

11th International Armament and Military Equipment Fair PARTNER 2023

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IT been more than two decades since the biggest International Armament and Military Equipment Fair on the Balkans was held for the first time at the Belgrade Fair. This year, at the end of September (25th – 28th) the 11th International Armament and Military Equipment Fair **PARTNER 2023** was held under the auspices of the Ministry of Defense of the Republic of Serbia. The main organizers were the Military Technical Institute and "Yugoimport-SDPR", leader in the area of production, integration and promotion of armament and military equipment in the region and respectable

participant in the world market. The holder of the technical realization was the Belgrade Fair, owner of the most representative fair facilities and provider of the fair services, supporting the most prominent and most requiring events.

The goal of such manifestation is to present the advancement of defense technology and industry capacities of the Republic of Serbia, as well as scientific achievements, last researches and, of course, a great opportunity for exhibiting and establishing new contacts and cooperation with foreign companies and participants.

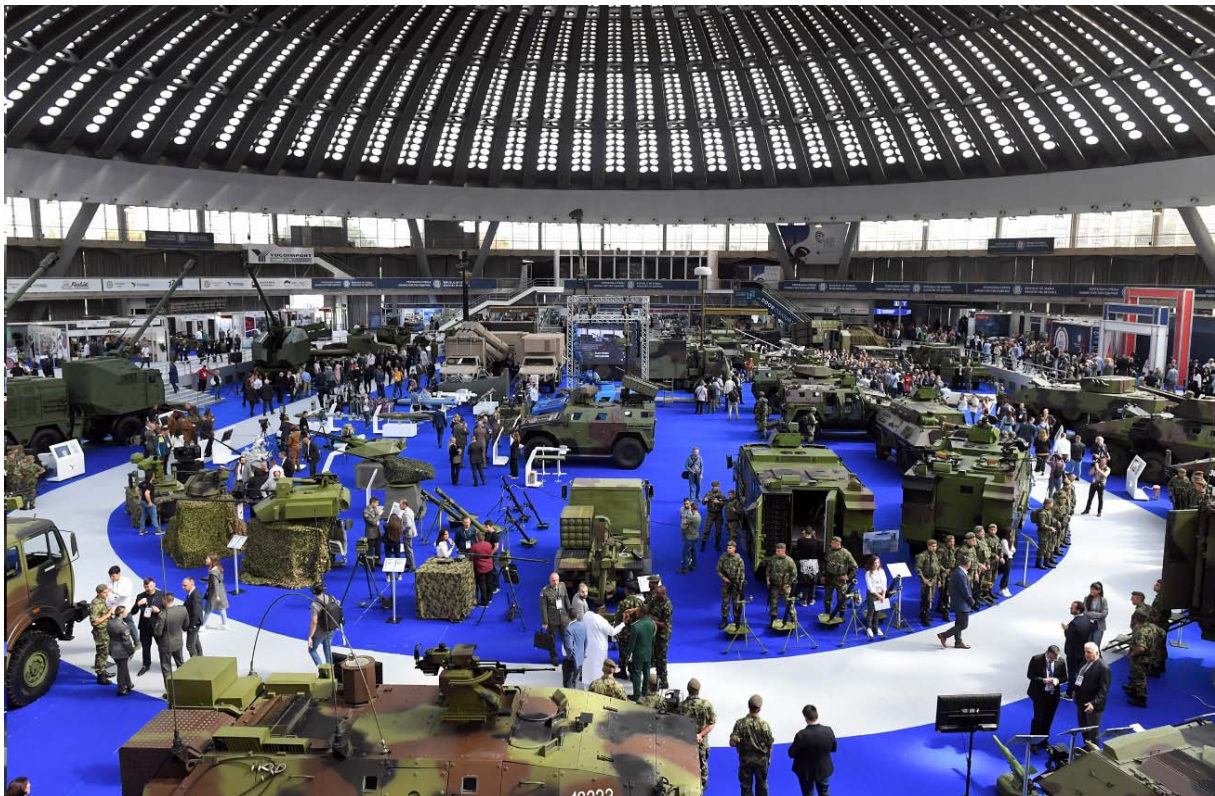


Figure 1. International Armament and Military Equipment Fair PARTNER 2023

It is always an expectation that meets the requirements and results in a positive outcome when it comes to the number of visitors which exceeded the results of the previous manifestations. Numerous representatives of manufacturers and business partners from more than 30 countries, 11 500 visitors, 20 foreign visits and official delegations of the Ministries of Defense, armed forces and state institutions of partner countries and organizations were registered (Saudi Arabia, China, France, Germany, Australia, Turkey, USA,

Iran, Slovenia, Austria, Italy, Bahrein, Egypt, Mexico, Kazakhstan, Lithuania), 154 exhibitors from Serbia and from: Austria, Turkey, Bosnia and Hercegovina, Italy, China, Germany, Finland, France, Montenegro, Slovenia, Sweden, Israel, Hungary, North Macedonia, Azerbaijan, Iran, United Kingdom, Finland, Kazakhstan and Russia.

The International Fair is visited by many high ranking delegations from the whole world, as well as the representatives of NATO, European Defense Agency and

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other international military and security organizations. Among all of them prevailed the development projects of the Military Technical Institute (VTI), "Yugoimport SDPR" and Aeronautical plant "MOMA STANOJLOVIĆ" – Batajnica – today the most important military institutions in the Western Balkans.

The remarkable role for development technology within the Serbian Armed Forces have: Military Medical Academy (VMA), Military Geographic Institute (VGI), Technical Test Center (TOC) and Military Academy (VA). Each of the above mentioned had a stand at the fair where they could present the activities from their domain. As always, the Military Academy attracted a lot of attention with the projects of young cadets and professors from the Mechanical and Electronics department as well as from the Aviation department. At the stand of the Military Academy, interested visitors could see the demonstration model of a remote operated machine gun combat station, didactic radar model, flight simulator for "Lasta" aircraft, weapons used in simulation pistol shooting hall as well as numerous books used for Basic Academic Studies at the Military Academy and the Military Medical Academy.

Also, a number of leading Serbian defense companies and weaponry and military equipment producers who have the enviable international reputation had the significant role at the Fair and the most prominent among them being: "ZASTAVA ORUŽJE" – Kragujevac, "PRVI PARTIZAN" – Užice, "KRUŠIK" – Valjevo, "SLOBODA" – Čačak, "MILAN BLAGOJEVIĆ" – Lučani, "IMK 14 OCTOBER" – Kraljevo, "FAP" – Priboj, "UTVA" – Pančevo, "PRVA ISKRA" – Barič, "TRAYAL" – Kruševac, "PRVA PETOLETKA" – Trstenik, "IRITEL" – Beograd, "EDEPRO" – Beograd, "EI OPEK" – Niš, "TELEOPTIK - GYROS" – Zemun, "Sova Night Vision" – Niš, "JUMKO" – Vranje, "MILE DRAGIĆ" – Zrenjanin, "KODŽIĆ & Co" – Beograd, "GEPARD" – Novi Sad, etc.

Apart from the armament and military equipment manufacturers, several overhaul companies presented their capabilities: "TRZ" – Čačak, "TRZ" – Kragujevac, "MOMA STANOJLOVIĆ" – Batajnica, "ORAO" – Bijeljina, etc.

Visitors had the opportunity to see modern small arms, contemporary shooting arms and ammunition of various calibers and purposes, fire support artillery and missile systems, self-propelled and towed artillery systems, anti-armor combat systems, combat and non-combat vehicles, tanks and armored vehicles, artillery and mortar fuse systems, mines, electronic reconnaissance and surveillance systems, telecommunication equipment, radar-computing devices, crypto protection devices, various simulators, unmanned aerial vehicles, combat armored vehicles, trainer aircraft for the initial pilot training, lightweight airplanes, river patrol boats, logistics and electronic equipment, antiterrorist and special operations equipment, personal protection ballistic equipment, fire-fighting equipment, etc.

Visitors were interested in new and modern equipment they had not seen at the previous Fair. So, further on in the paper, some of the newest, modernized and interesting equipment will be presented.

Partner 2023 marked the first public appearance of the latest iteration of the Nora wheeled self-propelled howitzers family, the fully new weapon system being exhibited in the Main hall.

The Nora B52 called PERUN is a Next Generation Armament and has a major difference that brings the new artillery piece to allow a quantum jump in terms of flexibility and mission capacity: while the previous system had only 12 rounds in the autoloader, the 24 extra rounds being carried in

stowage, the new one has 30 rounds that can be loaded automatically, only six being held in stowage. The gun remains the same already used on the other versions of the Nora, providing a range of 32.5 km with ERFB (Extended Range Full Bore) projectiles, 41.5 km with ERFB BBs (ERFB Base Bleed), and 52 km with VLAPs (Velocity Enhanced Artillery Projectile). PERUN can fire three rounds in MRSI (Multiple Round Simultaneous Impact) mode, up to 30 km.



Figure 2. Nora-B52 NG 155/52 Self-Propelled Howitzer

PERUN is fitted with an inertial navigation system, with satellite (GPS, GLONASS, Galileo) backup. PERUN is installed on a MAN 8×8 truck chassis, which being a commercial product does not generate issues with export licenses. The 4-man crew is hosted in the truck cabin, two at the front, driver and commander, and two more at the rear, gunner and loader, the latter entering action only when manual load is required or when the autoloader must be refilled. Reloading the full 30 rounds takes between 15 and 20 minutes, according to company sources, ammunition and charges being loaded through the side doors on each side of the turret. While the crew cabin is protected at Level 3, the level for the loading system is lower, no details being provided, a limited mine protection being also available.

Another piece of equipment that has attracted attention is the „HARPAS“ system. HARPAS is a modern hybrid artillery weapon system intended for anti-aircraft defense of troops and important objects from airplanes, helicopters, cruise missiles and unmanned aerial vehicles. It is integrated on the vehicle base of the M84 main battle tank, which is characterized by excellent mobility and the ability to protect the crew, devices and instruments from the action of small arms and pieces of artillery projectiles.

The „HARPAS“ hybrid system is armed with 40 mm L/70 Bofors guns, 170 mm anti-aircraft missiles RLN-TK and RLN-RF and is equipped with a short-range tactical radar, which is intended for performing aerial surveillance tasks and detecting targets with a small reflective surface in all weather conditions.

The UAVs have proven to be one of the most important factors when it comes to the modern warfare. Taught by experience from the real use on the field the industry followed with the rapid development of various types of aircraft and, on the other hand, the means for neutralizing them, so constant improvement in both branches can be easily noticed. Some of the most interesting systems will be presented in the following text.



Figure 3. Hybrid Artillery-Missile Anti-Aircraft System „HARPAS“

Loitering munition Osica is a fully autonomous loitering unmanned aerial system designed for attack missions (KAMIKAZE). It is a cost-effective high-precision loitering munition with capability to destroy armored vehicle. UAS is equipped with shaped-charge warhead from anti-tank weapon system M79 Osa. With fixed ultra compact Full-HD camera module and video processor it is able to detect and fully autonomously attack target based on video tracking system.

- UAS is designed to be an efficient, economical, mobile and small weight loitering munitions.
- The take-off of the LM Osica is fully automated using a lightweight pneumatic catapult launcher.
- LM Osica is equipped with flight control computer developed by the Military Technical Institute and equipment whose functionality has been checked on UAS Vrabac. Also, LM Osica has the possibility to execute missions in cooperation or via UAS Vrabac.



Figure 4. Loitering Munition System “OSICA”

Vrabac drone's role upgraded from surveillance to armed operations

Originally designed for intelligence, surveillance, and reconnaissance (ISR) tasks, the Vrabac drone has recently seen an expansion in its capabilities with the development of an armed variant. This new prototype is equipped with two small underwing pylons, each carrying three M22 40 mm grenades. These grenades come in two types: bounding high-explosive anti-personnel fragmentation and bounding high-explosive anti-armor fragmentation.

While the standard Vrabac drone features an electro-optical payload under its nose for surveillance purposes, this armed version marks a significant enhancement in its operational scope. The drone has already entered serial production and is actively serving with the Serbian Armed Forces. The armed version of the

Vrabac drone, with its grenade-carrying capabilities, can serve multiple tactical purposes. The high-explosive anti-personnel fragmentation grenades can be used for suppressing enemy infantry and clearing out fortified positions. On the other hand, the high-explosive anti-armor fragmentation grenades can be employed against light armored vehicles or fortifications. This makes the armed Vrabac a versatile tool for both anti-personnel and anti-armor operations.



Figure 5. Vrabac drone

PR-DC, Serbian company specialized in drones, exhibited a full range of products including loitering munitions. These are the third generation of drones developed by PR-DC.



Figure 6. PR-DC IKA-Bomber

The fully developed system is known as IKA-Bomber and comes in the form of an all composite hexacopter which lift is provided by six 812.8 mm rotors each one linked to a 5.7 kW brushless DC electric motor. These allow the IKA-Bomber to take off at a maximum 70 kg mass, carrying an optimal payload mass of 20 kg. Most of this is made of the “bomber” kit, composed of 12 vertical tubes each containing a 60 mm mortar bomb. A release system allows dropping the selected number of bombs over the intended target. The IKA-Bomber operates at an altitude between 150 and 300 meters and has a mission radius up to 15 km, with endurance between 20 and 40 minutes. Its maximum speed is 90 km/h, cruise speed being 60 km/h, has a climb rate of 10 m/s and can withstand winds up to 8 m/s, while its ceiling is 7,000 meters. The drone is operated via the IKA-CTRL flight controller, which has a control and a monitoring mode, the armament control being separate. The operator can see the scene via the video-stream provided by the data-link, images being provided by a 3axis gimballed electro-optical suite with day and thermal channel, a targeting camera with a x10 zoom being also installed on the drone.

It's mentioned earlier than the UAVs have proven to be one of the most important factors when it comes to modern warfare. As much importance can be given to the means of the counter UAV. There is always a race in development between these means in the world of armaments. A lot of attention was dedicated to Counter-UAV jammer designed by the Military Technical Institute and the anti-drone rifle

jammer designed by the Serbian company IRITEL called Drone Off.

Counter-UAV jammer is designed to neutralize the flight unauthorized drones by jamming their communication signals and/or GNSS subsystem. This jammer is primarily intended to protect military bases, facilities, high value assets, ceremony/meeting areas and public events, checkpoints and VIPs against drone attacks. The general drone threats comprise terrorist attacks, illegal surveillance and reconnaissance, smuggling, electronic snooping, and mid-air collisions.

C-UAV jammer can be activated either selectively or simultaneously across the 400 MHz to 6 GHz spectrum, targeting six threats 'bands' which are designed to defeat the C2 links commonly deployed throughout the UAS threat landscape (i.e. 433MHz, 915 MHz, 2.4 GHz, 3.6 GHz, 5.8 GHz and GNSS bands).

Various anti-drone technologies are available on the market, ranging from frequency jammers to lasers, and even trained birds to intercept drones. Drone Off stands out for its portability and high transmission power, making it a viable option for a variety of scenarios. With its impressive technical specifications and range, it offers a viable solution for neutralizing drones in various scenarios. The development and adoption of such technologies are crucial to address the challenges posed by the increasing use of drones, not just on the battlefield but also in areas such as security.



Figure 7. Counter UAV sistem Drone Off

The rifle operates on multiple frequency ranges, specifically 1164-1610 MHz for GPS L1/L2 and Glonass, as well as 2400-2500 MHz and 5700-5850 MHz for remote control and video transmission. With a transmission power of 78 W, it is capable of jamming drone signals within a radius of up to 2.5 km. The rifle weighs 3 kg, while the associated backpack weighs 10 kg. It uses "Sweep/multisweep" type jamming signals and is equipped with helical antennas with a gain of 12 dBi and an angle of 42°. The rifle can operate in temperature conditions ranging from -25°C to +50°C and is battery-powered, with a battery status indicator.

As far as air defence was concerned, as usually, attention was drawn to PASARS, the anti-aircraft system. It has been modernized and equipped with additional subsystems since the last presentation so now it represents one comprehensive and diverse system.

PASARS – Anti-aircraft self-propelled artillery rocket system is a hybrid combat system made of anti-aircraft gun 40mmL/70 "BOFORS", integrated at the driving base of the FAP 2228 off-road vehicle, 6x6. It is intended for protection of the land forces during marching position and during combat actions, as well as for protection of important facilities and installations from air attacks (cruising missiles, combat helicopters, unmanned aerial vehicles, low altitude aerial vehicles). The system is characterized by a high level of

mobility and quite a quick time of transforming from marching into combat position. The PASARS system is also characterized by a high level of ballistic equipment, as well as for guiding actions using "Giraffe" radar or optical target indicator. The system can also be operated in a completely independent way. The key element is the turret, which is fitted on top a FAP 2228 off-road 6×6 vehicle; the truck chassis has been fitted with an armored cabin at the front, the flatbed at the rear carrying the GBAD turret. This features in the center a single Bofors 40 mm cannon, while on the right we find a twin launcher for Mistral 3+ missiles provided by MBDA. These can reach a target at over 7.5 km range and 6 km altitude. On the left side another twin launcher hosts side by side two Strela.2M or Strela-2MA missiles. The latter is an improved version of the former, which maintains the range and altitude envelope, 4.2 km and 2.3 km respectively, minimum distances being 500 and 5 meters, but is fitted with a new dual-mode photo contrast/infrared seeker as well as the contact/proximity fuse. Although its key role remains air defence, the PASARS can also take action against enemy armored vehicles. On the same side of the Strela missiles but in a higher position a twin launcher for the newly developed Malyutka 2T5, with tandem warhead and a 5 km range is fitted.



Figure 8. Self-propelled hybrid anti-aircraft system "PASARS"

As said, UAVs are becoming a major threat. The PASARS is fitted with a jammer covering the 400 – 6,000 MHz band, which directional antenna is visible at the front, coaxially mounted with the 40 mm cannon.

Target detection is the responsibility of four RPS-42 radars, each covering 90° in azimuth and 80° in elevation, installed at the lower corners of the turret. These sensors can pick up targets up to 30 km distance and from 10 to 10,000 metres altitude. The achievable detection range against Nano UAVs is 3.5 km. The optronic suite includes a day channel and a night channel based on Sagem Electronics & Defense SATIS GS advanced multipurpose cooled thermal imager operating in the 3-5µm waveband and featuring a VGA/HD detector. When operating the cannon the firing control system constantly recalculates the impact point in order to feed the airburst round with the precise time to detonation, in order to maximize the terminal effect on the target.

Mortar fire control system

In the area of the mortar systems an upgrade of mortars has been carried out on 120 mm M75 and 82 mm M69 models in order to improve precision, speed and make handling easier. Accordingly, the following changes have been made:

- Introduction of digital devices for directing mortars and determining their position based on inertial sensors,

- Introduction of digital observation devices with improved software support applications used in the mortar fire control process,
- Use of Matrice 300 RTK drone for more efficient and reliable determination of target position,
- Use of UPAS (Universal Movement Artillery Station) software application that enables planning, receiving and processing data necessary for the execution of the mortar fire process. Also, one part of it is a ballistic module that serves for the calculation of the basic shooting elements, corrected shooting elements and forwarding calculated data to the mortars.

Observation device:

- eye-safe laser rangefinder with range up to 7 km,
- thermal imaging camera with uncooled detector, resolution 640x480 pixels, maximum detection distance of a tank-sized target in a narrow field of view up to 5 km.

Digitalized device for directing:

- accuracy of determining the position (X Y Z) up to 5 m,
- accuracy of determining azimuth: 0.2° RMS

Multispectral camouflage vehicle Kit M22

Multispectral Camouflage Vehicle Kit M22 provides an increasing of vehicle's camouflage protection in the visible, infrared, and radar range of the electromagnetic spectrum in place and during the execution of combat missions.

In the visible part of the electromagnetic part of the spectrum, it provides the characteristics of the terrain vegetation. It reduces the thermal reflection of vehicles in the infrared part of the spectrum (near, short-wave, mid-wave and longwave infrared). Also, specific materials provide attenuation of the reflected signal in the X-band (8.2 to 12.4 GHz).

Multispectral Camouflage Vehicle Kit M22 enables completely uninterrupted functioning of the vehicles, electronic devices, sensors, and crew in place and movement. Mass of Multispectral Camouflage Vehicle Kit M22 depends on the camouflage protection level and can be used in the temperature range: -20-80 °C.

The Multispectral Camouflage Vehicle Kit M22 is easy to use, store and transport and can be adapted to any color, pattern, and terrain.



Figure 9. Viatacom Integrated Loitering Ammunition Vila1

Viatacom, a private research institute, exhibited the mock-ups of two long range loitering munitions, the vILA 1 and vILA2, based on similar modules but aimed at different use, from surface and from the air. The difference between the two weapon systems is mostly in their use; the vILA 1 (for Viatacom Integrated Loitering Ammunition) is designed to be surface launched, either from a land-based system or from ships, while the vILA 2 is to be used on board combat aircraft.

The core elements of the missile, the guidance system and the warhead, are common, albeit some control software might have to be partially rewritten. The vILA missiles fly to the target area exploiting inertial navigation, GNSS and radar altimeter for guidance. EDR On-Line understood that the module on which the Institute is concentrating its efforts is the one dedicated to the final leg, when the system starts loitering over the target area in search of its target. Here an optoelectronic system is activated, which carries out autonomous target recognition thanks to Artificial Intelligence-based algorithms. Of course the man-in-the-loop concept is respected, a two-way data-link allowing the operator at the ground control station to validate the system target choice before the vILA switches to the attack phase. The vILA loitering munitions carry a 300 kg warhead that can be selected among different types. The vILA 1 is fitted with a vAF-M17//vFI.17 fuse, while no such information was provided for the vILA 2.



Figure 10. Viatacom Integrated Loitering Ammunition Vila2

Whoever wanted to see and hear more about everything that is beyond the equipment seen at the exhibition could join Conference Hall for additional lectures. For the first time since this exhibition was held, apart the regular, static demonstration of all the innovations made recently, there was as well the academic approach through lectures regarding most interesting topics for the technical and also military environment. Engaging most appreciated professors from different universities to deliver presentations and lectures as well as engaging local and foreign industry representatives to demonstrate the development of courses in the modern warfare led to a huge interest and overall success when it comes to technologies. All the conferences and lectures were open, for local as well as for the foreign representatives since the presentations were prepared both in English and Serbian. Lectures were divided into sections throughout the week following different activities in the main hall.

PARTNER 2023 was an excellent opportunity for the promotion of the Serbian military industry which resulted in fruitful contacts and cooperation on a number of projects with foreign partners. The next PARTNER Fair, that has grown into the biggest fair of this type in the region, will be held in 2025 when we can expect to see the realization of some projects which are now in the development phase or in the test range phase that could not have been seen on this Fair.

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