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## A Remotely Controlled Integrated Weapon Platform Developed on the Basis of Long-Term Experience and Competence

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**Abstract.** For two decades, AREX Sp. z o.o. (Gdynia, Poland), belonging to WB Group (Warsaw, Poland), has been dealing with special-purpose production, in particular mechatronics, and its solutions are used in electromechanical accessories for 155 mm KRAB gun-howitzers and 120 mm RAK self-propelled wheeled gun-mortars. The operations of WB Group on international markets has given a boost to its further development. The solutions of the remotely controlled weapon platform presented in this paper can be adapted to weapons with ammunition fed from the left or right side, owing to the self-diagnostics and verification system as well as the modular design. The intention of the designers was to create functional and intuitive equipment that allows the operator to focus on firing operations. The remotely controlled weapon platform is also equipped with covering capacity, such as smoke grenades, and is also electrically operated, can be operated manually in emergencies, is intended for installation on various combat vehicles and is remotely controlled by the operator remaining inside the vehicle compartment, which ensures full armoured protection against enemy direct fire. Remote control is based on two operating components — a fire control unit and a control grip. Additionally the system is capable of remote weapon loading, weapon cocking, and firing. Tracking and remote controlling capabilities of the integrated weapon platform ensure high probability of hitting stationary and moving targets during the first round, and the platform can be operated manually as required.

**Keywords:** remotely controlled integrated weapon platform, functionality, safety

## 1. INTRODUCTION

The remotely controlled integrated weapon platform developed on the basis of the long-term experience and competence of AREX Sp. z o.o. from Gdynia (Poland), belonging to WB Group (Warsaw, Poland), covers lightweight structures for installation on manned and unmanned platforms.

While participating in engineering design and the construction of such military equipment, a decision was made to provide the modular philosophy while developing an in-house adaptation system to introduce new elements or components into the assembly (various weapon types, scalable stability, and targeting systems) [7].

Modularity was also defined as the possibility of fast replacement of inoperable equipment and facilitated the fulfilment of the operating requirements. The aim was to create a functional and intuitive solution that allows the operator to focus on the task — rather than operating the instrumentation. To ensure that the remotely controlled, integrated weapon platform meets the requirements set out for weapons for the modern battlefield, it should have a series of important features [10], such as:

- provide light and effective weapons for tanks, other military vehicles (e.g. wheeled armoured vehicles, military light utility vehicles), vessels and stationary objects;
- ensure accurate and effective firing without exposing the team to enemy operations;

- be designed for the selection of weapon configuration (e.g. heavy machine gun, machine gun, automatic grenade launcher or guided missile launchers);
- ensure appropriate selection of surveillance and targeting modules for the weapons used and style;
- ensure proper adjustment of the required weapon angles as well as the speed and accuracy of aiming for the operators of these positions to fight ground targets moving at different speeds and aerial targets, e.g. helicopters;
- assure an appropriate range of observation, range of the target under any weather conditions and at any time of the day or night;
- be controlled using a panel with a monitor and a control unit placed inside the vehicle to ensure maximum safety for the operator, who is protected from fire by the armour of the vehicle on which the position was installed;
- be designed to allow easy installation and disassembly of various weapon types and be easy to operate;
- elevation and azimuth drive control systems required to be a programmable unit to set prohibited zones and monitor control protection, e.g. when opening a hatch;
- the control unit supporting input and output signals of the platform should have a ballistic calculator, and this unit should convert signals from the azimuth and elevation sensors, to allow for the operation and monitoring of the grenade launcher and electric trigger;
- include a system to count missiles and set round lengths;
- a stabilisation module to help keep the gun axis aimed on the target.

The remotely controlled, integrated weapon platform should be equipped with digitally controlled electric drives, but in an emergency manual control of the drives should be allowed. The mechanisms used should allow not only for precise and fast aiming at the target, but also, owing to the stabilisation systems, for efficient firing with ongoing monitoring of its effects [8]. Relocation of the remote weapon module to a safer, usually better protected location, is currently becoming a standard [9].

Therefore the unmanned firing position market is developing dynamically, and the forecasts for its future are bright. If one has competence in this field, has command and communication systems as well as intelligence and assault systems, one should take advantage of these resources.

Remote control provides safety for teams operating various types of vehicles. The operators have the possibility of carrying out observation and control fire from the transporters and vehicles, including while driving. The positions are equipped with a self-diagnostics system verifying the readiness of individual elements of the remotely controlled, integrated weapon platform to execute a task [3].

## 2. REMOTE CONTROL OF THE WEAPON MODULE

The remote weapon module is a light structure that can be used on both stationary and mobile platforms, and includes a stabilisation system. An optoelectronic sight equipped with a television camera and an infrared camera is used for aiming. The aiming system is additionally provided with a laser distance meter. Target tracking is carried out with the control unit (joystick) and monitored from the weapon operator's position or automatically using an external fire control system. The turret control unit has software to introduce prohibited zones in both azimuth and elevation.

Having digitally controlled electric drives with an emergency manual drive, precise and fast aiming the weapons on the target is possible [5].

Targets can be tracked by the operator using the control unit (joystick or control wheel), or automatically from the internal fire control system. The remotely controlled weapon modules are equipped with an aiming system including a television-type camera, an infrared camera, and a laser distance meter. Electric power supply is ensured, but if there is no such supply, the modules can be controlled mechanically. The modular system design allows for streamlined integration of new equipment and fast replacement in the field.

The remotely controlled, integrated weapon platform (Fig. 1) can be equipped with a machine gun and automatic grenade launchers with WARMATE-TL loitering munition launchers. Other configurations are available of equipment and weapons, with varying munition feeding side (right or left) [3].



Fig. 1. Front and side view of the remotely controlled, integrated weapon platform.  
(Photo: author's archive.)

The remotely controlled, integrated weapon platform is fully stabilised and modular and can be available in three basic options differing in terms of accessories, and primarily of weapon configuration possibilities.

Irrespective of the option, every remotely controlled, integrated weapon platform consists of a sight unit, servo drives (for azimuth and elevation), control system, power supply distribution unit, swivel connection, operator panel and control units. The design of the remotely controlled, integrated weapon platform allows it to be adopted to specific customer requirements [6].

Other configurations (Fig. 2) of the equipment and weapons are available. The platform can be equipped with various weapons: from 5.56 mm machine guns, 7.62 mm machine guns, 12.7 mm heavy machine guns (NSW-T or M2HB), 40 mm automatic grenade launchers, to dual weapon systems (e.g. 7.62 mm machine gun with 12.7 mm heavy machine gun, 7.62 mm machine gun with 40 mm grenade launcher) as well as an M230LF cannon fed with  $30 \times 113$  mm ammunition.

Configuration and weapons obviously have direct impact on the platform weight, which ranges from 150 kg in the light option to 450 kg in the most advanced and heavy variant.



Fig. 2. Remotely controlled, integrated weapon platform. (Photo: author's archive.)

During International Defence Industry Exhibition MSPO in 2021 (Kielce, Poland) a new version (Fig. 3) of the Remotely Controlled Weapon Modules developed by Group WB on the basis of long-term experience and competence was presented. They have already been implemented in some packages into the production process. This experience possessed by AREX WB GROUP has been on market for nearly 30 years, and for approximately two decades it has dealt with special-purpose products. Throughout the years AREX WB GROUP has worked with weapon system manufacturers and provided them with special components. The Group's portfolio is really extensive and includes electromechanical equipment for 120 mm RAK self-propelled wheeled gun-mortars [4]. Considering the possibilities and opportunities, the Group has grown to develop in-house final products offered to the users.

The Remotely Controlled Weapon Modules were developed and presented during tests on foreign ranges. They have fired thousands of pieces of ammunition, and all elements, such as the position's mechanical components, panels, power supply units, aiming systems, or drives, were integrated and functionally tested. This demonstrates a high level of product performance because the gunner usually loses eye contact with the object when firing at it with a round of missiles.

Targets can be tracked manually using the control unit and, in more advanced configurations, automatically. Along with the external fire control system, this shows a high level of firing means. It is also possible to set prohibited zones in firing in both the azimuth and elevation. This reduces the risk of fire hitting own troops or civilian facilities. This is an important feature in the world of subliminal activities, at the interface of war and peace, in the obscure environment of a hybrid conflict.



Fig. 3. The Remotely Controlled Weapon Modules presented at MSPO in 2021. (Photo: author's archive.)

The Remotely Controlled Weapon Module (Fig. 4) is provided with an optoelectronic sight with an infrared camera, a television (daytime) camera and a laser distance meter that is safe to the eye. The possibility to set prohibited fire zones is another extremely favourable solution. It minimises the risk of fire hitting own troops [7].

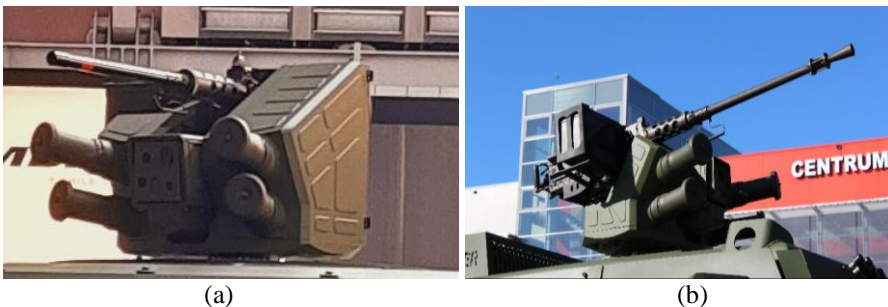


Fig. 4. Front and side view of the remotely controlled, integrated weapon platform. (Photo: author's archive.)

All solutions are domestic, which is highly important for both the manufacturer and a potential domestic user. An example of such an approach is the development of an in-house control unit (joystick), which may have an impact on the timeliness of export releases when it comes to more complex products. The above does not translate into the strategy of manufacturing everything in a single plant.

More than a dozen of these platforms have already been manufactured and tested on foreign ranges, such as in Ukraine. For this purpose the NOVATOR  $4 \times 4$  light armoured vehicle was used. At MSPO in 2021, the Remotely Controlled Weapon Module was presented installed on a COMBATMATE multipurpose armoured vehicle (Fig. 5), which is the result of cooperation of this company with external entities.

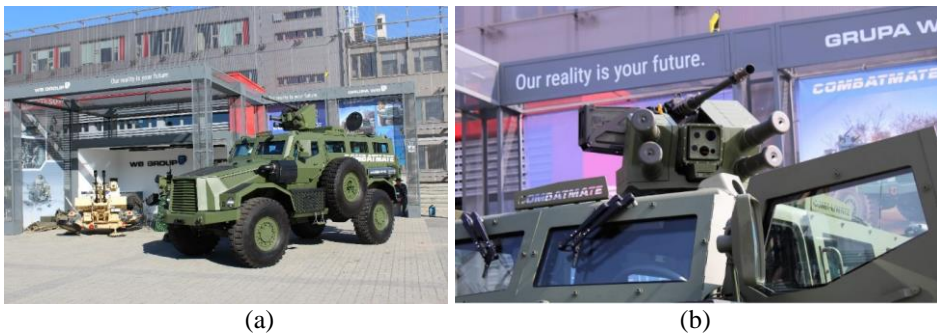


Fig. 5. Remotely controlled, integrated weapon platform at MSPO 2021.  
(Photo: author's archive.)

The vehicle was integrated into the FONET vehicle communication system, TOPAZ combat management system, and COMP@N and PERAD radio communication systems.

In general, WB Group intends to control technology and key components, but, according to international trends, it is a standard behaviour to cooperate as part of corporate networks. The same applies to export users intending to participate based on in-house co-production of the systems ordered, which improves the economic and industrial values of WB Group product range.

The common use of unmanned positions does not mean that only the most complex configurations are used. In many cases, in support and protection vehicles, simpler systems are sufficient. They are intended to be effective tools. A modular product must also indicate the same customer approach — tailored to their needs.

### 3. CONCLUSIONS

WB Group focuses mainly on export users, and it is known that it has varying budgets and demands. Therefore the Group's product range include the remotely controlled, integrated weapon platform that can be equipped with a 5.56 mm machine gun, a 12.7 mm heavy machine gun, and other effector combinations.

The remotely controlled, integrated weapon platform developed by AREX WB Group:

- has a modular design;
- is easy to install on the vehicle (base);
- can be equipped with different weapon types;
- offers high efficiency and accuracy under various conditions;
- is operated by a single operator whose maximum safety is ensured owing to the use of remote control units to allow staying inside an armoured vehicle or away from the platform;
- wide range of applications (armoured vehicles, light armoured vehicles, vessels, stationary objects, etc.).

The remotely controlled, integrated weapon platform developed by AREX WB Group is all about state-of-the-art, domestic weapon equipment necessary for the modern battlefield, with multiple intended uses. The tactical and technical parameters of the remotely controlled weapon platform developed by AREX WB Group do not deviate from the parameters of similar solutions offered by renowned international companies, which has been confirmed during joint range trials and testing.

There are currently at least 17 large-size defence companies offering weapon modules and competing with each other to obtain the right to supply the most attractive combination of the desired properties, such as the capability to support wide range of weapons, a single system or a complex of weapons, featuring modularity, fast and easy installation, and ease of use.

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## **Zdalnie sterowana, zintegrowana platforma uzbrojenia opracowana na bazie wieloletnich doświadczeń i posiadanych kompetencji**

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**Streszczenie.** Zakład Automatyki i Urządzeń Pomiarowych AREX Sp. z o.o. wchodzący w skład Grupy WB od dwóch dekad zajmuje się produkcją specjalną, głównie mechatroniką, a rozwiązania znajdują się w osprzęcie elektromechanicznym 155 mm armato-haubic KRAB, 120 mm samobieźnych moździerzy RAK czy wieży ZSSW-30. Operowanie na światowych rynkach dało impuls do dalszego rozwoju Grupy WB. Przedstawione w artykule rozwiązania zdalnie sterowanej platformy uzbrojenia dzięki systemowi autodiagnostyki i weryfikacji oraz modułowości umożliwiają szybką wymianę niesprawnego lub uszkodzonego sprzętu, co znacznie ułatwia obsługę tej broni. Intencją projektantów było stworzenie funkcjonalnego, intuicyjnego sprzętu, który pozwala operatorowi skupić się na zadaniu. Dzięki modułowej budowie może być przystosowany do uzbrojenia zasilanego amunicją z prawej lub lewej strony. Zdalnie zintegrowana platforma uzbrojenia jest również wyposażona w środki osłonowe, takie jak granaty dymne, i jest zasilana elektrycznie, ale może być również obsługiwana ręcznie w sytuacji awaryjnej i jest przeznaczona do montażu na różnych pojazdach bojowych i jest zdalnie obsługiwany przez operatora znajdującego się wewnątrz przedziału pojazdu, co zapewnia całkowitą ochronę pancerną przed bezpośrednim ogniem wroga. Zdalna obsługa jest realizowana przez dwa elementy operacyjne, – jednostkę kierowania ogniem – uchwyt kontrolny. System posiada również możliwość zdalnego ładowania broni do napełniania broni oraz strzelania. Możliwości śledzenia i kontroli zdalnej zintegrowanej platformy uzbrojenia zapewniają wysokie prawdopodobieństwo trafienia w pierwszej serii przeciwko nieruchomym i ruchomym celom, a razie potrzeby można również obsługiwać ręcznie.

**Słowa kluczowe:** bezpieczeństwo, funkcjonalność, zdalnie sterowana zintegrowana platforma uzbrojenia