

UKRAINIAN DEFENSE REVIEW

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UDR



RUSSIAN AGGRESSION

PUTIN HAS INVADDED UKRAINE

Defense^{GR} express

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UKRAINIAN DEFENSE REVIEW ARMS EXPORT AND DEFENSE INDUSTRIAL COMPLEX OF UKRAINE

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CENTER FOR ARMY CONVERSION & DISARMAMENT STUDIES

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Verkhovna Rada's adoption of the Law on "Amending the Law on 'State Acquisitions'" is intended to set up a system of state acquisitions of goods, works and services; increase Ukrainian exports to global markets; and to improve operational effectiveness and efficiency of the defense industries.

This was stated by Tetiana Khrypro, deputy director general of Ukroboronprom, as quoted by the Company's press office. It is determined by this legislative act that the Law on 'State Acquisitions' shall not affect the goods, works and services acquisitions made by the defense industries listed in Ukrainian Government Resolution dated 12 February 2014. The list in question includes 115 companies affiliated with Ukroboronprom, as well as the joint-stock companies managed by Ukroboronprom, which are producers of weapons and military equipment. "The need to hold tenders,



UKROBORONPROM'S CONSTITUTING COMPANIES ALLOWED TO PURCHASE WITHOUT OBLIGATORY PUBLIC TENDERS

along with the difficulties involved with the planning of acquisition amounts badly impeded manufacturing work by Ukroboronprom's constituting companies," Khrypko said.

The cancellation of the demand on obligatory public tenders for the acquisition of military equipment components would reduce the production, repair and upgrade cycle time for

weapons and military equipment; improve the competitive ability of domestic companies on export markets and enable an increase in the level and amount of orders awarded.

MAINTENANCE CENTER FOR ANTONOV-SERIES AIRPLANES TO BE SET UP IN LATIN AMERICA

State-owned Company "Antonov" is planning to promote its airplanes on markets in Latin America jointly with local partners.

In January 2014, Antonov announced that an understanding was reached on establishing an An-series aircraft maintenance center in that region of the world. The Company hopes that this project would enable it to sell at

least 50 aircraft on these markets, Kommersant-Ukraine reported. Antonov and its Peruvian partners are to select one of three proposed sites to set up a maintenance center for Antonov aircraft in Lima, Oleksandr Kiva, deputy chief designer at Antonov has said. "The maintenance center would be kind of a warranty for successful operation of our airplanes.

This is what our Company lacked previously for soliciting new partners in that region. Furthermore, this project has become more feasible now that there are local partners who would help with its implementation," Mr. Kiva said. Antonov also announced that Peru is drawing up a project on building an aircraft factory there.



Peruvian government agencies are particularly interested in cargo aircraft An-148T and An-178. At the end of 2013, Antonov, Ilyushin Finance Co. [Russian leasing company] and

Peruvian partners launched negotiations on implementing this project in Peru. It is calculated that the aircraft factory project will cost from \$250 million to 300 million.



CABINET OF MINISTERS APPROVES CONCEPT PAPER FOR DEFENSE INDUSTRY MODERNIZATION

The Cabinet of Ministers of Ukraine (CMU), at its meeting on 15 January 2014, approved a concept paper for State Purpose-oriented Program on the Reform and Development of the Ukrainian Defense-Industrial Complex to 2017.

"The approved Program includes projects on restructuring defense industries in order to upgrade their technological and manufacturing capabilities to modern industrial culture standards and to improve the quality and competitiveness of the products they manufacture and services they render», the CMU said in a press release.

The Program provides for measures aimed at stepping up research and development (R&D) work by defense industries, specifically as it concerns the development of leading-edge technologies and materials and their industry adoption.

"The document includes projects on restructuring defense industry companies with the aim of upgrading their technological and manufacturing capabilities to modern standards. The Concept Program would foster conditions for the defense industry operation by way of adoption and mastery of innovative solutions and soliciting investors for the defense industry", Ihor Prasolov said.

The government foresees that the Program would be implemented through mechanisms fostering investment and technological innovation, while providing resources for technical modernization of the defense-industrial complex and improving cooperation between the defense R&D and production communities.

The Concept Program provides for Hr 2.9 billion in government funding for projects on upstream research, R&D, the mastery of leading-edge technologies and materials, and their industry adoption. The Program also includes Hr 7.67 billion worth of other projects which would be funded from sources other than the State Budget.



UKRAINE WILL PERFORM SU-24 AIRCRAFT UPGRADES FOR BELARUS

PJSC "Radar" Factory of Kiev, within a license for the export/import of defense products to the Republic of Belarus, will overhaul and upgrade front-line bombers for that country, Ihor Myasishchev, acting CEO of "Radar" Factory told Defense Express on 18 February 2014.

"One of key reasons why we are restarting this work this year is that Belarusians offer an interesting job falling within our speciality competence, of which we, incidentally, hold a monopoly. I am talking about Su-24 aircraft overhaul works to be

done for the benefit of aircraft repair plant # 558 in Baranovichi, inasmuch as it concerns the PNS-24 integrated navigation and aiming system," Myasishchev said.

He added that his Company has already agreed future areas of work with one more Belarusian partner – CJSC Beltechexport. "Our work with Beltechexport will concern, again, the PNS-24 system, but it will be three times the amount of work [to be done for the customer in] Baranovichi. We also agreed with Beltechexport that we will do repairs and upgrades on R-27 missiles' seeker heads".



UKRAINE WILL PARTNER U.S., EU IN SPACE IN 2014

Space launch schedule for 2014 includes 11 satellite launches to be carried out using booster rockets built in Ukraine or, with Ukraine's inputs, in the U.S. or the EU under international cooperation programs, Yuri Alekseev, the head of the State Space Agency of Ukraine (SSAU) told Interfax.

Six of the 11 launches will be carried out using vehicles built under international cooperation programs in Ukraine. These include three launches with satellite launch vehicles "Dnepr" to be carried out under the name-sake Ukraine-Russia program, and as many blast-offs with Zenit rockets – under international programs "Sea Launch" and "Land Launch" (Baikonur Cosmodrome, Kazakhstan). Under the Land Launch program, a Zenit-3SLBF rocket will boost into space Ukraine's first telecommunication

satellite "Lybid" in April, Y. Alekseev said. The launch schedule for this year also includes three liftoffs with Antares medium-class space launch vehicle built for delivering cargo to the International Space Station (Ukraine has designed and supplies the first-stage of the vehicle) and two launches with the EU's new Vega booster with a Ukrainian-supplied fourth stage on board. According to the SSAU's statistics for 2013, four successful liftoffs with Ukrainian-built boosters were carried out – two with the Zenit and as many with the Dnepr, which lifted into orbit a total of 25 satellites for the benefit of 16 countries. Further to this, there were two successful launches made with the Antares booster and one with the Vega booster. The Sea Launch blastoff of a Zenit-3SL rocket carrying Intelsat-27 satellite ended in a failure. Experts calculate that Ukrainian-built rockets account for around ten percent of the commercial space transportation market.

PRODUCTS BY FIOLENT FACTORY MAKING THEIR WAY TO EXPORT MARKETS IN EUROPE

In 2013, PJSC "Fiolent Factory" expanded its market reach in Europe, particularly Lithuania, Ukroboronprom reported in a press statement quoting Oleksandr Batalin, President of PJSC "Fiolent Factory" as saying on 5 February 2014. Fiolent™ electrical tools are now available through the SENUKAU PREKYBOS CENTRAS network – the largest dealer and retailer of construction and home improvement products in the Baltic region, with 91 outlets in Lithuania alone. Fiolent Factory intends to enhance its brand presence in retail outlets throughout Lithuania by increasing exports to that country, and it hopes to sign similar deals with Turkey, Poland and the Czech Republic among other countries.

LIST OF ARMAMENTS FOR INDIGENOUS CORVETTE AWAITING MOD'S APPROVAL

The Ukrainian Ministry of Defense has yet to approve the complement of armaments for the indigenous naval corvette, a MoD insider told Defense Express on 17 February 2014. The [indigenous naval corvette] program is still active since it has not been suspended officially, the source said. "Construction of the corvette is currently the responsibility of PJSC "Chornomorsky (or "Black Sea") Shipbuilding Plant". This company will certainly agree the acquisition of armaments with the Ministry of Defense, but in most cases, this is more in the nature of inter-business coordination. The MoD has not approved operational requirements document regarding the composition of armaments yet. At this point in time, several options for cooperation with foreign suppliers are being considered. Work is now being conducted with suppliers from the Netherlands, Italy and France. Last year, serious work was launched with a state-owned Chinese company, and it appears that it offers the best conditions, both in terms of cost and proposed payment scheme which involves the provision of a government loan. So it is still remains unclear who will be selected as supplier of armaments for the Ukrainian corvette program.

State-owned Company Ukroboronservice has won a contract to overhaul and supply fifty T-64-BV-1 main battle tanks to an export customer, an official at the Company told Defense Express.

The vehicles will be overhauled by State-owned Company "Armored Military Vehicle Factory of Kharkiv", Dmytro Poliakov, head of Commerce Department at Ukroboronservice has said. Poliakov described the T-64 MBT's breakthrough into an export market as an important accomplishment for Ukroboronservice, considering that this vehicle was barred from export in Soviet-era days and, consequently, did not receive sufficient promotional effort outside the USSR. "This tank is superior to the T-72 MBT in terms of some key performance capabilities such as firepower, protection and ride performance, whilst the upgraded modification,



UKRAINE WILL SUPPLY 50 T-64BV-1 MBTS TO AN EXPORT CUSTOMER

the T-64-BV-1 nicknamed "Bulat" is superior to the T-90, respectively. In comparisons of cost versus effectiveness, the upgraded T-64 is better than foreign-made counterparts," said Vadym Fedosov, chief of the division on armored military vehicles, automobiles, engineering equipment and special-purpose vehicles at State-owned

Ukroboronprom defense industry holding group. The T-64-BV-1 contract was signed in pursuance of Ukroboronprom's strategy aimed at increasing the exports of armored military vehicles. "With a massive stock of T-64 tanks in Ukraine, it is certainly more profitable for the country to sell them on export markets than to

dispose of them. This contract would provide domestic factories with business, boost profits for Ukroboronprom and appropriations for the State Budget, and would create new jobs in the mid-term future. For example, each T-64 tank supplied will create at least one job at the contractor factory," Fedosov said.

Following the signing of the contract to overhaul and supply 50 T-64-BV-1 tanks, Armored Military Vehicle Factory of Kharkiv will be able to boost its yearly output to Hr 100 million and net profit to Hr 4.5 million in 2014, which would allow it to upgrade and modernize its capital assets.

SPETSTECHNOEXPORT WINS NEW CONTRACT FROM INDIAN MOD

Visiting official team of State-owned Ukroboronprom holding group held negotiations at India's Air Force Headquarters with the Indian Air Force's Air-Vice Marshal S N Murti, Maksym Hlushchenko, deputy director general of Ukroboronprom, reported. He said that the two parties discussed progress of the contract

on repair, life extension and modernization of the Indian Air Force's fleet of An-32 military transport aircraft, which is being carried out both in Ukraine and India. "Air-Vice Marshal Murti expressed satisfaction with the quality of the work done by the Ukrainian Contractor. As an outcome of the negotiations, a new aircraft overhaul contract was signed between the Indian Air Force and Spetstechnoexport,

which came as proof of the high quality of repairs," he said. The two parties additionally discussed further expansion of bilateral cooperation. "Overhaul and life extension upgrades on the Indian Air Force's helicopter fleet is a promising area of further cooperation in the aviation industry. Ukraine previously had already overhauled a number of helicopters for the Indian party," Mr Hlushchenko said.

It is to be furthermore noted that Ukraine intends to re-start a production line for the light armored multipurpose prime mover MT-LB at Kharkiv Tractor Works (KTW), as reported by Ukraine Industrial. Consultations with potential suppliers of components and subsystems have already got under way. Particularly on 5 February 2014, a team of KTW officials visited "Forging and Mechanical Plant of Lozova" OJSC.



Ukraine has won a tender to supply a number of BTR-4 armored personnel carriers to Indonesia, State-owned Company "Ukrspesexport" reported in a press statement released on 24 January 2014.

Spetstechnoexport, a firm affiliated with Ukrspesexport, has won an Indonesian MoD's APC competition and will be awarded a contract to supply five BTR-4 armored troop carriers to the Indonesian Armed Forces. The winner of the competition was selected by the Indonesian MoD on 22 January. The contract award is expected in the first

BTR-4 APC GOING TO INDONESIA

quarter of this year, Ukrspesexport said. An official team of the Indonesian MoD visited Ukraine in August 2013 to get familiar with the capabilities of the BTR-4 APC during proving ground trials.

"The Indonesian military officials gave a high evaluation to technical and performance capabilities of the new Ukrainian armored vehicle," Ukrspesexport said. Ukraine Industrial reported on 28 January 2014 that

Indonesia intends to purchase 55 BTR-4s from Ukraine to replace its aging fleet of BTR-50P/M armored vehicles. It is foreseen that the BTR-4 acquisition program would cover a timeframe from 2015 to 2019.



FIRST "Oplot" TANKS REACHED THAILAND

On February 4, 2014, the first batch of five T-84 Oplot main battle tanks arrived in the Kingdom of Thailand. The Ukrainian tanks produced by the State Enterprise "Malyshev Plant" arrived to the Port of Sattahip (Thailand) where they were discharged and directed to the place of acceptance testing. After the final testing by the Thailand side, the tanks will be finally accepted under the terms of the contract. In a ceremony in Kharkiv in November 2013, officials of SC "Ukrspesexport" and



the Royal Thai Army signed a technical acceptance certificate for the initial batch of Oplot main battle tanks. The shipment of the initial batch of Oplot tanks is part of a deal signed in September 2011 between SC

"Ukrspesexport" and operational command of the Royal Thai Army. The deal includes the supply of 49 Oplot main battle tanks and support vehicles. The overall cost of the contract far exceeds USD 200 million.

SRI LANKA WILLING TO EXPAND MILITARY-TECHNICAL COOPERATION WITH UKRAINE

State-owned Ukroboronprom defense industry holding group and the Armed Forces of the Republic of Sri Lanka are willing to expand their military-technical cooperation regarding overhaul/upgrade of existing inventories and supplies of new types of weapons and military equipment.

This was stated by Maksym Hlushchenko, deputy director general of Ukroboronprom, following a meeting with the Sri Lankan Chief of Defense Staff, Lieutenant General Jagath Jayasuriya, which took place on the sidelines of DEFEXPO-2014 exhibition.

The Chief of Defense Staff expressed an interest that Ukroboronprom and its constituent entities assist in repair, overhaul and upgrade of the Sri Lankan Armed Forces' helicopters and naval ships, M. Hlushchenko said. The meeting at DEFEXPO-2014 addressed the possibility of Ukraine supplying Sri Lanka with replacement parts for aircraft, armored military vehicles and naval ships.

The parties reached understanding to set up a mixed team of representatives from Ukroboronprom, Ukrainian arms dealers and the Sri Lankan Armed Forces. The team would work in Sri Lanka with a mission to investigate the potentialities for bilateral cooperation and carry out an evaluation of technical status of the existing military equipment inventories. Based on the outcomes of this work, Ukrainian arms dealers will draw up business and technical proposals regarding further military-technical cooperation and will submit them to the Sri Lankan party for consideration.



ZORYA-MASHPROEKT SUPPLIED MISSILE BOAT ENGINES TO INDIA

State-owned Company "Zorya-Mashproekt" has shipped to India an initial quantity of four gas-

turbine engines for Molniya-class missile boats used by the Indian Navy, Ukroboronprom reported in a press

statement released on 21 January 2014, quoting the holding group's deputy director general Maksym Hlushchenko as saying.

The said shipment is part of a 2013 export deal for eight gas-turbine engines. The remaining four motors are scheduled for delivery

in the second quarter of 2014. The engines are intended to replace older counterparts that have reached the end of their fatigue life.



RHEINMETAL SIGNED A MILLENIUM MDG-35 GUN CONTRACT IN FAVOR OF UKRAINE

On 11 February 2014, German group Rheinmetall AG announced that it had signed a €12 million supply contract with "a European navy" for two 35-mm naval gun systems Rheinmetall Millennium MDG-35 to be installed "on a surface ship". The delivery under this contract should be provided in 2015, bmpd. livejournal reported on 17 February 2014.



The identity of the customer has not been disclosed officially, but unofficially, according to bmpd and Defense Express reporters, this is Ukraine, and the two naval gun systems Millennium are intended for integration with the Project 58250 corvette First-Of-Class "Volodymyr Velikiy" which is being constructed for the Ukrainian Navy by the Black Sea Shipbuilding Plant in Mykolayiv. It was foreseen from the very beginning that each Project 58250 corvette will be equipped with two Millennium-type gun systems installed by one on each side of the aft superstructure.

[crimea crisis]

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MILITARY
(MARCH 3, 2014)



PUTIN

**IS A SINGLE STEP
BLOODSHED: HOW**



AWAY FROM TO STOP HIM

Valentyn BADRAK,
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WHAT'S GOING ON:

On 27 February 2014, Russian President Vladimir Putin violated the 1994 Budapest Memorandum and the underlying agreements of 1997 determining the terms and conditions for the Russian Black Sea Fleet's temporary presence and operation on Ukrainian territory.

On 27 February 2014, Putin UNLEASHED A REGIONAL CONFLICT and is now treacherously implementing the same plot as the one he used in Georgia. Russia is currently waging a unilateral – and, fortunately, bloodless – war against Ukraine.

It is important to understand that the key reason for Putin's aggression is one of psychological nature. What led Putin to this step was his defeat on the Maidan. Being essentially a defective, deconstructive and destructive individual, Putin would not stop short of plunging millions of people into chaos of war just for the sake of displaying power to Ukraine and third countries. A paranoid man with a Napoleon complex, he can burst all

bounds of humanity and adequacy for the sake of a revenge.

Relying on the hand-picked legislature of the Russian Federation, on the controlled mass media and the population thoroughly processed by a powerful state information-psychological machine, Putin has willfully destabilized the situation in Crimea.

At this moment in time, the tactics used by Putin is to take over the Crimean Peninsula by means of staging a separatist coup by the hands of Russian citizens and military units redeployed to Crimea from Russia. A more global aim pursued by Putin's administration is to achieve a change of government in Ukraine. It does not nec-

essarily mean restoring Yanukovich in power. All that means is that that government is controlled by Moscow and heed to orders from the Kremlin. Against this background, Crimea remains to be a potential "flashpoint"; when continuous provocations by Russian military men make Ukrainian army units respond with force, armed bloodshed will be imminent.

It is to be added that Putin and his administration are successfully exploiting to their advantage fugitive ousted president of Ukraine Yanukovich, announcing on his behalf some alleged agreements on redeployments (disguised as regular training exercises) of Russian forces in Cri-



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(MARCH 2, 2014)

mea. What is playing into Putin's hands is, unfortunately, the slow pace of decision-making by Ukrainian authorities; decisions made prior to March 2 were put into practice with several-day delays. The authorities failed to prevent Yanukovich from fleeing Ukraine or to isolate extremist and separatist leaders, including Russian citizens, neither did they manage to stage an all-Ukrainian information front.

It needs to be particularly emphasized that Putin as personality is strongly inclined to military invasion. Identifying himself for a long time with bloody dictator Josef Stalin (incidentally, as Saddam Hussein did), he is potentially ready to

kill huge numbers of people just to satisfy his own ambitions.

At the same time, there is a CLEAR DISTINCTION BETWEEN THE CONCEPTS OF "PUTIN'S ADMINISTRATION" AND "THE RUSSIAN PEOPLE". It is the Russians who have not forgot how to think and don't want a dictatorship again, who, along with the voice of the international community, could become a core of opposition to Putin.

It is to be added here that it is Putin who bears full responsibility for the Russians' thinking of Ukraine which has been worsening month and out. Hostile attitude of brainwashed masses has aggravated to the degree where members of the Russian Armed Forces have become ready for fratricidal war, and this war would find favor with a substantial part of the Russian people.

WHAT IS TO BE DONE:

On the one hand, the only restraining factor under the current conditions may be a consolidated effort of the international community and the conscious part of the

Russian people. Putin is expecting precisely a military force response from Ukraine, or that the mentioned aims will be achieved by a bloodless means. However, Putin is not so certain, and there are signs of that. THIS IS WHAT DICTATES THE NEED FOR THE INTERNATIONAL COMMUNITY TO LAUNCH A GLOBAL INFORMATION WARFARE ATTACK AGAINST THE PRESIDENT OF RUSSIA PERSONALLY.

It is necessary to launch the second information front in an uncompromising war against demonism of Putin's personality. The moment has come for the international community to begin using all its influence power available, with one single aim – to stop this inadequate man. The current conflict has fully revealed Putin as a destructive person equal in his ambitions to Hitler and Stalin. The world must not turn out to be weak to permit one demoniac man to plunge it into chaos of a potential Third World War! To that end, it is necessary to put to use all the available rostrums, information forums, mass media and social network services. Things must be called by their proper



Ilya Verlamov | zvalive.com

names to reveal a potential criminal against humanity. It should be understood that Putin is afraid of becoming a pariah of the world.

IMMEDIATE CHANGE OF INTERPRETATIONS is necessary among other things: “military action in the name of bringing Crimea back [under Russian control]” must be interpreted in terms of “military invasion, a war against Ukraine”.

New Ukrainian government should:

Immediately set up an information center for round-the-clock coverage of developments in Ukraine; translation to major languages is key. Correct the distorted information; warn about Russia’s misinformation. Recruit experts, analysts and journalists.

MRUSSIAN AND UKRAINIAN SOLDIERS BEHIND THE CHECKPOINT IN CRIMEA (MARCH 2, 2014)

Maintain restraint, **KEEP THE ARMY INACTIVE** for some time while preparing it for combat actions. Carry out limited mobilization; define in clear terms “the no-return point” – the moment when Ukraine’s Armed Forces come into combat. It is to be emphasized that the current level of morale in the Ukrainian army is sufficiently high. It is this factor, rather than the troop level or the available amount of armaments, which can make the aggressor stop. At the same time, this is going to be an uneven confrontation, considering intensive rearmament of the Russian army during the past five years and six-fold numerical superiority in combat capabilities. For this reason, combat actions could only be a last-resort means of settling the crisis.

Declare readiness to go for expanding Crimea’s autonomy; this is subject to negotiations, and this should be made known broadly to the population in Crimea.

Continue intercommunication with the USA and NATO regarding possible involvement in a potential military scenario. Be active to the maximum possible extent on the international scene. The voices of diplomats and politicians must not cease to be heard; the wave of anti-Putin protests must reach out to the entire conscious international community.

MAKE UP FOR LOST TIME. Arrange for operations to isolate extremist and separatist leaders; strongly warn the visiting Russian officials against making anti-Ukrainian statements; full deni-



Ilya Varlamov

al of entry for agent provocateurs such as Zhyrinovsky, Zatulin etc.

INTENSIFY COMMUNICATION WITH THE CRIMEAN TATARS, up to establishing the National Guards (adopt a relevant Law of Ukraine, urgently equip the National Guards units with arms).

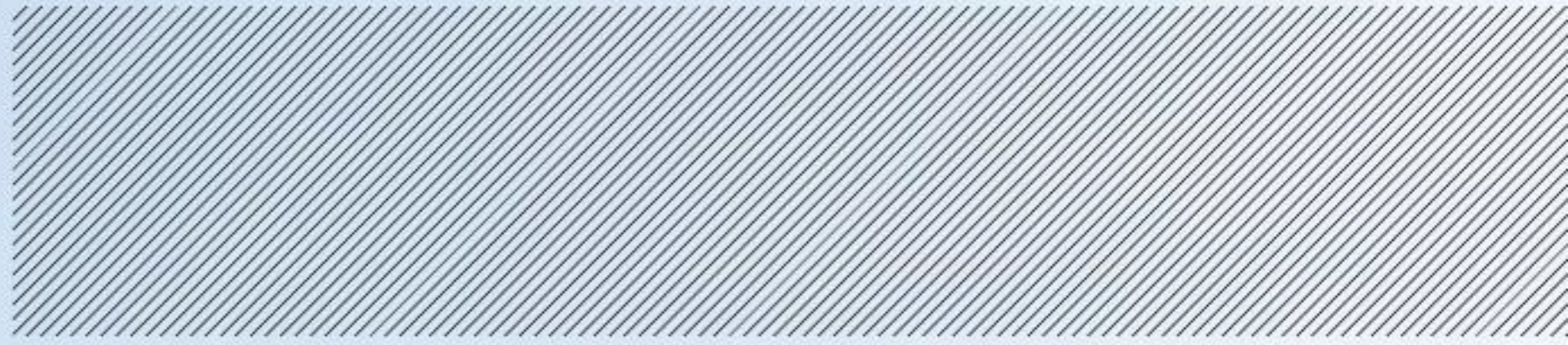
Finally, and most importantly, Putin's boldness is pretended since it arises from the false perception that Putin's Russia is firm in its determination to fight fiercely for Ukraine, whilst the West is not. Based on this perception, Putin awarded himself two points: in 2008, the West had had to "lump" Russia's invasion of Georgia, and the West left Ukraine alone when its European integration aspirations came to a standstill... Putin will quickly pull out once he sees that the West is ready to defend Ukraine with force, not with words. **JDR**

RUSSIAN ARMORED VEHICLES TIGR IN CRIMEA (MARCH 2, 2014)

RUSSIAN SOLDIER BEHIND SIMFEROPOL INTERNATIONAL AIR-PORT IN CRIMEA (MARCH 3, 2014)



[trends]



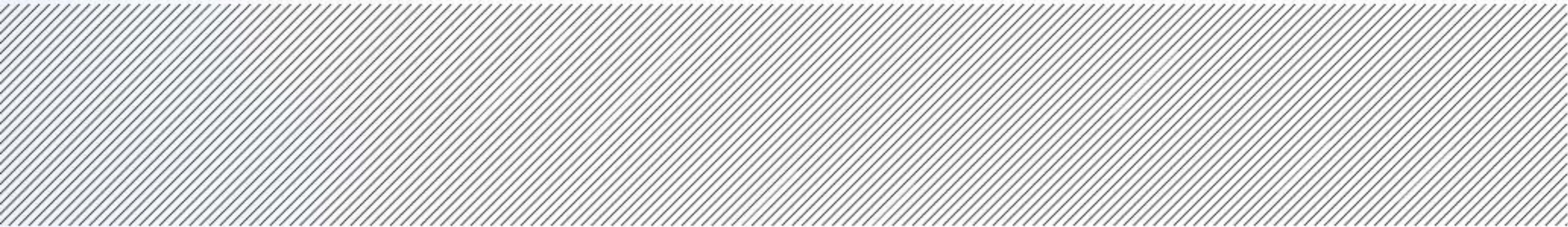
SKIMMING 'BISON'



UKRAINIAN-BUILT LIGHT
AIR-CUSHIONED ASSAULT
CRAFT IN DETAIL

Serhiy ZGHURETS, for UDR





In September 2010, Feodosia Shipbuilding Company 'Morye' laid down the keel of the first Project 958 'Bison' series craft for China. The Contractor then proceeded to mooring trials of the craft on 16 July 2012. The first Project 958 'Bison' landing craft air cushion (LCAC) vehicle was handed over to China in 2013.



Ukraine is carrying out a contract to supply four 'light' landing craft air cushion vehicles (LCAC) to China. The Ukrainian-designed LCAC vehicle is denominated as Project 958 and nicknamed "Bison". Following is a brief description of this rather unique item of the modern era.

The Bison LCAC is a current-generation follow-up to the Project 232.2 'Zubr' air cushioned hovercraft that was developed by 'Almaz' Central Design Bureau in the late 1980s and currently is the world's largest amphibious hovercraft. Aside from carrying out over-the-beach landing of assault troops and combat materiel, the Zubr can also provide fire support during operations ashore. The Zubr/Bison-type LCACs can usually navigate over 70 percent of coastal landing environments – including marshes and beaches – against only 15 percent for traditional landing craft.

The Ukrainian manufacturer of 'light' LCACs is the Shipbuilding Company "Morye" in Feodosia, which is part of the Ukrainian Defense Industries (Ukroboronprom) State Corporation. The Zubr/Bison craft are being manufactured in Ukraine based on a bilateral agreement with the Russian Federation concerning the division of intellectual property rights to Soviet-designed technologies. This agreement allows Ukraine to possess and use engineering documentation and manuals for Zubr/Bison-class vehicles.

Developed by Morye, the new spin-off modification of the 'Bison' craft features completely new control equipment, navigational aids and radar systems of the Ukrainian design and make.

Fiolent Plant of Simferopol designed and developed hardware and software needed for control of technical equipment and motion of this unique vehicle. For the Project 958 'Bison' air cushioned craft, Fiolent has

created remote motion control integrated management system 'Flora-958'. This innovative control system encompasses a current-generation microprocessor platform of reduced size and improved effectiveness and efficiency. Developed based on new ergonomic solutions, its motion control console has a radically new design. The integrated management system has passed the complete range of laboratory testing and evaluation procedures and computer-based bench tuning at Fiolent.

The main powerplant for the Bison was designed, developed and manufactured by Zorya-Mashproekt gas-turbine maker in Mykolayiv. High-temperature gas-turbine engines are powering air cushion blower fan drives and propellers. Air cushion under the craft's bottom hull is generated by four blower fan units with 2.5-meter axial flow wheels. Forward movement of the vehicle is ensured by three four-blade propellers with controlled-pitch



blades. 5.5-meter propellers are mounted in dedicated ring nozzles for increased thrust and higher propulsive efficiency.

The hull of the Bison is an all-welded high strength aluminum-magnesium alloy structure. High strength and buoyancy of the craft are provided by a rectangular pontoon, the main load-carrying part of the ship's hull. The superstructure built on the pontoon is divided into 3 compartments with two longitudinal bulkheads: combat materiel compartment in the mid-section fitted with tank ramps, and outboard sections housing main and auxiliary propulsion units, troop compartments, living quarters, and NBC protection systems. Nearly four-stories-high, the 550-ton LCAC can travel at up to 120 kmph. Skimming over 1.5-meter high waves, it can negotiate with ease undersea engineering structures and mine barriers. In approaching the shore at full speed, the vehicle brings down fire at the desired beachhead with its 140-

The shipping out of the first Project 958 'Bison' series craft to China in late 2012.

mm unguided rockets, while its automatic six-tube 30-mm AK-630M launchers destroy hostile aerial vehicles, boats, light armored combat vehicles and exposed forces, and disable floating mines by fire.

The signing of a US\$315 million deal between China and Ukroboronprom in 2009 came as an important achievement for Ukrainian shipbuilders. Under the agreement, two LCACs are to be built by the Feodosia Shipbuilding Company, and two more by Chinese shipyards, under the supervision of Ukrainian engineers. The full set of engineering documentation and manuals for the vehicle has been transferred by Ukraine to the Chinese party.

The first vehicle was laid down in 2010 and handed over to the Chinese Customer in 2013. As reported by Ukrspecexport (a state company within Ukroboronprom Corporation), the Chinese party spoke highly of the quality of the vehicle during acceptance ceremony. On May 25, the Ukrainian-built Bison reached China and was subjected to sea trials after being fitted with additional electronics and weapons systems at Guangzhou.

The second vehicle is scheduled for delivery in the second quarter of 2014.

On a parallel track, two more Bison LCACs are being constructed in China. In October 2013, mil.news.cina.com.cn posted a picture of the Bison being built at a shipyard in southern China showing the third power plant fan being installed on the vehicle.

Aside from purchasing the landing hovercraft from Ukraine, China is developing an indigenous air cushioned assault vehicle, which will be far lighter than the Bison. The 70-t Chinese counterparts will be equipped with Zorya-Mashproekt powerplants. Four sets of such powerplants have been exported to China by Ukraine over the past six years. "We only supply them with propulsion plants; the hulls for the vehicles have been designed and developed singlehandedly by Chinese engineers, and these are not replicas of the Ukrainian LCAC. We believe that China's indigenous LCAC was designed around the U.S. concept of air cushioned assault vehicles in the LCAC category", Ukrainian experts said.

China thus far remains the sole market for a peculiar item such as the Bison; more buyers are hard to be found, as the "terror of the straits" is a costly affair in terms of maintenance and operation. UDR



The first Project 958 'Bison' series craft being assembled at a Chinese shipyard in late 2013

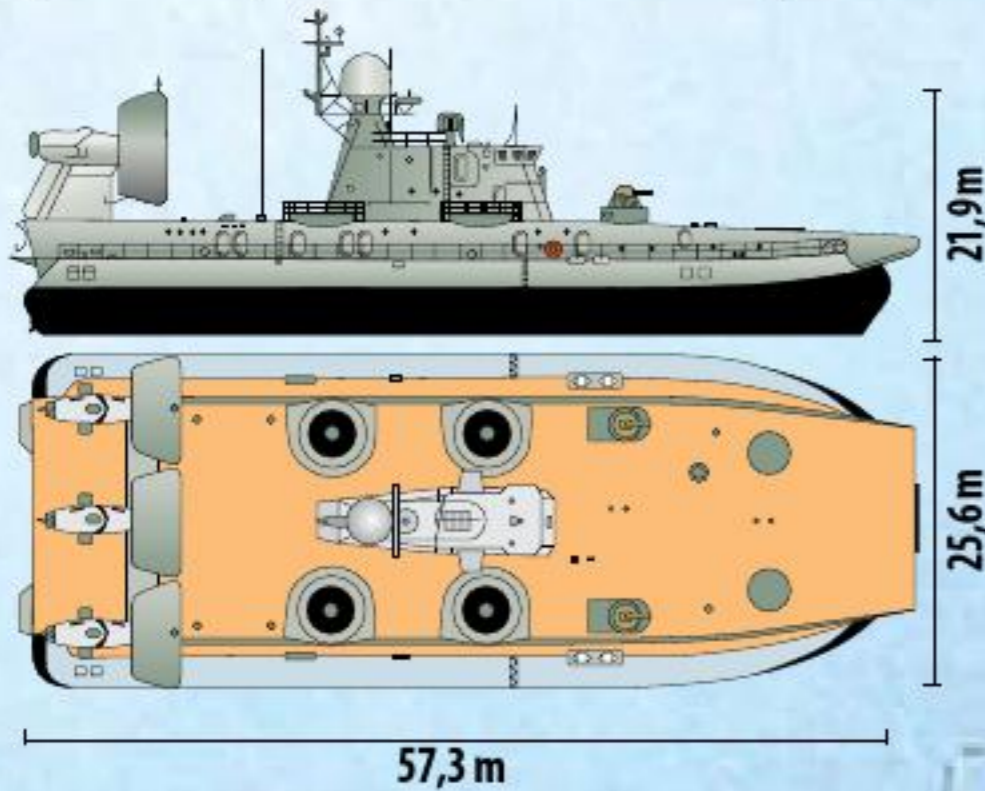
BISON

LIGHT AIR-CUSHIONED ASSAULT CRAFT



Light Project 958 air-cushioned assault vehicle 'Bison' is designed to sealift landing assault units from/to equipped/non-equipped shore, provide the transportation and landing of assault troops and combat materiel on hostile beaches and to provide fire support during operations ashore.

The Bison LCAC is the world's largest air cushioned landing craft. It can come ashore onto an unequipped beach, negotiate ditches and trenches, travel over marsh and swamp terrain and deliver assault troops to deep enemy defense zones. The LCAC Zubr-class can operate over 70 percent of the world's coastal landing environments.



550 tons -
Fully loaded displacement



 Manufacturer
Shipbuilding Company "Morye",
Feodosia, Ukraine

Deckhouse

During sea operations, control of the steering wheel is personal responsibility of the commanding officer. To improve working conditions in the battle stations, troop compartments and living quarters are fitted with air-conditioning and heating-systems, sound/heat-insulating coatings, and structures made of vibration damping materials. The ship provides normal conditions for the crew to take meals and rest.

2 x 30-mm AK-630 guns
with 3,000 rounds of ready-use ammunition

Flexible 'skirts'

Flexible 'skirts' surrounding the vehicle are designed to maintain the air cushion and the hover height enabling the craft to hover over surface and to come ashore and travel by land. To protect the 'skirts' from punctures or rubbing effects, the sides of the skirts have a three-layer layout structure, while the bottom part of the skirts has protective polyurethane cover. The skirts are able to withstand considerable small and medium damage without the fear of the vehicle losing its amphibious properties.

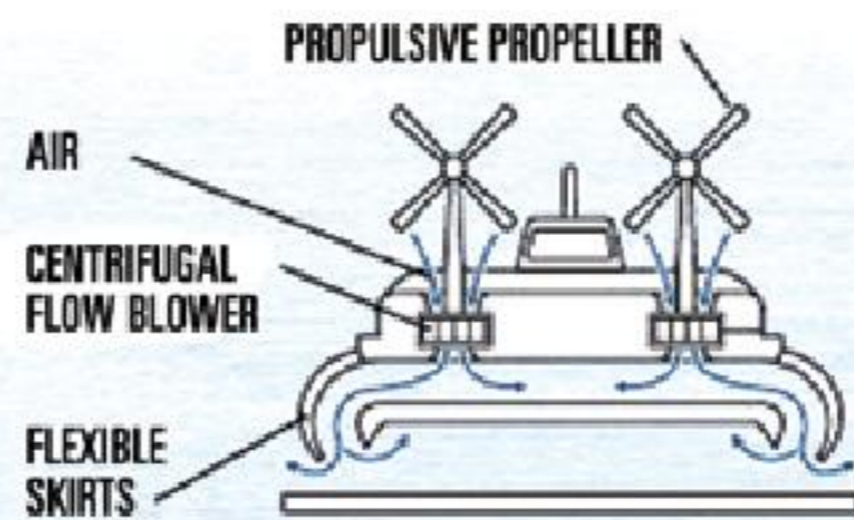


Integrated management system Flora-958

The Flora-958 Integrated Management System is an innovative design. It encompasses a current-generation microprocessor platform of reduced size and improved effectiveness and efficiency. Developed based on new ergonomic solutions, its motion control console has a radically new design.



 Manufacturer
PJSC «Plant» Fiolent,
Simferopol, Ukraine

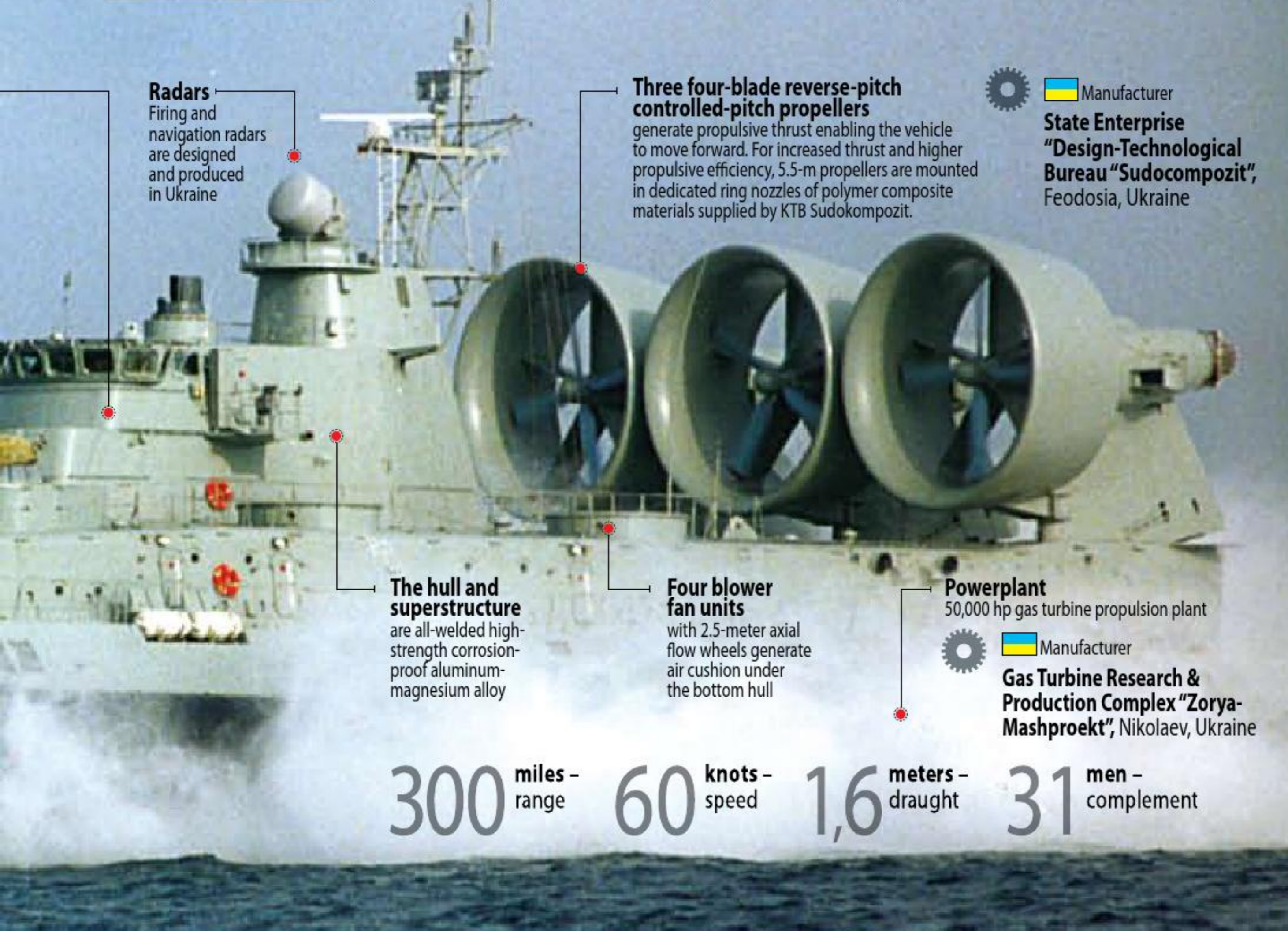


PAYLOAD CAPACITY

150 t



In 2009, Ukraine signed a \$315mn contract to supply a number of Zubr-class air-cushioned assault vehicles to China during five years, with Feodosia Shipbuilding Company 'Morye' acting as the Contractor. Under the terms of the contact, two vehicles are to be built in Ukraine and two more in China. Previously, Morye built 12 Project 958 (designated by NATO as Pomornik), vehicles – ten for the USSR's Navy and two for the Hellenic Navy.



Radars

Firing and navigation radars are designed and produced in Ukraine

Three four-blade reverse-pitch controlled-pitch propellers

generate propulsive thrust enabling the vehicle to move forward. For increased thrust and higher propulsive efficiency, 5.5-m propellers are mounted in dedicated ring nozzles of polymer composite materials supplied by KTB Sudokompozit.



 Manufacturer
State Enterprise "Design-Technological Bureau "Sudocompozit", Feodosia, Ukraine

The hull and superstructure

are all-welded high-strength corrosion-proof aluminum-magnesium alloy

Four blower fan units

with 2.5-meter axial flow wheels generate air cushion under the bottom hull

Powerplant

50,000 hp gas turbine propulsion plant



 Manufacturer
Gas Turbine Research & Production Complex "Zorya-Mashproekt", Nikolaev, Ukraine

300 miles – range

60 knots – speed

1,6 meters – draught

31 men – complement

LCAC "BISON" CAN DELIVER FOLLOWING CARGOS

3 tanks up to 150 t 

10 BTR up to 131 t 

8 BMP – up to 115 t 

ITS FOUR COMPARTMENTS CAN ACCOMMODATE 140 troops. Meanwhile, the materiel compartment, if required, can be outfitted with removable seats for 360 fully equipped assault troops, thus bringing the total complement to about

500 men

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[radar systems]



UKRAINIAN SHIP-BORNE RADARS

Dmytro BOGDANOV, Serhiy ZGHURETS, for UDR

Ukraine is in the first ten top countries according to capabilities in the development and production of radars. It is recognised that country has got a closed production cycle from design to serial manufacture of radars for wide spectrum of mission. Ukraine maintains leading position in sm- and mm-radiowave technologies and continuously implements various digital antenna array based programmes. UDR offer readers the review on Ukrainian ship-borne radars which are designed to providing awareness in air and maritime situation.



Ship-borne radars providing awareness in air and maritime situation are very complicated, advanced and expensive equipment. They have to detect air targets, above-water objects and high speed boats, low flying anti-ship missiles and guided air bombs. Detecting air targets requires the identification of at least three coordinates: direction to a target, angle of altitude and distance to a target. Ship-borne radars exercise navigational functions, send target detection information to missile systems, etc. Advanced radars are able to perform guidance and in-flight control of missiles simultaneously which were previously provided by target and missile locators and missile control units within radars within defence systems. Whilst on large ships it is possible to use a specialised radar station in addition to maritime surveillance radars small missile boats usually have multifunctional radar stations.

Wave transmission above turbulent water surface has some peculiarities related to specific qualities of salt turbulent water. Under turbulent conditions radar has to have a stabilisation system. Ship-borne radars must comply with very strict electromagnetic vulnerability requirements and perform target recognition.

For the past two decades due to a rapid development of computer technology and invention of NC-controlled high-accuracy machines radars with mechanical antenna have been replaced with phased-array antenna radars. The beam control is managed by active electronically

scanned array (through the combination of signals from specifically placed elementary aeriels) instead of mechanical rotation of antenna elements. After the debut of the American Aegis four fixed phased-array antennas on the topside have become a classic solution although rather expensive. When Ukraine was the part of the Soviet Union, Research-Production Enterprise 'Kvant' developed an analogue system which is still in service on the only Russian aircraft-carrier.

Ukraine has become one of the leading countries studying wave transmission above water surface owing to a long range of research institutes of the National Academy of Sciences of Ukraine including: Usikov Institute of Radio Physics and Electronics (IRE NASU, Kharkiv), Institute of Radio Astronomy (IRA), Kovalevsky Institute of Biology of the Southern Seas (IBSS) and other research institutes exploring the radio-wave propagation. Research have been conducted to study waves transmission in other spectra (for example, optical).

There are observatories exploring the atmosphere. Major Ukrainian education establishments do not only raise future scientists but also participate in scientific research. One of them is the National Technical University of Ukraine 'Kyiv Polytechnic Institute'.

A maritime surveillance radar is an integral part of any modern fighting ship. In line with worldwide trends Ukrainian designers integrate radars, TV and thermal cameras, laser rangefinders and others sensors into complex target detection systems. Nikolaev State Research Design Shipbuilding Centre acts as a primary supplier of such integrated solutions for fighting ships in Ukraine.

Scientific Research Institute 'Kvant' and Scientific Research Institute 'Kvant-Radiolokatsia' are two most important Ukrainians enterprise for the design and manufacture of ship-borne radars. Joint Stock Company 'Ukrspetstechnika' once the part of joint Research Production Union 'Kvant' still has got the potential for the development of maritime systems. State Enterprise Scientific Industrial Complex 'Iskra' specialises in air defence equipment and develops their own radar solutions based on well-known ground phased-array antenna radars with (79K6 'Pelikan', 80K6M). Whilst the Armed Forces of Ukraine do not have ship-borne solutions for Antiaircraft guided missile system C-125, the Black Sea Fleet of the Russian Federation still has a few ships with 'Volna' air defence system (with B-601 missiles). Scientific-Production Enterprise 'Aerotechnica-MLT' and enterprises of the State Company 'Ukroboronservis' can develop upgrade solutions for these systems.

Enterprises of 'Arsenal' corporation (Skynet ltd) have recently developed some innovative solutions for radars with digital antenna array. Digital antenna array allows to generate many beams covering much larger area. Central Research Institute of Navigation and Control has got some developments in the area. Kyiv State 'Burevestnik' Plant offers advanced solutions for maritime application.

The Research and Development Institute of the Ministry of Defence of Ukraine and Research Centre of Ukrainian Naval Forces (part of the Academy of Ukrainian Naval Forces). Adding to the potential of Ukraine in the area of ship-borne radar technologies separate small enterprises develop and produce key radioelectronic components for radar stations.



These are, first and foremost: Kyiv Scientific Development and Production Center 'Saturn' and Kyiv Plant 'Generator' specialising in super-high-frequency equipment. CJSC 'Fazotron-Ukraina' produces maritime radar subsystems. The availability of western hardware components has considerably extended capabilities of Ukrainian enterprises. Various repair plants and fast developing training centres can contribute to the development of upgrade solutions and advanced complex digital radar stations with various subsystems.

The aforementioned research institutes and production enterprises secure technical performance of radars installed on ships and patrol boats of the

Ukrainian Naval Forces and State Border Guard Service of Ukraine. Ukrainian enterprises service ship-borne AESA radar 'Fregat', artillery radars MP-184 'Lev', MP-123 'Vympel' and others, install radars on coastal posts and test EO fire control systems. 'Kvant' Research Institute has developed multifunctional radar with 4 phased antenna arrays specifically for 58250 class Corvette 'Vladimir Velikiy'. The majority of electronic warfare systems for this ship will be made in Ukraine.

The majority of works currently performed by Ukrainian

Scientific Research Institute 'Kvant' develops multifunction active phased array station with four fixed antenna curtain. Radar is developed for the detection and tracking air targets. Detection range – 200km. The number of temporarily tracked targets – 100

defence enterprises relate to export contracts including Russian contracts in the interests of third countries. Radar module for Air Defence Gun and Missile System 'Kortik-M' is the most popular equipment within Russian ship-borne defence complexes. The most popular maritime radars exported from Ukraine are: 3D 'Ring', 3D 'Pozitiv-U', multifunctional 4D MAARS (with track velocity). 'Pozitiv-ME' developed by Scientific Research Institute 'Kvant-Radiolokatsia' was first installed on 1159 project Algerian ship in the 1990s as part of an upgrade solution. Ukraine offers a solid solution for the upgrade of this soviet system increasing performance characteristics and providing new technical capabilities. Multifunctional maritime surveillance systems 'Mineral', 'Monolit' and 'Morena' ('Mineral-ME') effectively combine active and passive radar stations.

Various enterprises develop modifications of 'Burevesnik' radar stations (purchased in tens by the State Border Guard Service of Ukraine), navigation radar 'Rosava', 'Platon', 'Afrodita-K' with air and water target detection sub-

system 'Rubezh', coastal radar station 'Tsel-BASUR', radar station 'Bug' (developed in 2002 by the Central Research Institute of Navigation and Control, former Research and Development Institute 'Kvant-Navigatsia' and Institute of physics science, jointly with 'Kvant' Research Institute, as well as 2D maritime radar stations 'Delta-M' (developed by State Enterprise Research and Development institute 'Kvant-Radiolokatsia') comparable with ship-borne combat system. The complex is further equipped with advanced EO systems which considerably increase low-flying target detection capabilities. **UDR**

MAIN PERFORMANCE CHARACTERISTICS OF UKRAINIAN SHIP-BORNE RADARS



Ukrainian Defense Review

Name of radar	' Pozitiv-U'	MAARS	'Mineral-ME' ('Morena')
Type	Air and waterborne target detection radar	Air and waterborne target detection radar	Air and waterborne target acquisition and tracking radar
Developer	Scientific Research Institute 'Kvant-Radiolokatsia'	Scientific Research Institute 'Kvant'	Scientific Research Institute 'Kvant-Radiolokatsia'
Acquisition range, km	up to 150 60 (RCS 1 sq.m. at a height of 1 km)	200 (12 beams) 160 (RCS 10 sq.m.)	Above water targets: 35 km with active radar (standard refraction) 100-250 (superrefraction) 400 with passive radar
Acquisition range for low-flying antiship missiles with RCS 0.05 sq.m.	15 (RCS 0.1 sq.m. at a height of 15 m)	27 (RCS 0.03 sq.m.)	—
Locating angle, degrees	0-360	0-360	0-360
Site angle, degrees Kelvin	0-75	0-70	—
From top to bottom	up to 30,000	0-20000	—
Period of rotation, aperture, 1/sec	1;2;5;10	1;2;5	
Range scale, km		200;150;100;60	
from 0.25 km to 32 miles	12;24;48;96		
Frequency range	C	C	I, G, E/F, D
All-round surveillance radar with position finding		Width of OD: Site angle: 5.7 degrees Kelvin Site angle: 1.6 degrees Kelvin	Group of ships Active radar: at a distance of 50m Site angle: 0.25 degrees Kelvin Velocity: 2-3 knots Passive radar: Distance: 4-10% Site angle: 0.4-0.8 degrees Kelvin
Information renewal rate, sec		1;2;5	Communication cycle with command ship - from 5 sec
Quantity of automatically tracked targets	30-150	100	Active radar 30 Passive radar 10 (data generation mode)
Maximum number of information users	16		Number of interacting ships - 9
Weight of antenna post, kg	600		3800 (the whole radar complex)



Ukrainian Defense Review	Name of radar	'Burevesnik'	'Rosava'	'Delta-M'
	Type	Navigation radar	Navigation radar	Air and waterborne target detection radar
	Developer	'Burevesnik' Plant	Central Research Institute of Navigation and Control	Scientific Research Institute 'Kvant-Radiolokatsia'
	Acquisition range, km	120 Above-water targets: 80 km Buoy: 12 km Motorboat: 8 km	60 Above-water targets: 32 km Buoy: 10 km	96 Computing centre: 8-20 VW: radar horizon
	Acquisition range for low-flying antiship missiles with RCS 0.05 sq.m.	—	—	—
	Locating angle, degrees	0-360	0-360	0-360
	Site angle, degrees Kelvin	—	—	—
	From top to bottom	—	—	0-3000
	Period of rotation, aperture, 1/sec	—	—	3;6;12
	Range scale, km	9 scales	16 scales	—
from 0.25 km to 32 miles	—	—	—	
Frequency range	9430 ± 0.04 (MHz)	9400-9460 MHz	1	
All-round surveillance radar with position finding	—	In azimuth: 0.5 degrees Kelvin Distance: 0.5% Aperture angle 1.2 degrees Kelvin	—	
Information renewal rate, sec	—	—	2	
Quantity of automatically tracked targets	—	120	50	
Maximum number of information users	—	—	—	
Weight of antenna post, kg	—	—	300 (radar station)	

[arsenal]





BTR-3E

ON THE FRONT LINE

Anton MIKHENKO, UDR



Ukraine's defense industry is offering potential customers, both on the domestic and export markets, an armored personnel carrier APC designated BTR-3E. Developed and built up by the Morozov Machine Design Bureau in Kharkiv, next generation of this infantry carrier successfully used in Royal Thai Army and has every chance to open new markets. UDR decided to describe in details the most successful Ukrainian defense industry product over the last few years.

Now the procurement programs of the world's biggest military importers suggest that light-weight armored hardware scores a solid third place by the amount total of procurements, behind fighting aircraft and precision-guided weapons. Customers mostly demand wheeled

air-deployable vehicles, armed with light turret-mounted weapons complemented by the newest powerful precision weapons suites, and well protected.

The Ukrainian defense industry is offering its potential customers the APC designated BTR-3E. In its maneuverability and combat performance, this new Ukrainian designed armored vehicle far outperforms its rivals originating in the fellow former Soviet states. It has long been assumed that the APC should be as maneuverable as the battle tank, which would not only allow it for motorized infantry troops to march alongside armored units but in some cases even lead the way. In many countries such an approach has led to caterpillar APCs ousting their wheel-typed siblings altogether. But the lessons learned from the Iraq war revealed the advantages of precisely the wheel-typed vehicle

which, delivering a substantial amount of fire-power, is virtually equivalent to the infantry fighting vehicle (IFV) in its basic performance characteristics.

In that context, the projected APC, developed in 2002 by the Morozov design bureau in Kharkiv in compliance with the Ukrainian Ministry of Defense' (MoD) requirements specification, is deserving of consideration.

BTR-3E wheel-typed armored troop carriers are being assembled by MoD's repair factories, with 90 per cent of all the assembly units coming from domestic companies.

What make the vehicle particularly attractive to prospective buyers, are its price tag; low-cost serviceability and through life support; low weight; a great amount of firepower as compared to same-class equivalents; the capability to negotiate water obstacles of whatever width or depth; the ability to operate in environments heated up to +55°C, and air conditioning of crew and passenger compartments. The BTR-3E's design has enough room for extra combat modules and also for an automatic transmission (Allison or Ukrainian made). The baseline design is easy to convert into configurations for auxiliary applications such as medical evacuation, policing, command and control or repair and recovery.

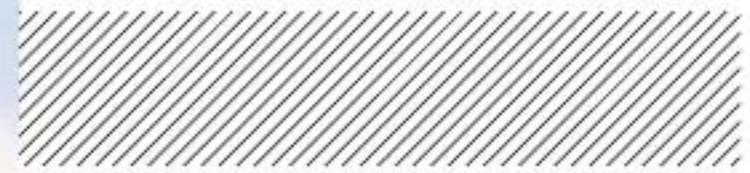
The BTR-3E is a highly-maneuverable wheel-typed amphibious combat armored vehicle. It can carry a 3-man crew, consisting of the commander (section leader), gunner and driver, plus six troops. Compared to Russia's BTR-80, the Ukrainian APC BTR-3E has a different body that has a greater usable space, hence heavier displacement. The Russian BTR-80 is claimed to be able to negotiate river obstacles in two-point river motions, while for the BTR-3E, as proven by the

testing, even three-point river motion is no obstacle.

The previous variant from the same family, BTR-3U, was equipped with a 320hp Deutz engine integrated with Allison MD 3066 automatic transmission. The BTR-3E is powered by Ukrainian-designed 300hp diesel engine UTD20 of Pivdendieselmach from Tokmak, Western Ukraine, which effectively operates in environments heated up to shade temperatures of +50C. The UTD20 can consume both diesel fuel or aviation kerosene, and offers a fuel endurance of 750 km on highway. With a mechanical gearbox, the vehicle is cheaper than equivalents with an automatic transmission. The BTR-3E also features an enhanced clutch; back-up (pneumatic) starting system for cold start; heating system for the coolant and oil, enabling the engine to start in temperatures as low as -55 C; new automatic equipment that discriminates cooler types (water or antifreeze), warning about critical temperatures of the cooler and shutting the engine once the oil pressure falls down to below critical levels.

Also the BTR-3E can be equipped with a computer controlled hydromechanical transmission from Allison, or a manual gearbox. The latter would reduce the overall price of the vehicle. The BTR-3E is two tons heavier than the 14 ton BTR-80. With French tires Michelin, which are ideal for operation in high-temperature environments, the Ukrainian vehicle makes 100 kph, whereas the BTR-80's «rubber legs» only allow for 85 kph during 30 minutes at the longest.

For comfort of the crew and passengers, passenger compartment's ceiling height has been increased by 150 mm, and air conditioning is optional. Air conditioner, as suggested by feedback from the Ukrainian military contingent in Iraq, is a prime necessity in high-temperature envi-



ronments. The armored vehicle is equipped with protective facilities to shield the crew and passengers from penetrating radiation from nuclear munitions, as well as from toxic agents, germ weapons or radioactive dust.

The vehicle's exclusive forte is a general purpose combat module called Shkval. The overall amount of firepower provided by a Shkval fitted BTR-3E is on a par with that of an IFV. The combat compartment is positioned in the vehicle's medium section, taking space between the crew commander's and driver's seats and engine compartment.

The BTR-3E is armored with more powerful weapons as compared with the BTR-80. These include a 30-mm automatic gun ZTM-1, a twin-barrel 7.62-mm machine gun, an automatic grenade launcher, an anti tank missile suite and a smoke grenade dispenser. The turret accommodates five surveillance devices TNPO-170A, backing up the PZU-7M sight and an optical television sight.

The vehicle's weapons, supported by an automatic fire control system and sighting devices, ensure speedy detection, identification and engagement

Ukraine developed combat module Shkval integrated with a 30 mm gun, and anti tank missile suite Baryer with two ready to launch missile containers.

of ground and low-flying targets with high rate and accuracy of fire. The overall price of the armored troop carrier varies with the cost of optional extras.

The price of the Ukrainian APC much depends on the terms and volume of every specific contract, and also on the customer's buying power. The vehicle sells at prices that are on the whole higher than the BTR-80's (due to more powerful, hence more expensive weapons), but far lower than foreign made rivals' such as the AMV XC 360P Rosomak, Pandur II 8x8, Stryker or Piranha II-IC, which are all completed with the expensive IR imaging systems, cameras and surveillance displays non-existent in the BTR-3E. The hardware may come to buyers with an associated production license.

DEVELOP AND WIN: BTR-3E-1

To develop the APC BTR-3E in Ukraine has been made next generation vehicle, to be known as BTR-3E-1. Ukraine developed combat module Shkval integrated with a 30 mm gun, and anti

tank missile suite Baryer with two ready to launch missile containers. State owned design organization Luch and state joint stock holding company Artem will ensure that BTR-3E-1 possess an enhanced amount of firepower by equipping this with new precision guided weapons.

The vehicle's combat module will undergo fundamental modifications as well. In particular, the current fire control system Tandem will be replaced with new indigenously designed TREK system, for which an electronic optical module is currently under development by an instrument making factory in Kharkiv region's Izyum. The module's designer and integrator is Kyiv's Kvant Radiolokatsiya research and development institute, known for its so far unique naval radar designs.

In the BTR-3E-1, the crew commander will be able to take over gunfire control if need be, unlike in the baseline configuration, where this was solely the gunner's responsibility.

The BTR-3E1 is offered in a number of configurations to meet the varied requirements of armed forces. The major variants are BTR-3E1K command vehicle, BRM-3E1 combat reconnaissance vehicle and repair-and-recovery vehicle. The other variants include the MOP-3E1 fire support vehicle, the BTR-3E1Sh command and staff vehicle, and the BSEM-3E1 armoured ambulance.

The Royal Thai Army acquired more than 230 BTR-3E1 APCs till date, under agreement with Ukrspecexport. The first 2 of 96 BTR-3E1 have been delivered at U Tapao Airport on 17 September 2010. The second batch of 121 BTR-3E1s with a price tag of 5 billion baht have been ordered by Royal Thai Army and 14 BTR-3E1s have been ordered by Royal Thai Navy to be used by Royal Thai Marine Corps



in August 2010 with the MTU Engine and Edison Gear.

Thailand placed an order for additional 15 BTR-3E1 and six BTR-3RK vehicles from Ukraine in August 2013.

EXTRA CAPABILITIES AND OPPORTUNITIES

Soldiers in the battlefield can choose variety of APC BTR-3E capabilities because Ukrainian BTR has a several variants of modernization packages, depending on customer's financial capabilities and requirement. Global weapons market players have tended to award contracts to several independent suppliers for one and the same modernization program. Combat modules, for example, can come from one supplier state, and security systems or communications facilities – from another country. Ukrainian suppliers offer an integrated modernization package, each of its components being totally autonomous and easy to integrate into an overall weapons system. The package includes the most advanced armaments and technologies, such as the Stugna laser guided tank gun and armored fighting vehicle gun rounds, explosive reactive armor (ERA) and explosive active armor (EAA) systems Nozh and Zaslou, electronic optical countermeasure system Varta, tank protective system Fantom 3, upgraded communication equipment, camouflage system Kontrast M and even tank simulators mounted on electric motion platforms for driving and firing training. Apart from Stugna, Ukrainian manufacturers offer potential buyers new anti-tank guided projectile Baryer for guns mounted on tanks, IFVs and APCs.

The armored vehicle modernization package offered by Ukraine also includes communications facilities with cryptographic modules to ensure that



The Royal Thai Army acquired more than 230 BTR-3E1 APCs till date, under agreement with Ukrspesexport.

MAIN TECHNICAL AND PERFORMANCE CHARACTERISTICS OF THE BTR-3E APC EQUIPPED WITH THE SHTURM REMOTE WEAPONS STATION

Combat weight, t	16,0
Overall dimensions, mm (Length / Width / Height)	7850 / 2900 / 2774
Ground clearance, mm	475
Crew	3
Fighting compartment's capacity	6 infantry personnel
Hull	Ballistic steel, waterproof, reinforced with Kevlar lining
Gun ports	8
Protection	12.7mm rounds
Mobility, road/river line obstacle	Wheels/ water jet
Wheel arrangement	8x8
Engine, hp/kWt	300/220.6
Tires	Tubeless, bulletproof, with centralized tire inflation control system
Operating temperature range,	0 C -40...+55
Transmission	Hydromechanical/mechanical
Road range, km	750
Track sighting suite	Tank-size target identification range, m
Daytime/Nighttime	5,000+/800+
Laser range-finder's effective range, m	160...10,000

classified information remain secret. The Ukrainian technology has an advantage of being an average half of the cost of western designed alternatives. Considering that reprogrammable communication devices are on some occurrences easy to counter using modern electronic warfare technologies and radio communication jamming systems, the cost advantage may become a weighty argument in the fight for future customers.

Ukrainian weapons designers have accumulated considerable expertise in the area of simulating facilities for armored fighting vehicles. In particular, Ukraine supplies to the export market simula-

tors supporting driving and firing training requirements for BMP-1 and BMP-2 IFVs, and also APCs. It is only natural that weapons modernization projects are not the 'thing in itself' but developed to suit specific customer requirements. For example, Kharkiv's Morozov design organization several years ago developed a modified version of the BTR-80 IFV, upgrading this to the BTR-3E capability, which was being supplied to a customer in Southeast Asia under a major framework contract. In addition, a new type light-weight armored vehicle BTR-3DA has been developed, marking for Ukraine the initial milestone accomplishment in this area. **UDR**



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[mr-1 up close]

Anton MIKHENKO, UDR

MR-1 RADAR SYSTEM

CLOSING AIR COVERAGE GAPS



ISKRA R&D AND MANUFACTURING COMPANY OFFERS NEW RADAR DESIGNS TO UKRAINE MOD



Defense industry companies in Ukraine are working intensively on the development and upgrade of meter-wavelength radars capable of defeating 'stealth' aircraft targets. New radar designs are currently being developed, in addition to the Malakhit and Malakhit-M, and a few upgrades of the P-18 radar system. The R&D and Manufacturing Company Iskra (which is part of Ukrainian Defense Industries (or Ukroboronprom) State Corporation) is developing – at its own cost and expense -- new meter-wavelength radar system to be known as MR-1.

It was found following comprehensive simulation trials and full-scale experiments that measures to ensure lower observability of aircraft using 'stealth' technology enable aircraft's radar cross section (RCS) to be reduced by a magnitude of two orders, thus allowing the range of their detection by centimeter to decimeter wavelength radars to be reduced by several dozen kilometers. Designed to defeat millimeter wavelength radars, the 'stealth' technology is almost utterly impotent when confronted with the metric wave radar. The most striking proof was the 1999 incident during NATO operation in former Yugoslavia, where an F-117A 'stealth' fighter was taken down after being detected by a meter-wavelength radar.

The MR-1 design being developed by Iskra encompasses the latest accomplishments by Ukraine's school of thought on radars designed to defeat 'stealth' aircraft targets.

Operating in the meter wavelength band and having a transmission beam forming control capability, the MR-1 can work standalone or as part of a nationwide (regional) Air Defense C3I network. Its capability range includes target detection/tracking and determining the target location in azimuth, range and elevation, in the presence of substantial noise and jamming. The



MR-1 is offered for employment as Air Defense alert radar by Army's and Air Force's SAM units.

The MR-1 is being developed by Iskra as a PFIP initiative – at its own risk and cost and with consent of the Ministry of Defense and under its close supervision.

Lacking the cash to pay for its own order, Iskra itself had had to develop and build its own

driving system (a high stability master oscillator for generating heterodyne frequency and other complex signals to ensure Radar's internal synchronization) in addition to a range of other technologies required for prototype trials to get started.

A disadvantage of earlier designs was that their power requirements were to be met by a

separate turbine-type generator housed on an additional vehicular transporter. The result was that the system required three to four (depending on specific configuration) vehicular platforms to transport, including dedicated platforms for interrogator unit and antenna unit together with associated transmitter and display units. By way of comparison, the MR-1 well fits into one single KrAZ-chassis based vehicle.

High mobility capability is one of critical requirements for a modern battlespace. The radar must offer 'shoot and scoot' capability, e.g. it has to be able to be relocated after each 5-10 minute work session. The MR-1 is controlled by operator without the need to leave cabin of the command & control vehicle. Air picture data is transmitted via digital radio data-links to multiple Army Air Defense command posts PU-12/15. Additionally, the MR-1 provides accurate enough target height finding functionality, making it truly three-dimensional radar.

For copyright protection of the proprietary solutions implemented in the MR-1 design, multiple copyright applications are currently being submitted. A number of potential customers have already begun showing a certain degree of interest in the new radar design, even though it has yet to complete state commissioned trials and to get Approval for Service Use in the Ukrainian Armed Forces, thus proving predictions of its future commercial success.

Global pack of successful meter-wavelength radar designs is not so numerous. In addition to the well established family of P-18 radar systems operated since 1971, this includes a range of Nebo-series designs (Nebo-U, Nebo-SV, Nebo-SVU), China's HK-JM, Belorussia's Vostok-E



According to the company's management, radar MR-1 is designed and manufactured by own funds. The state tests of MR-1 can take place in 2015.

and UK's MESAR (Multifunction Electronically Scanned Adaptive Radar) naval radar system.

The MR-1 is more energy efficient, more reliable, more accurate and, most importantly, provides much better mobility performance as compared to its older counterparts. According to the Designer, the MR-1, when compared to known metric band radar designs, offers superior clutter rejection capability, which is accomplished through the use of proprietary FFT (Fast Fourier Transform) algorithms developed by Iskra. The sidelobe noise is 2-3 dB lower than in case of the Nebo-SV and Nebo-SVU counterparts. Additionally, the Nebo-SV design employs vertical beam polarization, enabling the antenna array to be easily transformed into stowed configuration, but increasing false alarm rate and furthermore reducing the signal to noise ratio by about 6 dB. The Nebo-SVU employs horizontal polarization, which brings about a disadvantage such as the need to turn each of the 72 radiating antenna elements manually when the antenna is lowered back to stowed con-

figuration, affecting substantially mobility performance of the radar system as a whole. The MR-1 has its deployment/stowed time reduced to 3 minutes, increasing its 'shoot and scoot' capability, hence survivability performance in a combat environment. The MR-1 can be removed from its KrAZ-type carrying chassis and onto a bracing jack platform for air transportation by C-130-class aircraft, for example, or domestically manufactured military transports – in full conformity with the strategic mobility requirements of modern military operation.

Objectively, the MR-1 design is doomed to commercial success owing to engineering solutions adopted, and furthermore it has a considerable growth potential. It is to be hoped that the Ukrainian Government will duly appreciate Iskra's drive to support national security and homeland defense requirements, and will provide the badly needed current-generation radar capability for the national military before this promising technology finds its way to more forward-looking international customers. **UDR**

MR-1

THE METER-WAVELENGTH RADAR SYSTEM

The MR-1 is being developed by Iskra as a PFIP initiative – at its own risk and cost and with consent of the Ministry of Defense and under its close supervision A prototype of the new system is undergoing trials. In the future, as hoped by the Designer, the MR-1 would replace other radar systems performing similar tasks.

Designer
R&D and Manufacturing Company "Iskra",
 Zaporizhzhia, www.iskra.zp.ua

Operating in the meter wavelength band, the MR-1 can work standalone or as part of a nationwide (regional) Air Defense C3I network. Capability range of the MR-1 Radar System includes:

- Search, detection, tracking and azimuth/range/altitude/ground-speed measurements for aerial (including 'stealth') targets – in jamming free environments or in the presence of environmental or electronic countermeasures influences, or both at once;
- Bearing/position taking of active jamming dispensers;
- Data generation for standalone display systems; interface with command & control posts of regional/nationwide Air Defense C3I networks

Basic specifications

Operating frequency range	UHF (meter wavelength)
Effective range limits:	
• minimum, km	2,5
• maximum, km	400
• azimuth, degrees	0-360
• elevation, km	40
Scanning interval, sec	10/20
Level of clutter suppression, dB	50+
Number of targets tracked simultaneously	150-200
Watt consumption, kW	≤ 30



Operator

controls the radar from a computerized workstation. Air picture data is transmitted via digital radio datalinks to multiple Army Air Defense command posts



Monitor

Unified information mapping radar information (coordinate and trajectory) model is implemented on the screen, as well as management interfaces modes of operation, detection, tracking, interaction with consumers and diagnosis of radar technical status

50 METER WAVELENGTH RADARS – the average demand of the Ukrainian Armed Forces

Detection range

Дальность обнаружения целей

300-380 km at 10-30 km altitude

260 km at 10 km altitude

27 km at 100 m altitude



<15 minutes increasing its 'shoot and scoot' capability, hence survivability performance in a combat environment. The process to lower the antenna back into stowed configuration is automated to the maximum possible degree due to the proprietary design engineering and construction features of its horizontal radiating antenna elements.

The general appearance of the MR-1

cin transport configuration (with stowed antenna)

Key advantages:

digital beam forming phased array antenna; high mobility performance, reduced deployment/stow time

The advantage of a meter wavelength radar –

ability to "see" stealth aircraft targets

Deployability:

The MR-1 radar system is air transportable. Number of vehicular platforms required for transportation – 1+1 with powerplant vehicle.



crew

Detection range
for a 3-5 m² RCS target
with P=0.8 and F=10⁻⁶

Combined antenna

is used for emission and reception of the reflected signal. It has multibeam radiation pattern. This antenna provides an overview in vertical and horizontal dimension and measurement of the range, azimuth, altitude and speed of the targets.



[direct speech]



ALEXANDR PEREGUDOV

CEO OF JSC "PLANT" MAYAK

In the USSR, JSC "Plant" Mayak" was the lead organization responsible for the manufacture of magnetic recording equipment for special and household purposes. In independent Ukraine, the Company has completely abandoned the production of consumer goods and transferred to small arms weapons, which are successfully manufactured and marketed under defense export contracts. Mayak has recently produced a new sniper rifle and several assault rifles, which are all built to conform to NATO and international standards. The following is an interview conducted with Oleksandr Peregudov, CEO of JSC "Plant" Mayak", by Defense Express on these and other topics.



«OUR RIFLES ARE NOT INFERIOR TO THE WORLD'S LEADING BRANDS, DELIVERING HIGH ACCURACY AND DENSITY OF HITS»

Defense Express: Mr. Peregodov, what led your Company to re-focus its business from tape recorders and some other civilian products to small arms weapons?

Oleksandr Peregodov: It was back in 2008 when the Company became engaged in the production of small arms weapons and related products. This was conditioned by a number of factors, particularly the need to upgrade the small arms inventories left in Ukraine's weapon's stocks -- especially machine guns and automatic rifles -- for the benefit of both the Ukrainian armed forces and export customers. The Government assigned this job to our Company, and we have successfully handled it.

The Company has drawn up technical documentation and launched new processes to upgrade selected types of Soviet-vintage small arms weapons and to set up the domestic production of machine guns here in Ukraine. The Company furthermore has designed, developed and built special-purpose equipment (machine gun mounts for armored military vehicles) for use against ground and aerial targets.

DE: What has the Company achieved so far?

Oleksandr Peregodov: As of the start of this year, the Company has performed upgrades on a bit more

than 20,000 Kalashnikov rifles and some 8,000 infantry and tank mounted 7.62-mm machine guns. Mayak is working intensively on upgrading the full range of Kalashnikovs-series rifles with modern optical and red-dot sights and night sights. Our longer-term plans include the development and production of light machine guns.

All of the economic objectives set in the target plan for the first six months of 2013 have been exceeded. Production rates have been growing by an average 32 percent year-on-year during the past 13 years, thus providing a stable financial situation for the Company.

DE: During military exercises «Perspective 2012», your Company for the first time demonstrated a range of brand new types of small arms weapons, particularly the sniper rifles VPR-308 (7.62 x 51 mm) and VPR-338 (8.6 x 70 mm) and assault rifles. Could you give some details about these new weapons? What are their distinguishing features compared to international counterparts?

Oleksandr Peregodov: As you can see from their designators, the sniper rifles VPR-308 and VPR-338 are offered in the popular .308 Win and .338 Lapua Magnum calibers. The sniper rifle VPR-338 can defeat small targets out to 1,300 m and materiel targets (medium-power radios; landed airplanes and

helicopters) out to 1,500 m. The VPR-338 rifle is manually operated weapon weighing 9.8 kg when unloaded, delivering 15 rounds per minute. The VPR-338 rifle, in addition to having a different caliber, has a considerably lighter weight (some 7 kg) and a shorter effective range, which is 900 meters.

At the same time, our rifles have considerable durability. The VPR-338 can fire 1,500 to 2,000 shots without losing accuracy, the overall life of the weapon being 10,000 shots. The VPR-308 can fire 6,000 shots without losing accuracy and withstands a total of 10,000 shots.

All the component parts of the rifles excepting the barrels are produced by Ukrainian factories. The rifles have some features that are new to Ukraine. For example, they use Picatinny rails of two types (shorter and longer ones), which move back and forth, allowing for integration of a wide range of accessory equipment.

For user convenience, the collimator sight can be attached at 45 degrees in alignment with the telescopic sight. The trouble is that, in long-range engagements, the sniper has difficulty switching to highly mobile pop-up targets at shorter distances. So we added a collimator sight to facilitate the sniper in shorter-range engagements.

The butt is adjustable for length of pull and cheek height, and there is an

attachment point for a third leg. For accurate aiming and improved terminal accuracy, the bipod stud is forward mounted almost at the end of the barrel. The barrel is of free-floating type.

Our rifles offer one more advantage, which is high accuracy. Particularly during "Perspective-2012" exercises, some of which took place in the mountains of the Crimean Peninsula, our rifles were tested by special operations units. The VPR-338 hit four out of four full-height figure targets at a range of 1.3 kilometers away.

Defense Express: Is it an impediment that Ukraine does not have domestic capacities for manufacturing sniper rifle barrels?

Oleksandr Peregodov: Of course, the barrel is a key component of the weapon. So the need for setting up domestic production of sniper rifle barrels is high on the agenda. Mayak is now working on the acquisition of a relevant production line. This would enable us not only to manufacture barrels by ourselves and expand our product portfolio, but also to expand our arms customer base. This might happen after the rifles pass state commissioned trials and are approved for service use in Ukraine.

Defense Express: What about the ammunition? The manufacture of car-

tridges in Ukraine is dealt with by Cartridge Factory in Luhansk. It produces NATO-compatible cartridges among others, but does not have production capacities for 7.62 x 51 mm and 8.6 x 70 mm rounds. Is this a challenge, and how this could be handled?

Oleksandr Peregodov: It is true that rounds of this caliber are not produced in Ukraine. Whether there will be the domestic production in the future depends not on Mayak but rather on the Defense Ministry of Ukraine and State Corporation "Ukroborprom". Most of small arms weapons used by Ukraine's infantry units are optimized for the 7.62-mm caliber.

Our new rifles are tailored for the .308 and .338 calibers, reflecting our ambition to keep pace with the times. This caliber cartridges are most popular in the world market, and, curiously, they are also available in the Ukrainian market. The .308/.338 is currently the primary caliber of choice for a wide range of sniper rifle cartridges.

Production capacities for ammunition rounds of this caliber will most certainly be set up once relevant weapons are approved for service use and begin to be procured to meet the requirement of Ukraine's defense and security sector organizations. Time will tell.



Sniper Rifles
VPR-308/ VPR-338



JSC "Plant" Mayak,
Kiev

DE: What are the distinguishing characteristics of your assault rifles?

Oleksandr Peregodov: Self-loading rifles MZ-15 (5.56 mm) and MZ-10 (7.62 mm), produced with inputs from Ukrainian company "Zbroyar", share some resemblance with the AR-10 and AR-15 rifles, which at one time were manufactured in the USA. These weapons deliver high accuracy, have optimum weight, and allow for sighting equipment to be mounted directly onto the rigid receiver. The rifles are base-lined with a foregrip with a Picatinny rail. Most importantly, the modular design allows for easy replacement of various components (the butt, foregrip, flame suppressor, etc.) to meet specific customer requirements.

The shooter will have a choice of several caliber cartridges and will be able to switch from one caliber to another without the use of additional equipment, which expands operational versatility of the weapon.

DE: What are the milestones achieved by your Company to date with regard to the development and marketing of the sniper and assault rifles?

Oleksandr Peregodov: The pre-production stage began in 2013. I do hope that the assault rifle and sniper rifle will be brought to series production maturity by the end of this year. I was assured by Ukrainian Minister



of Defense P. Lebedev that that the defense department is interested in purchasing our rifles. After all, our rifles meet world market standards, being at least twice cheaper to buy than international counterparts.

DE: Still, what is the outlook for the sniper and assault rifles in the domestic market, given that the defense department does not have the money needed to push the project further?

Oleksandr Peregodov: I would put it somewhat differently. What is important for us is to have assurances that the products which we are going to make will be procured. We want to make sure that the government will buy what we will manufacture under a government order. The weapons types that we offer are in demand, indeed. Our studies indicate that the Ministry of Defense currently requires at least 600-700 sniper rifles.

DE: As you well know, there are several more companies in Ukraine dealing with small arms weapons, including Fort and Zbroyar. Is there competition between your company and those two, or do you have different areas of expertise?

Oleksandr Peregodov: I think there is no competition here. We are targeted at different market niches. Mayak is manufacturing and upgrading products for the benefit of the

Ministry of Defense of Ukraine, Fort – for the benefit of the Ministry of Internal Affairs, and Zbroyar operates primarily on the civilian market. Of course, we cooperate with each other since are working in one and the same country.


DE: Are there any requirements placed on current-generation small arms weapons types being produced in Ukraine, or, as is typical for our country, everything is developed with an eye to global trends under private venture projects?

Oleksandr Peregodov: It's difficult to be sure, but, perhaps, some requirements do exist. However, the rifles that we offer have been produced under private venture projects, with account taken of modern trends. Today, our rifles are kind of a proactive technical proposal on which we are working with the Ministry of Defense of Ukraine. This proposal still needs to be a little bit reworked on the basis of the needs of the military. For example, they already raised one objection to the butt, demanding that it must not be of collapsible type.

DE: In an earlier interview, you were talking about creating a 30-mm grenade launcher with a 5-round magazine, and about possible production of light machine guns. What is the situation with these projects?

Oleksandr Peregodov: Work on these projects has been put on hold for a while. This theme has lost some of its relevance, given that many in Ukraine began to deal with grenade launchers, the more so as we ourselves have re-focused our business to assault and sniper rifles. Still, a certain amount of work has already been done; we have reached the prototyping phase.

DE: How do you feel about the fact that the MoD is considering the acquisition of a quantity of 12.7-mm sniper rifles from a British manufacturer? Neither the barrel nor the ammunition are manufactured in Ukraine...

Oleksandr Peregodov: It depends on what kind of missions the weapons will be procured for. These might well be intended for use by special operations units. It would take quite a time for domestic companies to begin to produce such weapons. If our special operations units require such a rifle to become available this year already, we will not be able to set up production in a three months' period. It will take at least 12 months for a finished design to proceed to manufacturing maturity. So, if the current requirement is met through acquisition from a foreign supplier, a couple of years will pass and we will be able to manufacture the weapons by ourselves. 

Interviewed by
Anton Mikhnenko

[unmanned technologies]

THE «SPARROW»

NEW UNMANNED
AERIAL SYSTEM
DESIGNS BY SRIPSAF

Volodymyr Kopchak, for UDR

Following is a detailed review of the current UAV projects being carried out by Scientific Research Institute for Physical Simulation of Aircraft Flights (SRIPSAF) at Kharkiv's N. Zhukovski National Aerospace University, based on an interview given to Defense-Express by the CEO of SRIPSAF.

NEW WINGS FOR THE "CHIZH"

The project, which is currently known as "Chizh-L" (or "siskin"), is for SRIPSAF (it can be amply said today) if not the

off weight of up to 15 kg. SRIPSAF has leveraged the expertise that it has acquired in developing the "Bekas" UAV technology demonstrator (see the reference note nearby).

It is significant that the "Chizh-L" UAS was conceived with its functionality range limited to roles such as aerial surveillance and reconnaissance in support of special task units during emergencies, anti-terror, guarding and search operations by different security sector institutions, as well as the provision of services to civilian customers. From 2007 onwards, the "Chizh-L" UAS has been imple-

menting television and photographic reconnaissance in support of anti-terror operations, was handed over to the Security Service of Ukraine's Research & Engineering Department (for more details on "Filin-M", see issue 4/2009 of this journal). Incidentally, the pre-prototype sample of the "Filin-M" UAS was successfully tested during the international anti-terrorism exercises that took place in the Crimean Peninsula in September 2009.

However, the topic of putting this design into practical use did not go any further. As the Designer notes, the financial and economic downturn in October 2008

V» FAMILY

key priority, then certainly a basic one. The fact is that this suite in different configurations has been subjected to testing and evaluation with respect to its ability to handle different real-world challenges for the benefit of various domestic organizations. In late 2006, SRIPSAF launched a project on the development, pre-production and operation of the multi-role modular unmanned aerial system (UAS) "Chizh-L" with a take-

menting in two special-purpose variants meeting the requirements of specific customers and specific users. Particularly the "Astrogon-Sky" variant is designed for the exploration and mapping of mineral deposits onshore and offshore. To that end, a five-year R & D project commissioned by Pivden-Naftogas-geologia (Kiev) was launched. In September 2008, a pre-prototype sample of the "Filin" variant, which is designed for carrying

brought the "Astrogon-Sky" project to a halt. In the same vein, the "Filin-M" project was suspended due to a cash squeeze that curbed SBU's R&D spending.

Despite the persistent lack of government funding for defense industry projects in this country, work on the "Chizh-L" project has not been brought to a complete stop. Today, SRIPSAF – at its own cost and risk – continues work on the development of the multi-role unmanned aer-

ial system (UAS) “Chizh-L”. In particular, pre-prototype flight testing phase has been resumed. The nearest-term plans include joint implementation of the project with the industrial association MARS of Kiev. Related preparatory work is already underway.

As before, it is intended that civilian modification of the “Chizh-L” UAS system will be used for real-time monitoring of natural environment and infrastructural assets, high-resolution aerial survey, and exploration & mapping of hydrocarbon and other minerals. Dedicated emulation of the “Chizh-L” UAS will be a tactical short-range system designed to perform intelligence gathering, airborne surveillance and target acquisition tasks for the benefit of institutions of the security sector -- the Ministry of Defense, Ministry of Emergency Management, Ministry of Internal Affairs, the Security Service and the Border Guard Service of Ukraine.

The current status of the “Chizh-L” UAS project is the research phase involving pre-prototype flight testing (at the cost of SRIPSAF and the funding previously provided by the SBU under the “Filin-M” project). The amount of investment funds needed for completion of the five-year R&D phase of the “Chizh-L” UAS project is estimated at \$2.1 million, while the R&D phase of the dedicated “Chizh-L” variant requires \$3 million to complete.

The take-off/landing equipment set of the “Chizh-L” UAS includes:

- Transportation vehicle for operator crew, personal equipment and support and logistic provisions;
- Towed trailer for the UAV and take-off/landing equipment



The UAV system “Chizh-M” in its baseline configuration offers performances as follows: takeoff weight – 15 kg; wingspan – 2 m; endurance – 4-5 hours; ground control range – up to 60 km; payload equipment weight – up to 2 kg.

- Man-portable ground control unit
- Man-portable data link terminal capable of ranges of up to 25 kilometers
- Pneumatic catapult for assisted take-off
- “Chizh-L” UAV
- Modular payload system
- Landing equipment.

According to Anatoli Smolyakov, CEO of SRIPSAF, the current phase of the “Chizh-L” UAS project is mainly focused on optimizing the aerodynamic configuration of the unmanned aerial vehicle, adapting the structure and composition of the UAS, improving mission and ground software, investigating different compositions of payload equipment (including gyro-stabilized EO

platform “Sova-L”, which will be described below).

The fact is that today we are considering different multi-role modifications of the aerial vehicle (with double-stroke, four-stroke and electric engines), while several modifications of the system as a whole are being investigated with baseline, extended and full equipment fits. In other words, the system should get a multi-role capability to be ensured to the full extent desired by a modular architecture. It is noteworthy that in so doing SRIPSAF is guided by and looking up to the best popular foreign counterparts proven by multi-year operation. Thus, Smolyakov says, the “Chizh-L” in its baseline configuration might be superior to the U.S.

UAV system "SilverFox". With extended equipment fit it will be better than "ScanEagle", and with full equipment fit it will offer performances commensurate with those of the U.S. UAV "Shadow 200".

It is to be emphasized that SRIPSAF is willing to develop and build a short-range modification of the "Chizh-L" UAS that would comply with the requirements on UAS systems identified by the Ukrainian Armed Forces' General Staff in an official document released on 9 June 2008. However, no real action to meet this requirement has been taken by Ukraine thus far. It does not go farther than discussions and talks "on different levels". So the probability of the "Chizh-L" UAS project being brought to completion in Ukraine, especially for the benefit of security sector organizations, is seen as dream-like by SRIPSAF. In the civilian domain, there is still unresolved issue of the legality of using UAVs in Ukraine's standard airspace ...

A TILT TOWARD MINIATURIZATION

The work carried out by SRIPSAF for the well known UAV project "Aist" has evolved into a promising area of focus. We are talking about creating a family of unmanned aerial systems to be developed around the "Vorobey" (or "sparrow") family of mini-UAVs, exploiting the extensive experience in developing, testing and operating the miniature UAS "Aist" (or "stork") (see reference note nearby). So, in late 2008, SRIPSAF launched a private-venture project to develop a same-class unmanned aerial system with an extended functionality range, the "Vorobey-M".

It is significant to note that the multi-role UAS based on the mini-UAV with a takeoff weight of up to 3 kg would include two types of vehicles with electric propulsion: one built on conventional takeoff/landing concept ("Vorobey-M) and the oth-



Man-portable ground control unit of the "Chizh-L"

er being a VTOL UAV with a hovering capability (Vorobey-M-VVP).

It should be noted that one of modifications of the "Vorobey"-family UAVs was created as a result of international cooperation. Specifically at the end of 2010, SRIPSAF and "Bharuk Aerospace", a Ukrainian-Indian joint venture, investigated a simpler and cheaper version of a mobile miniature UAS with a take-off mass of 1.2 kg designed for real-time monitoring of agricultural and forest areas, to be known as "Vorobey-S". An investment project on this UAV system has been drawn up, and talks and written communication with potential investors and customers have been underway.

Civilian uses of the Vorobey-S UAS include the mapping and real-time monitoring of agricultural and forest areas; while special uses include intelligence gathering, aerial surveillance and target acquisition in favor of military and security services, including the Ministry of Defense, Ministry of Emergency Management, Ministry of Internal Affairs, Security Service and Border Guard Service of Ukraine.

Following are selected characteristics and performances of the "Vorobey-S" UAS:

Take-off weight of the UAV	2 kg
Wingspan.....	0.75 m
Mission endurance.....	45 min
Payload mass	0.2 kg
Full weight of the UAS	15 kg

At this point, the "Vorobey-S" project is in conceptual design stage, which is carried out by SRIPSAF at its own cost and risk. The amounts of investment funds needed for completion of the R&D phase of the "Vorobey-S" project are esti-



mated at \$0.3 million for the civilian modification and \$0.6 million for the special-purpose modification. The R&D phase of the “Vorobey-S” project would cover a timeframe of two years.

As regards the “Vorobey-M” configuration, its civilian uses could include real-time monitoring of natural environment and infrastructural assets, and it could be used as a cost-effective means of obtaining multispectral geo-referenced data of ultrahigh-resolution Earth surveying. The special-purpose “Vorobey-M” configuration will have the same functionality range as the “Vorobey-M-VVP”, which includes intelligence gathering, aerial surveillance and target acquisition in favor of military and security services: the Ministry of Defense, Ministry of Emergency Management, Ministry of Internal Affairs, Security Service and Border Guard Service of Ukraine. The aerial vehicles in both configurations can be equipped with photo, television image, thermal image and acoustic sensor equipment, along with radiation and chemical sensors and other special-purpose modular sensors.

The “Vorobey-M” project is currently in research stage, including pre-prototype flight testing, which is carried out by SRIP-SAF at its own cost. The amounts of investment funds needed for completion of R&D phase of the “Vorobey-M” project are estimated at \$0.5 million for the civilian modification and \$0.8 million for the special-purpose modification. The R&D phase of the “Vorobey-S” project would cover a timeframe of two years.

The “Vorobey-M” UAS and related take-off/landing equipment set include:

- Transportation vehicle for operator crew, personal equipment and support and logistic provisions;



“Vorobey-M” unmanned aerial system in testing

- Towed trailer for the UAV and take-off/landing equipment
- Man-portable ground control unit
- Bungee cord for assisted take-off
- Man-portable data link terminal with a range of up to 10 kilometers
- “Vorobey-M” UAV
- Modular payload system
- Landing equipment.

Following are selected characteristics and performances of the “Vorobey-M” UAS:

Take-off weight of the UAV	2.5 kg
Wingspan.....	1.05 m
Length.....	0.6 m
Height.....	0.15 m
Ground control range	25 km
Full mass of man-portable configuration	35 kg
Type of engine	electric, 350 W
Max. speed.....	130 km/h
Cruising speed.....	90 km/h
Loitering speed.....	85 km/h
Max. climbing speed.....	7 m/s
Operational ceiling.....	3,500 m
Mission endurance.....	1.5+ h
Payload mass	up to 0.5 kg

Key specifications of the UAS based on the “Vorobey-M-VVP” UAV platform

Wingspan	1.05 m
Length	0.6 m
Height	0.2 m
Max. take-off weight	3.0 kg
Max. payload mass	0.3 kg
Type of engine	electric, 600 W
Max. speed	160 km/h
Cruising speed	90 km/h
Loitering speed	30...65 km/h
Max. climbing speed	12 m/s
Operational ceiling	3,000 m
Mission endurance	45 min

The “Vorobey-M” and “Vorobey-M-VVP” systems offer advantages such as full autonomy of operation, ease of operation and low observable deployment (due to low visual profile and low acoustic signature of the UAV’s electric motor). The vehicle can be deployed from and land on improvised emplacements. The airframe is made entirely of advanced composite materials. Two UAVs together with ground support equipment kit well fit into a single man-portable container. The vehicles can be controlled by

operator or operate unattended, flying a pre-programmed path. The mission plan can be re-programmed in flight.

BREAKING THE STEREOTYPES

It is no secret that payloads, especially miniature gyro stabilized cameras and real-time data links are the tightest bottleneck of all the domestic UAS projects. One could hear many times officials of different levels saying something like this: "We are able to make an airframe of any type desired, but cameras, anyway, will have to be purchased [from a foreign supplier]". Purchasing sensor payloads for UAV platforms on the international market could be a way out, indeed. However, SRIPSAF could argue this by offering sensor designs of its own. We are talking about the gyro-stabilized optoelectronic sensor system (GOES) "Sova-L", as well as an advanced integrated navigation and piloting suite (NPS) for unmanned aircraft applications.

Thus, in early 2012, SRIPSAF launched the drawing up of design specifications for the gyro stabilized EO sensor system "Sova-L". It is intended that the Sova-L will be the most preferred type of payload to be used on future SRIPSAF UAV platforms. The Sova-L system will include imaging sensors of two types: one is a high-resolution variable focus lens camera, the other being a miniature IR camera with interchangeable lenses. In the future, a laser rangefinder/pointer could be added to the payload equipment set.

The mission equipment set for miniature unmanned aerial vehicles will include GOES "So-



Gyro stabilized EO sensor system "Sova-L"



Television image sensor Sony "FCB-EX11D"



Thermal image sensor FLIR Tau 640

va-L" and related ground software. The functionality range of the mission equipment set includes intelligence gathering, airborne surveillance and target acquisition.

Key specifications of the GOES "Sova-L":

Mass (with EO and IR imaging sensors)	0.95 kg
Rotation range of the imaging sensors' line of sight (in heading) relative to the UAV	unlimited
Rotation range of imaging sensors' line of sight (in pitch) relative to the UAV	+50 ÷ -1000
Max. rotation rate in pitch/heading	up to 1000/s
Error budget for the imaging sensors' line of sight alignment relative to the UAV	0,10
Watt consumption	20 W.

In addition to this, SRIPSAF is working to adapt mission equipment software to the STANAG-4586 standard requirements.

The mission equipment R&D phase would cover a timeframe of two years.

The main EO sensor is Sony FCB-EX11D color block camera, which provides outstanding picture quality and auto-focus performance. The FCB-EX11D incorporates a 1/4-type EXview HAD CCD™ sensor with 380,000 photosensitive members and is equipped with a 10x optical zoom lens that can provide a 120x zoom ratio when combined with the digital zoom.

Key specifications of the FCB-EX11D camera:

- Minimum Illumination – 1.0 lx (F1.8, 50 IRE typical)
- Angle of View (H) - 46.0° (wide end) to 4.6° (tele end)
- Mass: 95g
- Dimensions: 35.9 x 40.8 x 59.2 (mm)

The main thermal imaging sensor is the FLIR Systems' Tau 640 LWIR uncooled thermal camera, which comes with the following performances:

FPA format: 640 x 480; Sensitivity (NEΔT) < <50 mK; fields of view: 50° x 38° (14 mm FL), 36° x 27° (19 mm FL), 20° x 15° (35 mm FL); mass of camera core (without lenses): 52.1 g; dimensions of the camera core (without lenses) – 44.5 x 44.5 x 30.0 mm.

On a parallel track, young engineers at SRIPSAF carried out R&D on an advanced integrated navigation and piloting system (INPS) that includes a compact flight navigation, control, monitoring and diagnostics (FNCM&D) system (which uses unique algorithms for GPS-aided inertial navigation) and ground control equipment software. The system with core mission and ground equipment software has passed tested and evaluation installed on the “Chizh-L” UAV and the pre-prototype UAV “Vorobey-M”. The system’s software suite is currently being adapted to the STANAG 4586 standard requirements.

The functionality range of the INPS for UAS application includes UAV flight planning, spatial navigation, ensuring that the UAV follows the predefined path according to flight plan, performance monitoring and pre-flight diagnostics of mission equipment and ground components of the UAS.

Key INPS metrics:

- Mass of the FNCM&D system circuit board – 40 g;
- Mass of the FNCM&D system construct – 0.25 kg.

The current status of the INPS development project is the research phase involving pre-prototype flight testing (at the cost of SRIPSAF and the funding previously provided by the SBU under the “Filin-M” project). SRIPSAF is currently working to adapt the INPS software to the STANAG-4586 stan-



dard requirements. R&D on INPS equipment would cover a timeframe of two years.

One important area of focus for SRIPSAF is the drawing up of draft legislation that would regulate the legal use of unmanned aerial vehicles in Ukraine’s standard airspace for civilian and security purposes. The draft legislation is intended to ensure compliance with airspace safety regulations inasmuch as they concern the creation and exploitation of unmanned aerial systems. This work is funded by the government via the Ministry of Education and Science, and carried out with inputs from N. Zhukovski National Aerospace University. At the end of 2012, SRIPSAF submitted a regular report that included chapters on the admission of UAVs to Ukraine’s standard airspace, flight safety recommendations regarding the structure of UAS, methods for the formulation of requirement specifications, air-

worthiness standards and certification procedures concerning selected types of unmanned aerial systems.

In conclusion, we would like to emphasize that the mentioned UAS designs by SRIPSAF are actively advertised to potential export customers by Spetstekhnoexport state company, this against the backdrop of de-facto zero interest on the part of Ukraine’s Ministry of Defense. In view of this state of affairs, it is obvious that these technologies are losing one of their key advantages on the international market – the one that is available to foreign-designed counterparts, which are adapted to the needs of and used by respective armed forces while simultaneously being promoted on export markets. SRIPSAF still has to hope for itself and for export customers - a situation that has become commonplace in Ukraine’s national defense industry. **UDR**



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