

TRANSFORMATION OF THE T-72 MAIN BATTLE TANKS

Monika Kurpas
Marian Holota

Ośrodek Badawczo-Rozwojowy „OBRUM” Sp. z o.o.
Toszecka Street 102; 44-117 Gliwice, Poland
tel.: +48 32 30 19 430
e-mail: mkurpas@obrum.gliwice.pl

Abstract

The paper presents a proposal to transformation, in the direction of modernization and modification or conversion, decommissioned weapons to be reused in different versions of engineering vehicles. The process is illustrated with the example of the T-72 tank. The solutions presented in this paper describe the possibilities of constructing new tracked vehicles of various use at relatively low cost. Reusing of the vehicle can be also the most economical way to extend the product lifecycle of special purpose. Conversion of armoured equipment into products for other purposes may constitute a new stage in the product lifecycle that precedes the disposal phase. Initial conceptual work carried out at OBRUM Ltd. confirms the feasibility of a quick conversion of the T-72 tank into engineering vehicles in few versions, recovery vehicle with extended basic equipment with a view for further development.

The proposed methodology may be used as a commercial offer of the Ośrodek Badawczo Rozwojowy Urządzeń Mechanicznych “OBRUM” sp. z o.o. (Research and Development Centre Mechanical Equipment “OBRUM” Ltd.) and Polka Grupa Zbrojeniowa (Polish Armaments Group) (PGZ) (in the form of know-how (upgrade packages) or deliveries of complete vehicles different designation particularly to countries that have T-72 tanks in service.

Keywords: *tank transformation, engineering equipment, main battle tank, base chassis, functional characteristics of a converted product*

1. Introduction

Modernization, modification or conversion of the decommissioned current technical equipment, especially weapons, is the most economical product lifecycle extension special purpose. The countries with high manufacturing potential and scientific research are using with this possibilities very often.

Transformation process is administered tanks that are currently fully technically efficient but do not meet modern battlefield requirements because of obsolete weapons, or lack of fire control systems, or poor armour, etc... After the reconstruction process, vehicles can serve as a second-line cars that meet the requirements of a technical or engineering protection of the battlefield, the logistics cars (sanitary, ammunition carriers,..).

2. Examples of tank transformation

Transformation of armament and military equipment is an idea that has been known for a long time. Canadians were pioneers in this area. In Normandy, they used redesigned RAM medium tanks (a Canadian modification of the American M3 Lee tank) as ammunition carriers, mobile observation posts and, primarily, as KANGAROO armoured personnel carriers taking up to 11 combat-equipped soldiers. Several hundred of these were manufactured. The chassis of the PRIEST self-propelled howitzer was also adapted to serve similar purpose [1] (Fig. 1).



Fig. 1. M4A1-based medical evacuation vehicle

The idea of creating a heavy armoured carrier based on a tank came up after the Yom Kippur War of 1973, when the surprised Israeli Defence Forces suffered severe losses. The Israelis had in service M113 armoured carriers, which earned the nickname of "mobile crematoriums". This term can be considered accurate, because the crew of such vehicle struck with a shaped charge missile often burned alive. As reactive armour could not be used, the problem was addressed using more provisional methods. Before "the Peace for Galilee" operation, the M113 carriers were modernized.

Another vehicle based on captured tanks was the Israeli armoured personnel carrier "Achzarit" ("cruel"). The core of the vehicle was the Soviet-built T-54/55 tank, many of which (ca. 500) were "acquired" during the Six-Day War in 1967 and conflicts in 1973 and 1982. Many of these tanks were rearmed with 105 mm guns. However, since the 1980s these vehicles did not meet the requirements of modern battlefield and were retired. Conceptual work on the "Achzarit" armoured personnel carrier was launched in the early 1980s, and the first prototype left the repair facility in 1987. Mass production based on the T-54/55 tank chassis (with replaced power train) started in 1988, and the first military unit to be provided with these carriers was the elite infantry brigade "GOLANI" [1] (Fig. 2).

The Russian Tank Support Fighting Vehicle BMPT (Russian: Boyevaya mashina podderzhki tankov – unofficial name "Terminator") is based on the T-72 MBT [2] (Fig. 3). It was designed to cooperate with infantry and special/armoured troops, mainly for combat in urban and hilly areas, based on combat experience gained in Chechnya.



Fig. 2. ACHZARIT APC based on T-55 chassis



Fig. 3. BMPT – Russian heavy fighting support vehicle based on T-72 MBT chassis

In Poland too, in the early 1990s, vehicles offering completely new functions and designed for new purposes were created on basis of vehicles decommissioned in the PAF. One example of such a vehicle, developed at OBRUM and based on the T-55 tank chassis, is a tractor used in coal mining for levelling mining waste heaps (Fig. 4).



Fig. 4. ATS tractor based on T-55 tank chassis

The problem of using the T-72 chassis in new vehicle designs, including those fitted with an articulated or telescope JIB was the subject of development projects undertaken by OBRUM's research and engineering staff [3].

Further, on in this paper we present the possibilities of using subassemblies of decommissioned T-72 tanks, especially the chassis, to build recovery and engineering vehicles with the intention to sell them as support and maintenance vehicles for armoured and motorized units to countries that have T-72 (T-90, T-90S, M-84) tanks in service.

Another possible area of using recovery and engineering vehicles are sites destroyed by conventional arms, zones of natural and environmental disasters, including radiation-contaminated land. The solution is then dedicated to services, including national crisis response services.

T-72 tanks are in service in many countries. The USSR granted licence for the manufacture of the T-72 to several countries, among them Poland, Czechoslovakia, Yugoslavia and India. As a consequence of this about a total of 20 thousand such vehicles have been built since the mid-1990s, many of them still in service in the armies of various nations; for instance: the Russian Army had 1.200 vehicles in active service and 8.000 retired vehicles, Bulgaria – 430, Czech Republic – 543, Slovakia – 272, Ukraine – 2.200, Belarus – 1.200, India – 1.700, Syria – 1.500, Kazakhstan – 600, Turkmenistan – 500. Apart from the countries listed above the following nations have this type of tank in its service: Algeria, Libya and Egypt.

The described tasks will enable the reuse of selected, approved subassemblies and assemblies of the T-72 chassis in subsequent years. Many of the design solutions applied in the T-72 tank, despite the passage of time, remain attractive, and are characterized by high durability and logistical availability. The number of T-72/PT-91 tanks to be decommissioned in Poland is about 540, and the reconstruction thereof into vehicles serving other purposes seems to be the most efficient way of utilizing them.

3. Determine the possibility of transformation of the T-72 tank

Initial conceptual work carried out at OBRUM confirms the feasibility of a quick transformation of the T-72 tank into engineering vehicles of the following versions: basic, engineering tank (two variants), recovery vehicle with extended basic equipment with a view for further development.

- **Basic version.** This design corresponds to recovery vehicles WZT-3 in a configuration based on the T-72 body.

The attachments in this vehicle version include:

- a crane with an articulated JIB located on the right-hand sponson of the hull with a minimum lifting capacity of 20 kN, proportional control using a CAN network,
- earth moving attachments mounted onto hitch couplers (maintenance-free couplers and mechanical/hydraulic/electric sockets) located on the front plate, enabling discarding

damaged implements by the driver without the need to open hatches, even under the conditions of growing threat (e.g. in an area of increasing contamination from NBC weapons or damaged nuclear reactor systems),

- hydraulically driven main and auxiliary winches provided with proportional control system, also operable from outside the vehicle,
- other systems for rescue, recovery and maintenance operations.

The weight of the vehicle formed by conversion, and corresponding to WZT-3 in terms of equipment, is increased by about 700 kg in relation to the standard version of the WZT-3.

- **Typical engineering tank version [5] [6].** The design of this tank corresponds to that of MID Engineering Tank of which 13 were manufactured by OBRUM, and three of which are in service in the AF of the Monarchy of Malaysia.
- **Modified version of typical engineering tank.** This design corresponds to the Recovery Vehicle shown in Fig. 5 with the following main features:
 - articulated JIB for operating an excavator scoop, grabber jaw, ripper tooth [4],
 - vision systems installed on a JIB (with thermovision recording capability) with image transmitted to decision-making stations.
- **Extended version.** This version corresponds to recovery vehicles WZT-4 manufactured by ZM “Bumar-Łabędy” S.A. for AF of the Monarchy of Malaysia. Estimated weight increase in relation to standard WZT-4 vehicle is about 700 kg.
- **New proposal developed by OBRUM Ltd.** The proposed new configurable version that combines the recovery and engineering support features (Fig. 6) is a proprietary design developed by OBRUM [4, 7].

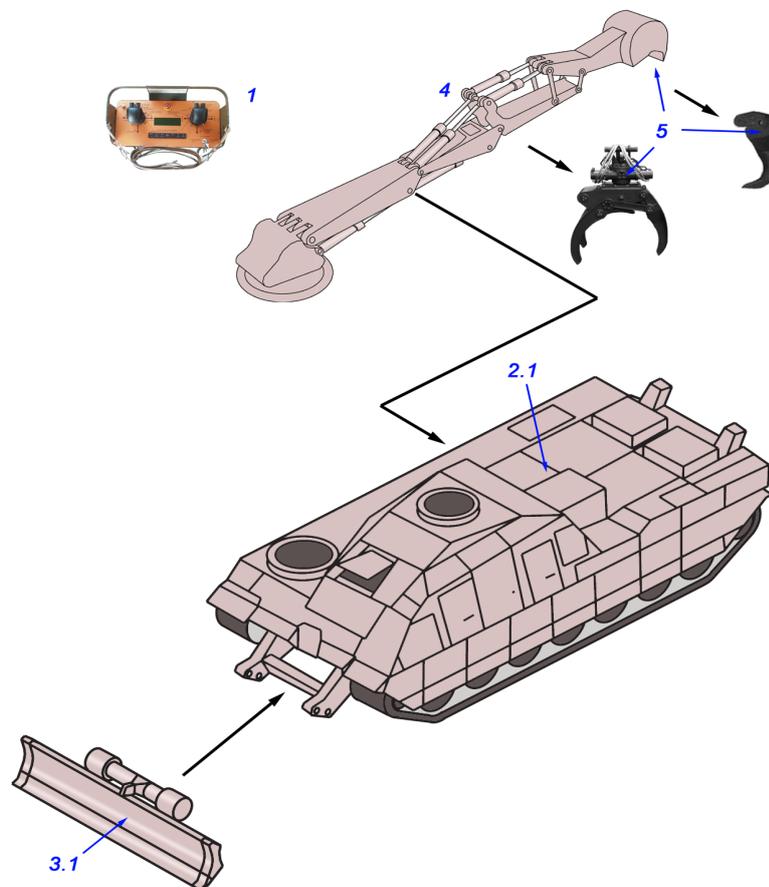


Fig. 5. Concept of a recovery vehicle based on T-72 tank 1. Electric control of hydraulic system; 2.1. Hydraulic system; 3.1. Front casting dozer, 4. JIB assembly, 5. JIB attachments: excavator scoop, grabber jaw

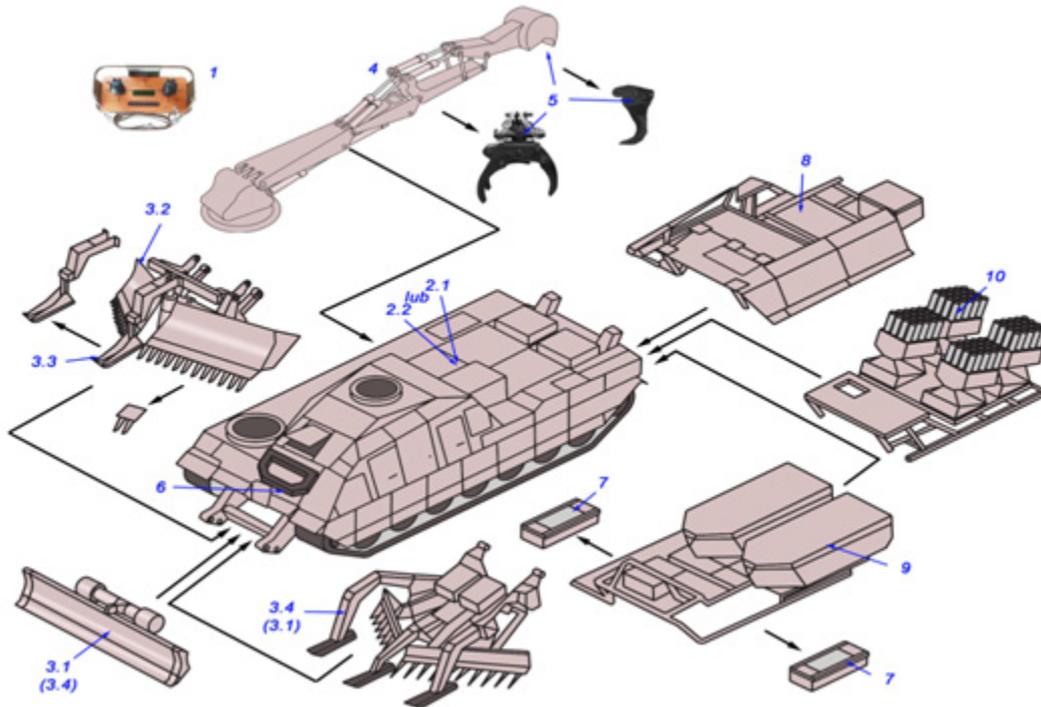


Fig. 6. Fully equipped Recovery and Engineering Vehicle: 1. Electric control of hydraulic system; 2.1. Hydraulic system modification unit – option I; 2.2. Hydraulic system modification unit - options II – V; 3.1. Front casting dozer with extended cutting width; 3.2. Front casting and V arrangement dozer; 3.3. Front casting and V arrangement dozer with mine clearing teeth; 3.4. Full Width Mine Plough (FWMP); 4. JIB assembly; 5. JIB attachments: excavator scoop, grabber jaw, ripper tooth. 6. Electromagnetic minesweeper; 7. Cleared path marking device; 8. Exchangeable engineering equipment module; 9. Exchangeable module with mine-clearing line charges; 10. Exchangeable module with mine throwers

4. Performance specifications of WZT JIB manipulator

The operating ranges of attachments installed on the JIB (excavator scoop, grabber jaw, ripper tooth, drill rig, etc.) determined in preliminary geometrical analyses are shown in Figs. 7-9.

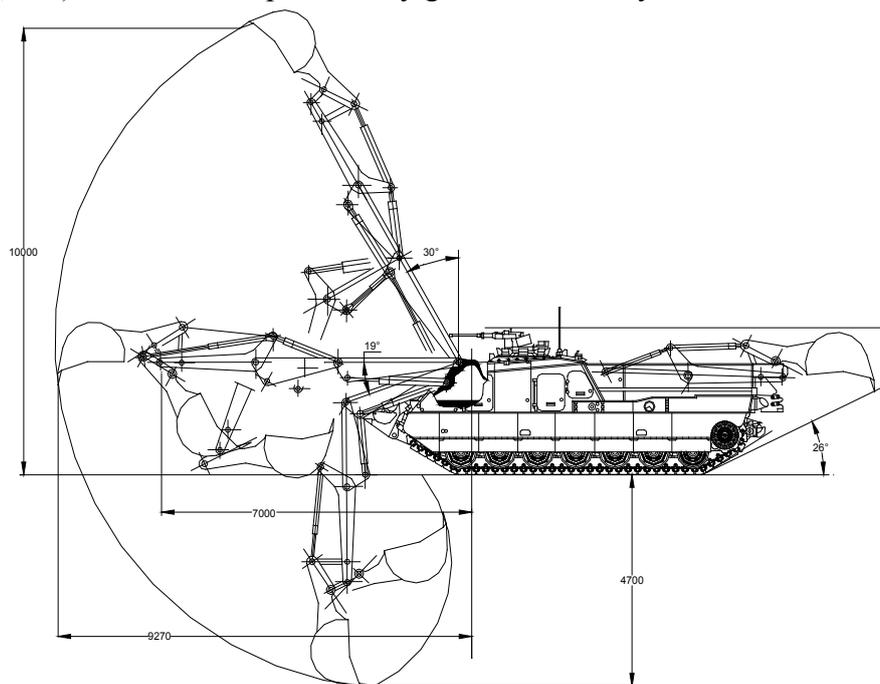


Fig. 7. Operating range of JIB manipulator. Excavating depth and lifting height – in front of vehicle

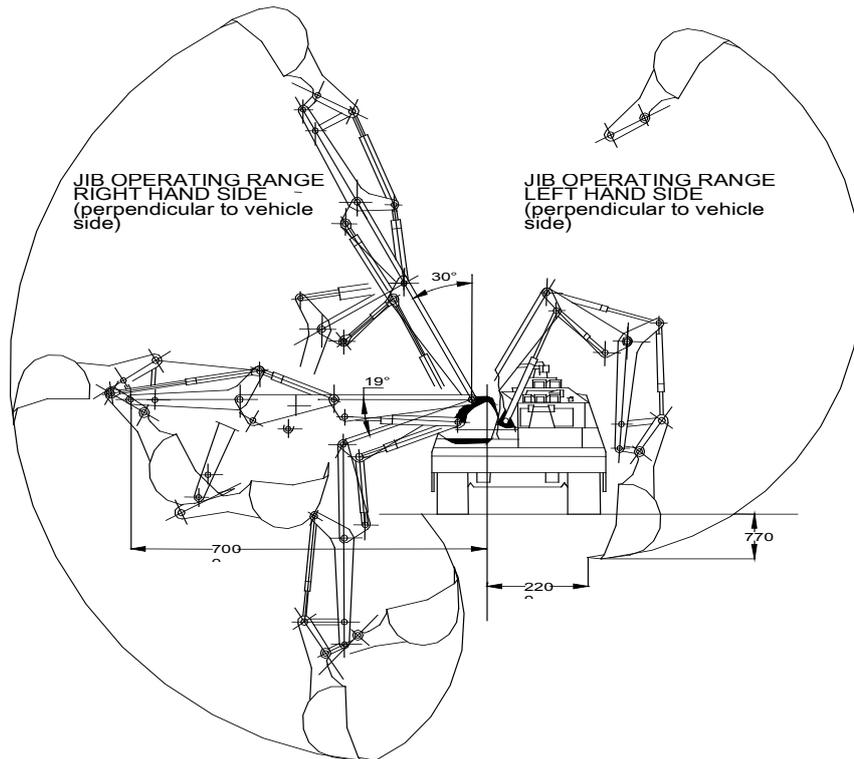


Fig. 8. Operating range of JIB manipulator. Excavating depth and lifting height – perpendicular to vehicle body side

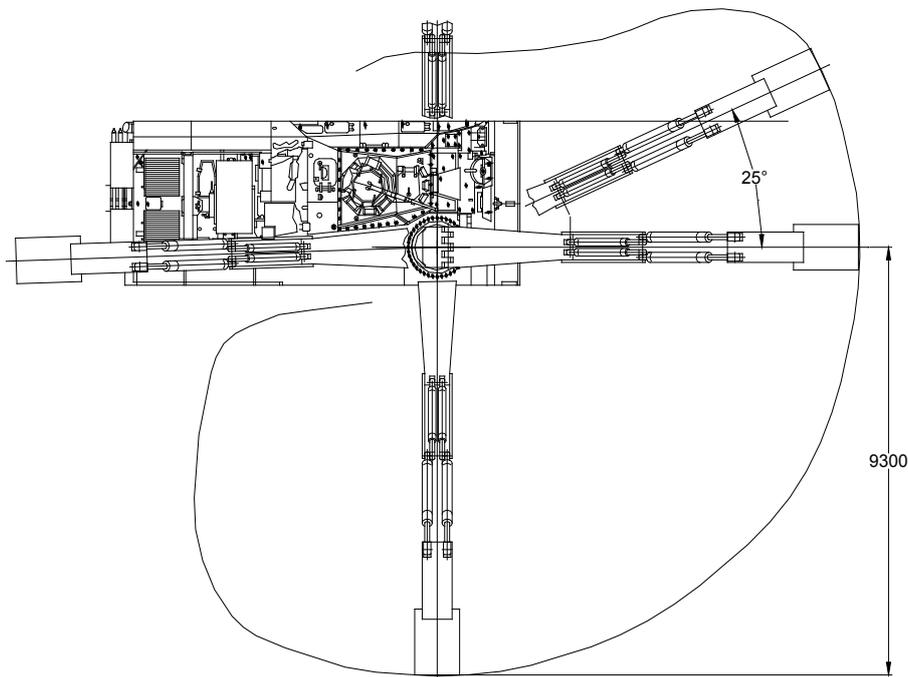


Fig. 9. Operating range of JIB manipulator in horizontal plane

The assumed performance specifications attained after conversion, such as:

- load lifting height (excavated material in excavator scoop or load in grabber jaw),
- maximum scoop discharge elevation,
- excavating depth (JIB lowering),
- JIB side rotation range,

are comparable to those of traditional excavators of non-military use [3].

5. Applications of the recovery and engineering vehicle

Possible applications of R&EV are closely related to the assumed application and depend on the details of the contract, setup or purpose. R&EV may be used for:

- field repairs of tanks, mainly of the T-72 class and derived vehicles, within the scope covered by the maintenance and repair kit (called ZOR in WZT-3/4 vehicles),
- clearing paths in minefields using equipment installed in front (innovation in quickly replaceable attachments and the ability to automatically “dump” the attachment in the event of damage, or the need to escape) – interchangeable excavation and rotor sweeping gear, and a set of line charge launchers, with automatic cleared path markers, with indication on maps via the BMS system,
- recovery of immobilized tanks and vehicles by means of winches and towing bar, including fire extinguishing and first medical aid,
- high capacity crane operations, e.g. for removal of turret, gun, suspension components, main engine, etc. under field conditions,
- crossing enabling tasks, including exit and entrance driveways, using exchangeable front-mounted attachments on quick action couplings,
- earthwork fortification works - construction/destruction tasks using excavator scoop mounted on the JIB (excavation depth same as in MID – ca. 5 m),
- allocation of hazardous materials in grabber jaw mounted on the JIB,
- removing the effects of conventional weapons in technical rescue and zones of natural and environmental disasters,
- flame (electric) cutting and welding.

6. Innovativeness of solutions

The transformation of the T-72 tank to a recovery and engineering vehicle structural form presented in this paper includes an innovative method of utilizing decommissioned equipment by providing it with new technical and operating features and systemic approaches to the problems of crew and vehicle survivability in future operations area, as well as design and process solutions. The following items should be mentioned here:

- solutions aimed to improve crew survivability,
- new special steel cutting and welding processes,
- new design of attachments for special purpose machines,
- diversity of systems supplied from one source and control using CAN network,
- methodology of design work aimed at attaining optimum functional features in the process of converting decommissioned equipment.

The concept of converting the T-72 tank is a new project, not undertaken yet by any other research and development unit in the country. Project implementation by OBRUM is feasible upon acquiring T-72 by way of purchase or lease after concluding appropriate agreements with the vehicle provider.

Until now, the main activities of research staff at OBRUM were focused on developing new products in a complete R&D cycle, with the new product adapted to customer requirements. This approach was extended by the provisions included in the decision of the National Defence Minister of 22 March 2013 on acquiring armaments and military equipment for the Polish Armed Forces, these provisions indicating the need to take into consideration the utilization or conversion of decommissioned equipment in the “Product Lifecycle”.

The conversion formulated here is some kind of proposal for extending the scope of T-72 modernization tasks performed earlier at OBRUM by indicating the possibilities of utilization. This

is an alternative for the product disposal process and seems to be an efficient way of utilizing decommissioned armoured vehicles.

The proposed method of converting decommissioned T-72 tank base into engineering, recovery, transportation, etc. vehicles, may constitute a commercial offer of the Polka Grupa Zbrojeniowa (Polish Armaments Group) (PGZ) in the form of know-how (upgrade packages) or deliveries of complete vehicles of various use, particularly to countries that have T-72 tanks in service. Moreover, this action will contribute to the strengthening of the market position of both the developer and the manufacturer.

7. Conclusions

The historical analyses of the development of the conversion process of engineering equipment products and OBRUM's current achievements in this area of science and research allows us to formulate the following conclusions:

- Transformation of armoured equipment into products for other purposes may constitute a new stage in the product lifecycle that precedes the disposal phase.
- The proposed conversion of T-72 tanks to be decommissioned by the Polish Armed Forces, based on technical analyses, is an example of the possibilities of extending product life. This may also be applicable to other vehicles, e.g. WZT-2, BWP-1, etc.
- Transformation of military equipment on the one hand will enable the Polish Army to acquire equipment that is competitive in financial terms and at the same time adapted to the conditions of the modern battlefield.
- Change of the functions of decommissioned equipment brings about economic benefits and is a process effected by leading states of the world, mainly those of high economic status, which is confirmed by examples presented in the paper.
- The presented transformation of the T-72 tank to a recovery and engineering vehicle structural form under development at OBRUM constitutes a plausible project that can significantly expand the scope of future R&D activities of the research facilities of the Polish defence industry.

References

- [1] <http://www.militarium.net/viewart.php?aid=313>.18.03.2014.
- [2] polish.ruvr.ru/.../W_Rosji-zostanie-zaprezentowany-woz-bojowy, 27.03.2014.
- [3] Zajler, W., Grabania, M., *Osprzęt inżynieryjny na podwoziu T-72*. Szybkobieżne Pojazdy Gąsienicowe, (22) no. 1, pp. 55-60. OBRUM Sp. z o.o., Gliwice. ISSN 0860-8369, 2007.
- [4] Holota, M., Zajler, W., Żuk, T., *Określenie możliwości zwiększenia zbioru zadań wykonywanych przez wojska inżynieryjne przy użyciu MID*. Szybkobieżne Pojazdy Gąsienicowe, no. 13, pp.19-34, OBRUM Sp. z o.o., Gliwice. ISSN 0860-8369, 2000.
- [5] Knapczyk, H., Zajler, W., Holota, M., *Maszyna inżynieryjno-drogowa MID*. Szybkobieżne Pojazdy Gąsienicowe, no. 4, pp. 39-46. OBRUM Sp. z o.o., Gliwice. 1993.
- [6] Szafraniec, A., Holota, M., *Osiągnięcia OBRUM Sp. z o.o. jako jednostki badawczo-rozwojowej w zakresie sprzętu inżynieryjnego*. SPG (24) pp. 17-28. OBRUM Sp. Z o.o., Gliwice. ISSN 0860-8369, 2009.
- [7] Holota, M., Tybińkowski, D., *Współczesne zapory minowe oraz koncepcja i struktura konstrukcyjno-funkcjonalna bezzałogowego pojazdu torującego*. Szybkobieżne Pojazdy Gąsienicowe (21) no. 1, pp. 75-86. OBRUM sp. z o.o., Gliwice. ISSN 0860-8369, 2005.
- [8] Design documentation of WZT -4, MID- M : OBRUM files, unpublished
- [9] Supplementary documentation of WZT-4, MID-M (technical description, instruction manual; OBRUM files - unpublished.