

№1 [JANUARY - MARCH 2020]

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MISSILES

52



TARGET IS CAPTURED

R-27

2414646
628046456444 555 2404
731908862 542552 23

5
14
47
29
664
74
5584
21

89



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UDR

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MOD OF UKRAINE EXHIBITS DEFENSE TRANSFORMATION PROGRAMS 2019-2020



The Defense Ministry, at a presentation held on December 19, 2019, exhibited 2019-2020 Transformation Programs for the Ministry and the Armed Forces. The event was attended by the Defense Minister Andriy Zahorodniuk, his deputies and assistants among other officials, Defense Express reports.

The Defense Ministry exhibited transformation programs for 2020 that deal with 11 areas of focus as follows: (1) homeland defense strate-

gy; (2) Black Sea Region security; (3) infrastructure development; (4) military professionalization and social welfare; (5) implementation of NATO standards; (6) weapons systems and innovative technologies; (7) military housing provision; (8) defense procurement reform; (9) electronic workflow; (10) territorial defense; (11) anti-corruption efforts.

The issues that should be given first priority are the defense procurement reform and revision of the State

Defense Procurement Contract with an eye to shifting focus in favor of domestic producers, Defense Minister Andriy Zahorodniuk has said. The Government will fund most of the projects under the Defense Procurement Contract, but will have to put on hold funding for some of them, Zahorodniuk said without specifying the projects.

According to deputy Minister of Defense, Oleksandr Polishchuk, the results of the defense review conducted in December 2019 will lay the groundwork for the development of the country's Military Security Strategy, which aims to put into practice an integrated, comprehensive approach to homeland defense that is common to most NATO and EU countries. This Strategy will then be used as basis in drawing up development strategies and programs for specific branches and arms of service of Ukraine's Armed Forces, using the capability-based planning tools as used by NATO countries.

Deputy Minister of Defense Alina Frolova said that Ukraine is looking to establish collaboratively with international partners a security belt in the Black Sea region. She described the Black Sea region's security to be an issue of priority for Ukraine, in terms that this would help keep the attention of the international public focused on that region, above all else, as it relates to the Russian occupation of the Ukrainian peninsula of Crimea.

UKRAINE VIGOROUSLY ARMING ITSELF

Ukraine's Ministry of Defense, at 2019 end-of-year news briefing held on 26 December, reported on the implementation of the Government Defense Procurement Contract 2019.

In 2019, the Defense Ministry fulfilled two contracts with the U.S. government, under the foreign military sales program, and one contract was fulfilled with the NATO Support and Procurement Agency, according to deputy Defense Minister, Anatoly Petrenko. "This allows us to use all the resources available in the arms market – government-owned, non-government-owned, as well as [the resources owned by] international

manufacturers and suppliers," Petrenko was reported as saying.

"The forces received, in 2019, a significant number of varied military weapons and equipment systems that are all-new systems. Please note that [Ukraine now has in its arsenal] a tactical-range unmanned aerial vehicle that can be used for air-to-ground attack missions. We have in our possession an automated artillery fire control system, along with a counter-battery radar system; this is what has been achieved by all stakeholders in the process, under the government defense procurement contract," Petrenko has said.

He furthermore said that "In the fourth quarter, due to the concentration of resources, the Ministry of Defense had been able to sign a contract with the United States for the second batch of the U.S. Javelin anti-tank missile systems. Simultaneously, we place purchase orders for this type of missile systems with a domestic manufacturer. We have purchased a number of gunfire spotting radars, some 100 armored fighting vehicles for a variety of roles, and several airplanes. By saying several, I mean [the number limited by the resources we had for] the fourth quarter. We are advancing on the path to fielding our forces with electronic warfare (SIGINT/EW) capabilities," Anatoly Petrenko has said.

NVO PRACTIKA DEVELOPS NEW APC VEHICLE TAILORED FOR MARINE OPERATIONS

NVO Practika, a member company of the Ukrainian League of Defense Industries, officially introduced on October 8, 2019 its new 6x6 amphibious APC vehicle Otaman-3 that is considered the most probable candidate for the Core Armored Personnel Carrier of Ukraine's Maritime Infantry. The Otaman-3 APC was introduced to the public at 2019 edition of the Arms & Security Expo.

The vehicle was designed by Kyiv-based private company Practika in a bid to propose a solution replacing Soviet legacy families of BTR and BRDM armored carriers with a highly protected, heavily armed vehicle fit for modern warfare, specifically for non-linear and asymmetric combat.

In tune with modern tendencies, the Otaman-3 vehicle was designed to have its engine (11.9l Deutz rated at 558 hp) in the forward body, while its troops compartment is located in the rear hull.

The vehicle armor protects against small-arms fire, shell splinters and grenade shrapnel. Ballistic protection is certified to Level Five protection by the Ukrainian PZSA standard, which can be improved to STANAG 4569 Level 4 (14.5-mm bullets at 200 meters) by the addition of ceramic armor plates.

Anti-mine blast protection measures include anti-blast floor, en-

ergy-absorbing seats and STAN-AG-4569 Level IIIa/b protection of the bottom hull (8kg TNT under central hull).

"Let's be honest: it will not be operationally deployed until 2021 or even 2022 at the earliest. We, for our part, are seeking the earliest possible date," Serhiy Vilkov, Practika Vice CEO for Business Development has said.



UKRAINE LAUNCHES NEW PRODUCTION FACILITY FOR ARTILLERY AMMUNITION, MISSILE WARHEADS



Shostka Impulse Factory, an affiliate of the Ukroboronprom State Defense Industries Group, has established a new production facility for artillery ammunition and missile warheads, Defense Express has reported citing a statement by n Ukroboronprom.

The new facility will focus on the production of fuses used in artillery rounds and missile warheads.

The facility, which took Hr 282M to build, will make Ukraine fully self sufficient in production of gun shells and missile warheads. It is equipped with a hundred or so computer-aided, high-tech machine tools and manufacturing equipment for production of ammunition fuse components.

"The machine tools are suited for the production of each and every

component in an ammunition fuse", Andriy Artiushenko, CEO of Ukroboronprom's division for precision-guided weapons and ammunition has said.

Ukraine's National Security and Defense Council (RNBO) has reported via at its official website that the facility established at Shostka Impulse Factory is the first in Ukraine to be able to produce, in required numbers, the full range of fuse components used in all kinds of artillery rounds and missile warheads. The new facility has sufficient production capacity to meet the Defense Ministry's needs.

Impulse has hosted the testing of the initial batch produced fuse V-429, to be followed by field tests. Since next January, the Factory will be fully prepared to launch series production of V-429 type fuses and other explosive-train elements, employing best of class production equipment and processes, per Oleksiy Danylov, RNBO Secretary.

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ANTONOV CONTINUES WORK ON AN-178 AIRCRAFT EXPORT CONTRACT WITH PERU

SE Antonov is currently working on a contract to export an An-178 transport aircraft to Peru.

The Company has already done a considerable amount of work; there have been completed the main structures and components of the aircraft that would have the Factory Number 006. This gives hope that the aircraft will be built and delivered to the customer in Peru in due time. This came in an exclusive interview conducted by Defense Express with Vitaliy Chytak, SE Antonov Vice President of Production.

"Antonov has so far manufactured components and subassemblies for construction of the core fuselage that is common to the An-148/158/178 series. I'm specifically talking about the wing assembly, the console part of the wing, the tail group, the rudder fin and the

stabilizing fin. There has been completed the assembly of the high-lift system, the rudder, elevator, and centerwing, and work began on the manufacture of fuselage parts. The aircraft will be built without the use of components sourced from Russian companies, and will feature Western-made avionic equipment and materials of origin other than Russia. The current status of the contract is such that it makes us confident that the contract will be completed on due date," Mr Chytak has said.

Antonov has, therefore, done a substantial portion of the work under this contract, and has successfully found substitutes for the materials and components that were previously sourced from Russian suppliers.

UDR note: Antonov signed a contract to sell an An-178 transport jet to

Peru's Police Force in November 2019. The contract additionally contains a provision on warranty servicing of the airplane during the warranty period. The contract stipulates that the aircraft must be delivered within 24 months from the date of first payment.

Spectechnoexport, an authorized arms dealer, signed the contract for Ukraine.

The Peruvian customer selected the An-178 for its multi-mission capability; the airplane can be used for air transportation of cargoes, containers, personnel, paratroopers as well as search and rescue teams, per Oleksandr Donets, SE Antonov President.

The An-178 was selected in a competition with Leonardo's C-27J Spartan and Airbus Defense and Space's CASA C-295.

UKRAINIAN GOVERNMENT GIVES ITS GREEN LIGHT FOR LOCALIZING PRODUCTION OF FRENCH PATROL BOATS IN UKRAINE



Ukraine's Cabinet of Ministers, at its meeting held on December 11, 2019, endorsed a draft resolution titled "On the submission for parliamentary approval of a Framework Agreement between the Government of Ukraine and the Government of France related to official support for enhancing Ukraine's

maritime safety and security". This resolution, if adopted, will pave the way for the procurement of modern patrol boats from France for the purposes of enhancing Ukraine's border security at sea.

France will manufacture and deliver by 2023 a total of 20 modern patrol boats made by French shipyard

OCEA, as reported by the press service of the Ministry of the Interior.

Designed for use in the Black Sea and Sea of Azov waters, the 32-meter boats will protect border security, carry out surveillance and monitoring and control missions, search and rescue and counter-sabotage operations, Serhiy Honcharov, deputy Minister of the Interior has said.

According to Honcharov, production of the French boats will have 30 percent localization in Ukraine. The project also includes boat servicing, as well as training of 240 crew and 120 technical personnel.

UDR note: Ukraine's Minister of the Interior, Arsen Avakov met and talked with the French Minister of Transport Jean-Baptiste Djebbari on October 15 to discuss the current status of bilateral projects, as well as possible mutual recognition of driving licenses.

Prior to this, on June 29, Ukrainian Cabinet of Ministers' press office announced that the Ministry of the Interior would buy 20 FPB 98 patrol vessels made by French shipbuilding yard OCEA.

NEW START TREATY

THE LAST CHANCE

There is a potential possibility that the year 2020 could mark the begging of a new nuclear missile arms race. After the breakdown of the Intermediate-Range Nuclear Forces (INF) Treaty, there has been an imminent risk of breakdown overshadowing another crucial arms reduction agreement – the Treaty between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms also known as the New START Treaty.

INF TREATY BREAKDOWN

The outgoing year 2019 saw the treaty signatory countries pull out of their INF obligations. The INF Treaty is a 1987 arms control agreement between the United States and the Soviet Union

signed in Washington on 8 December 1987. The treaty obliged its signatories not to produce, test or deploy ground-launched nuclear and conventional missiles as well as their launchers with ranges of 500-1,000 km (short-range) and 1,000-5,500 km (intermediate range). Within three years, the parties had eliminated all launchers and ground-based missiles with ranges of 500–5,500 km, including missiles and launchers deployed in the European and Asian parts of the USSR.

The INF was the first ever agreement seeking a true arms reduction with global implications, since it demonstrated that the superpowers are ready to de-escalate tensions and eliminate the threat of the nuclear-missile confrontation between them. The Treaty had been formally honored and enforced.

Over time, the situation has changed, however. These changes were catalyzed by a number of factors, including most notably the collapse of the Soviet Union, the loss of relevance of the battle for Europe, and changes in the nature and strategy of modern warfare among other factors. After all, the weapons of war have evolved to become far more powerful and effective than they have ever been before.

Beyond that, new security threats and challenges have emerged,

namely: increasing terrorist activities, an increase in the number of countries owning missile weapons of various ranges; and the growing threat of a missile attack from Iran and North Korea.

The "crux of the biscuit" was that, as found by U.S experts, Moscow had continued breaching its INF obligations. The Russian Federation has over the past 20 years produced and field-tested a number of ground-based missiles (both ballistic and cruise) that are banned under the INF treaty. This is particularly about the 9M729-SSC-X-8 long-range ground-launched cruise missile system, which is effectively a land version of the SS-N-30 3M14 missile complex "Caliber-NK" and allegedly a part of the 9K720 Iskander-M complex. The missile's range as assessed by American experts is between 2,000 and 5,500 km.

Washington pointed this to Moscow on multiple occasions. Beginning in 2014, annual reports by the US Department of State regarding compliance with arms control agreements contain evidences indicating that the Russian Federation had conducted multiple tests of ground-launched cruise missiles with ranges from 500 to 5,500 km.

The United States has, over the past few years, taken lots of actions in order to prevent the INF Treaty from being terminated. Meetings were held with senior officials of the Russian Federation, NATO and EU countries, etc. President Donald Trump's administration, at lots of international gatherings, recalled the Kremlin of the complexity of the situation and inadmissibility of breaching its INF commitments. Moscow denied the charg-

es while seeking to blame the U.S. of widely deploying its missile defense interceptor systems across Europe.

Finally, Washington, then Moscow formally pulled out of their INF obligations in early 2019. This has placed in jeopardy the future of another crucial nuclear security agreement – the Strategic Arms Reduction Treaty, known also as New START treaty.

BLEAK OUTLOOK FOR NEW START TREATY

The New START treaty was the seventh in the row of strategic nuclear arms reduction agreements signed bilaterally by the USSR and its successor state, the Russian Federation with the United States of America. It was signed on 8 April 2010 in Prague, the Czech Republic, and, after ratification, entered into force on 5 February 2011. New START, which replaced the START and START I treaties, is due to last ten years, with an option to renew it for up to five years upon agreement of both parties. Under the Treaty, the United States and Russia must, within seven years from the date the Treaty entered into force, reduce their respective arsenals of deployed intercontinental ballistic missiles (ICBMs), deployed submarine-launched ballistic missiles (SLBMs), and deployed heavy bombers equipped for nuclear armaments to 700 units. It also puts limits on the number of non-deployed ICBM launchers, SLBM launchers, and heavy bombers equipped for nuclear armaments to 100. The Treaty has a verification regime that includes on-site inspections and exhibitions, data exchanges and notifications related to strategic offensive arms and facilities covered by the Treaty, and provisions to facilitate the

use of national technical means for treaty monitoring.

The U.S. and Russia announced in early 2018 that they had met the Treaty's central limit of 1,550 units of deployed strategic nuclear warheads. But the Treaty's major weakness is that other nuclear-armed powers, most specifically China, UK and France are not parties to the Treaty.

Speculation about the feasibility of extending the New START treaty began immediately after the U.S. had formally withdrawn from the INF Treaty in February 2019. It was back then when U.S. officials began expressing skepticism over nuclear arms reductions, saying the treaty weakens U.S. defenses.

Speaking to a conference held in Washington in late July 2019, a former U.S. presidential national security adviser John Bolton criticized the INF Treaty as flawed and ineffective, and said that renewal of the treaty would make no sense. Russian President Vladimir Putin, for his part, initially said that Russia would not remain committed to renewing the treaty because its defense systems "are fully capable of ensuring the country's security for a sufficiently long historical period", but at a meeting with his French counterpart Emmanuel Macron a

few months later, on August 19, 2019, blamed the US administration for being unwilling to negotiate an extension to this "nuclear arms treaty".

However, if we analyze how the signatory parties view the New START Treaty, we see that their views reflect inherently different approaches to the treaty, and the agreement brings more advantages to Russia than to the U.S.

In particular, a view has been vigorously promoted by Russia across varied media platforms that the New START Treaty should be extended for the next five years past its expiration date of February 5, 2021, without any preconditions set. Why? Because, according to expert views, the Kremlin well realizes it clearly has no capacity to engage in a new arms race due to a lack of resources and technology as well as the country's stagnating economy. Moscow feels itself quite comfortable in the current situation as long as it does not require any significant new expenditures in the long term.

The Kremlin, and President Putin in particular, began talking →





Russian 9M729-SSC-X-8 long-range ground-launched cruise missile system

about their interest in keeping in place and renewing the New START Treaty since December 2018. The most recent occasion of this was the 5th December 2019 when Putin, speaking to a closed-door meeting, held in Sochi, relating to Russia's naval development, said, "Russia is committed to signing a renewal to the Treaty as soon as before the end of this year".

The Kremlin is going to continue speculating about the need for keeping the New START valid while seeking to retain its status as a nuclear-missile and space-faring power. However, Moscow's calls for an extension to the New START treaty gave rise to pessimistic thoughts about the future of this crucial agreement. Russian Chief of Foreign Intelligence Service, Sergey Naryshkin, for example, is very pessimistic about the prospect of the Treaty being re-

newed, predicting for it the "sad fate" of the INF Treaty. In his view, the New START is not likely to be renewed due to U.S. reluctance. Naryshkin follows the trademark rhetoric of the Kremlin when he blames the U.S. government for undermining global security.

The Kremlin has announced it would revise the country's military doctrine unless the New START is renewed. Here the talk is about combining efforts with China to produce a strategy that would nullify U.S. numerical superiority in nuclear missiles and strategic delivery vehicles and launchers. Strategic bombers from Russia and China conducted, in the summer of 2019, their first joint patrolling mission over the Sea of Japan and the South China Sea, and President Putin announced in early October 2019 that Russia would aid China

to develop and deploy a missile attack early warning capability.

Military analysts are warning that the latter news could upset the current vision of China's nuclear arms policy, for the deployment of an indigenous missile attack early warning system undoubtedly implies that China would be thus prepared to deploy its nuclear missile forces and to launch a missile counter-strike. Therefore, the U.S. would be forced to view China's nuclear forces as a direct threat similar to the Russian Federation's, and to respond appropriately.

That is, the United States would be caught in a difficult dilemma between treating the Russian Federation and China as one single adversary in case a conflict with one of the two evolves into a confrontation with both, on the one hand, and developing alternative means of deterrence, on the other. The United States can, for example, deploy its nuclear weapon delivery systems in areas closer to mainland China, above all else in Guam or even in Allied territories such as Japan and South Korea.

Russia is meanwhile blackmailing the world by continuing development of new weapons systems, such as the heavy Sarmat ICBM, the Avangard hypersonic glide vehicle, the Poseidon nuclear-powered submarine drone, and the Burevestnik nuclear-powered cruise missile. The Russians even rushed, in November 2019, to exhibit to US inspectors an Avangard vehicle that was under testing in the Arctic.

In addition, the current balance is unstable. It is about the expiration of the warranty period for many of the Russian nuclear missile systems, while new ICBMs Yars and Borei-class nuclear-powered missile submarines cannot fully make up for capability gaps resulting from the retirement of their legacy counterparts.

Yury Fedorov, a military & politics expert and professor at the Metropolitan University Prague (MUP) predicts that within the next 2-3 years Russia's strategic weapons capability will decrease approximately two-fold, or Moscow will have to extend the life of obsolete missile systems and submarines. The expert called it a "technological adventure with potentially disastrous implications". Something like this already occurred in August



Chinese DF-41 ballistic missile at parade marking 70 years of Communist rule in Beijing (China)

2019 when there had been an explosion at the training ground of the Russian Navy in Nionox on the White Sea, when a prototype nuclear-powered missile was tested.

The United States, for its part, has its own compelling arguments for not proceeding with the New START Treaty renewal, and those are the same arguments that were behind the U.S. withdrawal from the INF Treaty. One is China who is currently the world's second largest economy and is rapidly catching up with the United States in all aspects, including in terms of nuclear missile capability. That explains why Washington is not in a rush to pursue an extension to the New START Treaty, because it has a somewhat different view of this from that of Moscow, seeking a new, expanded agreement involving China among other world powers.

Michael Glenn Mullen, a retired United States Navy admiral, who once served as Chairman of the Joint Chiefs of Staff, spoke in favor of bringing China into the New START Treaty along with other powers that possess nuclear weapons. He is of the view that extending New START for another five years would allow both Moscow and Washington to maintain mutual advantages and stability. Speaking at a hearing on the Foreign Affairs Committee in the lower house of the US Congress, the admiral noted that the idea of connecting new participants to the contract may have a better chance of success if the base in the form of a treaty between the US and Russia remains valid. Bringing China into the treaty will take not just effort, but also time, and keeping this base in place will help in the future to draft a new multinational treaty that would supersede the New START.

Beijing, for its part, hinted it was not interested in such a deal, saying its nuclear arsenal is much inferior in power to the American and Russian. According to the head of the Department of Arms Control and Disarmament at the Ministry of Foreign Affairs of the People's Republic of China, Phu Tsun, in November 2019, Beijing is not shying away from responsibility and is ready to reduce its nuclear arsenals, but to "honest levels".

"If other countries reduce their arsenals to the level of China, we are ready



The USA conducted a flight test of a conventionally configured ground-launched cruise missile at San Nicolas Island, CA on Aug. 18, 2019


to join the process. However, it is unrealistic to expect China to join the so-called trilateral talks," the Chinese diplomat said at the IV Moscow Conference on Non-Proliferation.

As assessed and predicted by Robert Ashley, the chief of the U.S. Defense Intelligence Agency, China will double its stockpile of nuclear weapons in the next decade. The PRC already fields 50 ICBMs Dong Feng 31A. The missile carries multiple independently aimed warheads with a range of 11,000 kilometers and beyond. Alongside the DF-31A, China has successfully tested a newer (and heavier) version, the Dong Feng-41 multi warhead intercontinental missile that made its first public appearance on the 70th anniversary of China's National Day parade on October 1, 2019.

Military analysts say the DF-41 can carry up to ten nuclear warheads and is being designed in versions adapted for mobile and fixed launches. Washington is especially concerned with China's plans to begin in the mid-2020's the deployment of strategic bombers H-20 and of nuclear-powered missile submarines Type 096 armed with JL-3 missiles.

Given that China is obviously unwilling to be a party to negotiations

with the U.S. and Russia on reducing offensive weapons arsenals in the near term, the Kremlin is left with no choice but to wait for the results of the next presidential election in the U.S. that may change the current political environment. And while Trump does not want to take on a challenging commitment relating to bringing China into the New START treaty ahead of the election, his potential opponent and Democratic presidential candidate Joe Biden has made a clear statement in favor of the extension of the agreement.

The most dangerous scenario for the world would be if the New START Treaty became void and the major powers failed to supersede it with a subsequent treaty. If such a situation occurred, then the United States and the Russian Federation (as well as other nuclear-capable powers) will be made free of any restrictions in building up their respective nuclear arsenals. Our world may face the obvious threat of losing the last safeguard against a new arms race, especially between nuclear-weapon powers. 

Volodymyr ZABLOCKIY,
Defense Express

TRAGIC DOWNING OF 2014 MALAYSIA AIRLINES FLIGHT MH17

SUSPECTS WILL BE TRIED FOR MURDER IN THE NETHERLANDS IN MARCH 2020

To many international organizations and unbiased experts in the subject area it's an established fact that the Malaysia Airlines Boeing 777 Flight MH17 was shot out of the sky over eastern Ukraine's Donbas region on July 17, 2014 by a surface-to-air missile that had been launched from a territory controlled by Russian-backed separatists, from Buk-M1 anti-aircraft system that had been taken to Ukraine from Russia. But to the Russian authorities all evidences pointing to that are no proofs at all. Moscow has continuously fabricated and disseminated a series of alternative stories with the clear aim of muddying the waters and creating the false impression that there is no clarity.

WHAT HAS BEEN ESTABLISHED SO FAR

The investigations carried out in 2014 by the Dutch Safety Board and the National Bureau for Civil Aircraft Accidents Investigation, Boeing, the International Civil Aviation Organiza-

tion (ICAO), the European Organization for the Safety of Air Navigation (Eurocontrol), the International Criminal Police Organization (Interpol), the European Police Office (Europol), the European Aviation Safety Agency (EASA), the European Transport Safety Council (ETSC), as well as experts from Australia (ATSB), United Kingdom (AAIB), Indonesia (KNKT), Italy (ANSV), Malaysia (DCA), Germany (BFU), USA, and France (BEA) have found that the MH17 crash in July 2014 was caused by the detonation of a Russian-made 9N314M-type warhead carried on the 9M38M1 missile, launched from an area southeast of the town of Torez, in territory held by Russia-supported separatist fighters in eastern Ukraine, using a Buk missile system. The warhead exploded about four metres above the tip of the aircraft's nose on the left of the cockpit at 13:20:03 (16:20:03 Moscow time) at 10,100 m altitude. All 298 people on board the flight, including 283 passengers, 80 of them children died while in mid-air from barotrauma injuries and exposure to very severe cold as a result of instant depressurization of the aircraft.

In October 2015, the Dutch Safety Board released a technical aviation report on the causes of MH17 crash that concluded MH17 was shot down by a missile launched from a Buk trailer that had been brought in Ukraine from the Russian Federation territory.

In late September 2016, the international investigation team JIT published its interim findings that confirmed the findings made by earlier investigations that the mis-

sile had been launched from an area that at that time was controlled by Russia-sponsored separatist rebels and that the self-propelled Buk missile system, after having launched the missile that brought down MH17, was taken back to the Russian Federation to avoid detection.

In May 2018, JIT stated that the Buk that was used to down MH17 originates from the 53rd Anti-Aircraft Missile Brigade, a unit of the Russian army based in the western Russian city of Kursk. The investigators showed missile debris that had the side number 9D1318869032, clearly indicating the country of origin. They also played videos and recordings of intercepted phone calls proving that the Buk-M1 launcher had been taken into Ukraine from Russia's territory.

The European Union and NATO have called on the Russian Federation to accept its responsibility and to fully cooperate with all efforts to establish accountability.

The Netherlands and Australia are convinced that Russia is responsible for the deployment of the Buk missile system that was used to down MH17. The two governments are formally holding Russia accountable. The US has supported the decisions by the Netherlands and Australia.

On the basis of the JIT's conclusions, the National Prosecutor's Office of the Netherlands and the Security Service of Ukraine (SBU), on June 18, 2019, formally charged four people with murder over the shooting down of flight MH-17. One of the suspects, Russian national Igor Girkin led the separatist forces in Donetsk in 2014. The other three people charged are Sergey Dubinskiy and Oleg Pulatov, who both have Russian citizenship, and Leonid Kharchenko, who is a Ukrainian national. The trial is set to start on March 9, 2020 at the Hague



District Court, sitting in a high-security courtroom near Amsterdam's Schiphol Airport.

RUSSIAN FAKE STORIES ABOUT MH17

This all, however, doesn't suit the Russian Federation. Moscow has time and again intentionally shared fake stories shifting the blame for MH17 disaster from its own shoulders to those of Ukraine and "sinister West", who it claims are seeking to humiliate the Russian Federation at whatever the cost. Below are just some of them.

"Ukrainian Su-25 or MiG-29". One of the most widely exaggerated fake stories is that a Ukrainian Su-25 fighter jet was purportedly seen flying miles away from the flight path of MH-17, as Russia's Defense Ministry stated at a news briefing days after the disaster. The Ministry even cited objective control data as indicating that the Ukrainian fighter carried an R-60 rocket - the only air-to-air weapon available for this type of aircraft, which the pilot allegedly used to bring down the Boeing. Later on, an unidentified Ukrainian military airfield technician said he had heard sort of a "suspicious conversation". The absurdity of this fake story is made apparent when we learn that the Su-25 can only fly to 23,000 feet — far below the altitude of 33,000 feet MH17 was cruising at when it was shot down. Su-25 pilot does not even have the appropriate equipment available for flying at low-oxygen altitudes. Moreover, the R-60, which simply is not powerful enough to inflict catastrophic damage to a large passenger plane, is an IR homing missile that, having locked on target, hits the hottest spot of the aircraft, which is the area of engine and exhaust pipes, rather than detonates over the cockpit, as MH17 investigators have found.

A fake involving a repurposed satellite image of a Ukrainian MiG-29 aircraft firing an air-to-air missile at the MH-17 wouldn't pass laugh test either. Dimension comparison of the two airplanes shown in the image as flying at one and the same altitude suggests the genuine MiG-29 and Boeing 777 cannot have the dimensions shown there.

The fact that metal rods, which are submunitions of 9M38 ground-to-air missile's warhead from Buk missile,

have been found in the bodies of MH-17 pilots finally dispels all doubts that the Boeing might have been shot down with an air-to-air missile launched from a MiG-29 or a Su-25 fighter jet. That is to say that there were no tactical aircraft flying chase for nor firing a missile in the direction of flight MH17.

"Ukraine did not close its airspace to commercial planes". Russian President Vladimir Putin, in May 2018, accused Ukraine of "violating international rules by having failed to close its airspace over the conflict-hit zone", saying that "if the airspace had been closed, the [MH17] disaster would not have occurred".

The truth, however, is that Ukraine partially closed its airspace to commercial flights below Flight Level FL260 (7,900 meters) on July 1, 2014, then raised its restricted airspace ceiling to FL320 (9,500 meters) on July 14, 2014, after one of its Antonov An-26 military aircraft was shot down at 6,500 meters, five kilometers off the border with Russia, indicating an insurgent attack using a sophisticated projectile weapon. That said, at the time there existed no ICAO established regulations or guidelines in ref-

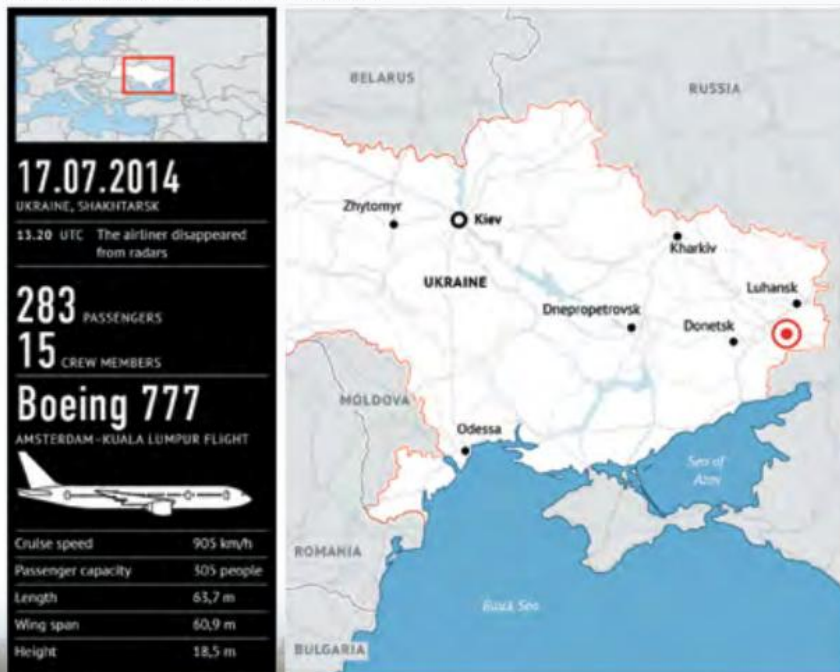
erence to mandatory airspace closures over military conflict zones. Thus, for example, airspace remained open to civil traffic over conflict-ridden areas of Mali, Sudan, Libya, Iraq, and Syria among other warring countries.

It's noteworthy that Russia, on the night to July 17, 2014, surprisingly prohibited commercial aircraft flights lower than the Flight Level 530 (16,000 meters) over its areas bordering on Ukraine. Although Moscow was supposed to notify Ukraine of this decision, it had never done so. For air traffic control of civil aircraft in that part of Ukraine is performed in sequences, where an air traffic controller in Dnipro, for example, hands over control of a transit aircraft to a counterpart sitting in Rostov-on-Don. The Russian side probably had known something is going to happen, but chose to pay lip service...

"Ukrainian Buk". Another fake story aimed to reveal "Ukrainian complicity" in MH17's downing was devised, in the summer of 2015, by Buk missile producer Almaz-Antey. The story alleges that the Malaysian Airlines Boeing 777 was indeed downed by a Buk, but a Ukrainian one, →

Malaysia Airlines MH17 crash near Donetsk

A Boeing 777 passenger jet crashed in Ukraine



not Russian. The deadly missile was launched from a site near Zaroshchenske village that the story claims was then under Ukrainian government control. To support this theory Almaz Antey used a simulation where two actual pieces of Buk missile were exploded and destroyed at a military proving range outside Nizhny Novgorod.

But the conclusions reached by Almaz Antey contradicted the actual situation that was available in Zaroshchenske at the time in question. In its investigative report published on June 8, 2015, the independent Russian newspaper Novaya Gazeta quoted evidences from Zaroshchenske village residents saying they had seen no signs of any Ukrainian military personnel being present in or nearby the village in the days leading up to and inclusive of July 17, neither had they seen any traces of heavy vehicles (wheeled or tracked) in nearby fields which could indicate a self-propelled Buk system might have been moving there. Moreover, the gateway to the village had an armed checkpoint of the self-styled People's Republic of Donetsk (DNR). These conclusions by Almaz Antey were later dismissed as untrue by independent investigators from Bellingcat.

In addition, both the Dutch and Russian experts questioned the validity of Almaz Antey's simulation with the Buk missile. They pointed to gross flaws and excessive assumptions the Company allowed in conducting the simulation experiment. Russian aviation expert Vadim Lukashevich believes the theory that the Buk missile that hit MH17 was launched from Zaroshchenske (allegedly Ukraine-controlled) has one important flaw.

According to Lukashevich, a surface-to-air guided missile's radar "sees" an outline of a plane which is formed by its most visible features. The radar then guides the missile to the center of that outline. Should a missile fly at MH17 from the front (matching a launch site south of Snizhne), its radar would "see" the engines and the front of the cockpit. The center of that outline would be the plane's nose — right where the missile exploded per Almaz-Antey's claims.

If, however, a missile would fly from the side (for example, the village

of Zaroshchenske, south of the MH17 flight path, cited by Almaz-Antey as the probable location), the Boeing's wide side would form the outline seen on radar. In this case, the outline's center would be 30 meters away from a Boeing 777's nose, where Almaz-Antey claims it actually exploded. According to Lukashevich, in practice a rocket launched at an angle of over 45° to a plane's course never hits the target's nose.

Therefore, a rocket flying from Zaroshchenske would have to miss by 30 meters to hit MH17's nose. However, it is much more probable that the rocket missing by 30 meters would go off above or below the target. Missing the target by 30 meters and still hitting MH17's nose is against impossible odds, which makes the frontal (possibly Snizhne) launch theory much more probable.

Despite these inconsistencies Russia's Defense Ministry, in an attempt to substantiate its theory that the Buk missile came from Ukrainian military arsenal, found, unexpectedly enough, "new data" from Utes-T radar located in Rostov-on-Don. The existence of this data was not reported by Russia's MoD until the fall of 2016 when it was made public at a special presentation. The "new data" indicates there were no military aircraft present near MH17, which contradicts Russia's earlier claims to the contrary. And more to this, the radar did not record any missile launches originating from Torez or adjacent areas. The fact, however, is that the means of objective control available to Russia don't have the capabilities that would allow to determine whether the missile was launched from an area to the south or to the west of the site where MH crashed.

"Ukrainian origin of the missile that brought down Flight MH17". Russian Defense Ministry, at its routine presentation held in September 2016, showcased documents purportedly indicating that the Buk missile originated from Ukrainian military arsenal.

According to the documents presented, the missile that shot down MH17 came from a Ukrainian missile regiment. The missile with the side number 886847379 that was used to down the jetliner was transported by rail to military unit 20152 in December 1986. At the time the Soviet Un-

ion broke up, this Ukrainian military unit was called the 223rd anti-aircraft defense regiment of the Ukrainian armed forces, stationed in Western Ukraine. It was then renamed and relocated to Stryi, Lviv Oblast. Personnel of the 223rd regiment have, since 2014, repeatedly been involved in the Anti-Terror Operation in Donbas.

But here the Russians lied again. Novaya Gazeta checked the documents for inconsistencies and discovered several interesting facts suggesting some of the data used in them is faked up or manipulated.

FALSIFIED ACCUSATIONS

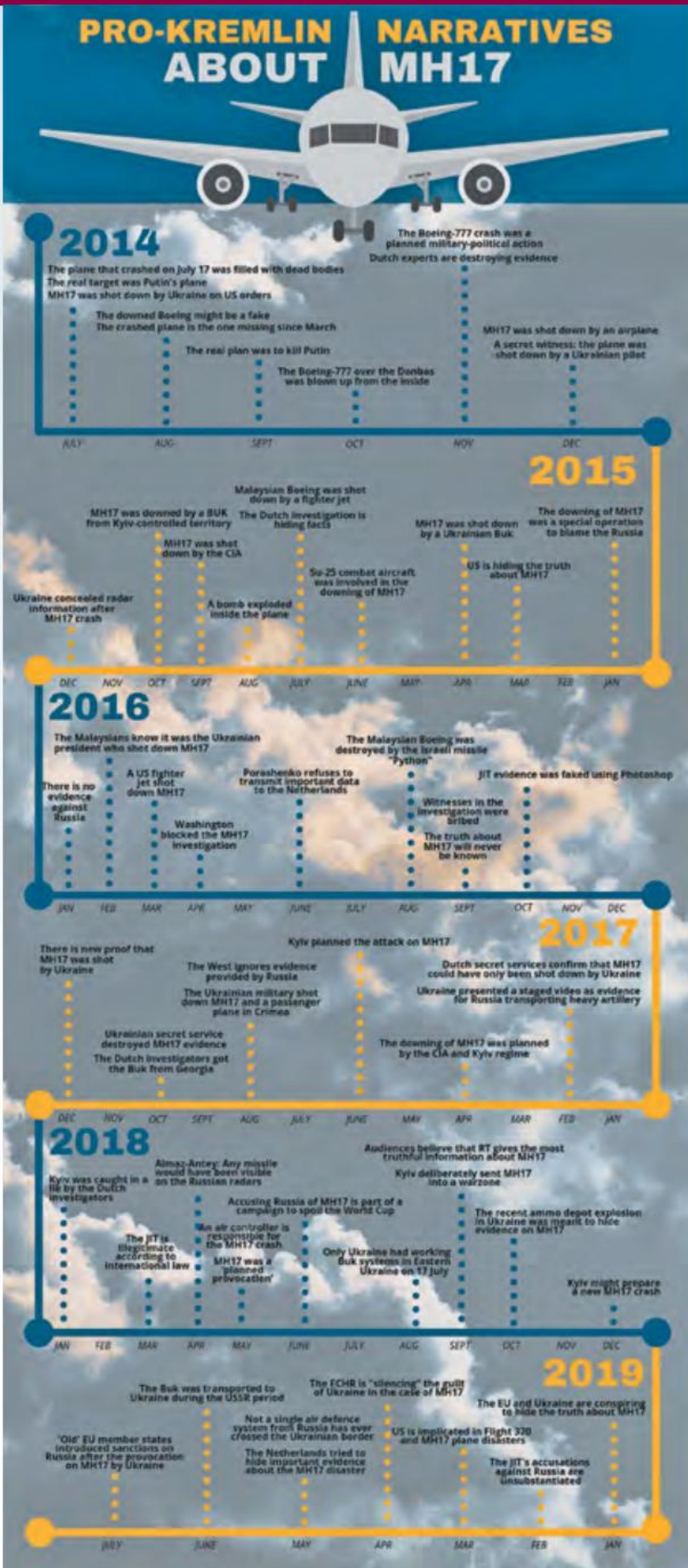
Having realized that the earlier arguments they presented to Western investigators weren't flying, the Russian MoD chose to shift their tactics towards putting in question the credibility of findings drawn by JIT and Bellingcat OSINT investigations, and even were so bold as to accuse the two teams of using fake data. The Russians particularly highlighted the video evidence collected from the Internet which they claimed to be "not authentic" and "modified" and being part of a "conspiracy to discredit the Russian Federation".

But there is one argument that can take to pieces results of the work done by the Russian MinDef in order to compromise the credibility of JIT's and Bellingcat's findings. This is the amount of time that even a highly skilled and experienced software engineer would need to compile and edit a fake video. Take, for example, the video showing the Buk launcher, minus one missile, heading back to Russia. It was first posted on Facebook on July 18, 2014 at 13:32, titled "Today, July 18 at 4:50 AM, a tracked trailer loaded with mobile tracked missile system ..." This means that a software expert (or a team thereof) had only some seven hours to make one-of-a-kind video compilation at the highest level of quality to produce this fake video. This was simply impossible to do for such a complex production, and particularly so in the turmoil situation that Ukraine was facing at the time.

CONCLUSION NOTES

This is only a small fraction of those fake stories that the Kremlin has continuously and consistently

The infographic traces the evolution of pro-Kremlin disinformation campaign regarding MH17 from the immediate aftermath of the crash to the present day. Source: Euromaidan Press



brainstormed, masterminded and shared in an attempt to shift the responsibility for the MH17 disaster onto someone else. In addition to those mentioned above there were numerous others such as "Spanish air traffic control dispatcher named Carlos", "the intended target was Putin's plane", "Ukrainian secret services doctored recordings of intercepted rebel phone conversations", and the list goes on and on. They all have proved their failure.

Moscow's room for maneuver is narrowing and the rope is tightening on the criminals' necks. MH 17 Trial, which is set to start in March 2020, will not be short, nor will it be smooth sailing. The Kremlin fully realizes this and the implications for itself.

Moscow's chosen strategy is simple and aimed at two goals. The first is wait until and see change of governments in the world's major powers, in the hope for a more favorable international environment for pursuing its policy objectives and for being able to evade responsibility [for Flight MH17 crash], using the country's huge international resources – media, special services, diplomatic corps etc. The second is to make Russian people believe that Ukraine holds the blame for everything that happened, as does the West who is unfair in its policy towards Russia. This will help create an image of an external enemy so that national solidarity is achieved and economic deterioration is forgotten.

This strategy seems to be yielding success for Moscow. It is self-speaking that (1) the Dutch parliament, in October, unanimously supported a resolution mandating an investigation into Ukraine's failure to close its airspace to commercial flights over the rebel-held areas of Donbas and as such prevent the fatal crash from happening, and (2) that the Dutch PACE delegation voted in favor of a motion to allow Russia back into the Assembly without any preconditions set.

But whatever the international environment or Russia's aims, justice and truth will be established, sooner or later. And this is what everyone should understand. **UDR**

Anton MIKHENKO,
military analyst, editor-in-chief
of UDR Journal

NEPTUNE, VILKHA

DETERRENCE WEAPONS FOR UKRAINE

Ukrainian defense industries continue their work under Government programs funding the development of a deterrent missile capability for Ukraine. At this stage, there have been ongoing testing and evaluation of the RK-360MTs "Neptune" ASCM System and of an improved and upgraded version of the Vilkha-M missile.

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 deployed operationally. Following are descriptions of two of the most advanced and capable weapons products developed in Ukraine recently – the mobile anti-ship cruise missile (ASCM) system "Neptune" and the Multiple Launch Rocket System (MLRS) "Vilkha".

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

The RK-360MTs "Neptune" ASCM System successfully completed another stage of its trials and evaluation program on November 28, 2019. Oleh Korostelev, Chief

of Design at Luch said, in a Defense Express interview, that this stage had been focused to test and verify performance capabilities of the Neptune's R-360 cruise missile and included a live fire launch over a few hundred km range where the missile was following a preselected altitude trajectory. The test launch was conducted from a military proving ground outside of Odesa, southern Ukraine.

"It was for the first time that the missile flew to a range of over 250 km flying at a set course and altitude. So we can say now that it's on that day that we completed development of an aerial vehicle with the desired characteristics," Mr Korostelev said.

The next round of trials will evaluate and verify the missile's combat performance. The R-360, in its current stage of development, weighs 870 kg, including a 150 kg warhead. It can engage targets out to 280 km at a speed of approximately 900 km/h and has a sea-skimming cruising altitude of 3-10 m.

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:

- Command-and-control post vehicle equipped for automatic control of the System's operation ensuring sustainable communication (over HF, UHF and satellite) with higher echelons and other Neptune vehicles. The five-member crew can replace the command-and-control post and have it ready for mission in no longer than 10 minutes.
- R-360 missile in the TPK-360 storage/transport/launch canister.
- Unified launcher system USPU-36 equipped for temporary storage, transport, pre-launch preparation and launch of R-360 missiles.
- Transporter/transloader vehicle T3M-360 carrying TPK-360 canisters with R-360 rockets.
- Ground support equipment kit KMO.

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, Telecart-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 roughly on a par with best international brands

"Neptune" ASCM System



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 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.

MLRS SYSTEM "VILKHA-M"

Vilkha-M has been designed as an extended-range follow-on to the original precision-guided Vilkha MLRS that has already been operationally deployed with Ukraine's Armed Forces.

Vilkha-M has a range capability of 110-120 km compared to 70 km range achievable with the Vilkha original.

Vilkha-M missile successfully passed another phase of its test and trials program after it had been launched, on December 18, 2019, from a military proving ground outside of Odesa and was able to fly over a range in excess of 110 km.

Oleh Korostelev, Luch CEO and Chief of Design, said, in an exclusive interview with Defense Express, "Luch has successfully completed the phase of the Vilkha-M System trials program that is leading up to the System entering official qualifi-

cation trials program. Distanced out to 110+ km, the target was hit with a CEP of just a few meters. Vilkha-M has, therefore, validated all of its Customer-specified characteristics both in terms of range and accuracy. Luch is currently preparing the System to enter official qualification trials process that is potentially leading to Approval for Service Use. This precision-guided MLRS capability is being developed and built fully domestically," Mr Korostelev said.

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 human targets as well as field fortifications and armored targets. It provides lethality proportional to theater-ballistic missile weapons.

The Vilkha-M has been developed out of the legacy Russo-Soviet 300-mm MLRS technology 9K58 "Smerch". It is designed such as to be suitable for launch from the 9K58 launcher tube. 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. 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 tanks within its range.

The Vilkha-M 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 munition has a highly maneuverable flight capability that reduces the probability of it being intercept-


ed by anti-missile defenses, making it virtually immune to enemy air defense attacks.

The Vilkha M, as Vilkha R, 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 operations 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.

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.

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".

Overall, the procurement of new Luch missiles would provide Ukrainian forces with a capability to defeat and destroy targets of a technologically developed adversary in severe air defense and ECM environments. 

Serhiy ZGHURETS,
Defense Express

"Vilkha" MLRS



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



DEVELOPER OF ANTI-TANK SYSTEMS IN UKRAINE



7,5 km



800 mm

5 km



800 mm

5 km



750 mm

5 km



700 mm

5 km



550 mm

5 km



550 mm

4 km



550 mm

2,5 km



550 mm

Armor penetration capability



Light portable
missile system
Corsar



Man-portable
rocket grenade
launcher



Man-portable
ATGW system Skif

UKRAINE OFFERS
UPGRADES TO SAM
SYSTEMS PECHORA,
OSA, SHILKA,
TUNGUSKA



S-125M Pechora

A NEW LEASE OF LIFE FOR PROVEN WEAPONS

Ukraine has developed life extension upgrades for Soviet legacy surface-to-air missile (SAM) systems, aimed to extend their service life and to bring up to date their specifications and performance parameters.

S-125M PECHORA

The S-125 Pechora is a Soviet-era SAM system developed for defense against aerodynamic threats, manned or unmanned, flying at 20 to 1,800 meters high, at ranges from 3.5 to 25 km away. In total, more than 400 units of the S-125 system have been sold worldwide. Some of them, despite their age, continue to be in operational use. However, the S-125 technology still has much room for upgrading and improvement.

Thus, Radionix, Kyiv, has developed an upgrade package for the S-125M "Pechora" SAM system which includes modernizing the 5V27D missile to the 5V27D-M1 and 5V27D-M2 standards equipped re-

spectively with semi-active and active seeker heads.

The package encompasses improvements to all the key components and subsystems, including the UVN radar post, high-frequency receiving devices, radio command transmitters, TV/optical sighting equipment; 5P73 launcher; 5V27D missile; and a new booster motor replacing the 5C45.

Upgrade package for the 5V27D missile includes a Customer-selectable semi-active/active seeker head and a fully redesigned missile guidance electronics set.

Other upgrades for the 5V27D missile include electrically driven steering gear and ailerons in place of air-driven ones to achieve a weight saving and improve control properties; adding a platformless inertial navigation system; an improved radio signal receiver; integration of a radar proximity fuse using new microelectronics hardware; replacing the missile control unit with a more current-generation counterpart.

The 5V27D-M1 uses a combined guidance method (radio-inertial guidance in the mid-course and semi-active radar homing in the terminal phase) enabling the missile's kill envelope to be extended to 40 km for high speed maneuverable targets and to 45 km for low-speed targets.

Other upgrades are to the UNV-M antenna post and UNK-M cabin to enable tracking of 3 targets simultaneously; and upgrades to the missile's line-of-sight radio command transmitter would increase the number of missiles being guided simultaneously to six missiles or more.

The 5V27D-M2 uses radio-inertial guidance in the mid-course and active radar homing in the terminal phase. This would enable extended kill envelopes of 40 km for high speed maneuverable targets and 45 km for low-speed (≤ 300 m/s) targets. The upgrade would replace the UNV-M cabin on each launcher with a 36D6 radar station. The 3D radar supports tracking of up to 8 targets →



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simultaneously, and up to 16 missiles will be able to be guided simultaneously due to upgrades to the launcher control equipment.

The upgrades would keep the 5V27D missiles in service for another ten years.

OSA-AKM SAM SYSTEM

The BM 9A33BM2 (BM3) Osa-AKM is one of the most common and successful army air defense systems in current use. It is meant to provide air defense cover for motor-rifle (tank) divisions in all kinds of combat scenarios. The Osa-AKM can operate in severe jamming environments, providing effective protection against low RCS, low flying threats.

This is quite a lethal system armed with six 9M33M3 missiles. Despite having been developed in the second half of the 20th century, the Osa proved its worth in fighting Russia-back insurgents in Eastern Ukraine. But it can have its capabilities improved and expanded through upgrades offered by Ukrainian defense industries.

Thus, several domestic companies, among them Ukroboronprom holding's Ukr radarproekt LLC and Defense Technologies LLC offer a package to upgrade the BM 9A33BM2 (BM3) Osa-AKM to the more capable BM 9A33BMD standard that would enable improved technical and operational performances along with an extended lifespan.

The BM 9A33BMD upgrade package includes among other things:

- improved detection and engagement capabilities against small-sized targets, cruise missiles, and UAVs, including low flying ones;
- enhanced immunity to passive/active jamming attempts due to the introduction of digital signal processing techniques;
- implementing an automatic downlink from an external control center at ranges 45 to 90 km, with the target detection envelope enhanced due to achieving an increased receiver system gain and shifting to digital signal processing;
- service life extended by up to 12 years and the mean time between failures by up to 1,500 hours due to analog-to-digital replacement;
- introduction of data communication between the BM 9A33BMD and a higher command center.

The upgrade would enable a 20 per cent increase in the detection and engagement capabilities against targets with RCS of 0.1 to 0.01 sq. m., while the altitude engagement envelope would be risen to 7.0 km. Simultaneously, the BM 9A33BMD would be able to engage targets travelling at 700 m/s on pursue courses and 350 m/s on lead-collision courses (an increase of respectively 200 m/s and 50 m/s as compared to the original version).

Analogue-to-digital replacement of the moving target selection equipment would help achieve a 20-fold increase in compensated interference with the functional checkout equipment. The BM 9A33BMD additionally includes an automated workstation for the operating crew leader, equipped with a modern computer with GPS and radio modem.

Also packaged is a TV/optical sight, with optical and infrared images of

up to 1,500 m and ranges up to 2,500 m, as well as land (surface) targets at ranges out to 2,000 m, while on short stops or on the move.

The Arsenal Factory, Kyiv, has developed a comprehensively upgraded version of the ZSU-23-4 "Shilka" anti-aircraft gun system.

Arsenals' Shilka upgrade, known under designator ZSU-23-4M-A, includes a multirole digital phased array radar Rokach-AS replacing the 1RL33M radar in the original version; a new optical location system; the addition of a missile guidance channel; a new fully digital computing system in place of the old analog computing device; integration of advanced weapon control algorithms; and replacement of other components with more up-to-date counterparts. Future improvements will include replacement of the currently used gas turbine power unit



Osa-AKM SAM System

objects displayed on an LCD screen monitor. This would enable targets to be searched and tracked without the use of additional radars, thus reducing the probability of the system being exposed by enemy assets.

ZSU-23-4 "SHILKA"

Another proven air defense weapon that has received a second lease of life in Ukraine is the ZSU-23-4 Shilka. Developed as a self-propelled anti-aircraft (AA) weapon system, it is intended for AA defense of ground forces and military facilities, and for shooting down air targets flying at altitudes

with a more economical electric power supply source.

Arsenals' Rokach-AS radar is undoubtedly the key element in the upgrade. It offers three-mode operation for 360-degree surveillance, air search and autotracking in an integrated package.

The radar Rokach-AS has the capability to pick up and track low-observable UAV targets with RCS as low as 0.01 sq. m, at ranges out to 7 kilometers. It far exceeds its predecessor in almost every area. Compared to the original radar, which could scan a 15-degree sector and track targets within its 1-degree FOV beam, the



2K22 Tunguska

Rokach-AS has coverage angles of 18 degrees, both in azimuth and elevation, and it can search and detect targets much quicker than its predecessor.

Finally, when compared to the 1RL33M original that occupied the entire perimeter of the turret inside the "Shilka" vehicle, the Rokach-AS is a compact device accommodated in a container on top of the vehicle, with the resulting benefit of a considerable amount of internal vehicle space released to improve the comfort for the crew and passengers, and enabling the installation of additional equipment like HVAC.

The ZSU-23-4M-A upgrade additionally includes the installation of an optical location system integrating television and thermal imaging cameras with a laser rangefinder. The upgrade would offer detection and autotracking capabilities along with a capability for automatic/semi-automatic generation of target location coordinates for the digital computing unit. The up-

graded system would also support air surveillance and engagement control missions. It would be able to detect targets at ranges up to 12 km, and to capture and automatically track them at ranges out to 10 km.

The upgraded ZSU-23-4M-A Shilka would be able to defeat targets at ranges up to 5 km away, which is twice the range achieved with the previous-generation system.

2K22 TUNGUSKA

Defense Technologies LLC, Ukraine, offers an upgrade for the Soviet designed 2K22 Tunguska – a self-propelled air defense system that combines a rapid-fire automatic cannon power and surface-to-air missile (SAM) capability. The upgrade includes life extension overhaul and replacement of the key subsystems and assemblies, including the cannon, missile launcher, and carrying chassis.


Defense Technologies also offers a more comprehensive package for the Tunguska, which additionally

addresses upgrades to the electronics set, ergonomics, and operator workstations (new screen monitors and communication facilities, reduced number of display indicators).

For upgrading the Tunguska, Defense Technologies has developed a range of technical solutions based on modern microelectronics hardware that can ensure benefits in terms of more energy efficient operation, a reduced requirement for system alignment, and high reliability of operation with minimum human intervention. In particular, we are talking about a broad presence of universal modules or so-called "cells" in electronic circuits. Those modules are adaptive for recording any kind of information and for processing it by the algorithms as needed. As well as the Tunguska, this "modular" method is suitable for upgrading other Soviet legacy SAM weapons like the Buk, S-300P or S-300V1.

Defense Technologies has also developed new display indicator units, and operator workstations can be upgraded with new VGA monitors.

The package also includes an electronic-optical system with a video processing capability to enable the detection and automatic tracking of airborne targets in all weathers and at all times of the day as well as to achieve a high kill probability, especially for the SAM part of the system. Another benefit achieved with the integration of the EO detection and tracking capability would be an increased efficiency of the system's use even with low-trained operators.

But any significant enhancement in the system's combat capabilities can only be achieved with new missiles in place of those currently used with the Tunguska. 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 is about 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 products. 



ZSU-23-4 "Shilka"

Anton MIKHENKO,
UDR Journal



TRIDENT
DEFENCE

SAFEGUARDING UKRAINE

through defence investment & security cooperation

www.tridentdefence.com

Trident Defence is a commercial enterprise established by Noosphere Ventures with the mission of ensuring the success of Ukraine through defence investment and security cooperation with the US, NATO, and the EU.

Trident Defence has two successful and already implemented projects. These projects: ArtOs and MyPol are currently used in Ukraine.

Partnership. Trident Defence is open to cooperation in any defence area of practical concern to Ukraine, and is currently developing partnerships in the following areas:

- Small arms and light weapons.
- Electronic warfare and directed energy.
- C4ISR.
- Data analytics.
- Demining.

ArtOs (www.artos.tech) is an artillery Fire Control System developed to optimize the employment of indirect fire weapons of different types (towed, self-propelled, rocket, mortar...) and serves as an all-in-one solution for communications, observer data gathering, ammunition consumption recording, and resupply order resolution

ArtOS reduces the time between target detection and initial firing to approximately 1 minute. It increases speed of firing up to 3 times, and provides firing data to hit the enemy target from the first salvo.

The System contains all the components required for successful operation. It comprises the software, the armored tablets (to run the software), network supply modules (to provide network and extend its range), and gun layer data display systems.

The executives of our projects have combat experience in the armed conflict in the east of Ukraine and have carried out combat missions on leadership positions, therefore, the software itself was developed with the nuances of modern armed conflicts in mind. Our developers recognized the need for this system during their military service in artillery units.



ArtOS



MyPol (www.appmypolice.com) is a smart phone app to call the police for help instantly and discretely. There are many cases when citizens need to make an emergency call quietly, without attracting attention such as in domestic violence situations. The system also provides handicapped persons the same ability to call for help quickly and discretely.

My Police consists of a mobile application which reports position and pertinent information to a web interface for police dispatchers.

My Police has proven record of success in Ukraine as nationwide emergency call application to call for police assistance.

My Police "white label" offers private security companies and corporations the same communication tools providing instant SOS call capabilities to their customers or employees.



My Pol
SYSTEM



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UPGRADE OPTIONS FOR STRELA, IGLA MANPADS

The ever rising role of combat aircraft in contemporary military conflicts dictates the need for enhancing and improving defenses against air-to-ground attacks. Man-portable shoulder-launched surface-to-air missile (MANPAD) systems are used to defeat aircraft threats attacking from low and very low altitudes, and still remain the most efficient anti-aircraft weapon to date, and in certain scenarios they have no alternative as a means of countering hostile aircraft.

Currently deployed with more than 60 armed forces, Strela and Iglu MANPADS have been well-proven in war conflicts throughout the globe. Ukraine has developed options to upgrade the Strela and Iglu to more capable STRELA-2MM and IGLA-1M configurations.

MANPAD IR seeker developed by SDP SE Arsenal

Capability improvements in the two legacy MANPADS are achieved by means of replacing their original IR guidance units with more up-to-date designs developed by the ARSENAL Special Device Production State Enterprise (ARSENAL SDP SE). The key elements of the upgrade packs are the optical seekers OGS 36-45 for the STRELA-2MM and the OGS UA-424 seeker for the IGLA-1M, which both have already been showcased at international defense exhibitions.

The upgraded STRELA-2MM is a head-on attack missile that is effective against both fixed-wing and rotary-wing targets. The missile's new optical seeker integrates technologies enabling it to defeat IR decoy flares and natural interference, and it is especially efficacious in severe clutter and ECM environments.

The optical seeker OGS UA-424 for the IGLA-1M provides enhanced capabilities against IR countermeasures. It boasts an improved single-launch kill probability and, most importantly, offers a far extended range as compared to the original missile while attacking its targets head-on.

The Arsenal's 336-24 package for the Iglu-M1 upgrade incorporates a newly-designed guidance unit replacing the 9E418 IR seeker used in the original IGLA missile. The new seeker would improve the missile's performance capabilities to levels much higher than those found in the established MAN-

PAD systems such as the STINGER, IGLA-1 or IGLA, and far more superior than the STRELA-2M's. In particular, the Iglu '336-24' has a kill probability of 0.4-0.6 while operating in heavy ECM environments, as compared to 0.1 for the IGLA. The 336-24 upgrade offers a maximum effective range of 5,200 m.

The 336-24 upgrade pack for the IGLA-1 MANPAD system provides a good example of highly fruitful coop-



A MANPAD launcher is seen here attached to an armored vehicle weapon station

eration between Ukrainian defense industries. In particular, the new 336-24 optical seeker could be manufactured by the R&D and Production Complex Progress company, and the Pavlohrad Chemical Plant, Ukraine's top manufacturer of rocket propellants, has developed a new solid propellant for the 336-24 missile, enabling extended effective ranges and enhanced maneuverability performance.

The STRELA-2MM and IGLA-1M MANPADS can be integrated into packs of 4, 6 or 8 launchers deployed on armored vehicles. In this case, weight constraints are much less critical than in man-portable configurations, and so missile ranges can be extended by using a more powerful (hence heavier) propulsion system.

With these MANPAD technology upgrades in place Ukraine can fill in the gap in its short-range tactical air defense capabilities and help foreign militaries upgrade and update their Strela/Iglu MANPADS inventories. UDR



Iglu-1M upgrade



T-72

UPGRADE: UKRAINIAN ACCENT



The armored vehicles sector still remains among the most promising and effective sectors of the Ukrainian defense industry. Ukrainian armored vehicles industries have pursued a number of projects that would give whole new capabilities to some of the time proven, Soviet-legacy armored ground vehicles.

T-72AMT UPGRADE OPTION PROPOSED BY KYIV ARMORED VEHICLES FACTORY

Kyiv Armored Vehicles Factory (KAVF), an Ukroboronprom's affiliate, has developed the T-72AMT upgrade to address the T-72 MBT's obsolescence.

Built to the Ukrainian Armed Forces' specifications, the T-72AMT upgrade was developed and financed privately by KAVF.

The upgrade incorporates enhancements that include (but are

not limited to): night vision equipment with third-generation electro optical converters; the 1K13 night vision sighting system enabling night firing with the Kombat (125mm gun-fired laser-guided) missile, which is capable of penetrating 550 mm of RHA behind explosive reactive armor (ERA); the V-84-1 engine replacing the B-46 engine used in the original vehicle; an ERA system (similar to that used in the T-72UA upgrade); the Aselsan radio; the SN-3003 "Bazalt" navigation suite; and caterpillar driving wheels (similar to those employed in the T-80 upgrade).

It's worth of note that the KAVF, a company that has been traditionally strong in MRO servicing of

T-27 MBTs, has developed at least 15 options for upgrading the T-72 MBT, but those were all tailored to meet the specific needs of foreign users, given that all T-72s had been withdrawn from Ukraine's military arsenals and sold in great numbers on export markets prior to the onset of Russian military incursion into eastern Ukraine in 2014. The war with Russia has made possible the return of T-72 tanks into Ukraine's armored arsenal.

The T-72AMT upgrade was developed based on real-world feedbacks from Ukrainian government forces deployed in the Donbas conflict area, and the KAVF had a very tight timeframe to implement it into production.

The T-72AMT was, in August 2018, subject to live fire testing that included firing different ammunition types, including specifically Kombat ATGMs developed by SK DB Luch, another affiliate of Ukroboronprom.

A capability to conduct firing with Kombat ATGMs is what makes the T-72ATM special against other upgrade options available for the T-72 MBT. Using the Kombat missile, armored targets can be hit from 5 km, which is twice the

T-72AMT
Upgrade Option
Proposed by
Kyiv Armored
Vehicles Factory





T-72AMT

firing range attainable with the T-72A upgrade.

That said, the Kombat has a tandem-charge HEAT warhead that can pierce through 750 mm of core armor behind ERA, effectively making the weapon highly lethal even against heavily armored targets.

The T-72AMT upgrade pack additionally includes improvements to tracks and suspension of the tank. In particular, all steel tracks have been removed in favor of 'rubber band' tracks with rubberized track treads to provide less rolling resistance, noise and vibration and up to twice the service life of steel tracks. Driving of the vehicle has been made easier and safer by adding a rear view camera. Furthermore, the T-72AMT is fitted with an auxiliary power unit to provide electrical power to onboard equipment (such as situational awareness cameras and weapon control systems, for example) without the high fuel and life consumption of the main engine.

The T-72AMT has generated an interest among the expert community in Vietnam.

MOROZOV/MALYSHEV PROPOSED UPGRADE TO THE T-72 MBT

Kharkiv-based Morozov Machinery Design Bureau, an affiliate of the Ukroboronprom state-owned defense industries holding company, has developed a comprehensive upgrade to the T-72 main battle tank (MBT),

which it pursues in collaboration with the state-owned Malyshev Factory.

The upgrade pack encompasses improvements to the vehicle's mobility performance, command and control equipment, and the level of armor protection along with the addition of some new capabilities.

The key element of the upgrade will be the new, 6-cylinder 1,200hp 6TD-2 engine that would allow potential benefits in terms of better mobility and maneuverability, as well as achieving a higher level of protection by means of adding extra armor or/and installing a hard-kill active protection system.

The Morozov/Malyshev proposed upgrade option for the T-72 MBT additionally includes an improved trans-

Enhanced capabilities against hostile tanks would be achieved by adding more capable weapons along with a new fire control system supporting the gun-launched anti-tank guided missiles (ATGMs) "Kombat" and "Konus".

Developed by Luch Design Bureau, the ATGMs Kombat and Konus are produced by the Public Joint-Stock Holding Company Artem.

Designed to be fired from guns on the T-72, T-80UD and Oplot MBTs, the Kombat missile can be launched when both the tank and the target are moving. Although intended primarily to engage targets beyond the effective range of the tank gun chambered for a 125mm AT Round, the Kombat can be efficacious also




Morozov/Malyshev proposed upgrade to the T-72 MBT

mission enabling higher speeds to be achieved, both in forward and reverse drive modes. With an improved reverse gear in place, the vehicle will be able to be relocated quickly on the battlefield without the need of being turned around.

Other enhancements include the EA10-1/EA8 auxiliary power unit for powering additional electronic subsystems, electromechanical actuators, the active protection system "Zaslin", and the optronic countermeasures system "Varta" among other systems on the vehicle.

against hovering helicopter targets and heavily fortified weapons emplacements among other types of targets. It uses laser-beam-riding guidance where the laser beam is directed above the target without actually illuminating it. It illuminates the target (tank or helicopter) for just 0.3 seconds prior to impact, making the missile virtually immune to enemy countermeasures.

The Konus ATGM uses a similar guidance technique, but is designed specifically for launch from the standard 120-mm NATO gun. 



«OTAMAN 6x6»



«KOZAK-2»



«KOZAK-2M1»



«KOZAK-5»



«KOZAK-5 PML»
Specialized armored vehicle
for pyrotechnic teams



ARMORED LOADER FOR
PYROTECHNIC TEAMS

PRACTIKA

www.practika.ua

PRA "Practika" is leading Ukrainian producer in sphere of armored vehicles.

The company was founded in 1993 and produces the vehicles of special purpose (including vehicles with armor protection) since 1997.

Production of military vehicles took start at 2009 (when "Practika" has received the order from Ministry of Defense of Ukraine for developing of light armoring vehicle, later be came known as "Kozak") and in 2014 it became the main trend of company.

Since that time a huge variety of military armored vehicles of different purposes and classes were designed and went in production:

- troop transporters on truck's basis
- command-and-control vehicles on truck's basis
- small class reconnaissance and patrol vehicles
- special forces vehicles

-front edge ambulances

-multifunctional tactical vehicles with dependent ("Kozak-2") and independent suspension ("Kozak-2M")

-Armoring Fighting Vehicles 6x6 and 8x8 Otaman 8x8 family (particularly, Otaman 8x8 is designed in two different ways – using some BTR-60 spare parts and as completely new vehicle)

-BTR-60 and BMP-1 modernized

Today, the Kozak-2 car is produced serially (more than 100 cars have already been manufactured) –it is put into service by the National Guard and the Armed Forces of Ukraine.

"Practika" has its own plan (located at Kiev) with several design departments (DD of regular products, DD of new developments, DD of electrical engineering), department of standardization and quality certification management with own testing laboratory, department of work with state secret documents etc.



PORTABLE SURGERY ROOM FOR THE FIELD HOSPITAL



ARMoured CHECKPOINT



PORTABLE ARMoured COMMAND POST



ARMoured CARGO TRUCK WITH LOADING SYSTEM



BTR-60 MODERNIZED



MI-SERIES HELICOPTER UPGRADES

UKRAINE'S MILITARY POISED TO FIELD AN ATTACK HELICOPTER WITH FULL DAY/NIGHT AND ADVERSE WEATHER CAPABILITIES

The Ukrainian military has long dreamed of having a gunship and attack helicopter platform equipped for precision-guided air-to-ground missions and for Day/Night battlefield surveillance and missile guidance and launching roles enabled with state-of-the-art thermal imaging, electro-optical and laser homing capabilities.

Ukrainian industries, among them privately-run Ramzai and government-run State KB Luch, NVK Photopylad and Iziium Instrument Factory, which are affiliates of the State Defense Industries Group Ukroboronprom, already have on offer certain solutions that hold a promise to get this dream into reality.

Ramzai, Luch, Photopylad and Iziium Instrument Factory have collaboratively developed an all-weather capable missile fire-control kit, code-named 524R, which is designed as part of an upgrade to the helicopters Mi-24, Mi-8, and Mi-2.

The 524R has been developed with day-and-night capabilities for



(1) battlefield surveillance; (2) search, detection, identification and automatic tracking of ground and aerial targets, moving or stationary, and (3) guidance and control of helicopter-launched, RK-2V missiles. When configured to operate with the RK-2V missile, the 524R supports the detection and identification of tank-size targets at up to 10 km range, allowing the missile to engage targets at ranges up to 7.5 km.

The helicopters are proposed to be upgraded with Photoprylad's gimbaled optronic sensor turret, the PM LKT Spectrum that can identify a tank-size target at ranges no less than 8,000 m in day-time and beyond 6,000 m at night. With laser-assisted guidance, the missile aiming range is between 50 and 7,500 m, with a CEP not exceeding 0.8 m whatever the aiming distance is.

Izium Instrument Factory and KB Luch are attached to the PM LKT Spectrum project as developers of the laser guidance capability and the RK-2V/Barrier-V ATGM and launcher, respectively. It must be noted for that matter that the RK2V/Barrier-V features in the attack helicopters Mi-24 that Ukraine had overhauled and upgraded for the Armed Forces of Azerbaijan in 2010-2011. In Azerbaijani service, the helicopters received the designation Mi-24G (where "G" - Gecə, stands for "night" in Azerbaijani). The overhaul/upgrade had been performed by Aircraft Repair Plant Aviacon and KB Luch. The South African company Advanced Technology and Engineering assisted in the project by supplying gyro-stabilized electro-optical systems for surveillance and weapon aiming.

The helicopters received high praise from the Azerbaijani pilots, most particularly for the performance of their night operation and Barrier-V ATGM capabilities, with approximately 30 RK-2V missile launches performed by the Azerbaijani military over the period from 2011. The Azerbaijani Customer has been definitely satisfied with the job well done, but even more so have been the Ukrainian contractors, because it is that contract that has brought Ukraine closer to having an indigenously developed guided weapons capability for helicopters.

The solutions created as part of this experience have again been offered for adoption by the Ukrainian military, whose helicopters are lacking the capabilities for night and adverse weather operations and are poorly equipped for combat. Unlike the collaborative project with the SAR and the terminated project involving Sagem, France (which was supposed to equip Ukraine's Mi-24PU2 upgrade prototypes with Sagem Euroflir 410 day/night gyro-stabilized optronic pod integrated with the LKK-V laser sensor for guiding the RK-2V missile), the missile fire-control kit 524R has been developed with reliance on domestic technologies and emphasis on domestic collaborations in Ukraine. "The 524R is fully indigenously designed and built, excepting thermal imaging camera sensors that are the only foreign imported components", the developers have emphasized.

Along with four anti-tank guided missiles (ATGMs) RK-2V, the 524R can support launches of the unguided missiles S-5/8, as well as air-launched bombs and the Unified Gun Pod UPK-232-250.

The 524R has already gone through the initial live-fire flight tests that involved missile launches against simulated tank and timber-and-sand fortification targets.

All the highest military officials involved, including the Minister of Defense and Chief of the General Staff have endorsed a document that outlines the process for conducting official qualifications trials leading up to the 524R's induction into the military. The 524R is expected to be ready for entering the official qualification trials in the near-term future, to be followed by user evaluation and the adoption for military service.

At the 16th edition of the International Expo Arms & Security, held in Kyiv from October 8 to 11, 2019, Izium Instrument Factory (an Ukroboronprom's affiliate) unveiled the first release of its new-gen optronic weapon aiming pod OPSN-1 which it developed collaboratively with KB Luch. Equipped with high-fidelity EO/Thermal Imaging camera sensors, a laser sensor for guiding ATGMs and a laser range finder, the OPSN-1 supports target detection and provides precision guidance to its →



Optronic sensor turret PM LKT Spectrum can identify a tank-size target at ranges no less than 8,000 m in day-time and beyond 6,000 m at night. With laser-assisted guidance, the missile aiming range is between 50 and 7,500 m, with a CEP not exceeding 0.8 m whatever the aiming distance is.



associated weapons. It is suitable to be mounted and used on a varied range of military platforms, including light armored and armored fighting vehicles, UAVs, helicopters and shipboard gun fire-control systems. With its Thermal Imaging capability, it can detect targets at ranges of 14,500 m or longer and identify them at ranges beyond 6,000 m. Its Laser Range Finder can measure distances ranging between 150 m and 15,000 m, and with laser-assisted guidance, the ATGM aiming range is between 50 and 7,500 m.

The OPSN-1 was showcased at presentation/exhibition of scientific-technical projects and technologies



New-gen optronic weapon aiming pod OPSN-1

MI-8 MSB-V ARMED AND DANGEROUS

The Mi-8MSB-V helicopter can be fitted with a diversified range of weapons, including bombs, small caliber firearms and missiles. On outer hardpoints there can be mounted bombs or incendiary clusters. The helicopter's arsenal of small caliber firearms contains Unified Gun Pods UPK-23-250 armed with GSh-23L guns for air-to-ground and air-to-air missions. There are 4 x 12.7 mm machineguns, 8 x 7.62 mm GShG machineguns, and 4 x AG-18A grenade launchers hosted in the outer pods. The armaments package also includes B8V8MSB/B8V20MSB4 packs of unguided missiles S-8. Finally, what makes the MSB-V special is the guided missile fire-control system 524R associated with the RK-2V/Barrier-V ATGM and launcher.

developed by the Ukrainian Academy of Sciences' institutions, held in honor of the 100th foundation anniversary of the Ukrainian Academy of Sciences and titled "Science for National Security and Defense". The OPSN-1 technology is now almost fully matured and ready to be finally brought to practical implementation.

The 524R and OPSN-1 are both likely to be capable of supporting control of the new air-launched missile RK-10 that made its debut at the Arms & Security 2019 Expo. Developed by KB Luch (an Ukroboronprom's affiliate), it is intended to defeat and destroy ground targets protected with explosive reactive armor (ERA), moving or stationary, as well as small surface combatants and slow-moving aerial targets. The RK-10 uses automatic laser beam riding guidance

and will be compatible with current helicopter-launched precision-guided weapon systems. The missile's tandem-charge HEAT warhead can penetrate 1,100 mm of core armor behind ERA. The 38-kg missile can reach ranges up to 10,000 m. It is packaged in a transport-and-launch canister that weighs 62 kg when loaded.

As seen from the above, Ukraine has a great potential to create new technologies for military weapons and equipment, and armed services, both in Ukraine and beyond, have a real opportunity to modernize and upgrade their respective helicopter fleets by adding current-generation technology solutions. [UDR](#)

Serhiy ZGHURETS,
Anton MIKHENKO,
Defense Express

DB "LUCH" UNVEILS ITS MOST RECENT MISSILE, THE *RK-10*



170-mm ATGM RK-10

State Enterprise "State Kyiv Design Bureau "Luch" (an affiliate of the Ukroboronprom State Defense Industries Group), has won great renown, both in and outside of Ukraine, as developer of a range of precision-guided missile weapons products such as tank-launched ATGM *Kombat* as well as *Skif*, *Corsar* and *Barrier* line-ups of man-portable and vehicle-mounted anti-tank missile and launcher systems.

At the 16th edition of the Arms & Security International Expo, held in Kyiv in October 2019, the Company unveiled its most re-

cent development – a highly versatile guided missile system that received the nomenclature RK-10.

Designed in 170-mm caliber size, the RK-10 missile is intended to be used against targets such as ERA-protected armored vehicles (both static and moving), small surface ships, and slow flying targets in the air. The missile is delivered and transported as an all-up round in a storage/transport/launch canister and can be attached with different types of warheads.


So far the ammunition has been developed in two versions:

- anti-tank guided missile R-10-K, developed specifically for use with rotary-wing aircraft. It is armed with a tandem-charge HEAT warhead boasting an armor penetration capacity of 1,100 mm behind ERA;
- guided ground-to-air missile R-10-OF developed for use with mobile SAM air defense systems; armed with a proximity-fuzed, high explosive, explosively formed (HE EF) penetrator warhead, it can pierce through 120 mm of core armor behind ERA.

Both versions feature an automatic laser-tracking guidance system.

Luch is also developing a variant of the missile armed with a Fuel-Air Explosive (FAE) warhead.

A highly versatile missile, the RK-10 is suitable to be launched from platforms based on land, at sea or in aircraft, against aerial and land targets distanced at up to 10,000 m. The missile weighs 38 kg, and when it is ready to fire in canister it weighs 62 kg. It can be launched at temperatures ranging from minus 40 to plus 60 degrees Celsius.

Some analysts are looking at the RK-10 as an improved and enhanced follow-on to the already renowned 130-mm ATGMs *Barrier* and *Barrier-V*. By way of comparison, the *Barrier* missile can reach targets out to 5,000 meters and can be launched primarily from turrets on BMP and BTR series of armored fighting vehicles, while the *Barrier-V*, which was designed as part of upgrade to the Mi-24 series of helicopters among other combat aircraft platforms, can be fired to a range of 7,500 meters. 



RK-10 features an automatic laser-tracking guidance system



FROM PROCUREMENT TO CO-PRODUCTION

UKRAINE-TURKEY COLLABORATION IN THE UCAV REALM

Robust development of military-technological ties between Ukraine and Turkey over the past few years has produced a varied range of projects, especially in the realm of unmanned aerial vehicles.

After almost four years of negotiations, Ukraine signed, in January 2019, a contract with Baykar, the top leading producer of military UAVs in Turkey, to purchase six Bayraktar TB2 Unmanned Combat Air Vehicles (UCAVs), three mobile Ground Control Stations (GCS), and six Canadian-made EO/IR imaging and targeting sensor systems Wescam, along with Maintenance kits and spare parts kits. Deliveries under the contract came in two equal shipments in March and October 2019, the shortest time for similar contracts ever recorded in Ukraine.

The Bayraktar TB2, which is rated among the world's best in this class of tactical armed UAVs, is the first and so far the only such system to have been adopted by Ukraine's Armed Forces. Classified by international standards as a Medium altitude long endurance (MALE) unmanned aerial vehicle

and Unmanned combat air vehicle (UCAV), the Bayraktar TB2 can conduct reconnaissance and surveillance missions at quite long distances from its related GCS, and can track and engage targets autonomously. One GCS can support TB2 remote control and data links at up to 250 km away, which is a significantly long operational radius in a modern combat setting. The flight range is extended much more through Ground Data Terminal Systems placed on various locations so that during the flight antenna switching is handled automatically. The TB2 can fly out to 4,000 km from its starting point, flying a preprogrammed path in autopilot mode or, alternatively, taking over control from one GCS to another.

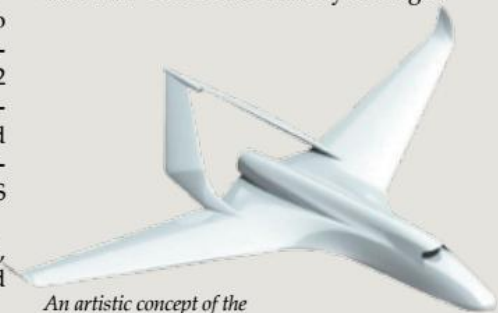
With a camera payload mounted, the TB2 can climb up to 8,000 m and stay aloft in the air for 27 hours.

In Ukraine, the six TB2s are now being prepared for operational deployment. In September-November, Ukrainian Air Force personnel were in Turkey undergoing a three-month training program to operate TB2 drones.

As reported in late December 2019 by the Unmanned Aviation Depart-

ment at the Ukrainian Air Force Headquarters, Bayraktar TB2 operators will begin combat training with TB2s in late January 2020 after completion of training on simulators scheduled for earlier that same month. Bayraktar TB2 is currently awaiting to be registered and certified with the State Aviation Service of Ukraine.

However, Ukraine-Turkey cooperation does not end with the TB2 contract. There has recently emerged



An artistic concept of the unmanned fighter jet looked at by Baykar and its partners in Ukraine



AI-25TL engine

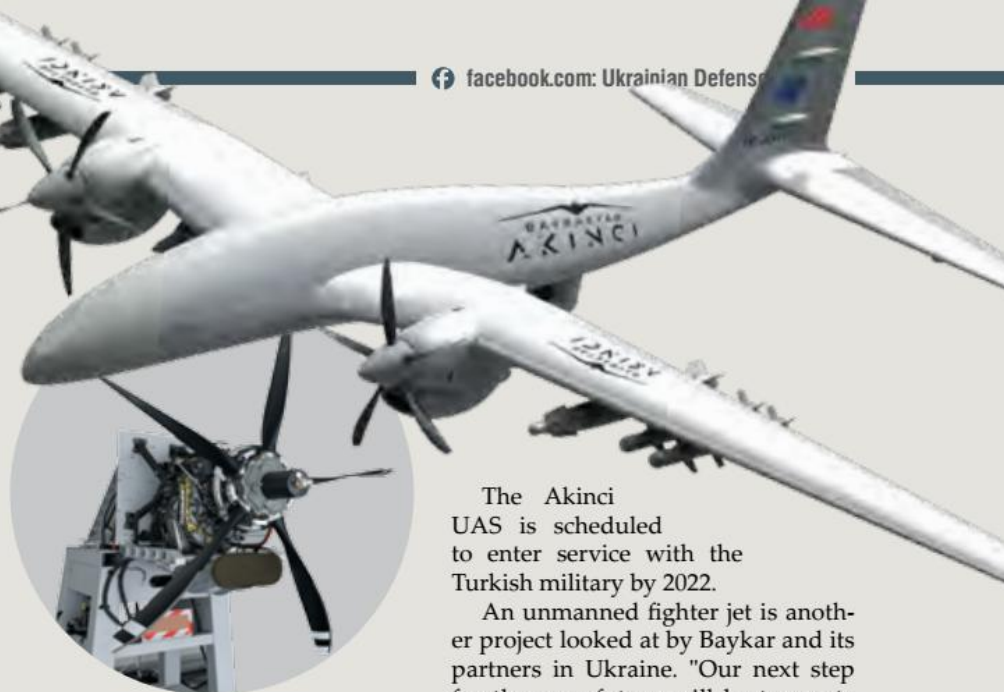
Akinci, a new-gen Unmanned Aircraft System (UAS) developed collaboratively by Turkish and Ukrainian companies. The Akinci UAS is one of Baykar's first projects to involve a Ukrainian-produced engine by Ivchenko Progress. To effectively coordinate and cooperate on defense-technology projects a joint venture was established in 2019 between Baykar Defense, a Turkish defense industry company and Ukrspesexport, an affiliate of the Ukrainian state defense industries group Ukroboronprom. Akinci made its first public appearance at the Teknofest-2019 Aerospace and Technology Festival held in Istanbul in September.

A High-Altitude Long Endurance (HALE) UCAV, Akinci, with a size three times that of Bayraktar TB2 and a 1,350 kg payload capacity, will provide air surveillance support to deployed forces and carry out lethal attacks on enemy targets.

Equipped with a varied range of sensor systems, from high resolution thermal imaging and daylight cameras up to AESA radars, the Akinci will be able to detect well-camouflaged targets from substantial distances, then transmit their location coordinates to friendly batteries or attack them autonomously with precision-guided weapons.

With a 20-m wingspan and 12.3-m width, Akinci has a maximum takeoff weight of 5,500 kg. It can carry a 1,350 kg (2,980 lb) payload, including 450 kg internal and 900 kg exterior payload. The drone can climb up to 40,000 ft (12,000 m) altitude and will cruise at 30,000 ft (9,000 m). It is designed with an air endurance of 24 hours and a max speed of 450 km/h.

The Akinci drone is powered by two Ukrainian turboprop engines Ivchenko-Progress AI-450T, each producing 450 hp. "Baykar intentionally selected "Ivchenko-Progress" engines to strengthen the relationship between two countries. In this regard, to widen the cooperation and realize the potential, Black Sea Shield Joint Venture was created in 2019 by Ukrainian state-owned company Ukrspesexport and Turkish private company Baykar. This is totally a win condition for both countries" - said Haluk Bayraktar, Baykar CEO, in a comment to Defense Express.



The HALE UCAV Akinci is powered by two Ukrainian turboprop engines AI-450T

Akinci is special in that it can carry varied weapons that are used in manned aircraft. Here there is talk about various types of bombs and missiles, including specifically Turkish long-range, "stealth" cruise missiles Roketsan SOM that can reach targets at up to 250 km. The SOM, incidentally, is powered by turbojet engines AI-35, developed and produced, again, by Ivchenko-Progress. The Ukrainian engine was selected by Turkey after failed attempts with French engines, then with a domestic alternative. Baykar is also working on Ukrainian air to air missile integration on Akinci.

The Akinci drone's characteristics, combined with its cruise missile capability make it into a highly effective 'long-arm' aircraft system that can engage targets at stand-off range. Other munitions to be carried in Akinci besides SOM missiles are Cirit rockets, MAM-L/C smart guided micro munitions, and general-purpose bombs Mk.81 (113 kg) and Mk.82 (227 kg).

The UAV, powered by Ivchenko-Progress turboprop engines AI-450T, made its maiden flight on December 6, 2019, from the Turkish Army's Çorlu Airfield (the Province of Tekirdağ, northwestern Turkey). The first test flight was a success, attended by officials from Ivchenko-Progress among other stakeholders.


The Akinci project is in progress, with efforts underway to develop sub-main systems, analyze telemetry data, and to optimize flight performance and control systems.

The Akinci UAS is scheduled to enter service with the Turkish military by 2022.

An unmanned fighter jet is another project looked at by Baykar and its partners in Ukraine. "Our next step for the near future will be to create an unmanned fighter jet with high maneuverability and sonic speed. It will be a great project and we believe that Turkey, in collaboration with neighboring and friendly countries, will bring it to fruition," said Haluk Bayraktar told Defense Express.

Controlled via a satellite datalink, the unmanned fighter jet must have a take-off weight of no more than 5.5 tons (including a one-ton weapons payload), be able to climb to 12 km or higher altitude, and to fly nonstop for up to 5 hours. It will have a speed exceeding 900 km/h, enabled with Ukrainian turbojet engines Ivchenko-Progress AI-25TLT refined for this application.

The unmanned fighter jet project can potentially involve the production of 500 plus UAV engines. For that purpose, there might be needed to establish a joint venture between Ukraine and Turkey to produce turbofan and turbojet engines both for the two countries' needs and for third-country markets.

During the next years of bilateral cooperation Turkey will, of course, work on the design of indigenous engines, both for aircraft and missiles. But Ukraine can also exploit these new projects to build up its knowledge and expertise in the UAV technologies. Because wings get bigger and stronger in those who despite all the odds against them have the ambition and courage to spread those wings and go. 

Serhiy ZGHURETS,
Anton MIKHENKO,
Defense Express

Ukraine has bought Turkish Bayraktar TB2 UAVs together with Roketsan MAM-L' laser-guided munitions



UKRAINE'S UCAV CAPABILITY

The world has recently seen acceleration in development and combat deployment of Unmanned Combat Aerial Vehicles (UCAVs) for air-to-ground missions. The Major powers are most active in this realm, and Ukraine, too, seeks to keep pace with current technology trends going on in UCAV world. The country has developed and built a range of new-gen UCAV systems, both by itself and in collaboration with international partners.

High-intensity hostilities ongoing in eastern Ukraine due to Russia's military incursion revealed the need not only for gunfire spotting drones and spy drones, but also for armed UAVs for defeating armored or hard-to-access targets on the ground. Prior to 2017-2018, the core of the Ukrainian military's drone inventory consisted of spy drones of both foreign and domestic brands. But this situation is changing now as the Ukrainian army has added to its arsenal its first UCAS, purchased from Turkey, and domestic companies have began offering their proprietary solutions that are properly optimized for modern battlefield environments.

Thus, Ukraine, in early 2018, purchased from Turkey one unit of the medium-altitude long-endurance (MALE)

Tactical Unmanned Aircraft System (UAS) Bayraktar TB2. Each Tactical UAS is configured with six aerial vehicle platforms, two Ground Control Station (GCS) vehicles, three Ground Data Terminals (GDT), two Remote Video Terminals (RVT) and Ground Support Equipment. The Bayraktar TB2 contract additionally includes Roketsan MAM-L' laser-guided munitions as well as localization of part of Bayraktar TB2 manufacturing processes in Ukraine.

With its 560 kg MTOW and payload capacity of 55 kg, Bayraktar is capable of loitering for more than 24 hours, at altitudes up to 27,000 feet (8,200 m), transmitting live video footage over ranges up to 150 km. The laser-guided Roketsan MAM-L Smart Munition can defeat targets at ranges from 500 m to 8 km, with a miss distance not exceeding 1 m. TB2 marks the first armed UAV system to have been operationally deployed with Ukraine's Armed Forces.

It's worth of note that PJSC "Chernihiv Radio Equipment Plant" (otherwise known as PJSC "CheZaRa"), NVO Practika, Kyiv, and WB Electronics, Poland, collaboratively developed and demonstrated an improvement to their unmanned aircraft

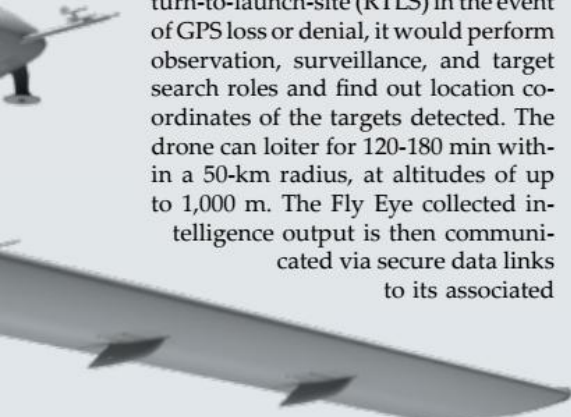
system Sokil (meaning "Falcon" in Ukrainian), which is designed to perform the dual role of tactical ISR and air-to-ground attack.

Sokil consists of two UAVs associated with a shared ground control station.



Loitering munition drone 'Hrim'

One is Fly Eye UAV system, which would perform tactical ISR missions. Equipped with daylight and IR camera sensors and with a function for return-to-launch-site (RTLS) in the event of GPS loss or denial, it would perform observation, surveillance, and target search roles and find out location coordinates of the targets detected. The drone can loiter for 120-180 min within a 50-km radius, at altitudes of up to 1,000 m. The Fly Eye collected intelligence output is then communicated via secure data links to its associated



ground control station for mission setting to the other member of the tandem – the suicide Kamikaze drone Warmate. The loitering munition drone allows several different types of warheads to be installed, depending on specific mission needs; it can engage targets at ranges up to 30 km. The warheads, ranging from 530 g to 1,350 g TNT, are of explosive fragmentation, high-explosive fragmentation, penetration, and incendiary types.

The full system is ground transportable in several Practika Kozak-2M armored vehicles.

Sokil has been tested and tried out successfully by Ukraine's Armed Forces, but is as yet awaiting to be allowed into service.

At the 3rd edition of IMEX-2018 International Unmanned Systems Exhibition & Conference held in Abu Dhabi, UAE, from 25 to 27 February 2018, Defense & Electronics Technology Company (CDET) LLC, Kyiv, unveiled its latest UAV/loitering munition drone named RAM.

RAM UAV is meant to search and attack air defense batteries and armored targets to be located in the target area on land or at sea.

The RAM drone is built with extensive use of composite materials, which its designer claims makes it very low-observable to enemy air defenses. Propelled by a low acoustic

signature electric motor, the drone can covertly attack by surprise, even from a short distance from the target.

An electric motor enables it to loiter within a 30 km radius at 70 km/h. Launch is catapult assisted.

The drone takes only 10 minutes to go from unpack to launch. It can stay aloft for up to 40 minutes, which is quite enough to get a target detected and destroyed by lethality.

The RAM UAV has an integral flight controller capability supporting the functionality that includes autonomous preprogrammed flight, live

rebels in Eastern Ukraine, and showed very high immunity against enemy jamming attempts.

At the Arms & Security 2019 Expo, R&D and Production Corporation Athlone Avia unveiled the first release of its loitering munition drone "Hrim" (Ukrainian for "Thunder").

Hrim is of a biplane design with two sets of X-shaped control surfaces on a front fuselage extension mounting an EO guidance system. This design enables an optimum between the controllability performances of the drone while in horizontal flight and



This new evolution of the PD-1 UAV platform carries two loitering munitions, each armed with a 3 kg warhead and designed to be deployable from hardpoints on each of the wings.

video streaming, and guiding the munition to a target once it is located.

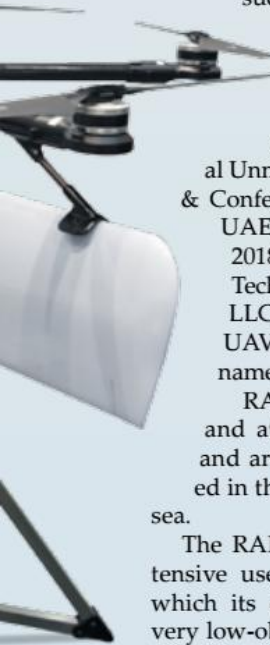
The munition comes with three options for warhead depending on the types of targets to be attacked:

- fuel-air explosive (FAE) warhead will be used to defeat enemy personnel sheltered in buildings or field fortifications, and to destroy light armored vehicles with crews and infantry passengers;
- High Explosive Anti-Tank (HEAT) warhead will be used against armored targets on land or at sea;
- High Explosive Fragmentation (HEF) warhead will be used against personnel targets encountered in open-area engagements.

RAM has been successfully tested in real-world combat engagements against Russian-sponsored separatist

in diving at the target, the Developer has said.

There is a multirotor aerial vehicle used as launch platform for the drone Hrim. 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 and to verify target hit. This altitude is high enough for sustained video streaming from the drone at ranges of 30-40 km. Designed with a take-off weight of 10 kg, including a 3.5kg warhead payload, the drone will be able to loiter aloft for up to 60 min. →



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 loitering munition is special in that it 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.

The munition will be available with warheads of several different types and weights. Work is now underway on a FAE warhead weighing 10 kg, but other warhead types, including inter alia HEAT and HEF are also under consideration for this application.

Hrim has now reached the stage of factory flight trials and is being prepared to enter official qualification trials process that is potentially leading to Approval for Service Use.

The year 2019 also saw the release of next evolution to Ukraine's renowned spy drone People's Drone PD-1 – a modular unmanned aerial vehicle platform developed by The People's Project – Ukrainian Nationwide Volunteer Center in collaboration with UkrSpecSystems.

Initially developed in a fixed-wing configuration for ISR roles, PD-1 was, in 2018, redesigned to add a ground attack capability along with a VTOL capability to enable the drone to take off like a quadcopter.

This new iteration of PD-1 features a new, more powerful engine and a

RAM UAV



8-kg payload package comprising two loitering munitions, each armed with a 3 kg warhead and designed to be deployable from hardpoints on each of the wings.

In its most recent configuration, the PD-1 drone is able to endure flight durations of up to 5 hours, at altitudes of up to 2,000 m.

At 1,000 altitude, miss distance would be in the range of 10 m, depending on whether the munition is fitted with capabilities for precise targeting and in-flight trajectory update.

In addition to UCAV technologies listed above, mention should also be made about the future short-range tactical UAS "Horlytsia" (Ukrainian for "dove") that is being developed by SE Antonov. The UAV was flight tested in October 2017 after having succeeded through survivability and wind tunnel trials.

Horlytsia is designed with a non-stop flying range of 1,050 km, an operational combat radius of 80 km, and a maximum in-air endurance of 7 hours.


Antonov says it is now working collaboratively with the Design & Development Company Luch, Kyiv, to equip Horlytsia with lightweight mis-

sile weapons, which would bring it into the category of tactical UCAS.

As of the end of 2019, the Hortysia UCAS project is still in progression.

CONCLUSION NOTES

The onset of Russian military intrusion in Eastern Ukraine had driven a surge in development of UAS technologies meeting the requirements of defense and public safety customers in Ukraine. Within a few years there

emerged a varied range of UAVs equipped primarily for ISR and gunfire spotting roles. But real-world experience with their use in combat operations, along with a growing requirement for capabilities to defeat and destroy ground targets, especially in urban and built-up operational settings like in Eastern Ukraine's Donbas necessitated an expansion of the range of missions for military UAVs. This has resulted in the emergence of a range of precision attack drones capable of destroying enemy targets with minimum risk to nearby civilian lives and infrastructure. Although many of them are still in the stage of development and testing, they hold the promise of being adopted by the Ukrainian military to bolster its warfighting capability. 

Hryhory KUSHCHELEP

Reconnaissance strike complex "Sokil"



SECURE PHONE



WHAT IS SECURE PHONE?

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Autonomous key generation, no pre-installed key material. Dynamically generated keys destroyed after each call.

DEVICE PROTECTION

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Seamless secure boot chain featuring secure boot, kernel, recovery, kernel object and APK signature keys.

Hardware module controller and permission enforcement module control access to network, data and sensors (microphone, camera etc.)

SECURE PHONE FEATURES



HARDENED ANDROID

Hardened operating system with secure boot and device runtime integrity checks



VOICE ENCRYPTION

AES256 encryption + VPN + ZRTP/SRTP



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ANTI-DRONE HAND-HELD GUNS

Russia-sponsored separatist insurgents fighting government forces in Donbas, eastern Ukraine, have extensively deployed drones and unmanned aerial vehicles (UAVs), both for battlefield surveillance and for artillery fire adjustment roles. This has driven Ukrainian industries, specifically UkrSpecTechnika, Proximus LLC, and InterProInvest LLC among others, to launch projects for development and production of air defense countermeasures required by the Ukrainian Armed Forces and the National Guard. With this purpose in mind, and given the trends going on in the international UAV market, the Ukrainian companies opted for solutions such as anti-drone jamming guns that neutralize UAV threats by disrupting their GPS and C2 datalinks.

WHAT IS AN ANTI-DRONE GUN?

Counter Unmanned Aerial Vehicles (C-UAV), or anti-drone weapons and guns are any of a range of countermeasures designed to immobilize a target drone by jamming its remote control and GPS datalinks. They can come in the form of handheld weapons akin to traditional projectile guns, to larger artillery-scale devices which are differentiated by size, the number of personnel involved, and operational range among other characteristics.

UAVs are currently commercially available in many countries, and this is what is driving this market up. The converse of this is that individ-

ual persons, or groups thereof, can use drones for malicious or nefarious activities involving, for example, delivery of contraband, narcotics, or banned food to prisoners, or breach of security to take photos or record video footage. For this reason, governments in those countries had challenged their industries to produce countermeasures against the threats small commercially available UAVs can pose. This led to emergence of anti-drone hand-held guns.

The U.S. is leading this market with products such as DroneGun Tactical (by DroneShield), DroneDefender (by Battelle), and Skywall100 (anti-drone bazooka by OpenWorks).

In Russia, there is the counter-UAV gun Rex-1 by Kalashnikov (which made its first public appearance at the defense expo Army-2017) and its more recent iteration, the Rex-2 that was unveiled at the Army-2019 expo. There is no information on whether or not Russian-produced Rex-series anti-drone guns have been deployed and

used in military operations in eastern Ukraine and Syria, but it's likely they have been there, given the extensive use of commercial UAVs in those conflicts.

The design & development company Radar, Belarus, has produced the counter-UAV jammers Groza-S and Groza-R.

In Germany, H.P. Marketing & Consulting Wust GmbH has developed the HP 47 Counter UAV Jammer that was seen used at World Economic Forum Annual Meeting 2017 in Davos, Switzerland, while Aeronautica SDLE, Spain, offers its Aeronautica Anti-drone system.

The Turkish company Aselsan has developed its own anti-drone solution, the IHASAVAR that was introduced at the 2017 Arms & Security Expo held in Kyiv.

UKRAINIAN SOLUTIONS

Over the five years of military hostilities in its Donbas region Ukraine has gained an extensive experience



InterProInvest introduced its RIFF-P Anti-Drone Gun at the 2019 Arms & Security Expo held in Kyiv in October

in countering a wide range of drone threats and in using own UAV capabilities against the adversary. This experience provided Ukrainian industries valuable insights into how a domestically developed counter-UAV weapon should look like. There have been created three anti-drone jamming guns that, while introduced in different years at different expos, have retained their relevance and conformity to current trends.

InterProInvest revealed its counter drone technology, the RIFF-P, at the 2019 Arms & Security Expo held in Kyiv in October. A man-portable system, the RIFF-P is specifically designed to defeat rotary-wing drones (quadcopters and gexacopters) and flying/fixed-wing UAVs.

Defense and public security services can use the RIFF-P for protection of critical infrastructures, military bases and checkpoints, and for support of border security missions. The RIFF-P technology is also suitable for protection of public events, whatever the size or the scope. The gun has a bull-pup design that makes it look like the automatic rifle Malyuk, another product by InterProInvest. Weighing just 5.8 kg, the RIFF-P is portable and usable by one person without assistance. It can disrupt GNSS signals over up to 1.5 km and jam UAV remote control signals and video signals at ranges up to 0.9 km. The weapon has enough power to run continuously for 1 hour (or longer with additional rechargeable batteries which are provided as optional extras).

It's worth of note that anti-drone guns almost all belong to a sub-category of directed energy weapons, and the RIFF-P is no exception. The system is a shoulder mounted jammer with a directional antenna that covers a 20-degree sector, emitting 100-W RF jamming power on four bandwidths and 200-W power on six bandwidths. A one-button-press-system enabling easy and rapid deployment, the RIFF-P jammer works by disrupting the connection between the target drone and its pilot's controls and by jamming GNSS (GPS/GLONASS/Galileo/Beidou) signals.

The RIFF family of anti-drone jammers consists of several different models ranging from a conventionally configured shotgun to the RIFF-S and

RIFF-M systems optimized for fixed and mobile uses, respectively.

UkrSpecTechnika, a Private Joint-Stock Holding Company, introduced its Anti-UAV Gun at the 2017 Arms & Security Expo held in Kyiv. The weapon would have utility to prevent commercial UAVs being used for subversive or terrorist attacks or crimes against privacy. It is suitable to provide protection for both civilian and military targets of whatever size.

UkrSpecTechnika, which is more renowned for its products for defense and military use, developed its Anti-UAV Gun with an eye to civilian needs, especially security protection of highly populated events.

UkrSpecTechnika's Anti-UAV Gun employs a directional antenna that can reach up to 2,000 m, but the ad-

ator, the Jammergun 3 interrupts the link between drone and pilot and its navigation, and, like its counterparts as described above, is suitable to be used for security protection of civilian and military targets.

Featuring three directional waveguide antennas and weighing 10 kg, the Jammergun 3 is able to reach 0.1-0.6 km away and to work continuously during 30 min. It is carried in a backpack, which has pockets for accessories and provides ease of use for the operator. The backpack is integrated with a cooling system, and protects from water and dirt getting inside.

The directional antennas are mounted on a dedicated Picatinny rail that can also mount a "red dot" collimator sight to facilitate more accurate aiming.



Anti-UAV Gun, product by the Ukrainian company PrAT "Holding Company UkrspecTechnika"

dition of optional omni-directional antennas would provide a 360-degree, extended range GNSS (GPS/GLONASS) jamming capability of up to 5 km. The Anti-UAV Gun can run continuously for 8 hr.

The Anti-UAV Gun developer points out that the system with its low weight is one-person portable in a transport case or, alternatively, can be transported on a quad bike, motor vehicle or other conveyance.

Jammergun 3 by Conus Research & MFG. At the 2018 Arms & Security Exhibition, Ukraine's Conus Research & MFG Company unveiled the first release of its anti-drone gun Jammergun 3.

Portable enough to be carried in a backpack and used by a single oper-

Five years of the "hybrid" aggressive war being waged by Russia in Ukraine have driven Ukraine's air defense industry to develop, grow and to adopt new technologies and processes. Not only are Ukrainian industries keeping pace with current trends going on in the global arms market, but can offer competition in this market. The anti-drone weapons as described above are only the first buds of this emerging branch of the air defense industry in Ukraine, and this gives hope that those Ukrainian products would not go unnoticed by potential customers in Ukraine and beyond. **UDR**

Denis PONOMARENKO,
Defense Express

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TRITEL UNVEILS MOBILE VERSION OF ITS SYSTEM *NOTA*

Tritel LLC continues effort to help Ukraine's military improve and bolster its ability to counter the growing threat from air drones and other advanced military technologies deployed by Russian intervention forces in the Donbas conflict area. The Ukrainian company has recently demonstrated an improved iteration to its counter-UAV system "Nota", offering new features added for increased functionality.

Since its first public appearance at the 2018 Arms & Security Expo held in Kyiv, Nota has gained great renown in Ukraine and become a real threat to Russian use of drones in Donbas.

Development of the Nota technology was driven by the onset of Russian military incursion into Ukraine in 2014 and by the impunity with which separatist rebels had been using Russian supplied UAVs and Electronic Warfare (EW) capabilities against Ukrainian forces. So Nota has been developed as a solution to the challenges brought by drone and EW threats and to interfere with and frustrate the operation of hostile counter-battery radars and cellular communications of all currently existing standards.

Nota can use directional and non-directional arrays in a single mode of operation, which allows it to provide anti-drone perimeter protection to permanent facilities while scanning a sector of interest.

The Nota can detect hostile drones at ranges out to 20 km and intercept them at ranges of at least 15 km away. Cellular communications can be jammed from distances up to 1,000 m. The full set of the Nota equipment weighs 250 kg and is served by a crew of two.

The system does not emit while on standby, which effectively makes it "stealthy" to enemy surveillance radars. Once a threat is detected, the Nota immediately turns active to direct its jammer and neutralize the threat.

In addition to anti-drone protection, Nota has the capabilities to identify targets and transmit relevant data to friendly batteries or for further processing and analysis. The system has now been fielded in quantity with Ukrainian forces; it has proved its worth both in combat settings and in providing anti-drone protection to facilities located in the depth of Ukrainian territory.

At the 2019 Arms & Security Expo, Tritel unveiled a mobile version of Nota, offering expanded combat functionality and permitting the system to quickly move to a new position to avoid detection and destruction by the adversary. In this new version, Nota would scan the defined sector of interest to search, detect and identify drone threats before neutralizing them by jamming remote control and data links. This thus makes it suitable to provide anti-drone protection to high-value targets such as munitions depots, command and control centers,

power generation plants, bridges, airports, checkpoints etc.

With new capabilities added, mobile Nota will be able to perform SIGINT missions and to support the operation of multiple networked systems controlled from a single command center and sharing data online. Mobile Nota features an antenna mounted on a telescopic mast.

Mobile Nota system has been designed mounted on the armored military vehicle "Kozak" that is being produced by Practika, a privately-run Ukrainian company. An all-terrain vehicle, Kozak has robust protections against small arms fire and impacts of shell and mine blast fragments.

Deploying mobile systems like Nota along the "line of contact" would significantly reduce the adversary's use of drones and capabilities for command and control, communication and radio location. **UDR**

Anton MIKHENKO,
UDR



TECHNOLOGY GENERATOR

RADIONIX, KYIV, OFFERS UNIQUE AIRBORNE SOLUTIONS PERTAINING TO AVIONICS, PRECISION-GUIDED WEAPONS, ELECTRONIC WARFARE AND RADIOLOCATION

Ukraine's Defense Industry would be a little more unhappy if Radionix were not there. In such a case it would have to proceed slower with developing new precision-guided weapons and would only dream about advanced technologies such as Neptune or Esmeralda. Aviation would not have electronic countermeasure capabilities for self protection, and unmanned aerial vehicles would be unable to fly their missions in low visibility weathers.

But we have it all available to us, because we here at Radionix are committed to doing work qualitatively, no matter how many impediments there might be to turning a conceived idea into a product. Either way, the Company's chosen focus on complex, sophisticated systems has justified itself by 100%; Radionix products rival world-renowned brands in terms of technical performance and they sell well on the export market. But it would be great if domestic customers too paid more interest to Radionix products, because they are truly needed by our Defense Industry.

STRAIGHT ON TARGET

Radionix can boast of having developed genuine unique solutions for varied applications. The Company's true pride lies in the de-

velopment and production of radar homing systems for missile guidance. This indeed is a highly sophisticated challenge, but without it there can be no development of precision-guided weapons and munitions. That Radionix, a privately-run company, has managed to handle this challenge with success is clear proof of its high level of R&D and production proficiency.

Radionix has in its product portfolio a lineup of active, semi-active and passive radar seeker systems, which it developed as private ventures, with no Gov-

ernment funding involved. The seeker systems have all been designed such as to be dually applicable to surface-to-air missiles (SAMs) and air-to-air missiles (AAMs), and they are designed and built with 60-65 percent electronic parts commonality.

Active and semi-active radar seeker heads by Radionix have been used in export contracts, specifically for upgrading of the S-125 Pechora SAM system, where they are mounted to the system's upgraded missile 5V27D to enable it to hit targets at extended ranges of 40 km in distance and 25 km in altitude.

FROM NEPTUNE TO ESMERALDA

Radionix developed solutions are used in new military technologies that have become emblematic for Ukraine's Defense Industry. Here we are talking particularly about the cruise missile Neptune that currently mounts a Radionix active radar seeker, but, if equipped with a passive radar seeker, can also have utility for defeating air defense radars.

Radionix is developing an innovative multifunctional airborne X-band radar system named Esmeralda, which, in one of its iterations, is present in an upgraded S-125 SAM system produced for an export customer.

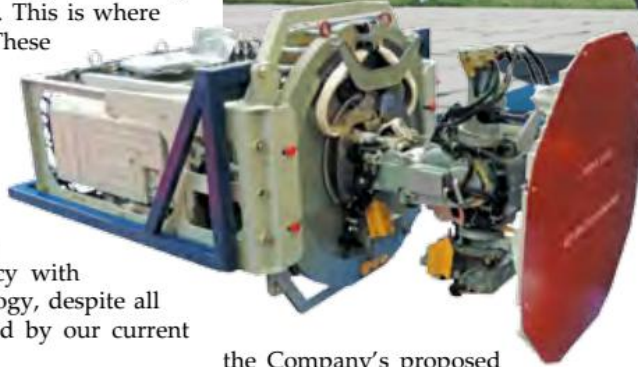
In an UDR interview, Stanislav Zavyalov, Radionix CEO,



observed, "Ukraine stands a good chance to develop and bring into production an indigenous radar for fighter aircraft. I don't know if the Ukrainian military has a requirement for a radar like that, but we will continue with it anyway. There are governments that seek to acquire modern technologies, and geographical and political considerations are secondary in selecting who provides them. This is where our chance lies". These words were pronounced in 2012, and it's only due to concentrated knowledge and effort that Radionix has been able to increase its proficiency with this type of technology, despite all the challenges posed by our current reality.

NEW EYES FOR TACTICAL FIGHTER AIRCRAFT

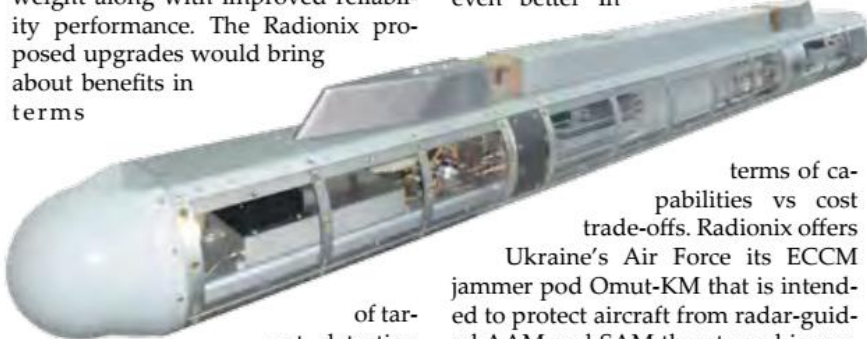
Radionix has been successful in improving warfighting capabilities in tactical fighter aircraft. Thus, the Company has developed an upgrade package for integrated, radar-assisted sighting systems equipping Su-27 and MiG-29 fighter jets. The package includes new modules (designed with a high level of parts commonality) in place of old, Soviet-era counterparts. All the solutions that Radionix developed for this application are distinguished by offering reduced size and weight along with improved reliability performance. The Radionix proposed upgrades would bring about benefits in terms



the Company's proposed solutions for upgrading the Force's inventories of Su-27 and MiG-29 tactical fighters. Radionix, however, is proposing more than Ukraine's military is going and willing to adapt to its needs and operational capabilities.

RADIONIX AIRBORNE SELF-DEFENSE SYSTEMS

To date, ECM/ECCM capabilities have become organic part of warfare. In this category, Radionix offers a lineup of products (which it developed as private ventures with no government funding involved) that are as good as world-renowned brands or even better In



terms of capabilities vs cost trade-offs. Radionix offers Ukraine's Air Force its ECCM jammer pod Omut-KM that is intended to protect aircraft from radar-guided AAM and SAM threats and is specifically tailored for platforms such as Su-27, MiG-29, and Su-25 (Omut-25KM). However, procurements are

of target detection range increased by 25-30% as well as significantly enhanced resilience to jamming attacks of varied kinds. Radionix has also developed upgrades for electro-optic sighting systems used on Su-27 and MiG-29 fighter jets.

The Ukrainian Air Force has since 2014 shown an increased interest in

few and quantities are small, lagging far behind what the Air Force's tactical fighter units require. That said, advanced technology products by Radionix sell well in the global market.

THROUGH FOG AND CLOUDS

At Global Security Exchange (GSX) 2019, Chicago, Radionix exhibited its unique integrated solution – a small-dimension synthetic aperture radar (SAR) for UAVs and small manned aircraft that allows high-resolution radar images to be successfully transmitted under all weather conditions or while flying over large cloud formations. The radar is fully built into the fuselage structure, excepting the antennas that overhang the fuselage skin by a few dozen mm. The radar has relatively small dimensions, weighing approximately 2 kg, but Radionix is working to reduce the dimensions further. The radar software has been proprietary developed by Radionix.

At GSX-2019, the Radionix SAR was exhibited mounted on Skyeton's ACS-3 (Raybird-3) UAV platform, and made splash among visitors; potential customers said they would only agree to buy ACS-3 if it comes packaged with the Radionix SAR.

Radionix has been able to create a truly unique technology product that few can rival due to the complexities involved with software development and due to small dimensions of physical antennas.



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NAVAL SIGINT CAPABILITY FOR UKRAINE

A SYSTEM THAT ENEMY WILL NEVER BE ABLE TO SPOT



Melkhior (Ukrainian for “German silver”). This is the name chosen for a new shipboard Signals Intelligence (SIGINT) system developed by the Quant-Radiolocation R&D Institute for Radar Systems.

The Melkhior is going to become the hallmark of and a key competitive advantage for the SIGINT ship being built for the Ukrainian Navy, under the Government Defense Procurement Contract, at Kuznya na Rybalskomu Shipyard, Kyiv. The naval SIGINT system Melkhior has already gone through factory-level tests and is now being prepared to enter official qualification trials process onboard the ship once she is finished.

INNOVATIVE DEVELOPMENT

The development of passive radar location systems in Ukraine has until recently been Identified with the renowned system Kolchuga. After Rus-

sia's seizure and de-facto liquidation of the Topaz Factory in Donetsk, the production of Kolchuga systems in Ukraine was discontinued and never resumed. But now Ukraine has something with which to plug a gap in the development of modern SIGINT capabilities.

Quant-Radiolocation, an affiliate of the Ukroboronprom State Defense Industries Group, has developed its Melkhior system that uses a passive radio location technique focusing on radiofrequency analysis of reflected signals for "fingerprinting" transmitters or operators.

Quant-Radiolocation is confident about the potential and capabilities of its developed system Melkhior, describing it as "representing new-gen, world-class technology in this domain, which compares with top of the line brands such as Thales." The French firm is mentioned here for good reason. A Thales' SIGINT system was among those considered for this Ukrainian project, but the Ukrainian Navy's top brass decided to choose in favor of own domestic capabilities, and this decision seems to have been right.

The Melkhior can operate over ranges up to 450 km, which is a lot farther than the radio horizon range. This is achieved due to the use of the effect of super-refraction – the bending of the radar beam in passing through layers of air of varying density. The effect of super-refraction is to increase the bending of the radar wave and thus increase the range from which echoes may be returned. The knowledge of the laws of physics, integrated into state-of-the-art technologies produces a capability to detect adversary radars at substantially longer ranges.

In addition to boasting its impressive range performance, the Melkhior can track up to 200 targets simultaneously, ten times as many as the Kolchuga can. Moreover, while the Kolchuga is effective against primarily aerial targets, the Melkhior can track targets over sea surface and in the air,

as well as targets ashore. By fusion of data from Melkhior and other multiple sensors it's possible to evaluate true capabilities of the opposing forces and to keep track of enemy movements and activities in real time. But there is more.

FROM EDGE TO EDGE

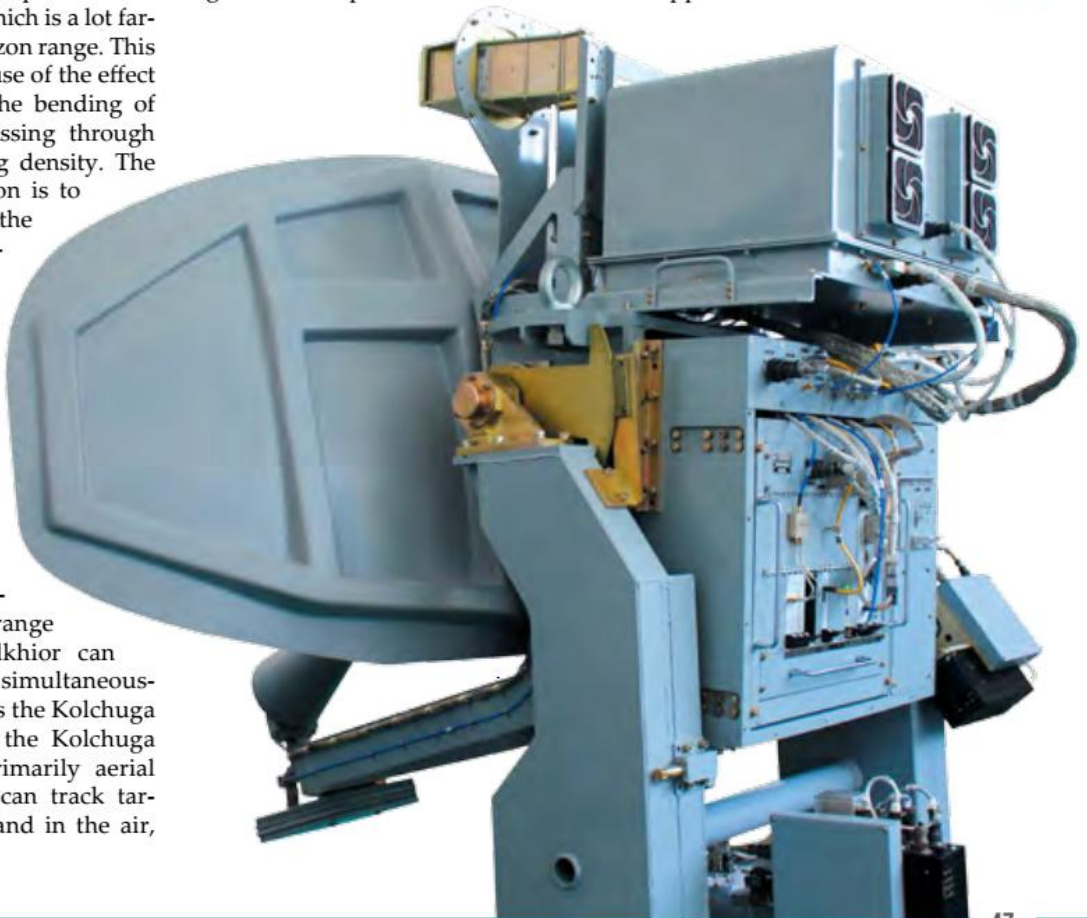
Another advantage that can be achieved with the Melkhior lies in its wide Seamless frequency range covering 1 to 18 GHz. This frequency range was chosen because many of modern airborne radars typically operate at frequencies of 12 to 18 GHz. "We were the first to provide full coverage of that wide frequency range without gaps in frequency coverage. Seamlessness dispenses the need for fine-tuning the system for a given sub-band of frequencies as was the case with the Kolchuga," the Melkhior Developer says.

The Melkhior System is composed of an antenna post and two operator workstations. The System has been developed with a maximum possible automation level of processes relating to search, detection and identification of radio transmission sources. It is designed with capabilities to: locate the

position of transmitters, analyze and classify reflected signals, and record those unique signal profiles in relevant data libraries. The System would certainly come pre-loaded with an "a-priority library" encompassing data on a majority of targets that may be most commonly encountered in the Black Sea Theater of operations. But everything is changing and so must the Melkhior's library of targets.

A monitoring operator can hold, for as long as necessary, on any of the 200 targets that are within the radar's field of view and visualized on his display. The data recorded for each target, or, more specifically, transmitter includes transmission power, pulse duration and repetition rate, and transmission frequency range. All relevant detailed data is then automatically forwarded to on-line database. Data collection is conducted with the other workstation that hosts a high-capacity data storage device. Data from the on-line database can be shared to other SIGINT sensors.

The Melkhior has its "brains" built into silver-colored boxes measuring 150x100 mm that comprise part of the antenna post. These can be easily swapped in and out as needed. →



This is about not just the ease of maintainability but the implementation of an open architecture that makes it easy to upgrade or swap components without the need for redesigning the other units or an entire system.

Miniaturization of the System's "brains" and concurrent improvements in the power and quality of processing input signals from the wideband receiver have come about through the use of foreign-brand electronic and hardware components (specific brands would be selected based on Customer needs and preferences).

The hardware is important indeed, but the software is the brain that runs it. It is, therefore, precisely the signal processing algorithms which, along with the knowledge of their logic and operation, make up the hallmark of this Quant-Radiolocation's development, making it truly competitive against counterparts developed by foreign, high-value companies with multi-billion revenues.

"Our serious achievement is the development of software. We have known how to identify frequency ranges, and we can draw waveforms of signals. An incoming signal is processed while it is already in the front UHF channel. To do this requires high-performance integrated circuits. We are using top of the line processors from the U.S. manufacturer Virtex. The use of a highly sensitive wideband signal receiver and of our devel-

oped algorithms has made it possible to achieve substantial increases in the System's productivity and operational robustness and reliability compared to its previous iterations," the author was told at the Company.

IN SEARCH OF INNOVATIVE SOLUTIONS

The antenna post integrates a reflector antenna with a wideband signal receiver, signal processing units and antenna stabilization system. "The antennas that we used in all our previous projects had their curtains made from aluminum alloys. In developing this new system, however, we were confronted with the fact that the quality of aluminum available in the market doesn't allow us to produce a curtain with the required performance, with all the implications for the performance of the system as a whole. Accuracy requirements are quite high, with the mean-square error on the reflector's surface not exceeding 0.2 mm," the Developer has explained.



This is where new technologies came in hand, again. The antenna for the Melkhior was for the first time made from composite materials. The ductility of carbon fiber allows to customize the configuration, dimensions and sphericity of the antenna curtain, in addition to strength and robustness. Moreover, there had been worked out a new process for embedding a metal grid into the carbon fiber structure. It is this metal grid that reflects the RF waves.

For protection against the weather, dust, salt water, foreign matter, etc the rotating antenna assembly is mounted inside a composite-material dome that is transparent to radio-frequencies. The protective dome and the carbon-fiber antenna have both been produced by a privately-run firm based in Mykolayiv.

The antenna post comes with a stabilizer system to ensure stabilization against motions of the carrying platform at sea. Interfaced with the ship's navigation suite, the stabilizer measures the angle relative to the horizon and azimuth of the antenna at which the antenna should be rotated so that its radiation pattern remains stable, whatever the roll and pitch angles of the carrier ship.

FROM SEA TO GROUND

But the Melkhior may find its utility also in domains other than the maritime domain. Weighing approximately 900 kg with full complement of equipment (the antenna post plus two operator workstations), it well fits into a KRAZ 6x6 truck bed to provide a mobile ground SIGINT capability that would be able to detect and identify targets while remaining stealth to enemy radars. A capability like that is sought after on markets in Ukraine and elsewhere.

Quant-Radiolocation is now poised to develop a configuration that would be tailored for installation on ground platforms, fixed as well as mobile. There is an expectation that the Melkhior, in its ground vehicle-based configuration will be ready for display at the Arms & Security Expo next year. **UDR**

Serhiy ZGHURETS,
Defense Express

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KAIRA-150

R&D SHIPBUILDING CENTER UNVEILS CONCEPTUAL DESIGN OF ITS MULTIFUNCTIONAL SURFACE SHIP PLATFORM

At the Arms & Security 2019 Expo held in Kyiv from 8 to 11 October, the Mykolayiv-based R&D Shipbuilding Center (RDSC, an affiliate of the Ukroboronprom State Defense Industries Group and the leading company in design/development of surface vessels in Ukraine) showcased for the first time its most recent development – a conceptual design of a multifunctional, surface ship platform, named Kaira-150.

Developed under a Private Finance Initiative, the Kaira-150 has now reached the preliminary design and development stage.

Here the talk is about a Basic Ship project which is specifically designed to be multifunctional, meaning it can provide a platform for developing a complete family of vessels for military, paramilitary and commercial uses. The special-mission configurations proposed by the Designer for the Kaira-150 platform include patrol boat, counter-diver boat, mine countermeasures vessel, coastguard boat, fast response search and rescue boat, firefighting boat, diving boat, training boat, and emergency ambulance boat.

According to analysts, this approach is beneficial in terms of holding promise for substantial cost sav-

ing involved in series construction of the boats, as well as in their operation, maintenance, repair and overhaul (MRO) and in crew training.

Some analysts consider the Kaira-150 as potentially being a domestic alternative to U.S. Island-class boats that have similar physical and performance characteristics, but which, importantly, would surpass the American boats in some respects.

The Kaira-150 will feature a steel hull and an aluminum, or alternatively composite superstructure, depending on the Customer's request.

In the forward superstructure there can be mounted artillery weapons, including a 30-mm cannon in addition to other weapons. The design allows for installation of current-generation systems (of domestic or foreign brands) for mine countermeasures and search-and-rescue missions.

The platform will feature a U.S.-brand ship stabilizing gyro that,

unlike conventional counterparts, doesn't rely on the forward speed of the ship to generate a roll stabilizing moment, meaning it can stabilize the ship while slow or even at anchorage. This would contribute to crew comfort and productivity, especially while in high seas. Another feature is the availability of a maneuvering propulsion device, which would assist a ship in maneuvering in cases in which it lacks maneuvering performance while slow.

The Kaira-150 project conforms to rules and standards for ship certification and classification set by the international accredited registrar and classification society DNV-GI.

The Ukrainian Naval Forces, that face an acute shortage of the above mentioned types of vessels, especially



in the Azov Sea operating area, is considered a major potential customer for the Kaira-150 platform, and a measure of interest can be expected from the State Border Guard Service among other public safety services as well as civil agencies and organizations in Ukraine. For the boat is conceived to be a relatively cheap, mass-produced "workhorse" craft.

That said, the RDSC regards its Kaira-150 to be a product with a potentially large market to capture, given the high international demand for precisely this category of ships. A key advantage of the Kaira-150 platform is that it can be supplied configured for any of the roles as mentioned above, depending on the Customer's needs and requests.

The privately-owned shipyard Nibulon, Mykolayiv, that is being considered to become the prime manufacturer for the Kaira-150 platform, stands ready and willing to build ready

for sea ships to orders from varied government agencies as well as export customers, or they can be alternatively supplied semi-knocked down for assembly in any location the Customer chooses.

Technically, it's possible that Kaira-150 platforms be series produced at Nibulon, then disassembled into three loads for transport by land to Mariupol Ship Repair Yard for reassembly.

If built for Ukrainian customers, above all else the Naval Forces and the State Border Guard Service, the Kaira-150 is designed such that it can

BASIC PLATFORM KAIRA-150 KEY SPECIFICATIONS:

Displacement	155 t
Length	38 m
Beam	7 m
Water draught	2 m
Propulsion system	double crankshaft diesel
Speed	12-27 kn (varies with the type of propulsion system used)
Unfueled range	≥1,000 ml
Time between food resupplies	5 days
Crew complement	15 personnel plus accommodations for up to 6 passengers

ARMAMENTS

- MANPAD Igla
- 30-mm cannon
- 2 x 12.7 machineguns

OPTIONAL EXTRAS

- Diver detection sonar + MRG-1
- Ship-deployable autonomous underwater vehicle
- Laser warning sensor
- Seaworthiness: up to Sea State 5

NAVIGATION, COMMUNICATION AND FIRE CONTROL

- Opto-electronic naval gun control system Sens-2
- Sonar system Simrad
- FLIR navigation
- Special communication kit GMSSB
- Navigation radar

ELECTRONIC WARFARE CAPABILITIES

- ECM system UPPP-20
- Roll stabilizing gyroscope

**some specifications can vary based on the Customer's needs and requests and on a specific mission configuration chosen for a ship*



be trailer transported from Mykolayiv to Mariupol in semi-knocked down condition for subsequent assembly and testing.

Alternatively, construction and maintenance for the ships could be set up at Mariupol Ship Repair Yard who has the capacities, expertise and experience gained in repairing naval and border patrol ships for Ukraine. This option allows avoiding the need for transporting the ships by sea via the

Kerch Strait and transition waters close to Russia-annexed Crimea.

Alternatively again, hulls for the ships could be constructed at factories in Mariupol that produce the required hull steel grades, which would make production more cost and resource efficient. If this option is adopted, the prime manufacturer, Nubilon, could be made responsible for production of all subassemblies and components other than the hull, including especially the superstructure built out of plastic or light alloy materials. **UDR**

Volodymyr ZABLOCKIY,
Defense Express

GAS TURBINE ENGINES FROM UKRAINE

INS Ranvir, Rajput class Destroyer of the Indian Navy, with Ukrainian gas turbine engines



Ukraine has inherited a unique legacy from the Soviet Union – a fully self-sufficient industry integrating the design, development, testing, and series production of the gas turbine engines (GTE) of various power output and purpose, as well as various gearboxes and gas turbine units (GTU), using the capacities of the Union Design Bureau “Mashproekt” and the Yuzhnyi (Southern) Turbine Plant “Zorya”, both located in the city of Mykolayiv. The two companies merged in 2001 to form what is now the State Enterprise “Gas Turbine Research & Production Complex “Zorya”-“Mashproekt” (SE GTRPC “Zorya”-“Mashproekt”), which is an affiliate of the Ukroboronprom State Defense Industries Group. SE GTRPC “Zorya”-“Mashproekt” has won renown far beyond Ukraine for its products for both civilian and military markets. The Company doesn’t rest on its laurels but offers potential customers promising innovative solutions along with already well known products.

POTENTIAL AND CAPACITIES

SE GTRPC “Zorya”-“Mashproekt” currently is Ukraine’s top leading developer and supplier of gas-turbine equipment of international quality standards. Employing a workforce of up to 9,000 highly skilled and experienced workers and engineers, the Company has a great experience and a long tradition in the world of marine gas turbines. It is there in Mykolayiv where there were produced the world’s first variable-speed combined gas turbine and gas turbine (COGAG) propulsion system, the M3, and again the world’s first gas-turbine powered anti-submarine warfare ship, the Project 61 Komsomolets of Ukraine, which the Americans nicknamed “Singing Frigate” for the characteristic noise of its gas turbines.

Initially the Company has developed, produced and sold great quantities of the second-gen engines M60 and M8, DT4 with efficiency of 28 percent; COGAG propulsion systems M5, M7 and M9. Afterwards the third-gen engines M75, M70, and M90 for all classes of ships with improved efficiency of 30-35 percent entered in service. SE GTRPC “Zorya”-“Mashproekt” pioneered the use of new structural materials, such as ceramics and compounds, capable to withstand



The line of some Zorya-Mashproekt engines

higher temperatures, contributed into development and production of internally cooled turbine blades, and thus resulting in a substantial increase in service life of the GTE in the whole. In 1990s SE GTRPC "Zorya"-Mashproekt" developed, the fourth-gen GTEs M80 and DN70 having efficiency of 36-37-percent. The Company is also the developer of the gas turbine propulsion systems GTU M21 for missile cruisers, the M16 for hydrofoil craft and the M35 for large hovercraft.

Overall in 1990, up to 65 percent of the surface ships in the Soviet Navy's inventory were equipped with SE GTRPC "Zorya"-Mashproekt" GTEs that combined amounted to about 35 percent and 30 percent of the global gas turbine fleet in terms of aggregate power and the number of gas-turbine powered ships, respectively.

COLLABORATIONS

The Company has so far developed and produced over three dozen varied types of propulsion gas turbine engines for propulsion of surface ships and craft, including hydrofoils and hovercraft. SE GTRPC "Zorya"-Mashproekt" GTEs, which make up to 25 percent of the world's gas turbine fleet, equip ships and craft that are in service with or fielded by the naval forces of a wide-ranging set of countries that include: (1) India (Delhi, Kolkata and Rajput classes of destroyers; Talwar

classes of frigates; Veer-class corvettes); (2) Bulgaria (Lightning-class corvettes); (3) Greece (Bison-class light landing craft air cushion (LLCAC) vehicles); (4) the Russian Federation (Atlant-class missile cruisers, Berkut-B and Frigate classes of guided missile cruisers; Burevestnik and Gepard classes of cruisers; Bison-class LLCAC vehicles; Lightning-class corvettes; Sivuch-class missile corvettes); Ukraine (Hetman Sahaidachny Frigate); Poland (Warsaw-class destroyer, Lightning-class corvettes), Romania (Lightning-class corvettes), Vietnam (Gepard-class frigates, Lightning-class corvettes), China (Lanzhou-class destroyers, Bison-class LLCAC vehicles) and the USA (Roy M.Wheat Naval Auxiliary).

India is the largest export customer for Zorya-Mashproekt marine GTEs. Few know that the Indian Navy was the first to place an order for GTEs from Zorya-Mashproekt after Ukraine regained its independence in 1991 and it has accounted for approximately 30 percent of the Company's sales every year since 2009. Presently, the repair base KSILA is established in the city of Vishakhapatnam. Under the dealing, KSILA conducts repair of GTEs manufactured by SE GTRPC "Zorya"-Mashproekt".

SE GTRPC "Zorya"-Mashproekt" signed in New Delhi on September 12, 2019 several contracts to sell to the Indian Navy a large quantity of gas turbine equipment, including GTEs, reduction gears and replacement parts kits for many varying classes of naval ships. The contracts furthermore include a gas turbine propulsion system operator training program along with an Engineering Support Package.

On the other hand, the frigates Project 11356 will be built at the Goa Shipyard in India. These frigates will get modernized GTU manufactured by SE GTRPC "Zorya"-Mashproekt".

China too has a history of relations with the Ukrainian Company. PRC's Navy previously selected U.S.-made GTEs LM2500 for its destroyers, but after the U.S. had imposed an embargo on exports of gas turbine engines, Beijing bought from Ukraine ten UGT25000 GTEs along with a full set of relevant engineering documentation and technical manuals under the contract for localization.

The UGT25000 was then reverse engineered by China to produce their own variant, the QC280 featuring an improved performance (achieved by using UGT25000 technology solutions among other things) and an increased power rating of 30,000 kW. The QC280 is designed for integration to China's new Type 055 (Nanchang-class) heavy guided missile destroyer with displacement of up to 12,000 tons – the PLA Navy's largest ship in this class. The QC280 is now 95 percent produced locally in China.

Ukraine was during 2013-14 exporting Bison-class LLCAC vehicles (Ukrainian-designed follow-up to the Project 232.2 "Zubr" air-cushioned hovercraft) to China. Relevant contracts made provisions that Ukraine would also supply spare engines and replacement parts and provide maintenance and repair services for those vehicles. Simultaneously, China received the full set of engineering documentation and technical manuals for the Bison landing craft →



Delhi class destroyer in Indian Navy with Zorya-Mashproekt engine

air-cushioned hovercraft vehicle. The first Bison had been shipped to China in April 2013, followed by the second one on March 1, 2014, days before the Ukrainian peninsula of Crimea was illegally annexed by Russia. Both of the vehicles, built in Morye Shipyard (Fedorosia, Crimea), have already entered service with the PLA's Navy, while construction of the other two vessels is progressing with technical support from Ukraine.

The PLA's Navy wants a fleet of 10-15 air-cushioned hovercraft, with Ukraine hoping to supply marine GTEs for the vehicles. Given that China is building a domestic capacity for GTE production, the country may in the future begin to build the engines under license or even become a fully independent producer.

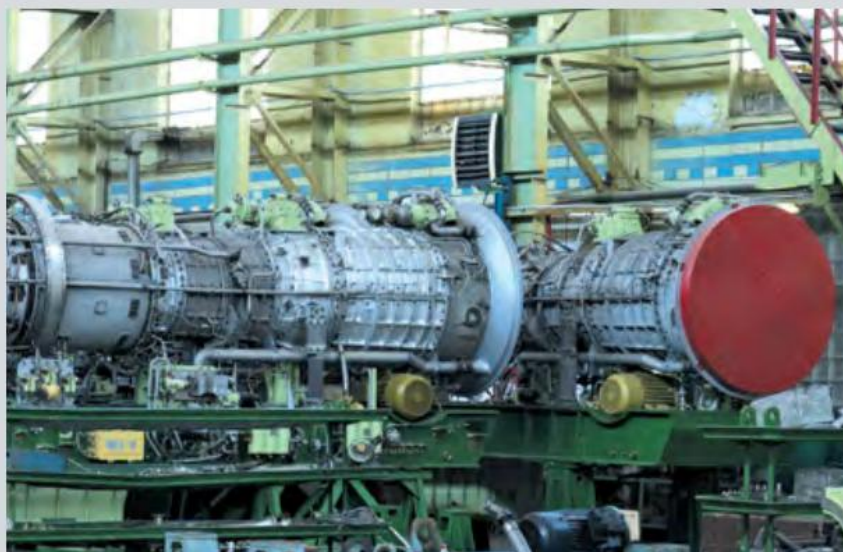
At an earlier time in 2001 Ukraine exported one Bison-class LLCAC vehicle with a Ukrainian-produced GTE to Greece, a NATO member.

Overall, the Company has produced and sold over 2,500 units of marine GTEs along with several thousand reduction gears, which provide power for a combined fleet of 600 warships in 20 navies worldwide.

The Company continues its work on the design of new types and models of marine gas turbine engines.

NEW PRODUCTS ON OFFER

Zorya-Mashproekt offers GTEs rating from 3 MW to 25 MW for integration with propulsion systems on all types of both naval and commercial vessels. Zorya-Mashproekt GTEs are renowned for operational robustness and reliability, long service life,




economy of use, low size and weight that all meet the stringent standards required in naval and commercial ship engine building. The Company has begun testing a prototype of its new GTE rated at 32-35 MW, which was under development from 2011 to April 2019 and is claimed to be the world's unique type. The new GTE is being developed in four configurations, one for use in the power generation industry as a mechanical drive for electricity generators; the second for use in natural gas pipeline nets as a mechanical drive for natural gas compressors, while the two others are designed for use as part of marine propulsion plants.

The Company is of the view that the employment of these GTEs in electricity distribution systems will increase operational flexibility and reliability of Ukraine's national power system, will

bolster the country's energy self-sufficiency and will provide sustained business for Zorya-Mashproekt.

The new GTE is no worse in performance than international-brand counterparts and can well compete with them in export markets.

In view of this and of the practical experience and expertise the Company has in creating effective, efficient and reliable GTEs for different uses, SE "Zorya-Mashproekt" holds a substantial potential for developing cooperation and synergies with potential customers in creating and bringing to market world-class marine gas turbine engines, marine reduction gears and complete propulsion systems for propulsion of all types of ships and craft. 

Volodymyr ZABLOCKIY,
Exclusively for UDR

Bison-class LLCAC vehicle (Ukrainian-designed follow-up to the Project 232.2 "Zubr" air-cushioned hovercraft) with Zorya-Mashproekt GTE built for Chinese Navy in 2013





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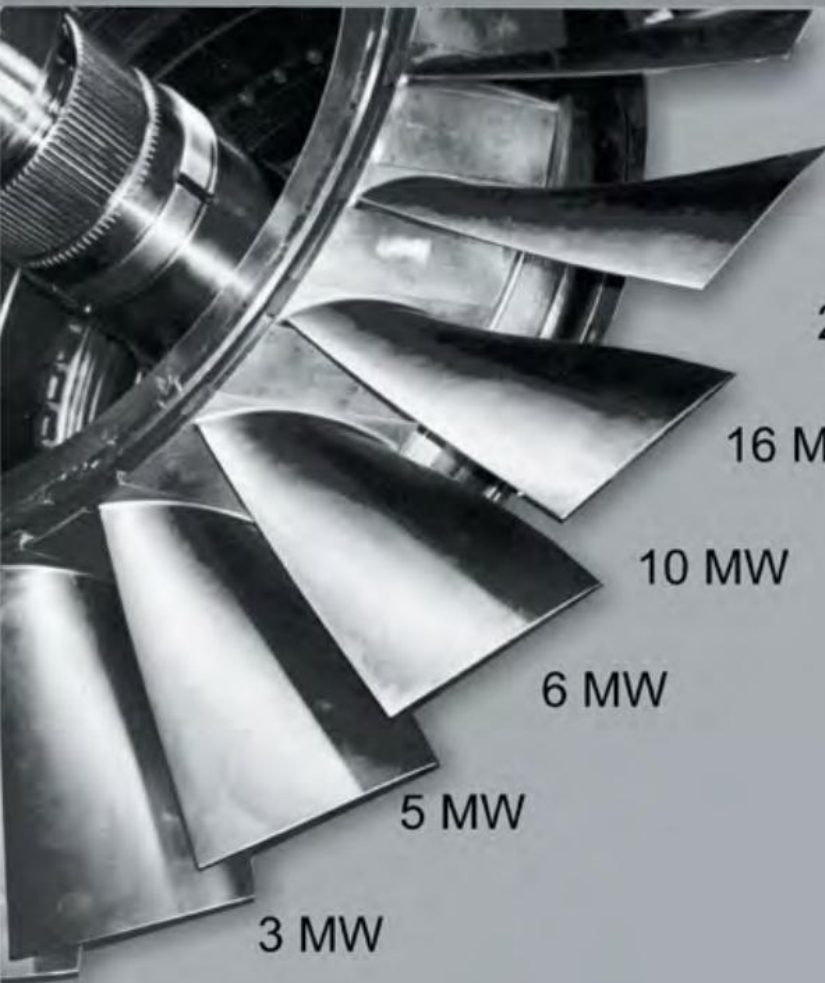
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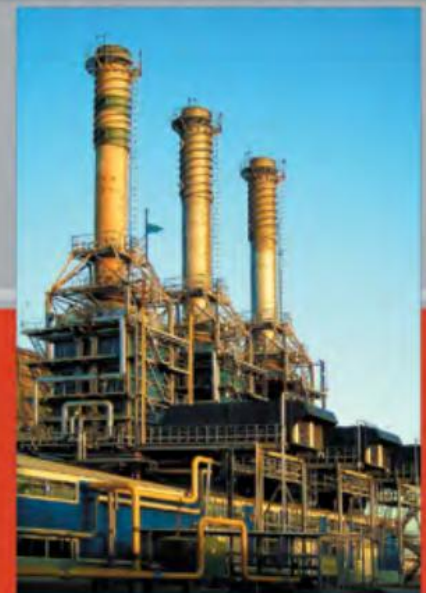
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