

## BASIC CONDITIONS INFLUENCING THE DEVELOPMENT OF A CONCEPT FOR AN AMPHIBIOUS UNIVERSAL MODULAR TRACKED PLATFORM DESIGNED TO BUILD AN INFANTRY FIGHTING VEHICLE AND SPECIAL VEHICLES

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### Abstract:

*The paper presents the basic conditions influencing the development of a concept for an amphibious universal modular tracked platform designed to build an infantry fighting vehicle and special vehicle.*

### Keywords:

*conditions, amphibious universal modular tracked platform*

## INTRODUCTION

Vehicles operated in the army are used mainly as the carriers for weapons, indispensable fighting load and logistics equipment, and also as the means of transportation and protection for infantry units. It is impossible for one vehicle to fulfil all requirements set for military vehicles, mainly because such requirements are mutually exclusive, e.g. high resistance to enemy fire (heavy weight) and dynamic properties. Therefore, depending on the designed use of military vehicles, they are given specific functional characteristics. Because of the diversity of design and features of military vehicles a large number of such vehicles were built, different with respect to, for example, their intended use, armament, level of resistance to firepower, maximum authorised (combat) weight, ability to cover ground, driveline system (wheels, tracks), vehicle dynamic properties, specialist equipment, design solutions, their manufacturing technol-

ogy, etc. The diversity of such vehicles leads to significant difficulties in the process of their operation and providing logistics support and supply of the means of combat, consumables and spare parts. This is particularly so when vehicles are made by various manufacturers and represent different stages of their design.

Taking account of the above and the planned partial replacement of the armoured equipment in the Polish Armed Forces the standardisation of vehicles is desirable in many respects.

## **1. CONDITIONS INFLUENCING THE ACQUISITION OF A UNIVERSAL MODULAR TRACKED PLATFORM**

The commencement of the works on acquiring an amphibious universal modular tracked platform to be used to build an infantry fighting vehicle and special vehicles should be preceded by:

- identifying the needs of the Polish Armed Forces;
- becoming familiar with the proper terminology for the naming of vehicles;
- creating a logical classification of vehicles according to unambiguous division criteria. The adopted classification will provide the basis for acquiring vehicles according to a predefined key, making it possible to build modular vehicles and naturally contributing to their considerable standardisation [2];
- defining which special vehicles should be built on the basis of a universal modular tracked platform;
- examining the possibilities of achieving by the vehicle the desirable tactical and technical parameters enabling it to complete the planned missions;
- investigating the possibilities of manufacturing vehicles in Poland;
- estimating the costs of acquiring the tracked platform and operating it;
- checking the possibilities of securing the vehicle's operation, in terms of the availability of means of combat, consumable materials and spare parts;
- investigating the possibilities of and the time needed for repairing vehicles;
- checking the delivery lead time for spare parts;
- verifying the possibilities of upgrading vehicles in the future;
- investigating the possibilities of selling abroad the vehicles manufactured in Poland.

At present, the Polish Armed Forces use, among others, the light multi-task armoured tracked personnel carriers MT-LB, which form the basis for building special variants. The MT-LB vehicles were designed in the 1970s. They no longer meet the requirements of the contemporary battlefield and should be modernised or replaced. The poor potential of the MT-LB for upgrading prevents it from acquiring the desirable tactical and technical parameters. It results mainly from the low ballistic resistance of the hull, suspension that prevents an increase in the vehicle's combat weight (increased armour) and other equipment failing to meet the requirements of the contemporary

battlefield, e.g. armament, means of communications, firefighting systems, systems protecting against weapons of mass destruction, etc.

Therefore, there is an urgent need for developing a new generation universal modular tracked platform that will serve as a modern tracked carrier for building armoured fighting vehicles, artillery vehicles and special vehicles (for example command vehicles, reconnaissance vehicles, minelaying vehicles, engineer vehicles, recovery vehicles, ambulances, surveillance and electronic warfare vehicles and others).

One carrier (universal modular tracked platform) used to build several vehicles with different intended uses will make it possible to considerably:

- shorten the lead time for acquiring such vehicles;
- decrease the costs of acquiring these vehicles;
- reduce the number of different vehicles with a similar intended use operated by the Polish Armed Forces;
- standardise vehicles coming from one manufacturer;
- simplify the process of delivering means of combat, consumables and spare parts;
- simplify the crew training process;
- simplify the adaptation of the vehicle to combat operations under specific terrain conditions, etc.

Becoming familiar with and using the proper terminology for the naming of vehicles will facilitate the understanding of their intended use and tasks to be completed. At present, there is a tendency for devising names for vehicles that have nothing to do with their intended use.

The classification of vehicles, correct and prepared in accordance with predefined criteria, should be a very useful tool for developing an amphibious universal modular tracked platform for building vehicles with different intended uses [2]. The current classifications used in the Polish Armed Forces do not ensure a legible and logical division of vehicles with different intended uses. This leads to the situation where, for example, there are vehicles with different bodyworks on chassis with a similar load capacity, coming from different manufacturers. Such situation does not contribute to the desirable standardisation of vehicles operated by the Polish Armed Forces.

Owing to the determination of intended uses of vehicles that should be built on the basis of the amphibious universal modular tracked platform it will be possible, during the process of designing the platform, to identify the most unfavourable variant of the installation of specialist equipment. Thus, in the future, there will be no need to acquire another platform to install specialist equipment which could not be installed on the amphibious universal modular tracked platform due to, for example, its weight or volume.



The possibility of carrying out by vehicles the planned missions on the contemporary battlefield depends on their tactical and technical parameters. The achievement of desirable tactical and technical parameters by the vehicle depends in turn on:

- access to modern design solutions, required engineering materials and technologies for manufacturing parts, subassemblies, assemblies, equipment, systems and whole vehicles;
- the possibilities of purchasing the necessary equipment, systems, assemblies, subassemblies, parts and consumables in Poland or elsewhere;
- the production capacity of the Polish armament industry;
- the time available for building the vehicle;
- the funds available for acquiring the vehicle;
- the number of tasks to be performed by the vehicle.

A mistake often made while defining the operational and technical requirements for a vehicle is to specify too many tasks to be performed by such vehicle. Thus, it becomes necessary to install too many pieces of equipment and systems in the vehicle. Many pieces of equipment planned to be installed in the vehicle make it necessary to build vehicles characterised by relatively large overall dimensions and a higher load capacity of the chassis, which results in an increase in the weight of the whole vehicle. An increase in the vehicle weight translates into bigger problems with logistics.

Vehicles added to the equipment of the army are operated for many years. Some vehicles remain in operation even for 30 years. With such a long service life of vehicles the development of new equipment and systems should be taken account as well as the possibility of their installation in the vehicle subject to upgrading. Therefore, the vehicles should provide for the possibility of increasing the weight of installed equipment.

During military operations the time needed for vehicle maintenance and repair is of utmost importance as non-operational vehicles cannot be used for warfare. The time needed for vehicle maintenance and repair is influenced by the following factors:

- vehicle design;
- required level of training of vehicle crews or servicing teams;
- lead time for supplying means of combat, maintenance supplies and spare parts.

The production of vehicles by the Polish armament industry should ensure faster access to the means of combat, maintenance supplies and spare parts.

## **2. CONDITIONS INFLUENCING THE ACQUISITION OF AN INFANTRY FIGHTING VEHICLE**

At present, the Polish Armed Forces use, among others, the infantry fighting vehicles BMP-1, which were designed in the 1960s. These vehicles no longer meet the requirements of the contemporary battlefield and should be modernised or replaced. The poor potential of the BMP-1 for upgrading prevents it from acquiring the desirable tactical and technical parameters. It results mainly from the low ballistic resistance of the hull, suspension that prevents an increase in the vehicle's combat weight (in-

creased armour), inability to operate in amphibious mode should the vehicle's weight be increased and obsolete armament.

Therefore, there is an urgent need for acquiring a new infantry fighting vehicle that would meet the requirements of the contemporary battlefield and of the Polish Armed Forces.

The acquisition of a new infantry fighting vehicle meeting the requirements of the contemporary battlefield and of the Polish Armed Forces is not an easy task. Its complexity results from the necessity of taking into account numerous needs influenced by the conditions described hereinbelow. The order of the listed conditions is random and it does not reflect their value or significance.

Pursuant to the Treaty on Conventional Armed Forces in Europe [3] the term "infantry fighting vehicle" means "an armoured combat vehicle which is designed and equipped primarily to transport a combat infantry squad, which normally provides the capability for the troops to deliver fire from inside the vehicle under armoured protection, and which is armed with an integral or organic cannon of at least 20 millimetres calibre and sometimes an antitank missile launcher. Armoured infantry fighting vehicles serve as the principal weapon system of armoured infantry or mechanised infantry or motorised infantry formations and units of ground forces".

Pursuant to the Polish Standard [1] "an infantry fighting vehicle is a combat vehicle adapted to transport a combat infantry squad, which provides the capability for the troops to deliver fire from inside the vehicle, and which is armed with an integral weapon of at least 20 millimetres calibre. An infantry fighting vehicle can be equipped with an antitank missile launcher".

The standard definitions of an infantry fighting vehicle, available to the authors, do not specify, in an unambiguous and accurate manner, the most important requirements that should be met by these vehicles on the contemporary battlefield. Therefore, the design of an infantry fighting vehicle should take account of a larger number of tasks that such vehicle is supposed to perform.

The condition influencing the shape and assembly of an infantry fighting vehicle should be the theatre of operations in which it is planned to be used. The basic area of operations of infantry fighting vehicles used by the Polish Armed Forces should be the territory of Poland and Europe. This area is characterised, among others, by a complex network of rivers and channels and the presence of waterlogged areas (particularly in the spring and autumn), which makes it necessary, at least for a part of infantry fighting vehicles, to be adapted to cross water obstacles by being able to wade and swim. The adaptation of infantry fighting vehicles to crossing water obstacles, while maintaining the vehicle's required overall dimensions, limits their maximum authorised (combat) weight to about 24 ton. Infantry fighting vehicles capable of swimming can cross water obstacles quickly and covertly, in accordance with the rules of warfare on the contemporary battlefield. When there is a need to use infantry fighting vehicles in the area without a complex network of rivers, channels and waterlogged areas, e.g. on a desert, the capability to swim is of no effective use. Combat in urban areas with

the use of infantry fighting vehicles still gives rise to many controversies, because they can move only through a non-built up area (e.g. streets, squares, parks) and form an easy target that can be destroyed from a relatively close distance. It should be noted that the works on appropriate armament and equipment for combat in urban areas are still in progress (e.g. sets of equipment for urban combat, USK – Urban Survivability Kit).

The adaptation of infantry fighting vehicles to crossing water obstacles by wading or swimming, taking account of the overall dimensions of existing vehicles with a similar intended use, limits their total (combat) weight to about 24 ton. After taking account of the weight of a driving engine and its systems (e.g. air and fuel supply systems and cooling, lubrication, exhaust and electrical systems, etc.), power transmission system, tracked driveline system, armament and specialist equipment, the remaining portion of the vehicle weight is available for designing a hull with the required parameters of ballistic protection.

New infantry fighting vehicles should be equipped with the state-of-the-art means of protection and self-defence by the use (mounting on the vehicle), in different variants, of:

- openwork screens made of metal bars (the so-called grills) protecting from shaped charges fired from RPG;
- the latest generation of reactive armour modules;
- special multilayer structures (composite materials: ceramic – multi-layer armour, spall liner);
- active vehicle protection systems;
- appropriately selected special reinforcement of the bottom of the vehicle.

The main and ancillary armament of an infantry fighting vehicle should be adapted to ammunition supply used in the majority of the NATO member states. At present, the most popular ammunition used in infantry fighting vehicles includes the following: 30 x 173 mm, 12.7 x 99 mm and 7.62 x 51 mm. Armament, the main one in particular, should guarantee a high probability of hitting with one projectile in various combat situations, e.g. a moving target at a distance of at least 1,500 m, a vehicle moving on hard-paved surface and non-paved surface, during the day and at night, and under limited visibility conditions.

The requirements set by the contemporary battlefield generate a need for dynamic military operations, which can be fulfilled by infantry fighting vehicles owing to their:

- dynamic properties, described, for example, by a unit power factor, maximum speed, time to achieve a specific speed;
- capability to cover artificial obstacles and natural terrain barriers.

Infantry fighting vehicles should be able to transport at least three members of the vehicle crew and six soldiers (it would be desirable to transport eight soldiers).

The most important conditions influencing the design of an infantry fighting vehicle, presented hereinabove, do not form an exhaustive list as, depending on the user's requirements, they may be subject to change or new conditions can be formulated.



### 3. CONDITIONS INFLUENCING THE ACQUISITION OF ARTILLERY PRIME-MOVERS AND SPECIAL VEHICLES

Polish Standard PN-V-01002 [1] classifies armoured equipment into such groups as tanks, armoured fighting vehicles, artillery prime movers, special vehicles and other armoured vehicles. Armoured personnel carriers and infantry fighting vehicles, belonging to the group of armoured fighting vehicles, and the whole groups including artillery prime movers and special vehicles can be built on the basis of one carrier (amphibious universal modular tracked platform). The condition for adopting the above-mentioned concept of building vehicles with different intended uses on one carrier is as follows:

- the weight of installed systems and equipment may not exceed the load capacity of the carrier;
- the volume of systems and equipment installed inside and outside the carrier may not interfere with the clearance gauge applicable to air, road, rail and sea transport, if the technical requirements for the vehicle provide for such restriction.

On the assumption that vehicles should be capable of swimming their total (combat) weight should not be higher than about 24 ton. A part of this weight is attributed to the carrier (amphibious universal modular tracked platform) and the remaining portion of the weight is added by the installation of special equipment and the crew. If the weight of the carrier does not exceed 18 ton, the weight of special equipment and the crew may reach about 6 ton.

Apart from providing an appropriate carrier, another condition for building various artillery prime movers is to define which artillery systems are needed and which tactical and technical parameters should be fulfilled by them. Such parameters should not prevent the system from being installed on the carrier. When the needs for artillery prime movers in the Polish Armed Forces have been identified, it is necessary to consider:

- the installation of artillery systems already operated by the Polish Armed Forces (meeting the requirements of the contemporary battlefield or having a large stock of means of combat) on the amphibious universal modular tracked platform, to ensure a standardised modern carrier;
- the acquisition of new artillery systems (meeting the requirements of the contemporary battlefield), including the possibility of producing means of combat in Poland.

The condition for building special vehicles, such as, for example, command vehicles, reconnaissance vehicles, artillery prime movers, minelaying vehicles, mine clearance vehicles, engineer vehicles, bridges, recovery vehicles and ambulances, is to provide the possibility of mounting different types of special equipment on one carrier.

The utilisation of one carrier to build recovery vehicles and vehicles with different intended uses (e.g. infantry fighting vehicles, artillery prime movers) should ensure the proper process of evacuating damaged vehicles and the standardisation of vehicles in the Polish Armed Forces.

Since the various artillery systems (with a cannon, howitzer, cannon-howitzer, mortar, missile launcher) currently used by the Polish Armed Forces or the special equipment designed to build vehicles with a specific intended use do not exceed, together with the crew, the weight of 6 ton, the concept of building different vehicles on one carrier, presented hereinabove, is feasible.

## CONCLUSIONS

Summarising the issues discussed in the article, it should be noted that:

1. The diversity of vehicles operated by the Polish Armed Forces leads to significant logistics and operational problems;
2. There is a need for standardisation of vehicles in the Polish Armed Forces;
3. Using one carrier for building vehicles with different intended uses should lead to the standardisation of vehicles operated by the Polish Armed Forces;
4. It is possible to build different vehicles on one carrier (amphibious universal modular tracked platform);
5. To build different vehicles on one carrier it is necessary to adopt a certain philosophy for building vehicles in the Polish Armed Forces.

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## BIOGRAPHICAL NOTE

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