151RL13 "Tropa"

A special mention should be made about the various electronic warfare capabilities Russia deployed in its occupied areas in eastern Ukraine. Reports from Ukrainian military sources indicate that electronic warfare (EW) operations are the responsibility of the Company-size EW subunits within the 1st and 2nd Army Corpses, equipped with legacy Soviet and Russian-produced EW capabilities. As well as those EW subunits, there are deployed mobile EW teams from independent EW battalions 8A, Southern Military District and 20A, Western Military District of the Russian Armed Forces. These teams are fielded with brand new EW/ECM capabilities such as the SPR-2M "Rtut-BM", 1L269 "Krasukha-2", RB-109A "Bylina", and "Repellent".

UAV drones of various sizes and purpose have also been deployed and extensively used by the intervention force, primarily for purposes of aerial surveillance of the battlespace and for other roles that include Theater and battlefield surveillance, gunfire adjustment, and impact analysis when firing from mortars, artillery guns, and multiple-launch rocket launchers. Major types of UAV drone capabilities fielded with the adversary force are the Theater surveillance UAVs "Orlan-10" and "Forpost", and battlespace surveillance UAV systems "Granat", "Tachyon", "Zastava", and "Zala-421-08".

## EVIDENCES OF IMPRESCRIP TIBLE CRIMES OF WAR

There has been gathered a compelling evidence base for the International Criminal Court. Hundreds of Russian-produced military technologies have been reported illegally deployed in eastern Ukraine. Russia continues deploying its newly developed weaponry and equipment to its occupied areas in Ukraine's Donbas region,



which are then used to verify and validate their performance and capabilities in real-world combat operations and for user training purposes.

According to Ukrainian military sources, the following capabilities have been deployed to Ukraine and fielded with the 1st and 2nd Army Corpses, Southern Military District of the Russian Armed Forces, in the period since September 2014:

- Main battle tanks T-72B/BA/B3/C1;
- Armored fighting vehicles BTR-82A, BTR-80 equipped with TKN-4GA sighting devices; BDM-2 GIL; armored vehicles "Rys", "Tiger", GAZ 3937 "Vodnik"; KamAZ-43269 "Vystrel", "Mustang";
- Artillery gun systems: 2B16 "Nona-K", 2S7 "Pion", 2S1 "Gvozdika", 2S3 "Acacia", 2A36 "Giatsint-B", 2A65 "Msta-B"; laser-guided artillery rounds 2K25 "Krasnopol";
- Multiple launch rocket systems: "Grad", "Smerch", "Tornado"; surface-to-air missile systems "Buk-M1", "Pantsir-SG", "Strela-10"; radar systems "Kasta-2E2", launch control kits "Barnaul-T" used in short range air defense systems; MANPAD systems "Verba";
- Beyond that, substantial amounts of Russian-produced weapons and equipment have been deployed for

use by specialist subunits of the intervention force, which include:

- Anti-tank warfare subunits: anti-tank guided missile systems 9M133 "Kornet";
- Electronic warfare subunits: EW systems R-330 "Zhitel", SPR-2M "Rtut-BM", RB 34IB "Leer", R-378B "Borisoglebsk-2", 1L269 "Krasukha-2", RB-109A Bylina", "Repellent";
- ELINT/SIGINT subunits: ELINT systems 1RL243 "Rubicon" and "Orion"; SIGINT systems "Thorn-MDM" and RB-636AM2 "Svet-KU", electronic jamming system "Repellent-G";
- Aerial surveillance subunits: UAV drone systems "Orlan-10", "Granat", "Tachyon", "Aileron", "Zastava". Aerial surveillance missions are also performed with UAV drones "Forpost" launched from the Russian territory;
- Communications subunits: R-166-0,5 radio communication systems based on the K1Sh1 chassis; radio systems R-441-OV "Liven", radio systems R-161A2M "Equator-3M", jam-resistant secure VHF radio systems R-187P1 "Azart" and R-392ARK "Arakhis";
- Operational/combat support subunits: anti-personnel mines PMN-2 (proximity-activated explosive mines NVP-P "Okhota", MON-50/100).

## ENDNOTES

Contrary to the Kremlin's official statements that Russian military personnel and new weaponry technologies are not present in the Donbas conflict area, there has been gathered a sufficient amount of evidence of Russia waging an aggressive "hybrid" war against Ukraine, which amounts to a crime that falls under the jurisdiction of the International Criminal Court, The Hague.

At official marketing events for promoting Russia's new weaponry products for export to the International market as part of work with its traditional customers, the fact that the products saw combat in real-world scenarios in Donbas and Syria is often advertized by Russian officials as a competitive advantage. It's important to note that executives of Russian arms trade entities and their customers both should be prepared to face trial at the ICC, The Hague – at least, as being eye-witnesses to the crimes committed by a multinational criminal group, which the Russian military and political establishment actually is, with a high probability of being later transformed from eye-witnesses to accomplices in crime. UDR

**Analysts team,**  
Defense Express



Russian soldier holding in hands Russian-produced "Aileron" drone. One such was downed in the Svitlodar Bulge area by members of the Ukrainian National Guard's Azov Regiment on March 1, 2019



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



**BARYER** | VEHICLE-CARRIED LOG-RANGE ATG MISSILE SYSTEM



**KOMBAT** | GUIDED MISSILE ROUND



**KONUS** | GUIDED MISSILE ROUND



**FALARICK 105** | 105 MM GUIDED MISSILE ROUND



**STUGNA** | GUIDED MISSILE ROUND



**FALARICK 90** | 90 MM GUIDED MISSILE ROUND



**KORSAR** | MAN-PORTABLE ATG MISSILE AND LAUNCHER



Type of carrier platform | Missile mass | Missile diameter | Missile length



# DEVELOPER OF ANTI-TANK SYSTEMS IN UKRAINE



**7,5 km**



**800 mm**

**5 km**



**800 mm**



Light portable  
missile system  
Corsar

**5 km**



**750 mm**

**5 km**



**700 mm**

**5 km**



**550 mm**



Man-portable  
rocket grenade  
launcher

**5 km**



**550 mm**

Man-portable  
ATGW system Skif



**4 km**



**550 mm**

**2,5 km**



**550 mm**

Armor penetration capability



# UKRAINE HAS CREATED NEW MISSILE SYSTEMS

THAT ARE BEING PROCURED BY ITS ARMED SERVICES AND ALSO OFFERED TO POTENTIAL EXPORT CUSTOMERS

**F**or five years now, Ukrainian Armed Forces have successfully faced up to the military might of Russia who is waging a hybrid war against Ukraine. Russia has unlawfully captured the Crimean Peninsula from Ukraine, and there remains a constant threat of Russia intensifying its military activity against Ukraine, on land and at sea.

Russia's aggressive actions have demanded a prompt, adequate response from Ukrainian defense industries. New armament products have been developed which can help Ukrainian forces nullify the adversary's numerical superiority in land and sea operations. Ukraine opted to focus on indigenous development and production of precision-attack missile systems. Some have already successfully passed through the official trials and qualification process and begun to be fielded on the battlefield. Following are descriptions of two of the most advanced and capable weapons products developed in Ukraine recently – the Multiple Launch Rocket System (MLRS) "Vilkha" and the mobile anti-ship cruise missile (ASCM) system "Neptune".



## MLRS SYSTEM "VILKHA"

Developed by the State Enterprise KB Luch R&D Company, Kyiv, the Vilkha has successfully completed the full cycle of the official trials and qualification process, has been officially accepted into service and begun to be fielded with artillery battalions of the Ukrainian Army.

The Vilkha is the most capable MLRS weapon system currently in military use in Ukraine. It is designed to combine excellent multifunctionality, maneuverability, probability of success, operational reliability, accuracy and lethality in a single system. The Vilkha offers a sufficiently long range and high lethality against personnel targets as well as field fortifications and armored targets. It provides





lethality proportional to theater-ballistic missile weapons.

The Vilkha has been developed out of the legacy Russo-Soviet 300-mm MLRS technology 9K58 "Smerch". In terms of terminal effectiveness, 300-mm MLRS weapons are sometimes argued to be able to rival even with tactical nuclear weapons. One Vilkha vehicle can launch a salvo of 12 rockets/missiles to targets distanced at 70 km. A single salvo can demolish almost everything on an area of 67 hectares, which is roughly equal to 100 football fields. At attack of just a single Vilkha would be sufficient to destroy all enemy airplanes and helicopters on an airfield, and six would disrupt an offensive of a brigade-size mechanized or tank force.

The Vilkha rocket/missile is designed such as to be suitable for launch from the 9K58 Smerch launcher tube.

The Vilkha MLRS Project is a collaboration of about a dozen and a half domestic companies who have contributed herein their proprietary technology solutions, with no dependence on foreign suppliers for structural components and subsystems.

The Vilkha missile weighs ~800 kg, of which ~500 kg consists of a jet engine, ~250 kg of warhead, and ~70 kg of guidance and control kit. The engine gives the missile a speed of 1,200-1,300 m/s (which exceeds Mach 3) during the boosted phase of the flight, and ~Mach 3.4 is achieved at the terminal phase of flight. The munition has a highly maneuverable flight capability that reduces the probability of intercept by anti-missile system, making it virtually immune to enemy air defense attacks.

The Vilkha rocket would deliver its warhead to a range of 70 km with a CEP of 10-15 m, and can achieve accuracies that approach zero meter CEP, as evidenced on many occasions by the results of earlier test launches.

As well as excellent accuracy, the Vilkha is advantageous over its Smerch original in that, in the terminal phase of flight, multiple Vilkha rockets launched in a single salvo can be dispersed and guided independently of each other and toward different



targets. Each rocket would defeat its designated target of known location preloaded into its "brain". Twelve rockets launched simultaneously at a certain common angle would disperse within a ~1.5 km radius. The rockets can be fired individually or in ripples of two to 12.

The Vilkha is equipped with an automatic launch capability that allows a significantly shorter time for inputting target-specific ballistic and targeting data into each missile and for pre-launch preparations. The aiming of missile launch tubes in azimuth and elevation has been made much easier as well.

The Vilkha is designed with a shoot-and-scoot capability. The GPS and targeting data downloading op-

erations would be performed while at the firing position, but reloading would typically take place a few kilometers away from the firing position to avoid counter-battery fire. A full load of 12 missiles takes 48 seconds to deliver, and the system can be packed up and ready to move in 3-4 minutes. All 12 launcher tubes would take 20 min to reload using a transporter/transloader craned vehicle with 12 stowed missiles/rockets.

An extended-range rocket designated Vilkha-M has been developed to enable ranges up to 120 km without compromising accuracy. With this longer-range capability at hand, targets can be engaged from defilade under ECM conditions. →



On a parallel track, projects are being pursued to replace the currently used wheeled Vilkha vehicle of non-Ukrainian origin with a domestically manufactured platform, and to set up domestic production of launcher platforms for 300 mm MLRS rockets.

Thanks to the knowledge, experience and passion of the Luch engineer team, Ukraine's armed services now have in possession a new weapon capable of the multiple functions inaccessible to legacy MLRS weapons originating in the Soviet Union.

Vilkha's capabilities, which have been verified and validated during the official trials and qualification process, are going to become a key component to Ukraine's future enhanced "missile shield and sword".

### MOBILE ANTI-SHIP CRUISE MISSILE (ASCM) SYSTEM "NEPTUNE"

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 RK-360MTs '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 positioned 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.

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 launchers USPU-360 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 KB Luch R&D Company, 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, Telectart-Prybor, UkrInMash, Ukrainian Armored Vehicles, 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 rocket, while being cheaper to buy, exhibits performance capabilities rough-

ly on a par with 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 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.

Overall, the procurement of new missile products developed and produced by SE KB Luch would provide Ukrainian forces with a capability to engage, with a 100 percent probability of success, targets of a technologically developed adversary, in severe air defense and ECM environments. **UDR**

**Serhiy ZGHURETS,**  
Defense Express





# TRADE FIRM «PROGRESS»

the Oldest Exporting Company  
in Ukraine



**P**rogress 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.



Corsair man-portable missile & launcher system



**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 sub-assemblies 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 rigidity.

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 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



UAR-10

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.

**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.

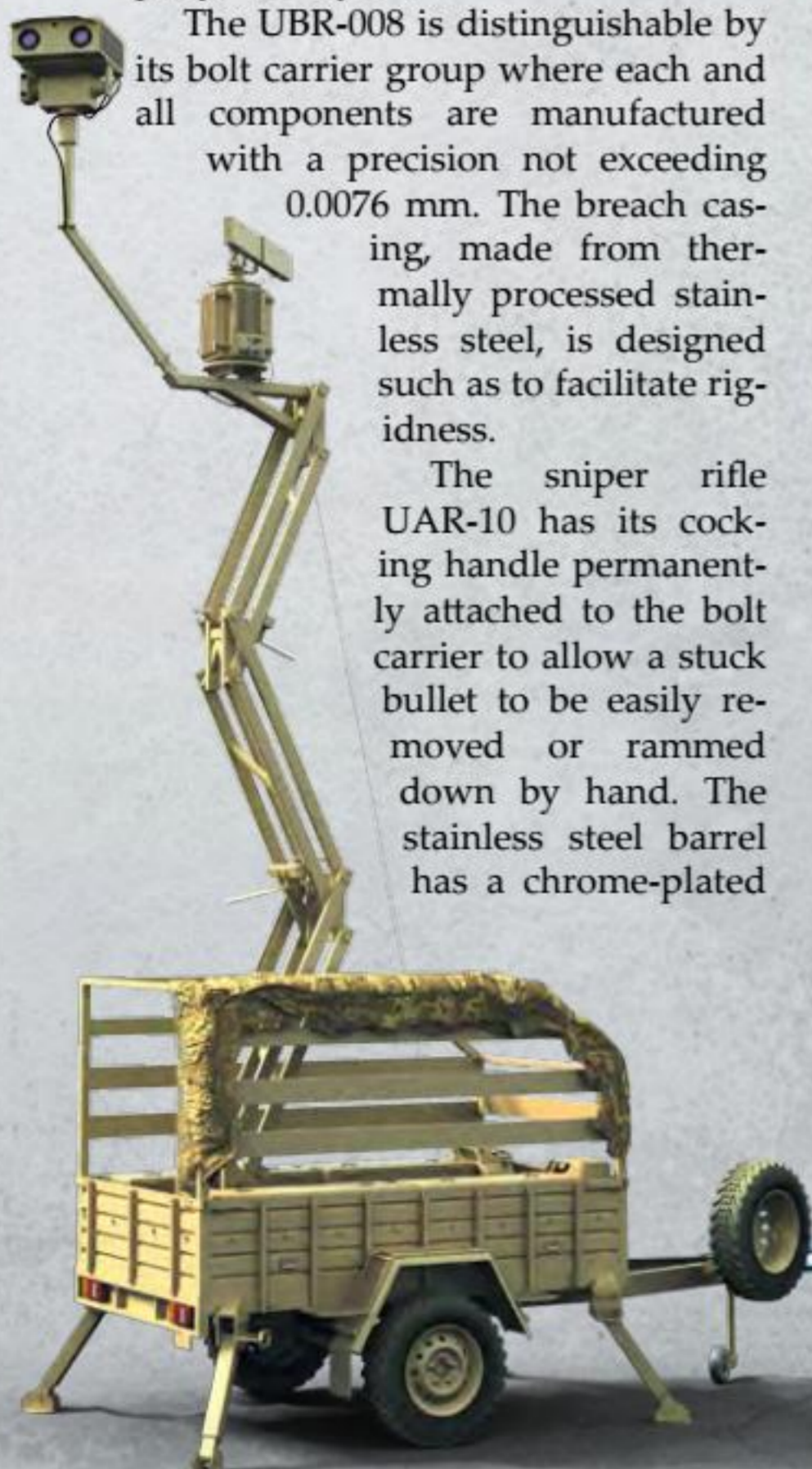
**We invite potential partners to dialogue on future opportunities and collaboration.**



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Mobile Radar Facility "KHARZA"





# A NEW LEASE OF LIFE FOR THE 2K22 TUNGUSKA

DEFENSE TECHNOLOGIES OFFERS ITS NEW CAPABILITIES FOR OVERHAUL, MODERNIZATION AND UPGRADING OF WEAPONS FOR AIR DEFENSE

**P**rivately-run Defense Technologies company, based in Nizhyn and Odesa, is the leading company in the overhaul and upgrading of air defense equipment in Ukraine. Defense Technologies is selling Tunguska air defense systems, overhauled and upgraded, to both domestic and international customers. Defense Technologies' upgrade solution gives a new lease of life for the Soviet legacy weapon system and also allows customers to choose from a variety of upgrade packages depending on their specific operational needs.

The 2K22 Tunguska (SA-19 Grison) is a self-propelled tracked air defense weapon armed with a surface-to-air gun and missile system that combines a rapid-fire automatic cannon power and surface-to-air missile (SAM) capability. Moving along with tactical formations being protected, the Tunguska is capable of performing the full range of combat missions, from detecting for targets to destroying them with missiles or gun fire. The Tunguska was the first anti-aircraft system designed in the Soviet Union to combine autocannon power

and SAM capability. The weapon is armed with 2 x double barrel 30-mm 2A38 rapid-fire autocannons and four ready-to-fire 9M311 SAM missiles on each side. The 2A38 cannon can be operated while the carrying vehicle is moving or at rest; it is able to shoot down targets flying up to 3,000 m and out to 4,000 m. The 9M311 missiles can only be fired while the vehicle is static, against targets flying no higher than 3,500 m and no farther than 8,000 m.

Defense Technologies has implemented an integrated approach to life extension overhaul and moderniza-



tion of Soviet vintage air defense systems, which is excellently exemplified in its Tunguska upgrade. The upgrade is aimed to achieve improvements in terms of increased operational reliability, maintainability and driving performance of the carrying platform; improved ergonomics and expanded functionality of operator workplaces; and more energy efficient operation. The upgrade addresses five key points:

**1 "Smart" cells.** The air defense weapon systems operated by Ukraine's Armed Forces, including the S-300 and its modifications, the Buk and Tunguska, are all electronically sophisticated systems. In those Soviet-designed systems, control and signal generation and processing operations are performed by units and modules built on technological solutions and with electronic hardware components developed at least thirty years ago. Those modules or, as air defense experts term them, "cells" essentially cannot be replicated in modern technology solutions, since many of the semiconductor components, not even considering vacuum-tube elements, have long been out of production. In a modern air defense system, such "cells" are present in abundance and differ in numbers between systems, each being unique in terms of the mixture of hardware components used. In the S-300, for instance, there are more than 5-6 thousand such cells, each built with outdated Soviet-era electronics hardware.

Defense Technologies felt that the only feasible and possible solution



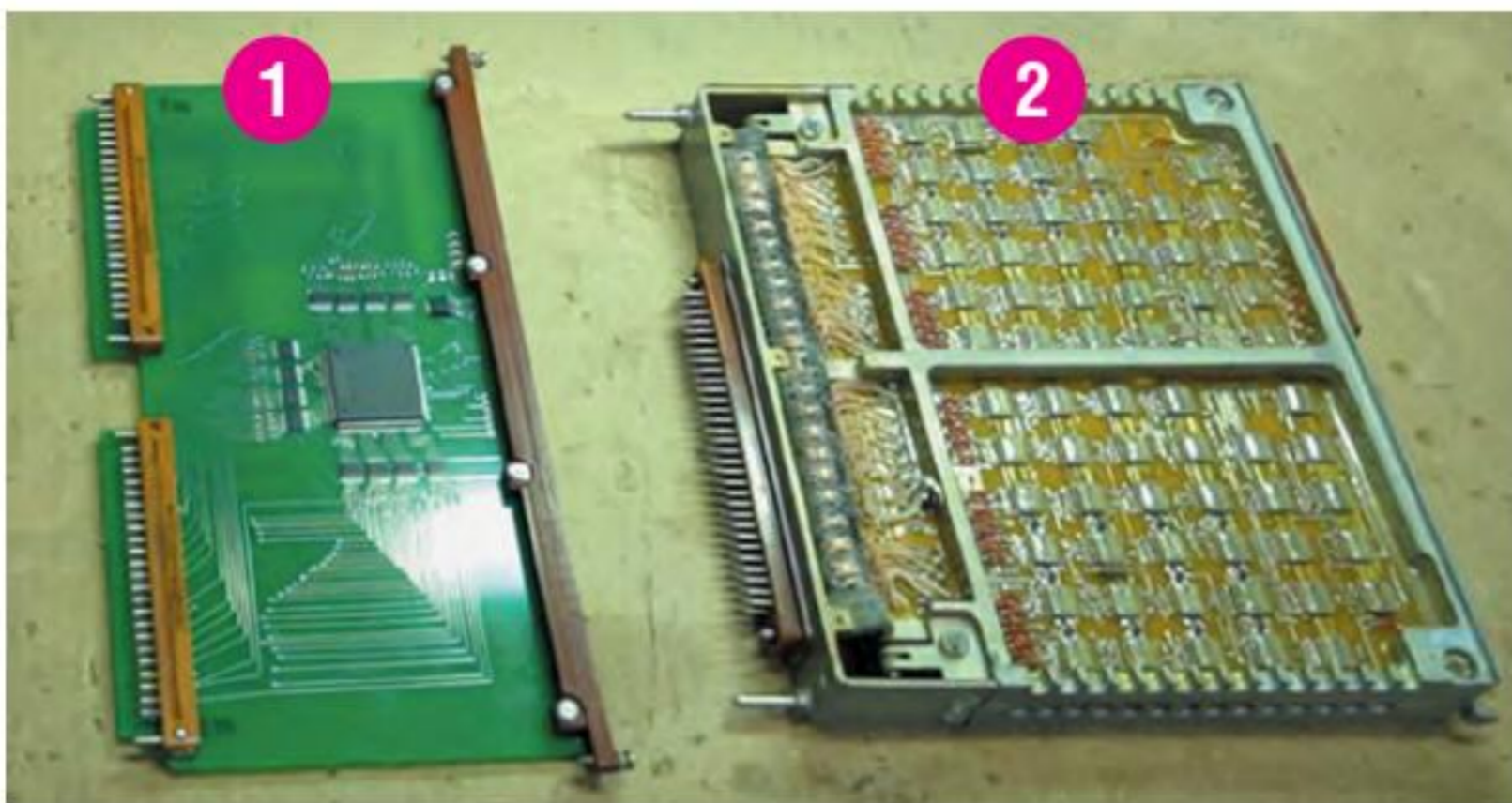
to updating and upgrading air defense equipment originating in the Soviet Union is to replicate the functionality of each and every cell. More simply, there should be a replication of the signals inputting into each of the cells, and the signals outputting from them. This issue was addressed by integrating a new module into the System. The Company developed an innovative solution that is applicable to upgrading any of the existing SAM systems. "This is an electronic circuit integrating several chips that would be made to specific Customer's requirements for vibration and temperature extremes. The circuits and chips would be adaptable to specific SAM system models. Those new cells are suitable for recording any kind of information and for processing it by the algorithms as needed. Suppose now we need Cell # 1. We would record on the module information acceptable by

Cell #1, then place it in the position of Cell #1. This would shorten overhaul time and improve reliability, since the innovative "smart" cells ensure benefits in terms of increased energy efficiency and reduced requirement for System alignment", an engineer at the Company said.

**2 New display indicator units.** The upgrade includes new display indicator units in the System control cabin. Vacuum-tube monitors that have long become obsolete and worn-out and served past their life span have been replaced with LCD display units, with the resulting benefits in terms of improved System reliability and maintainability.

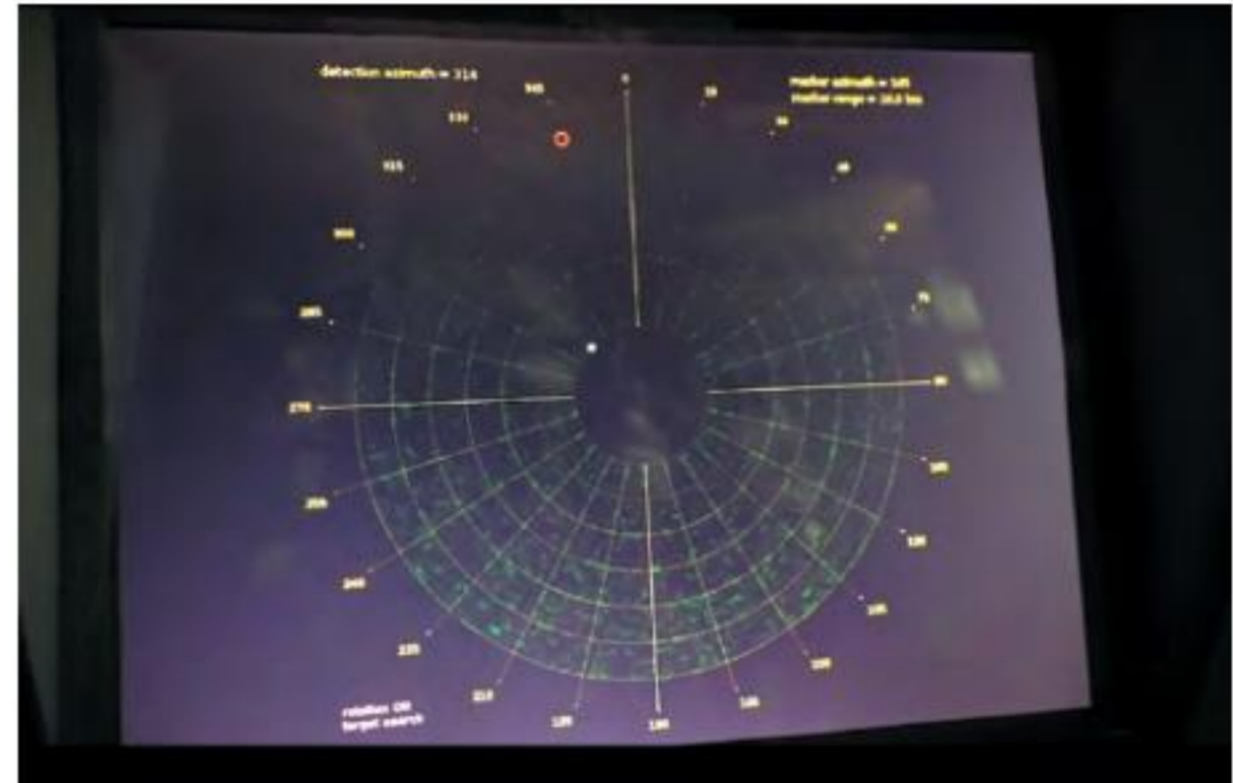
**3 Navigation and communication.** The upgrade additionally addresses improvement of navigation and GPS location measurement capabilities as well as communication capabilities. With these improved capabilities in place, the crew on each vehicle can now easily pinpoint their exact location on an electronic map, and Soviet legacy radios have been replaced with modern digital radio communication systems.

**4 Carrying platform.** The V-46 engine on the original Tunguska vehicle has been replaced with more powerful V-84 tank motor. This ensures improved off-road performance but doesn't affect vehicle driving range or its unique performance capabilities such as the ability to change hull ground clearance as needed or to keep the vehicle hull →



*Digital solutions for a SAM system: 1 - an innovative, programmable "smart" cell with integrated circuits. 2 - a standard cell in an original configuration. Tunguska vehicle's crew cockpit interior.*





Original (1) and upgraded (2) configurations – with digital display units. 3 – GPS display unit.

horizontal to the horizon line while on a static position, whatever the terrain.

**5** The 2S6 Tunguska system gets its energy from a DC generator powered by a propulsion engine or a diesel turbine. The Soviet produced turbine found in the original system was extremely fuel inefficient and had a life span of just 300 hours. In the Defense Technologies' upgrade, this is substituted for an economical and reliable diesel engine from a German manufacturer.

The Tunguska remains to be a highly capable weapon system with excellent mobility and combat capabilities, and a great potential for modernization and upgrade. It has the capabilities to detect for targets, track their trajectories and destroy them with gun fire or missiles. It is effective, among others, against small form-factor targets like UAVs that have recently become common on a modern battlefield.

Defense Technologies has developed several packages offering different levels of upgrade for the Tunguska. These packages address areas that cover "automation of operations for

target detection and trajectory tracking; optimization of crew effectiveness and improved collaboration between Tunguska vehicles. The upgrades aim to enable the vehicle to autonomously search for and find targets, then await clearance to open fire at them, and this all with minimum human intervention. This is going to be an automatic, combined gun and missile system. We are capable of and willing to do the job", the Company says.

Defense Technologies is also looking to make the system significantly more rapid. But any substantial enhancement in the System's combat capabilities can only be achieved with new missiles in place of those currently used with the Tunguska. Ukraine keeps a certain stock of SAM munitions 9M311 left behind by the Soviet era, but they are rapidly approaching

the end of their shelf-life. Ukrainian defense industries, among them Luch Design Bureau and Arsenal Factory, are looking to develop what would be Ukraine's indigenous missile for short-range air defense. This would be a bi-caliber missile that could be developed within a short timeframe leveraging the technical and technological expertise the two companies had acquired with developing their earlier missile technologies, and with key components and assemblies already tested and trialed on off-the-shelf products. This would allow a substantial reduction in time and cost of achieving an improved indigenous SAM capability for short-range air defense. **UDR**

**Serhiy ZGHURETS,**  
Defense Express





# TECHIMPEX

## RCWS SPYS-M

30 mm cannon ZTM-1 (2A72)  
7.62 mm MG PKT  
ATGM BARRIER  
Smoke grenade launcher 902B Tucha



## APC VARAN

## RCWS SPYS

30 mm cannon ZTM-1 (2A72)  
7.62 mm MG PKT  
30 mm AGL KBA-117 (AGS-17)  
ATGM BARRIER  
Smoke grenade launcher 902B Tucha



## APC SWIMMER

## RCWS SPYS

30 mm cannon ZTM-1 (2A72)  
7.62 mm MG PKT  
30 mm AGL KBA-117 (AGS-17)  
ATGM BARRIER  
Smoke grenade launcher 902B Tucha

## RCWS GUARDA

12.7 mm HMG DShKM-T (DShKM)  
30 mm AGL KBA-117 (AGS-17)



## IFV BMP-1T

## RCWS SPYS

30 mm cannon ZTM-1 (2A72)  
7.62 mm MG PKT  
30 mm AGL KBA-117 (AGS-17)  
ATGM BARRIER  
Smoke grenade launcher 902B Tucha



- ▶ WHEELED & TRACKED APC
- ▶ MODERNIZATION PROGRAMS
- ▶ CUSTOMIZED SOLUTIONS
- ▶ IN-HOUSE R&D

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# BOGDAN MOTORS



## NEW PROJECTS FOR THE ARMY

**C**herkasy Bogdan Plant (ChBP) – a new motor vehicle factory built by Bogdan Motors Corporation, a leading Ukrainian automobile-manufacturing group – is the most recent addition to the country's motor industry. By the time the factory was commissioned in 2008, construction of the factory buildings and associated industrial infrastructures had cost USD 350 million in initial investment. The ChBP has now evolved into a strong actor in Ukraine's domestic armaments market, producing vehicles for military and government customers and exploring the possibilities to break into new export markets.

Built for mass production of motor vehicles for civilian uses, the ChBP was initially focused on the assembly of foreign-brand vehicles for the needs of domestic and export customers, with yearly production amounting to the thousands.

Bogdan Motors ventured into the defense segment after the Kremlin launched military aggression

against Ukraine in 2014 and, also, in response to private-sector initiatives aimed to meet the Armed Forces requirement for automotive and armored fighting vehicles.

In the early years of war in Donbas the Ukrainian forces had to make up the shortage of wheeled vehicles they required by way of requisition from civilian organizations or emptying out strategic reserves, but this was a stopgap measure. It simply was not possible to maintain fighting capacity and logistical needs of the deployed forces without ensuring the continuing supply of modern military equipment. This brought on the agenda the need to replace the Army's fleet of Soviet legacy (i.e. Russian produced) wheeled vehicles that are still in use by the Ukrainian forces deployed in

Donbas. The goal was to phase out those vehicles, which are liable to failure due to having become obsolete and worn-out,

to be replaced with domestically produced, more current-generation counterparts, with due account taken of the needs and demands of potential military users.

In 2014, Bogdan Motors launched R&D projects to develop military vehicles in several categories. One was a modern armored personnel carrier – speedy, highly maneuverable, and offering a sufficiently high level of armor protection for the crew and passengers. The Company developed its lineup of APC vehicles named BARS. The first vehicle in the lineup, the BARS-6 was subjected to multiple upgrades and modifications, which resulted in what is now known as BARS-8 – an armored multipurpose platform that is suitable for use by all armed service branches that may require it for their standard missions. The BARS-8 vehicle incorporates parts from a world renowned supplier, which are all proven technologies that are currently operated in all climatic and geographical environments across the globe.

The BARS-8 APC technology has been used as the baseline for development of the mobile 120-mm mortar system BARS-8MMK and the counter-battery radar vehicle BARS-8AR, which both have been developed

BARS-8 APC





by Bogdan Motors through collaboration with UkrOboronService.

In 2016, Bogdan Motors began R&D on the medivac vehicle Bogdan-2251, which was needed to replace its Soviet legacy counterpart, the UAZ-452 that has become outdated and outworn. The initial shipment of Bogdan-2251 medivac vehicles was delivered to the Armed Forces medical services in June 2017.

The Bogdan-2251 vehicle and its patient compartment had both been subjected to continuing upgrades based on user inputs during its first year of deployment. This resulted in an improved and enhanced version that began to be fielded as early as in 2018. There had been no serious warranty complaints filed with regard to the performance of the Bogdan-2251 medivac vehicle over that year.

Truck vehicles is another category of vehicles that Bogdan Motors develops and manufactures. In 2015, ChBP set up an assembly line to assemble the trucks Bogdan 6317 using knock-down kits sourced from an international supplier, and initial deliveries to deployed forces began in 2016.

The Bogdan 6317 was then modified to accept the Weichai Power engine, which was needed to attain a higher level of commonality within the Armed Forces' truck inventory. Bogdan Motors also proposed changes to the knock-down kit, which required a minimum amount of re-design to be made in the vehicle's chassis. The modified and upgraded version, the Bogdan 63172 successfully passed through the crucial governmental trials that revealed only minor drawbacks to be repaired. The Ukrainian military has thus obtained a new truck vehicle, the Bogdan 63172, equipped with a powerful, reliable engine, the Fast Gear transmission, and the Turkish-produced clutch Hummer.

The Ukrainian Armed Forces have the highest requirement for truck vehicles, given that 80 percent of the existing fleet is outworn and outdated. The new trucks are intended to be deployed with the field Army units, primarily artillery and logistics units.

In response to a requirement from the Ukrainian military, Bogdan Motors has also developed a multipurpose off-road vehicle, the Bogdan-2351, →



Bogdan-2351



Bogdan-2251 medivac vehicle



Bogdan 3355





Bogdan 5317



Bogdan 6317

which has already passed through governmental trials and has been cleared for user evaluation. The initial shipment came to the Armed Forces in 2018 and received very positive feedback from military personnel in the field. The Bogdan-2351 has been put in service with C2 and logistics units, counter-battery units and other users requiring light motor vehicles with high-speed off-road capability.

In 2018-2019, the Bogdan 3355 and Bogdan KM-450 vehicles have succeeded through the crucial phase of the governmental trials process. Both have been developed to replace the Soviet legacy military truck GAZ-66 that is still in operational service with the Ukrainian Army.

The KM-450, a light utility truck produced under license by Bogdan Motors, has been in military use in 29 countries. In Ukraine, the KM-450 has been produced with some changes made to its design, aimed to meet specific requirements of Ukrainian military users and to expand its operational capabilities. The vehicle is intended to be used by artillery and communication units, and for light cargo roles.

The Bogdan 3355 has been developed as a modern replacement to the GAZ-66. Bogdan Motors is looking to modify the vehicle for the medivac roles that used to be performed with the Soviet legacy AS-66 vehicle.


In 2015, Bogdan Motors did a huge amount of work developing a full lineup of universal, standard truck bodies. Overall, bodies in seven different configurations have been developed using structural frames that had earlier been proven in the construction of bus and trolley bodies and, later,

in rugged and durable construction of the patient compartment in the Bogdan-2251 medivac vehicle.

The military vehicles produced by Bogdan Motors have all been designed to have a substantial export potential. Unlike many of their international rivals, Bogdan Motors' vehicles have been proven and tested in real-world combat operations. Over the years in this field, Bogdan Motors has acquired a unique experience in developing and improving military vehicle technologies for various purposes to address the evolution of the modern battlefield.

The lineup of motor vehicles being produced by ChBP could be considered to be promising for use by military and security forces of the countries keeping large inventories of Soviet equipment. Ukrainian experience proves that procurement of Bogdan-63172 and Bogdan-53162 vehicles is a suitable and cost effective option for the armies looking to modernize their logistics operations, and it also ensures the minimum time and cost of adapting the existing maintenance infrastructures and practices to the new vehicles.

In the field of special-purpose vehicles, Bogdan Motors would offer its Bogdan-2251 and Bogdan-2351 vehicles that have already fared well in combat and never received any serious complaints from users while under warranty during all of 2018.

Bogdan Motors has had as its prime goal not just to supply the Customer with modern equipment it requires, but also to continue with R&D to ensure the vehicles it makes are more capable, more reliable, more durable, more fault-proof, and less prone to failure. Over the years in development and production, Bogdan Motors' medivac vehicle, for example, has gone through three upgrades from the initial design; heavy-load off-road trucks have received two upgrades; and BARS-series APCs, beginning from the first prototypes through to the test proven models, have gone through seven evolutions. Even the multipurpose off-road vehicle Bogdan-2351, which received no serious user complaints during its first year of operational use, would be subject to several changes to its design in 2019, to be developed based on inputs from deployed military users. 





## MAIN BATTLE TANK BM «OPLLOT»

The modern Ukrainian tank BM OPLLOT is intended for effective day/night combat use, in difficult geographic, climatic and weather conditions, including high ambient temperatures and high dust level. The design of the tank includes: a powerful multi-fuel engine 6TD-2, a reversing transmission with an extended speed range and an integrated movement control system, an auxiliary power unit for tank power supply with the main engine off, a unique explosive reactive armour protection against tandem HEAT and APFSDS projectiles, and effective complex detection and optical-electronic suppression system of the enemy's guidance and sighting devices, modern sighting and observation complex with thermal imager, digital ballistic computer, and navigational support system, the possibility of destroying targets with missiles at a distance of up to 5 km, without entering the affected area.



### THE BM OPLLOT TANK MAIN SPECIFICATIONS

Main gun caliber.....	125 mm
Combat weight.....	51 t
Crew.....	3 members
Engine power.....	1200 hp
Power-to-weight ratio.....	23,5 hp/t
Temperature mode.....	- 40 ... + 55°C
Speed.....	Up to 70 km/h
Reverse speed.....	Up to 31,3 km/h

## 6TD-2 - THE UP-TO-DATE DIESEL ENGINE OF 1200 HP EFFICIENCY

The 6TD-2 is the two-stroke multi-fuel 6-cylinder diesel engine with opposed pistons, liquid cooling, with direct fuel injection, supercharging compressor with mechanical drive and driven by a gas turbine. Practice of this engine and its modifications usage showed that it belongs to the most advantageous designs among the tank engines of the main worldwide manufacturers including the power-to-weight ratio index. Due to the compact design the minimum space compartment is required for its placement in comparison of it with any other engine of the same class. A number of unique design solutions allows the engine to operate at an ambient temperature of up to 55°C without any reduction in power.



### THE 6TD-2 ENGINE MAIN SPECIFICATIONS

Maximal power.....	1200 hp
Rotational velocity at maximal power.....	2600 rpm
Weight.....	1180 kg
Specific fuel consumption.....	160 g/hp h
Dimensions: length, width, height.....	1602x955x581 mm

## BTR-4

The BTR-4 is an 8x8 amphibious armoured vehicle. The armoured personnel carrier has been designed as a basic vehicle for a new generation of wheeled armoured vehicles.

The design and layout of the BTR-4 make it possible to develop versions that feature by different protection levels and various weapons, without having to dramatically redesign the baseline vehicle. As a result, the BTR-4 can be used in mechanised infantry units as an armoured carrier or as a wheeled infantry fighting vehicle.

The big payload volume of the hull makes it possible to accommodate various equipment when developing support and utility vehicles. In contrast to the similar vehicles produced previously, much consideration is given to the comfort of the crew and vehicle-borne troops.

BTR-4 participated in real combat operations, whereafter a number of improvements were introduced into the design.



### THE BTR-4E VERSION MAIN SPECIFICATIONS

Weight .....	21.9 t
Crew.....	3
Vehicle-borne troops.....	7
Dimensions.....	7878x2965x3050 mm
Main armament.....	automatic gun (30 mm), ATGM
Engine output.....	500 hp
Maximum speed.....	road - 110 km/h, water -10 km/h
Cruising range.....	700 km







# IR VS IR CONTENTION

## INFRARED COUNTERMEASURE SOLUTIONS BY ADRON

**A**ir-to-air (AAM) and surface-to-air (SAM) guided missiles have now become the most effective and common weapon used in combat against airplanes, helicopters and other aerial targets. As suggested by the experience of regional conflicts and wars of the past decade, over 80 percent of aircraft, helicopters, and unmanned aerial vehicles lost in combat are from IR SAMs. Combat aircraft are especially vulnerable to attacks with IR-guided missiles launched from man-portable air defense systems (MANPADS).

IR guidance technologies have in recent years achieved high levels of maturity and sophistication, especially in terms of electronic counter-countermeasures (ECCM) capability. Along with active Infra-Red Countermeasures (IRCM) jamming systems, used to add modulated IR energy to the IR signature of an aircraft to confuse IR guided seekers, false heat targets, e.g. IR flares, usually pyrotechnic, that are released from the aircraft to confuse the IR seeker of the incoming missile and decoy it away from the target aircraft, have also seen a widespread use recently, particularly due to advantages such as low cost, affordability, simplicity and effectiveness of operation.

As recently developed IR guidance systems are receiving increasingly ef-



fective ECCM capabilities, many within the expert community began talking about the end of era of IR decoy flares. Adron, however, disagrees, believing that IR flare countermeasures remain and will continue to remain an effective means for protection of aircraft against both the current and earlier generations of IR guided missile threats.

### IR COUNTERMEASURE FLARES BY ADRON

High-temperature flare countermeasures can be made more effective by employing advanced techniques and patterns of their use. Previously,

flares used to be sequentially released one by one at intervals of several seconds. Now the trend is toward IR flares being released in ripples to ensure that the IR signature of the target aircraft becomes "blurred" against the background of one or several infrared fake target clouds. This technique, while being effective enough, requires a large number of decoy flares to be carried by the aircraft.

### ADRON'S APPROACH TO AIRCRAFT SELF-PROTECTION

Adron, a R&D and production firm based in Kyiv, offers an approach where a certain number of



flares are released such as to make them dispersed in the air in such a pattern as to confuse and distract the missile seeker away from the true target. Upon release, the flares are supposed to generate an IR source that would be distributed energetically and spatially in such a manner as to make the missile seeker believe it to be the true target.

In modeling spatial, energy, and trajectory features of a target aircraft, decoy flares should be launched in "intelligent" ripples where flares would have different characteristics of IR energy output, air drag coefficient and related rate of speed loss; the time intervals between sequential flare launches in a ripple mode should be such as to confuse amplitude, spectral and trajectory selectors in modern IR guidance systems. The flares could be launched from dispensers of 26 mm/50 mm calibers.

In the 26/50mm caliber category, Adron offers its developed dual-caliber flare dispenser system KUV 26-50 being serially produced by DAHC "Artem" holding company. The KUV 26-50 system consists of a control/indicator panel and from two to thirty holders pre-loaded with two IR flare packs each. Each IR flare pack consists of 10 x IR flare countermeasures of 50 mm caliber and 20 x of 26 mm caliber.

The ADROS KUV 26-50 is suitable to be installed in any aircraft type, fix- or rotary-wing. For installation in rotary-wing aircraft, the ADROS KUV 26-50 can be fitted out with reduced length launcher arms for 50-mm caliber flares. Both the standard, 202-mm long 50-mm caliber flares, and Adron-developed reduced-length (100 mm) 50-mm caliber flares are suitable for this application. The burn-in time of the reduced-length 50-mm caliber flare is about 3 seconds to ensure complete burn-out while still in the air when released from low altitudes.

The ADROS KUV 26-50 is advantageous over current counterparts in that the flare packs are mounted in external stores support assemblies (the holder essentially serves as a support assembly), which are universally attached to hardpoints on



the aircraft structure. Currently, the ADROS KUV 26-50 countermeasure flare dispenser system is mounted in external pylon of An-26/32 airplanes, in tail boom section of Mi-8/-24 series helicopters, and in engine nacelle of Su-25 fighter airplanes.

For maximum effectiveness and efficiency as a countermeasure to the anti-aircraft missiles, IR flares are required to meet the specification in terms of:


- maximum IR energy output within a defined band – usually 3-5  $\mu\text{m}$ ;
- ignition time – time interval between release and the moment the flare reaches a given pre-defined level of the IR energy output (usually 20 percent of the maximum level) –  $\approx 0.2$  s;
- usable burn time – time during which the amount of flare-produced

IR energy exceeds 10 percent of the maximum level –  $\approx 2.5$  s for 26-mm caliber flares and  $\approx 3$  s for 50-mm caliber flares.

The level of the flare-produced IR energy output, measured as the thermal energy flux per one steradian, shouldn't be lower than 2.5-3.5 kW/sr for the 26-mm caliber flare and 25 kW/sr for the 50-mm caliber flare under standard measurement conditions.

Adron has developed and patented its IR countermeasure flares Adros PIK-26 in 26-mm caliber and Adros PIK-50 in 50-mm caliber. Both have been designed with operational capabilities that meet most recent requirements and emerging threats.

### ENDNOTES

IR countermeasure flares, most of which belong to the high-temperature type, combined with the most advanced techniques and patterns of use, remain to be a highly effective means for protection of aircraft against both the current and earlier generations of IR guided missile threats, and are expected to remain so in the short term. The countermeasure IR flare systems, which Adron has developed with the use of modern approaches and tools, can ensure effective self-protection of aircraft targets against IR guided missile threats, which has been verified and validated in field tests. 

*ADROS PIK-26, PIK-50, PIK-50V are used for helicopters aux protection against guided missiles with infrared homing heads*



**Illia KRAVCHUK,**

Head of Research and Development, Adron R&D and Production Firm



# RAYBIRD-3 CONQUERING NEW HEIGHTS



**S**kyeton, an aviation products company based in Kyiv, has delivered ahead of schedule its new ACS-3 Unmanned Aircraft System (UAS) to the Ukrainian Air Force. The ACS-3 UAS development and production project has been developed and produced by Skyeton under the Government Defense Procurement Contract. This new UAS capability will allow Ukrainian forces fighting Russia-sponsored separatists in the Donbas conflict area to conduct intelligence, reconnaissance and observation missions with much greater effectiveness and efficiency.

Established by a team of engineers and pilots in 2006, Skyeton initially focused its business on developing light sporting airplanes and marketing them in Europe, North America, the CIS and the Middle East.

Now the Company has shifted its business focus towards developing and manufacturing modern UAS technologies. In June 2018, Skyeton completed the full cycle of trials of its ACS-3 UAS it developed under a contract from the Ministry of Defense. Military officials who observed and monitored the trials have stated that

the ACS-3 UAS fully conforms to the technical and performance specifications required by the Ukrainian Armed Forces. After successful completion of the trials the MoD awarded Skyeton a procurement contract for the ACS-3 UAS.

In its configuration approved for procurement for the needs of the Ukrainian Armed Forces, the ACS-3 will consist of two drones fitted with the required payload equipment kit, a

catapult launcher, a Ground Control Station (GCS), and an antenna system.

Alongside the ACS-3, Skyeton offers domestic and export markets a civilian configuration designated Raybird-3. Like its related military sibling, the Raybird-3 offers capabilities for missions requiring long range endurance or an ability for surveying extremely vast areas.

Let us give just one highly remarkable figure. The 21-kg Raybird-3 drone





carrying a payload of 5kg can stay airborne for over 24 hrs covering a range of 2,500 km. There are only five manufacturers worldwide who can produce UAV drones of similar capabilities, but Skyeton's ACS-3 is without rival in terms of cost/capability trade-off.

In designing its ACS-3/Raybird-3 technologies, the Company focused on three key aspects: the airframe and its capabilities; the maximum possible degree of flight automation from take-off to landing at the selected place; and reliability of operation and durability. It could be said with certainty now that it is this combination that provides the synergy scores needed to make the products competitive in the market.

Along with long endurance, the Raybird-3 UAV would be made available with a broad range of payload kits to choose from depending on the mission to be flown – day and night, in any seasons, and under Electronic Warfare conditions.

Since the flight is highly automated from takeoff through flight to touchdown, the human operator's duties are mainly limited to dealing with payload equipment. UAV flight automation is highly demanded since it allows for a shallow learning curve for new operators and offers operational benefits enabling safer and more efficient flight operation. Modular architecture allows for payloads of up to 5 kg, ranging from snapshot and video camera sensors to laser rangefinder or synthesized aperture radar mounted in a gyro-stabilized gimbal. Payload packages can alternatively include a gyro-stabilized OCTOPUS Epsilon 140 electro-optical and infrared (EO/IR) sensor gimbal. The Epsilon 140 has optical and digital zoom capabilities for recognizing, identifying, and tracking objects at day and night with excellent image stabilization. It offers a 3 cm resolution at an altitude of 2 km.

The Ground Control Station (GCS) can be vehicle mounted or deployed in open terrain, and needs only a few seconds of warm-up time. It is equipped with an embedded large-capacity memory with three spaced dis-

play screens, the main one displaying data from video/snapshot camera sensors, and smaller ones showing ACS-3 Status in Flight along with a map of the flight path being flown. Built to the IP67 environmental protection standard, the GCS can be operated in conditions of rain or snowfall as well dusty environments.

The drone is launched by a mechanical catapult of a proprietary design developed by Skyeton. The catapult system can operate without fault even when exposed to the effects of dust, mudding or low temperatures. After mission is completed, the drone accurately lands on an operator-defined target point. Landing is assisted by parachute to slow down descent, and a reusable, electrically pumped airbag is used to cushion the impact on the airframe. While approaching the landing site, the drone "turns on its back" to minimize the risk of mechanical damage to costly payload cameras, which are additionally protected in landing by means of being retracted into the gimbal attachment.

The Raybird-3 drone is powered by carbureted piston engine developing 3 hp. Max operational ceiling is 3,000 m. Onboard starter/generator provides electric power to the drone and payload equipment, and enables remote engine on/off control while in flight. There is a cooling system ensuring fault-free operation both under low and hot temperature conditions. Critical systems such as flight control surfaces and servos are duplicated to improve reliability and safety of operation.

As validate by test flight missions conducted by Skyeton in late June, the Raybird-3 drone, if powered by carburetor piston engine, can stay airborne for almost 30 hrs. It can optionally be powered by fuel injected engine allowing 15 percent higher fuel efficiency and the operational

ceiling increased to 4,500 m, and featuring an electronic fuel injector that ensures appropriate air-fuel ratios. The use of this solution for propulsion effectively makes the Raybird-3 unreachable by rivals.

In this drone product, Skyeton also implemented its new proprietary solutions in the fields of control and data communication. For control of the drone in flight, spread spectrum signals are used, which makes them immune to interception and jamming by hostile means of electronic warfare. Skyeton has developed an innovative signal converter technique, based on modern electronic hardware components, allowing drone control signals to be transmitted within a substantially expanded bandwidth. "Different countries or even different units within our armed services use certain allocated frequency bands for control of their UAV drones. With legacy hardware components we had a bandwidth limited to 900 MHz. Now this can be expanded to anywhere within up to 16 GHz, making it much easier for us to configure the system up to specific customer needs and specific information battlefields", says Skyeton.

Skyeton's drones can now accept new technologies from U.S. firm Silvus Technologies, i.e. the Tactical Radio which is fielded with the U.S. Army and allows wideband transmission of high volumes of data. →






Being battle proven, highly reliable system, the Tactical Radio provides jam-resistant transmissions over distances exceeding 150 km, along with the capabilities for UAV teaming and relay/range extension.

Skyeton's UAV technologies also incorporate solutions that would enable an extended range of video transmission via communication satellites. These solutions will be optional to customers who wish, and can afford, them.

Skyeton has expanded the choice of automated solutions for preparing the drone for launch. In a new configuration of the drone, the process of engine starting is fully automated; it is sufficient to press a button on the GCS to make the engine start. The drone landing process has been made automated too. Whereas the drone's landing path, target point of landing, and the parachute deployment point once needed to be defined by the human operator, now the latter just needs to define the target landing point, on which the drone would safely land after making one or one and a half turns in the air just above the desired point. The next challenge to be addressed is to automate the process of catapult launch.

In its current configuration, the Raybird-3 UAS consists of two UAV aircrafts with mission-specific payloads, a foldable catapult launcher, the GCS, aerials and other support equipment, including spare parts and fixings, all transportable in five ruggedized containers weighing collectively about 200 kg. The UAS can be transformed from unpack to operation by two personnel within 15-20 minutes. The aircraft doesn't require any screwdrivers, wrenches or other similar tools to assemble for use or disassemble for storing.

The engineering and software solutions tested and validated by Skyeton can all be incorporated into the Company's systems already supplied to and operated by customers, domestic or international. It is also worthy of note that in developing its high-tech UAS technologies Skyeton is looking at artificial intelligence, machine vision, and swarm operation, which are all needed to maintain the hard won position in the rapidly evolving marketplace. 



**ACS-3 UAS. TECHNICAL AND PERFORMANCE SPECIFICATIONS**

Max range	2,500 km
Pre-programmed flight mission radius	1,000 km
Mission radius, with live video streaming and telemetry transmission: **stated by the developer, * validated and verified by trials of the configuration delivered	80 km* (120 km**)
Counter-ECM capability (C2 link jamming, GPS jamming/spoofing)	Available
Endurance* * validated by industry trials, with a fuel injector engine; varies with payload power output and aerodynamics, as well as mission specifics	>24 hrs*
Max/cruising/min air speed	160/120/80 km/h
Max service altitude *with a fuel injector engine	3,000/4,500 m*
Cruise altitude *with stabilized Epsilon 140 gimbal	1,000 m*
Wing span/length/height	2,965/1,442/335 mm
Max takeoff mass	21 kg
Empty weight	11 kg
Propulsion	carbureted piston engine/fuel injector engine
Cruising fuel consumption* *varies with payload power output and aerodynamics, as well as mission specifics	0,3-0,5 l/h*
Fuel tank capacity of standard-configuration drone	9 l
Method of launch	Mechanical catapult
Landing	Assisted with parachute and airbag
Size of storage/transport container for one drone	1,600x540x555 mm

**GROUND CONTROL STATION (GCS)**

Control system	automatic
Video bandwidth	2.2 – 2.5 GHz
Telemetry bandwidth	450-470 / 900-930 MHz
Transmission encoding	Available
Number of UAV drones controlled simultaneously/collectively from a single GCS *using a purpose developed software package	1 up to 4*
Overall mass with one battery	22.9 kg





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**MERIDIAN**  
n. S.P.KOROLYOV

# SPECTATOR-M1: MISSION SUCCESSFUL

## UKRAINE'S FIRST INDIGENOUS UAS ENTERS OPERATIONAL SERVICE

**U**krainian Ministry of Defense, in summer 2019, issued a directive ordering the entry of the Spectator-M1 Unmanned Aircraft System (UAS) into operational service. The Spectator-M1, produced by VAT S.P.Korolev Meridian JSC, Kyiv, an affiliate of the State-owned Ukroboronprom defense industries holding company, is the third-generation evolution of the Spectator UAS technology. The Spectator, which came along five years ago as a collaborative product by Kyiv-based engineers and industrialists, has since undergone numerous improvements to its design and performance, and is now ready to perform its mission objectives in a variety of tactical scenarios.

### SPECTATOR UAS TECHNOLOGY EVOLUTION

The Spectator UAS technology began to be cooperatively developed in 2014 by Polytech Aero, Kyiv, and the R&D Park at the National Technical University "Kyiv Polytechnic Institute", while Korolev Meridian JSC assisted in the project as production partner.

The Spectator was initially aimed for use by Ukrainian Mil-Spec units who, after the Russian incursion into Donbas, had a requirement for a compact, man-portable capability for tactical air reconnaissance and aerial battlefield surveillance. The Spectator drone is designed in the form of

T-tail high-wing monoplane (parasol) that is mostly made from composite materials and foreign-sourced parts. For propulsion, the vehicle uses a low acoustic signature electric motor with a two-bladed propeller. The payload package can be customized to include a snapshot camera, a thermal imaging camera, or an exposure dose rate meter. The first drones produced used an analogue data link. The first-generation Spectator UAS was comprised of a drone, a ground control station, batteries, an antenna assembly, and a transport backpack. Initial batches were delivered to the Ministry of Defense and the State Border Guard Service (SBGS) in 2015.

The technology then underwent several evolutions and improvements. The Spectator was followed by its second-generation, Spectator-M, featuring improvements in terms of mission radius, portability, assembly/disassembly, and ground impact tolerance. Other upgrades included a bigger size, heavier payload capacity, a new thermal imaging camera sensor, and more capable ground control station. Ultimately, the Spectator-M UAS was accepted for operational use for the duration of the Contingency Period, by a Defense Ministerial directive issued in December 2017.

But the Spectator UAS technology's evolution didn't stop there. In 2018, Meridian requested the Minis-

try of Defense to authorize R&D for developing the next evolution of the Spectator-M UAS technology, exploiting the outputs produced from previous R&D programs, inputs from military users, and results of post mission analysis, and with due account taken of new technology development trends in this field. This resulted in what is now known as UAS Spectator-M1.

### NEW GENERATION

The Spectator-M1 has received major improvements to its performance, including particularly a weight reduction and increased in-air endurance, while retaining the size of its predecessor, the Spectator-M. This new-generation evolution features a new thermal imaging camera system, a more capable camera for daytime surveillance, and new video signal transmission controls.

### UAS SYSTEM COMPOSITION

The sub-systems are: a new Ground Control Station (GCS); three (as opposed to one in the first-generation Spectator) drones; four different payload packages selectable depending on the specifics of the mission to be flown; two battery packs for each aircraft plus two for other power consumers. The baseline fit additionally includes a set of transport backpack systems, each rated for carrying two



drones by one personnel; a maintenance tool kit; replacement parts and fixings.

**Payload package.** The Spectator-M1, which has had its sensor package expanded substantially, compared to that seen in its earlier-generation configurations, is fitted as standard with a digital color 10x optical zoom daylight camera for still and video photography, and a thermal imaging IR camera. Housed in quick-attach optical-mechanical modules, the sensor payloads are easily swappable in field conditions within three minutes. At a 1,000m altitude, the video imagery resolution is 0.1m or higher.

Overall, there are five different payload packages available for the Spectator-M1, from conventional EO/IR camera sensors through to environmental contamination measuring instruments and leaflet-dropping containers.

**Drone flight control system.** For flight control, the Spectator-M1 drone uses a control system that combines features of Inertial Navigation System (INS), telemetry control system (control commands transmitted via a radio link), and a GPS-assisted navigation system, and is complemented by a backup control system.

The System supports the following modes of operation: (1) semi-automatic and manual operation for take-off, in-flight and landing; (2) fully automatic pre-programmed flight; (3) fully automated approach to the landing site with a parachute deployed; (4) in-flight mission updating by ground command; (5) the conduct of flight and transmission of target location data in the coordinate systems adopted by Ukrainian armed services; (6) the conduct of mission with jammed GPS and control signals.

**Take-off/landing system.** The Spectator-M1 drone is launched by a mechanical catapult as the main launching method. The catapult has received a weight-saving improvement over the one used in previous configurations, achieved through the use of innovative materials, and a hand-launched configuration requested by the Ministry of Defense is now being worked on.

The landing system has had its functionality expanded to include new algorithms for different landing

conditions. There has been added an emergency landing mode where a parachute is deployed in an emergency.

Two methods are used for landing the drone. One is parachute-assisted landing, performed either by ground command or in a fully automatic mode where the drone would land on a pre-selected spot following operator defined settings/instructions. The other is manually controlled landing like airplane.

The Spectator-M1 UAS technology has been developed with special emphasis placed on anti-jamming capability. The system incorporates proprietary solutions from Meridian – including, but not limited to an ECM warning system which alerts about the incoming jamming signal; automatic switchover between control modes;



the use of long-range secure communication links; and digital encryption of signals – allowing it to operate in heavy ECM environments. The Spectator-M1 has been successfully tested against all counter-drone systems currently available in Ukraine.

The Spectator-M1 succeeded through government trials in late February 2019 and was approved for operational service entry that same year in July. As a matter of fact, this is the first UAS drone to have been able to pass through the full cycle of trials and enter operational service, as opposed to its counterparts developed in Ukraine recently, which haven't got farther than being accepted for user evaluation by Ukrainian Army field units. So it is to be hoped that Ukrainian forces would get in possession a truly mature, highly capable UAS system developed from real-world combat experience. **UDR**

**Anton MIKHENKO,**  
UDR

SPECTATOR-M1 UAS. KEY SPECIFICATIONS	
Length/wingspan, mm	1,295/3,000
Take-off mass, kg	5.5
Payload, kg	1.5
Maximum useable altitude, m	3,000
Max speed, km/h	120
Cruising speed, km/h	70
In-air endurance, hrs	3
Live video transmission range, km	35
Max flight path length, km	200
Max mission radius (while in manually operated mode), km	30
Max mission radius (while in fully automated mode), km	50
Number of missions launched per day	5
Wind tolerance, m/s	10
Prep time from unpack to launch, min	15





# SILENT THUNDER

## LOITERING MUNITION DRONE – THE MOST RECENT DEVELOPMENT BY ATHLONE AVIA



**Artem V'yunnyk,**  
Athlone Avia CEO

**T**he Athlone Avia R&D and Production Company, a privately-run defense technology firm based in Kyiv, is most renowned for its A1-SM "Furia", one of the first battlefield surveillance UAS to see operational deployment in the Donbas Theater of operations in Eastern Ukraine. Here we offer our readers an interview with Artem V'yunnyk, Athlone Avia CEO, who kindly agreed to tell about what his company has achieved thus far and what new product it offers to customers in Ukraine and elsewhere.

- Athlone Avia's Furia UAS drones have flown frontline missions, perhaps, from the earliest days of the Russian military incursion into Donbas. Ukrainian Army gunmen, who are the main users of these drones, say your company has achieved much progress in perfecting your core prod-

uct, the UAS Furia A1-SM. What has driven Athlone Avia to shift focus toward developing a kamikaze drone?

- In the early years of the war [in Donbas], we were sure we would never get engaged in developing weapons of any kind, because we thought that would go contrary to our basic values. But the cynicism and meanness with which the enemy is destroying our country and seizing our lands have made us revise our principles-based policies. We began developing the Silent Thunder as a private venture project. So we ventured out to develop and produce a prototype of a capability that had not been officially listed among the capabilities required by our armed services. Knowing the needs of our forces deployed on the frontline, we gave thought to creating a capability for search, detection and engagement of defilade targets located deep in enemy held territory. The goal we set ourselves was to develop a precision guided weapon capability that would defeat and destroy enemy targets with minimum risk to nearby civilian lives and infrastructures.

In this effort, we closely collaborated with the military community and analyzed the intelligence output produced by our Furia. The results motivated us to draw up a draft design and operational requirement document on a loitering munition drone. Of course, this concept document was not developed in a year, but was conceived during the past few years of our firm's presence in the active war zone.

- Would you tell in more detail about this development? What speci-

fications does the loitering munition have?

- 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 was validated during test flight missions. Under normal weather conditions, the drone is not supposed to loiter over the target area for longer than 15-20 minutes plus the time needed to reach the target. With strong front wind it would take as long as 40 minutes for the drone to reach the target area, but even then it will have enough time in store to complete its mission objective. The first-evolution configuration of the Silent Thunder, designated ST-35, was 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 and weights. Work is now underway on a Fuel Air Explosive (FAE) warhead weighing 3.5 kg, but other warhead types, including inter alia HEAT and HEF are also under consideration for this application. In the future we are planning to work also on a shaped charge warhead to be used where there is a high risk of collateral damage.

The munition will be guided semi-automatically by television or IR guidance heads, which will be swappable as needed depending on the visibility and weather conditions. This is also a cost-saving measure; as thermal





imaging cameras are steadily becoming less expensive, it might be expected that conventional optical cameras will soon become unnecessary, given that thermal images are sharper and take less resources to process.

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 Silent Thunder 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.

It should be noted that, given the low effectiveness shown by GPS/GLONASS aided navigation when used in war zones, this loitering munition is being developed with a GPS-independent navigation capability, meaning it would be capable of fulfilling its mission objectives even in severe EW jamming environments.

**- What about the design features?**

The use of a conventional aerodynamic design is obviously unsuitable for attaining our goal, which is to enable targets to be attacked from nearly normal angles of incidence. Kamikaze drones of a conventional aerodynamic design are notoriously hard to control while at the terminal, diving-at-the-target phase of flight, the result being that the circular error probable exceeds 2-3 meters. So for our loitering munition we selected 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 us to achieve an optimum between the controllability performances of the drone while in horizontal flight and diving at the target. The aforementioned aerodynamic de-

sign is perhaps the only one suitable for relevant missions, which makes it the design of choice for an increasing number of manufacturers, for the laws of physics are hard to escape. The aerodynamic design that we accepted for this application is the most effective when it comes to hitting defilade targets by vertical attacks.

**- What technique will be used for launching the Silent Thunder?**

The launching system has been designed as an integrated, comprehensive solution to a number of important challenges that included minimizing the space/area necessary for launching the drone; verification of the target hit; weight reduction; and, of course, reliability and simplicity of operation. This solution came in the form of a multirotor aerial vehicle to be used as launch platform for the kamikaze 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 for sustained video streaming from the drone at ranges of 30-40 km. Besides, this solution offers a substantial weight saving over a technique using a mechanical or pneumatic catapult launch.

We are planning to demonstrate two configurations of the 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.

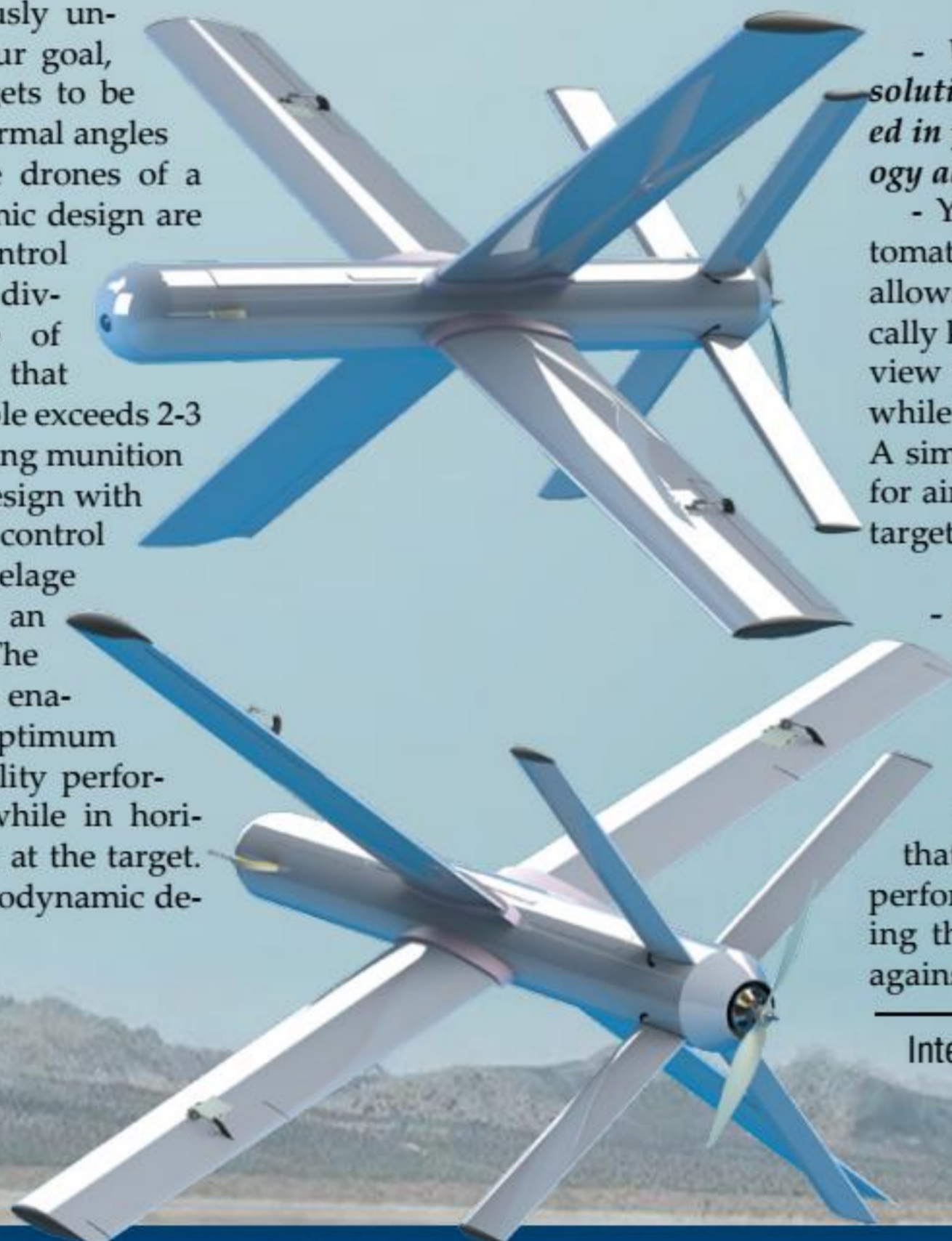
**- Will there be any technology solutions you've already implemented in your Furia A1-SM UAS technology adopted for the Silent Thunder?**

Yes, and 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 artillery fire. A similar algorithm will be used also for aiming the loitering munition at a target.

**- What timeframe are you expecting to need in order to produce the first production unit?**

It is my expectation that October or November will see initial trials of production units that are supposed to validate key performance specifications, including the effectiveness of the warhead against conventional targets. **UDR**

Interviewed by **Serhiy ZGHURETS**,  
Defense Express





# QUEST FOR EXCELLENCE



**Voldemar Kurm,**  
Senior Account Manager -  
Eastern Europe  
COMMUNICATIONS SYSTEMS /  
L3HARRIS TECHNOLOGIES

RADIO SATCOM GROUP IN QUEST TO HELP  
UKRAINIAN ARMED FORCES MODERNIZE THEIR RADIO  
COMMUNICATION CAPABILITIES WITH HARRIS RADIOS

**L**3Harris Technologies started on June 29, 2019 as a merger between Harris Corporation and L3 Technologies to become the sixth largest defense company in the U.S., and a top 10 defense company worldwide. L3Harris has approximately \$17 billion in annual revenue and 50,000 employees, with customers in 130 countries. The company provides advanced defense and commercial technologies across air, land, sea, space and cyber domains.

International sales, which currently account for approximately 23 percent of revenue, are regarded by the Company to be one of the key parts of its strategy for future growth.

Ukraine has become a growing market for Harris radio communications products, especially in the tactical communications domain. The Corporation entered Ukraine's domestic defense market 20 years ago with a \$20,000 contract for the Ukrainian Navy needs. During multiple years, Radio Satcom Group

(referred herein below as RSG), representative and authorized service center for Harris radio products in Ukraine, has worked hard promoting the Company's tactical communications products in Ukraine's domestic market. As of this date, the overall value of Harris products sold to Ukraine under Government procurement contracts, as well as U.S. Foreign Military Funding (FMF) and Ukraine Security Assistance Initiative (USAI) has amounted to hundreds of millions of US dollars and is expected to grow further substantially with new deliveries planned for 2019 and 2020. Harris-supplied communications technologies are a key enabler of the strategy being pursued by Ukraine's defense forces, National Guard, and State Border Guard Service (SBGS) to digitalize their command, control and communication (C3) infrastructures of all levels – from strategic down to tactical. Not only can Harris radios support secure communication, but they are also highly immune to electronic warfare attacks. With these robust, operationally reliable high-tech radios it's possible to achieve superiority over the enemy by setting up more flexible, more sustainable, more secure and more reliable C3 networks.

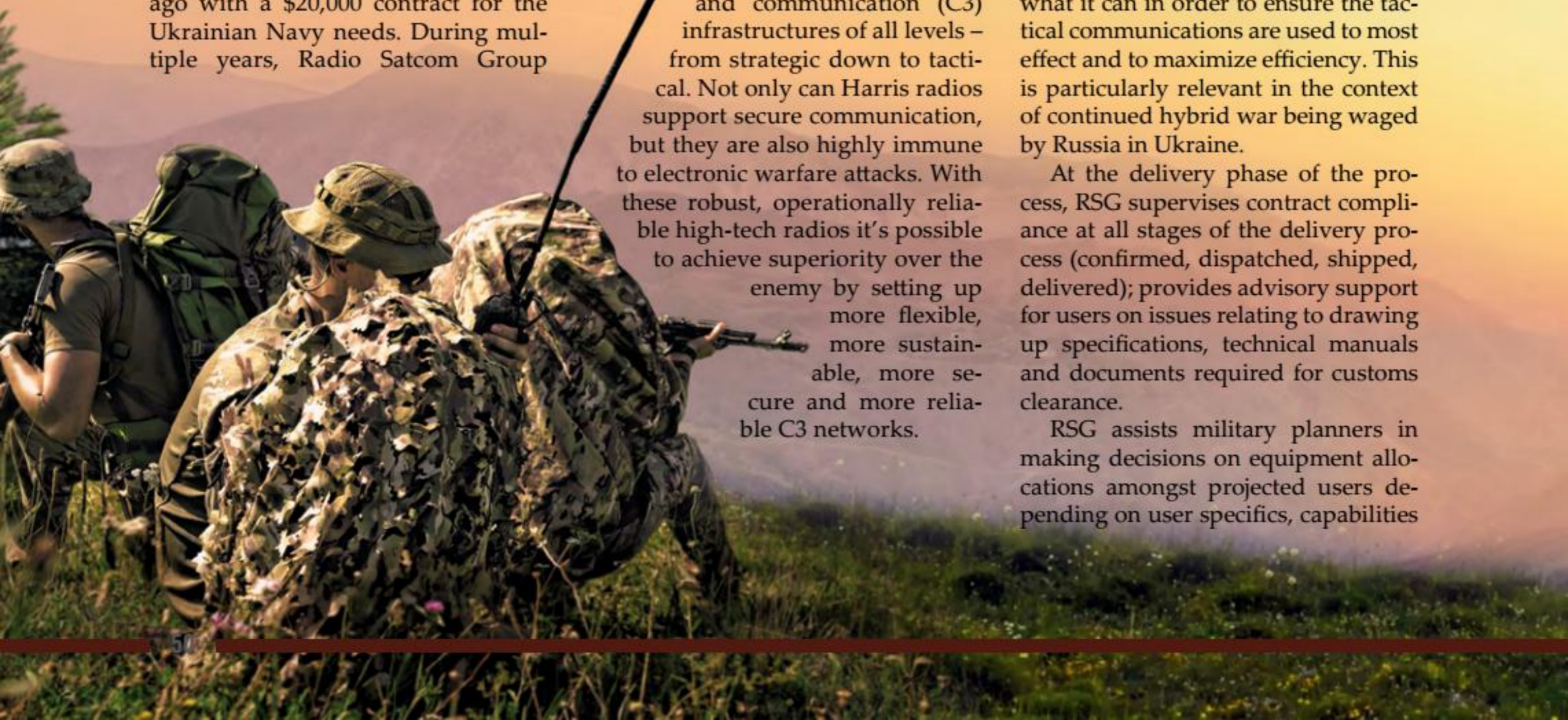
The ever widening use of Harris radios within the military and security communities in Ukraine reveals problems with the effective use of these new capabilities. These problems could be solved by ensuring improvements in the following areas of concern:

- timely and prompt delivery to deployed forces, rapid installation into transportation vehicles, armored fighting platforms and fixed/stationary sites;
- adequate operator training to ensure skill proficiency at three levels of competency – radio network administrator, operator, and end user;
- appropriate maintenance and repair;
- provision of users with replacement parts, accessories, software updates and other related items needed to maximize use-effectiveness of the equipment.

RGS has worked successfully in all these areas, being committed to doing what it can in order to ensure the tactical communications are used to most effect and to maximize efficiency. This is particularly relevant in the context of continued hybrid war being waged by Russia in Ukraine.

At the delivery phase of the process, RSG supervises contract compliance at all stages of the delivery process (confirmed, dispatched, shipped, delivered); provides advisory support for users on issues relating to drawing up specifications, technical manuals and documents required for customs clearance.

RSG assists military planners in making decisions on equipment allocations amongst projected users depending on user specifics, capabilities





and specifications of the radio systems under delivery, and the level of each user's software and battlefield management capabilities.

At the equipment installation phase, RSG draws up relevant design documentation for all platforms – armored fighting vehicles, command and control vehicles and communication centers. The Company's on-site installation teams, assisted by engineers of the Armed Forces, National Guard and SBGS, do installation works for Harris radio systems all across Ukraine, including frontline areas in the east of the country. RSG has set up a dedicated business operation, the Constanta Armor, to draw up design documentation and produce installation tool sets for each individual category of platform.

Constanta Armor is oriented also to production of accessories for Harris radios, including power adapters, voltage converters, antennas, transportation backpacks etc.

RSG and its affiliate Constanta Armor have been in negotiations with managers of L3Harris to localize VHF Harris radios for production in Ukraine.

RSG also has its training and service center which provides maintenance and repair services for Harris equipment, along with software updates, hot-line support and training of military and security users at its training centers and at client locations. RSG's training and service center is staffed with knowledgeable professionals who underwent relevant training and certification at Harris' Rochester facilities in New York. Most of the Center's employees have real-world combat experience gained in eastern Ukraine, and many of them are experienced in using Harris radios in actual combat.

The results of this work are worth of the efforts invested by RSG as the authorized dealer for Harris radio products in Ukraine. In the sales area, RSG has worked much with manufacturers of the combat platforms that are designed equipped with Harris radios. Commercial sales are rising and potentially (and hopefully) will rise exponentially as the new platforms begin to be produced serially. RSG has also worked with the General Staff at the Ministry of Defense and the Ministry's Armaments Department, in order to ensure new, FMF funded procure-

ments of Harris equipment, under direct contracts with Ukraine's Ministry of Defense. RSG and Constanta Armor are both doing well in supervising contract compliance relating to USAI/FMF funded procurements.

Over the past five years, the two companies have arranged for the installation of over 1,000 Harris radio systems of various types onto vehicular platforms, as well as dozens of warships and boats; and provided user training for hundreds of personnel of the Armed Forces, National Guard and SBGS, thus allowing each of the three services to have own core expert teams of operators and radio network administrators.



In the subject-specific "Military Communications" outlet, RSG has for several years published user and handling instructions for Harris equipment, in bi-annual issues that have been distributed by the hundreds amongst deployed units operating Harris radios. RSG and Constanta Armor have maintained direct contact with multiple different military users, providing everyday hotline support and remote assistance. Knowing the importance of enhancing military user competence, the two companies have compiled dozens of user and handling instruction manuals and distributed them by the hundreds among all the deployed units fielded with Harris brand equipment.

RSG exhibited Harris radio products and technology solutions at the 2018 edition of the Arms & Security defense and security exhibition held in Kyiv,

and a similar display is being prepared also for this year's season of the Arms & Security fair to be held in October.

Moreover, the Company holds yearly training conferences at the Navy's Communications Center in Odesa, providing a platform for expert users from across the defense and security community to share experience with using Harris radio systems in real-world combat scenarios.

Executives and employees of RSG and Constanta Armor are facing the future with confidence and remain committed to doing their best to ensure the Ukrainian Armed Forces have in their possession most state-of-the-art communication capabilities,

and to ensure consistent growth of sales through effective operations.

The success the two companies have been able to achieve in promoting and marketing Harris-brand products in Ukraine's domestic market couldn't be possible without kind and generous support from Rick Dickson, Director International Sales Eastern and Central Europe, and Voldemar Kurm, Senior Account Manager - Eastern Europe, Communications Systems/L3HarrisS Technologies, to whom RSG and Constanta Armor owe an especially deep appreciation.

Our team continues on its way to operational excellence. Our mission is effective work for military power of Ukraine and our victory of the war. We have achieved a great deal, but much more remains to be done. Like L3Harris, we must move forward faster. **UDR**



# COMBAT "TURTLE" AND ITS RELATED SIBLINGS



**M**odern warfare requires modern technological solutions - innovative, flexible and adaptable to the needs of forward deployed soldiers. It is such solutions that Ukrainian firm Roboneers, based in Lviv, is offering the Ukrainian armed services as well as potential export customers.

Roboneers, one of three businesses of parent company Global Dynamics, is now focused on developing ground robotic platforms and related technologies. The firm, which employs some 20 full-time staff, has its headquarters in Lviv and offices in Kyiv and other cities.

There are two unmanned ground vehicles (UGVs) currently under

development. One is an armed UGV and the other is a load-carrying UGV. The former features a remote weapon station (RWS) "Shablya@ (Ukrainian for "saber") armed with a 7.62-mm machine gun, but in future configurations this can be replaced with a 12.7-mm machine gun or an automatic grenade launcher. Additional payloads being developed for this application include special-mis-



UGV control panel



sion equipment, armaments and communication systems.

Being smaller in size than its combat-capable sibling, the load-carrying UGV would be able to carry up to 600-kg loads on its roof-mounted cargo racks.

The two robotic platforms incorporate innovative technology solutions ensuring improved traction on ground when travelling over rugged terrains. Each is made to two articulated modules linked together by a turning joint technology adopted from Caterpillar, allowing all four wheels to always keep contact with the ground. Each wheel is moved by an electric motor with epitrochoid harmonic drive ensuring a high torque. In one test drive mission, the vehicle was able to drive its front wheels up onto a concrete wall with rear wheels remaining on ground.

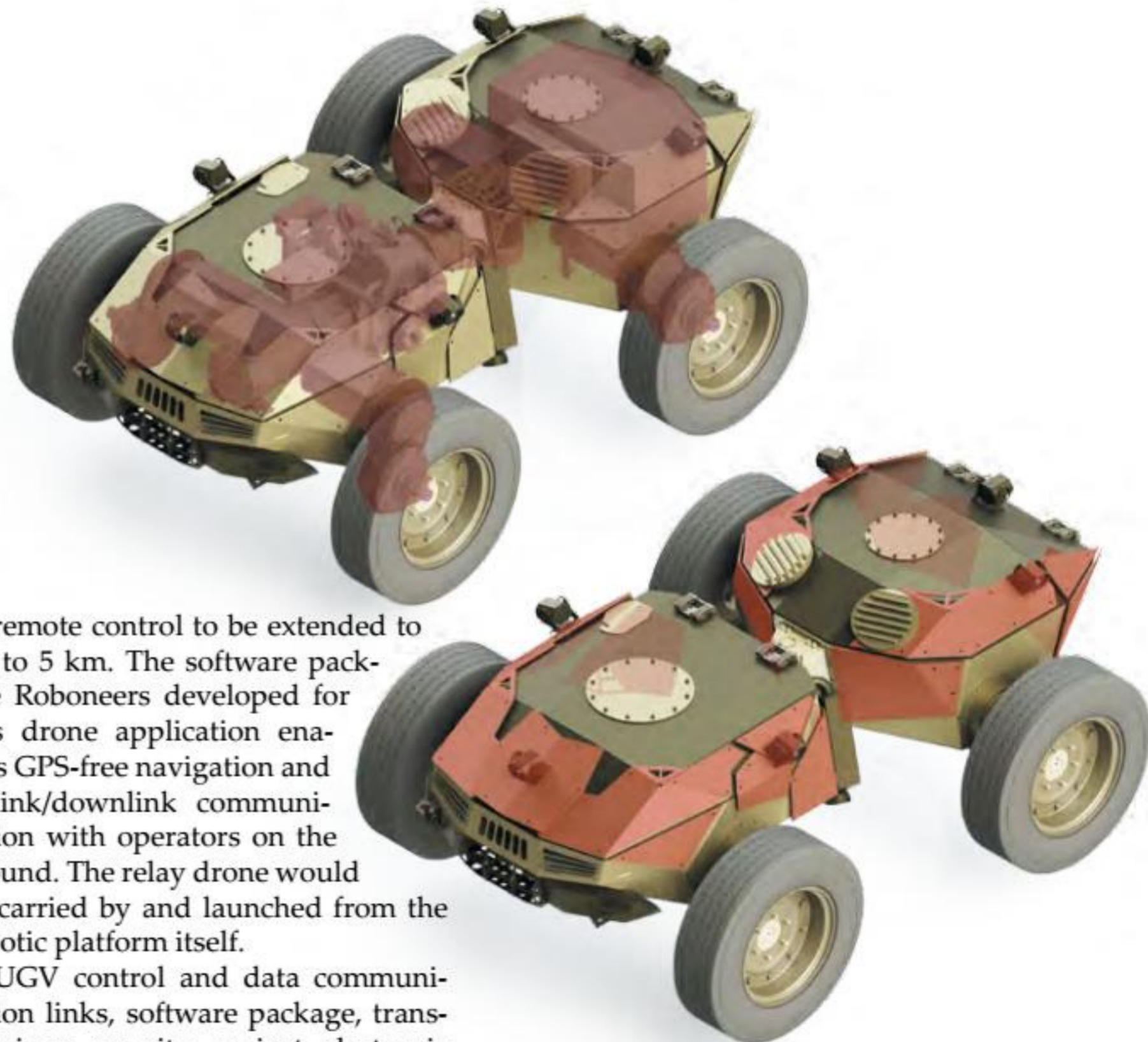
The UGV platforms have been both designed without suspension, the function of which has been adopted by the turning joint, and they are made with minimum moving parts courtesy of the modular architecture used. Roboneers is now working to increase the modularity level to enable "Lego-style" assembly of multiple subsystems and thus allow easy swapping in and out.

The running gear has been designed such as to enable effective operation on difficult terrains. The front module hosts a 15 kW diesel generator while Lithium-ion batteries are located at the rear, this hybrid configuration allowing up to 80-10 hrs operation, electric-only endurance being 1 h. Diesel engine is used when the vehicle leaves its base, and it is taken over by battery powered propulsion (albeit complemented with diesel power if needed) where silent driving is needed for stealthy movement. Each wheel is powered by its own geared motor.

A ground robotic vehicle needs to be able to operate in a variety of environments, be it an urban area, forest or desert, and it also needs to be able to be controlled remotely from distances of at least 2 km. But remote control over a distance that long is only possible in open terrain. So it was decided that remote control via a relay drone would be a suitable solution, which would allow more robust transmissions and enable the range



*A proprietary technology that we adopted from American firm Caterpillar is a turning joint that links together two modules comprising the robotic platform and allows all four wheels to always keep contact with the ground in any landscape environment*



of remote control to be extended to up to 5 km. The software package Roboneers developed for this drone application enables GPS-free navigation and uplink/downlink communication with operators on the ground. The relay drone would be carried by and launched from the robotic platform itself.

UGV control and data communication links, software package, transmissions security against electronic attacks – these challenges have all been handled by Roboneers in a →

*UGV's protection elements and internal mechanisms*



**FAHD UGV**

Fahd UGV is an armed unmanned ground vehicle (UGV), which is designed for missions such as reconnaissance, observation and target acquisition (RSTA) as well as to provide fire support and protection to forward deployed forces. The vehicle is able to operate in locations that are remote, unreachable by route, exposed to extreme hazards or challenging in other ways.

The Fahd is simple in design and operation. Each wheel is moved by an electric motor featuring epitrochoid harmonic drive technology. The company claims this arrangement offers robust torque transmission for improved traction on rough terrain. The vehicle is controlled remotely via a relay drone, which allows the range of remote



control to be extended to up to 5 km. It features a modular architecture allowing multiple subsystems to be easily swapped in and out as needed.

The vehicle's steel hull is protected with add-on armor that makes it immune to 7.62 mm rounds. It features the indigenous remote weapon station (RWS) 'Shablya' (Ukrainian for 'saber') armed with a 7.62 mm machine gun, and this can be adapted for installation of a 12.7 mm machine gun, or an automatic grenade launcher, or an anti-tank rocket launcher.

The company is considering also special mission configurations equipped with a radar system, or a system for the detection, disruption and pre-detonation of explosive hazards, or a handling device, or other specialty payloads.

**FAHD UGV, KEY SPECIFICATIONS**

Weight when not fitted with the Shablya RWS	970 kg
Overall weight when fitted with the Shablya RWS	1,100 kg
Armor protection	Local
Payload	≤200 kg
Endurance in hybrid power mode	8 ... 10 hrs
Electric-only endurance	1 ... 1.5 hrs
Max speed	20 km/h
Diesel generator power output	15 kW
Angle of ascend	30°
Ground clearance height	400 mm
Dimensions in length/width/height	2,564/1,720/945 cm (1,625 cm when fitted with the Shablya RWS)
Armaments	Shablya remote weapon station carrying a 7.62 mm machine gun

systemic manner, effectively and efficiently, and at a high level of quality. "The robotic platform should be able not simply to get to the battlefield and launch fire against the adversary, but also to be aware of what the situation is, what aerial intelligence and observation says, where adversary forces are located etc. These challenges cannot be handled without appropriate

software tools – a key component of robotic technologies that is going to become most important in five years or so. How cameras recognize and identify targets, how Friend-or-Foe works, target identification techniques, target movement tracking, coordination and collaboration with friendly entities on the battlefield, machine learning – these should be the priorities to be

developed", says Maksym Ryabokon, Roboneer business manager.

The armed UGV and load-carrying UGV platforms have both undergone trials with the Ukrainian Army and are now being further matured for fielding. **UDR**

**Serhiy ZGHURETS,**  
Defense Express

**JAMAL**

The Jamal is a load-carrying UGV that is designed to perform logistical support and evacuation missions in locations exposed to extreme hazards. Due to being equipped with a hybrid



transmission, the vehicle can operate autonomously during several weeks, gathering video and other sensor data for subsequent analysis and processing. Independently moving wheels and a flexible frame chassis ensure improved mobility performance on rough terrain and steep slopes.

The Jamal UGV can be interfaced with C4ISR networks and unmanned aircraft, and it is also suitable to be used as UAV carrier and launch platform. Future upgrades being considered for the Jamal include the addition of a wireless charging device for UAV batteries and the range of remote control and observation extended to up to 30 km.

**JAMAL UGV, KEY SPECIFICATIONS**

Weight	600 kg
Armor protection	Not available
Payload	600 kg
Endurance when fully loaded	4 hrs
Endurance with reduced payload	10 hrs
Battery powered endurance on tough terrain	≤1 h
Range on hybrid power, on easy or tough terrains	≤130 km
Max speed	20 km/h
Diesel generator power output	5 kW
Power of electric motors (x4)	7 kW
Wheel torque	≤2,500 Nm
Angle of ascend	30°
Length/width/height	2,166/1,660/787 cm



For marine propulsion



32 MW

25 MW

16 MW

10 MW

6 MW

5 MW

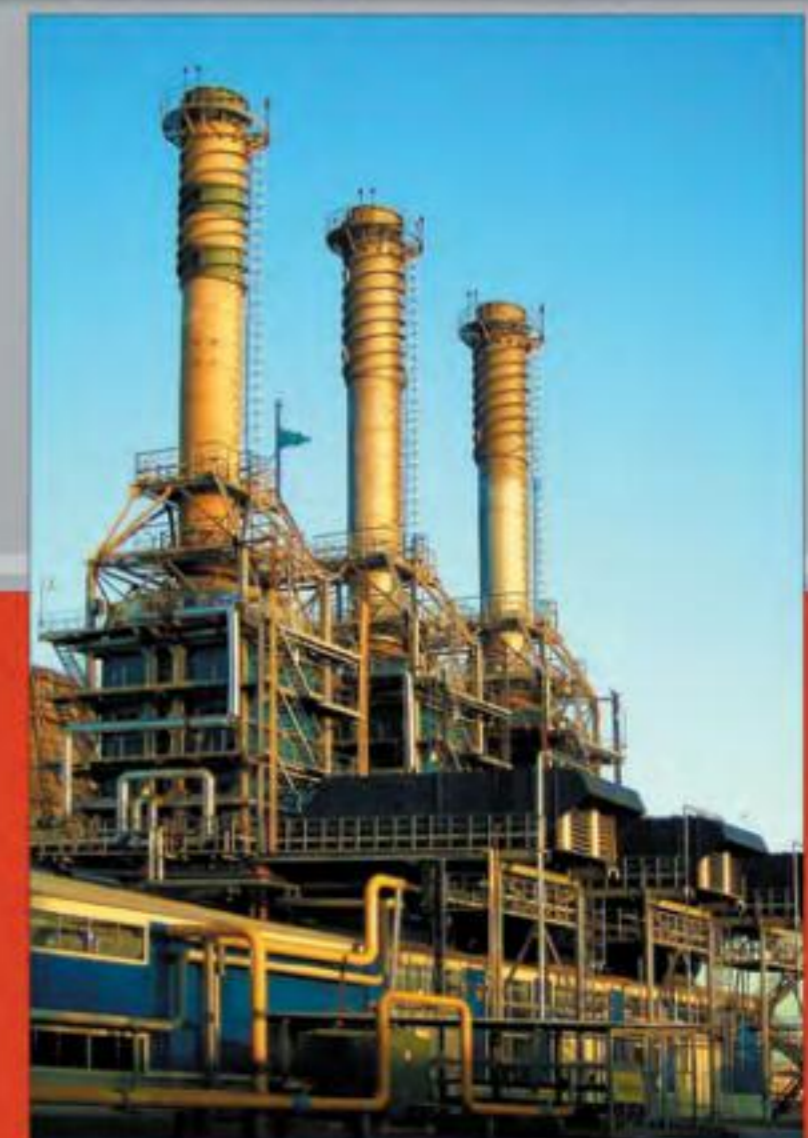
3 MW

2,5 MW

For gas industry



For power generation



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