MILITARY ENGINEERING EQUIPMENT DEVELOPED AT OBRUM

Abstract. During the 50 years of OBRUM's functioning in the defence industry the company has completed a number of projects pertaining to modern products for the engineering troops. This article presents the major products based on tracked chassis developed by OBRUM's research and technical staff. Clearly defined needs and good cooperation with the engineering troops have brought about launching of products based on modern technological solutions. OBRUM's specialization in the field of engineering equipment resulted from the need to use the available chassis and to ensure compatibility between the vehicles manufactured in the country. In the products developed use was made of chassis of tanks T-54, T-55, T-72 and PT-91. The machines developed and introduced into production included tractors, minelaying vehicles, recovery vehicles and engineer tank.

Keywords: engineering troops, engineering equipment, tracked vehicle, tracked tractor, minelaying vehicle, engineer tank, recovery vehicle.

1. INTRODUCTION

It would be difficult to find a company similar to OBRUM Research and Development Centre of Mechanical Appliances with so many scientific and product launching achievements.

OBRUM's history dates back to 1968 when an Experimental Production Plant (ZPD) was established at the Łabędy Mechanical Works. Today, it is a research and development unit cooperating with many technical universities, military and civilian institutes, as well as other research and development centres, and in Poland it is a leader in the field of design, research and development of armoured armaments and engineering equipment.

OBRUM's portfolio includes construction and mining machinery, heavy armoured and engineering equipment, wheeled platforms for radar stations, and trainer devices and simulators. During OBRUM's presence in the market, the completed projects and implemented results of research and development work were often transformed into key products for the Polish Armed Forces, as well as for the armies of several Middle East countries, India and Malaysia.

Fifty years of OBRUM's activities have translated into several dozens of implemented research and development projects. Among them, of high importance were products: engineering vehicles based on heavy armoured vehicles on tracked chassis.

2. RECOVERY TRACTOR B-70 (WZT-1)

The first task faced by the newly formed and yet not fully integrated ZPD was the design of recovery tractor B-70 (WZT-1) – Fig. 1.

The design was based on Soviet licensed documentation of an unarmed tractor based on T-54 tank components. OBRUM's task was to base the design on the components of the T-55 tank, which was then already manufactured at the Łabędy Mechanical Works, as well as to equip the product, even to a minimum extent, for engineering works.
Fig. 1. Recovery tractor B-70

The B-70 was designed to recover damaged vehicles from the battlefield and to carry out minor repairs. It was therefore equipped with:
- rope winch with a capacity of 25 kN and usable rope length of 200 m;
- an anchor enabling full use of the winch;
- drawbar for towing tracked vehicles with damaged steering mechanism;
- load-carrying body for transporting spare parts;
- manually operated crane with a capacity of 15,000 kg.

The manufacture of B-70 was launched in the Łabędy Mechanical Works with the intention to equip the Polish Army units.

2. TRACKED TRACTOR MTS 306

OBRUM acquired 306 tractor design documentation that was at the pre-prototype stage. OBRUM design engineers have made a number of modifications and additions. OBRUM's contribution was so far-extending that the licensor proposed to establish a joint design office in order to refine the construction documentation.

Fig. 2. MTS-306 tractor

The result of the cooperation was the first Polish vehicle with hydromechanical transmission, hydrostatic steering mechanism and track links with pressed-in metal-rubber bushings (silent
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block type) for absorbing vibrations during track contact with ground and wheels. Changes in
the design were implemented in subsequent versions of the vehicle.

Series production was launched in the FABLOK Construction Machines and
Locomotive Plant in Chrzanów. Due to the interruption of negotiations on the export of the
tractor to the USSR, production was abandoned. A trial lot of 18 tractors was manufactured
and these went into service in the Polish Army.

3. KALINA SELF-PROPELLED MINELAYER

The 306 tractor licence purchased by OBRUM was used to develop a new product: a
self-propelled minelayer (SUM KALINA), shown in Fig. 3.

![Self-propelled minelayer](image)

**Fig. 3. Self-propelled minelayer**

**SUM „KALINA”** - a self-propelled minelayer. It was one of the subjects of
collaboration with the German Democratic Republic (GDR). Based on the "306" product
units, a vehicle was constructed for laying mines on ground and in water to a depth of 0.9 m.
The minefield plan was saved on the on-board computer, and minelaying was monitored by
means of a television camera being a part of the minelayer equipment. Minelaying could be
effected using either the open or the concealed method.

Within the framework of collaboration:
- the Polish party developed the basic vehicle;
- the German party developed the minelaying device with control over mine spacing,
  tracking of minefield setting quality and correctness.

After the reunification of Germany, OBRUM carried on the design of the vehicle on
its own. One of the innovative solutions devised was an automatic mine laying system built
on a programmable controller. Several of the vehicles developed, KALINA, which included
components of Polish design, went into service with the Polish Armed Forces.
4. RECOVERY VEHICLES

One of the tracked vehicles important in the battlefield is the recovery vehicle provided with a set of tools enabling repairs in the battlefield, and above all enabling towing/moving a disabled tank into a safe zone, where it is possible to carry out the necessary, more complex repairs.

4.1. Recovery vehicle B-71 (WZT-2)

The B-71 (WZT-2) (Fig. 4) was a modern construction in the 1970s. It was a recovery vehicle developed by OBRUM based on the T-55A tank.

Fig. 4. Recovery vehicle B-71 (WZT-2)

WZT-2 was equipped with a hydraulic crane with lifting capacity of 10,000 kg, and with a winch with pulling force of 25 kN, and with earth-moving dozer blades, and a set of tools, instruments and equipment for repair works. Its performance and features placed this recovery vehicle among the best in the world. Its manufacture was launched in the BUMAR-ŁABĘDY Mechanical Works. For many years the 71 product (WZT-2) was profitably exported to Middle East countries and India.

4.2. Recovery vehicle WZT-3

At the time when the BUMAR-ŁABĘDY Mechanical Works manufactured the T-72 tank under a licence, in the late 1980s OBRUM designed a new recovery vehicle - the WZT-3 (Fig. 5).

That vehicle was equipped with a hydraulic crane with lifting capacity of 15,000 kg, with a winch with pulling force of 25 kN, and with an earth-moving dozer blade, and a wide range of tools for:
- repairing armoured steel structures using welding equipment and a set of spare units and parts;
- taking part in combat vehicle maintenance;
- providing first aid to combat vehicle crew members and evacuation of wounded from the battlefield;
- maintaining two-way communication between vehicles by means of two radio stations installed in the vehicle.
4.3. WZT-4 recovery vehicle

On the basis of the PT-91M tank developed and implemented for production at the beginning of the 21st century, another, advanced design of the WZT-4 recovery vehicle was created, based on the solutions of the PT-91M tank and the MID body. The vehicle is provided with special equipment that enables:

− recovery of tracked vehicles from the battlefield;
− pulling out tracked vehicles stuck in various terrain conditions using hydraulic winch with a pulling force of 30,000 kg;
− towing of damaged tracked armoured vehicles, performing earthworks using a dozer blade (preparation of excavations, battle stations for tanks, crossings in antitank embankments, backfilling of craters, etc.), assembly and dismantling works using a crane with a lifting capacity of 20,000 kg.

The vehicle is shown in Fig. 6.
5. COMBAT ENGINEER TANKS

The potential threat of a military conflict during the Cold War did not exclude the use of weapons of mass destruction. From the early 1960s the Polish Army showed an increasing interest in heavy, tracked engineering vehicles that could operate in radioactively contaminated areas.

5.1. B-72 KLON combat engineer tank

The B-72 KLON (maple) (Fig. 7) combat engineer tank was designed to cooperate with armoured troop units. The basic tasks of these units were to include: clearing passages in areas of mass damage and obstructions after nuclear strikes, clearing passages across minefields, evacuation of damaged equipment, earthworks, such as building shelters and concealed sites, entrenching vehicles and equipment, carrying out rescue operations. Due to the fact that most of the work was to be carried out in a radioactively contaminated area, it had to be carried out without leaving the vehicle. This was to be solved by appropriate design solutions - remote control of working attachments and systems of work area observation.

![Fig. 7. KLON combat engineer tank](image)

5.2. MID engineering and road vehicle

The successor of the KLON engineer tank of the 1960s and 1970s was the MID engineering and road vehicle (Fig. 8). The vehicle is able to operate virtually in all areas of direct and indirect enemy contact in a variety of terrain and weather conditions, under conditions of environmental contamination with nuclear and chemical weapons, in areas of mass destruction resulting from the use of nuclear and conventional weapons.

MID is designed to carry out tasks related to supporting combat operations, mainly those of engineering troops, and in particular: supporting the movement of troops, earthworks (including crossings), rescue and evacuation operations, constructing earthen barriers (bulldozer with variable blade setting angle), pulling out and towing damaged combat vehicles.

A jib with a lifting capacity of 7,000 kg enables carrying out complex load handling operations, while interchangeably mounted implements, scoop with a capacity of 0.96 m³ and grabber jaw, enable carrying out various earthworks.
6. SELF-PROPELLED BRIDGES

Support bridges and assault bridges on tank (tracked) chassis complement the special vehicles used by engineering troops (tractors, recovery vehicles, engineer tanks).

6.1. B-75 (BLG-67P) assault bridge

In the years 1972-1974 OBRUM and the Military Institute of Engineer Technology and partners from the German Democratic Republic (GDR) developed a support bridge, the B-75 (BLG-67P) (Fig. 9), which was based on the German project BLG-67, and the carrier being the modified chassis of the T-55A tank.

The tank-launched bridge Laur was to comprise: base vehicle based on a T-72M1 tank chassis, three-part bridge span of the treadway type, launched in a telescopic or scissors-like manner, mechanisms for unfolding, launching and retracting the span, hydraulic control and emergency hydraulic system. The bridge span length, upon launching, was to be 25 m, and in folded position - 10 m. The bridge load capacity was to be 50,000 kg. The maximum width of a water obstacle negotiable by the bridge was to be 24 m.
6.2. BLG-67M2 (BLG-68) tank-launched bridge

At the time when the LAUR project was carried out, OBRUM was working, together with the Military Engineering Works (WZI) in Deblin, on the design of another tank-launched bridge.

The BLG-67M2 (BLG-68) tank-launched bridge is designed to negotiate terrain obstacles: rivers, streams, canals, crevices, antitank ditches, explosion craters, embankments:
- up to 19 m wide using 1 span (load capacity – max. 50,000 kg);
- up to 36 m wide using 2 spans (load capacity – max. 40,000 kg);
- up to 52 m wide using 3 spans (load capacity – max. 40,000 kg).

The carrier vehicle for the bridge span is an adapted chassis of a tank, e.g. T-55 (without the turret and weapons). Fig. 10 shows the bridge during span launching.

![Fig. 10. BLG-68 bridge](image)

6.3. PMC-90 assault bridge

In the mid 1990s a new assault bridge was designed, the PMC-90 (Fig. 11). The bridge was designed to replace the phased out BLG-68 bridges, and the carrier vehicle was the chassis of the PT-91 tank.

The span of the PMC-90 bridge is folded in a scissors manner with relation to the transverse axis halfway along its length. The span is moved from the carrier vehicle over an obstacle and from the obstacle to the carrier vehicle by means of a lever mechanism, a manipulator actuated by a set of hydraulic cylinders. The design of the span allows its folding (lifting) towards either of its ends, i.e. after crossing an obstacle, it can be set again on the carrier chassis and used/launched over another obstacle.

![Fig. 11. PMC-90 tank launched-bridge](image)
6.4. PMC-LEGUAN assault bridge

Another bridge design was the PMC-LEGUAN (Fig. 12). Its design was based on PT-91M tank chassis version developed for the Malaysian army in cooperation with the German company MAN.

Horizontally slid spans reduce to a minimum the space needed for launching, and thus minimize the possibility of spotting the bridge launching process from a long distance. The bridge launching cycle can be carried out in automatic, semi-automatic or manual mode, under the control of a microprocessor system, with a control panel operated by an operator. Bridge launching takes about 5 minutes. The bridge spans are 26 m long and their load capacity corresponds to class MLC 60 (54.75 t).

6.5. MG-20 assault bridge

The MG-20 bridge (Fig. 13) is the latest solely Polish design produced by OBRUM's engineers and scientists. The MG-20 is a mobile bridge set on a tracked chassis compatible with the PT-91 tank chassis, capable of rapid negotiation of natural and artificial terrain obstacles up to 20 m wide, with a load class 70/110 MLC (up to 86,000 kg).

The developed bridge carried on a tracked chassis is a modern design which features many innovative solutions, such as:

− automatic systems for launching the span under combat conditions;
− self-guiding of the span into correct position;
− same span design for both the wheeled carrier MS-20 as well as the tracked carrier MG-20;
− the bridge span with extended deck between treadways that enables passage of infantry and vehicles of various width;
− proportional power hydraulics with CANbus communications in the control system and a number of other solutions.
7. INTERNATIONAL COLLABORATION

After many years of implementing innovative projects and programmes for the engineering troops of the Polish Armed Forces OBRUM's research and technical staff gained experience and practice in conducting complex research and development tasks. One could say, without false modesty, that OBRUM is an avant-garde among the Research and Development Centres in Poland.

Our scientific and research facilities allowed OBRUM to take part in international development projects for the development of an engineer tank for the United Kingdom in two variants, and several tracked engineering vehicles for the Kingdom of Malaysia.

7.1. FET (Future Engineer Tank) Program

One of the first such programs was: "Engineer Tank for the British Army". The British Ministry of Defence invited OBRUM to participate in a tender to develop an engineer tank in two versions:

− tank for carrying and laying bridges;
− engineer tank (engineering and road vehicle).

OBRUM, as a reference, presented the vehicles shown in Fig. 14. FET was a pioneering research and development work that was for the first time carried out by a former Soviet Bloc state for a Western state. It was a precedent on a European scale, and its implementation faced numerous protests by British society concerned about the possibility of losing jobs.

In preliminary work during the drawing up of the feasibility study, which also included design concepts, some Western companies participated: VICKERS (UK) and GKN Defence...
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(UK), in collaboration with MAK (Germany). OBRUM worked on the project together with British BAE Systems. Unfortunately, although the Polish offer was the most advantageous (lowest price), social considerations had an impact on the final decision of the British government. The presented results of OBRUM's work were highly evaluated. However, OBRUM's participation ended at the stage of feasibility study and further stages of research work were carried out by the British company VICKERS.

7.2. The Malaysian contract

Another program of international importance in which OBRUM had participated was the design and production of engineering tracked vehicles for a Malaysian customer. The portfolio of modern products and research facilities of ZM BUMAR - ŁABĘDY S.A. and OBRUM enabled the companies to enter the so-called "Malaysian Program" of the highest degree of technical complexity.

For the first time in the history of the companies, OBRUM and ZM BUMAR-ŁABĘDY provided the customer with a package of vehicles including: main battle tank, special-purpose engineer vehicles and instruction and training devices.

ZM BUMAR-ŁABĘDY S.A. manufactured and delivered 48 PT-91M tanks (Fig.15).

OBRUM, on its part, delivered:
- 4 MID-M engineering and road machines;
- 4 PMC LEGUAN assault bridges;
- 6 WZT-4 recovery vehicles;

and instruction and training devices:
- SJ-01M training station;
- SJ-02M training station;
- SJ-09M driver training device.

Fig. 15. PT-91M on a military parade in Malaysia

Employees of BUMAR ŁABĘDY S.A. and its subsidiaries and of OBRUM carried out a complete series of research and development work, which resulted in the implementation of the developed, new PT-91M tank and its variants (based on the tank chassis) in the form of engineering equipment (WZT-4; MID-M; PMC-LEGALUAN). At the
same time, huge knowledge and experience were gained during the implementation of this complex international contract. This created a unique opportunity for low-investment use of new solutions to be offered to other foreign customers. The engineering equipment developed by OBRUM is shown in Fig. 16.

Fig. 16. Engineering equipment developed at OBRUM based on MBT PT-91M

8. SUMMARY

The space available here does not allow for a detailed presentation and discussion of all projects carried out at OBRUM that included tracked vehicles for use by the engineer troops.

The products presented in the article, those most important in the field of engineering armoured vehicles, are key for the Polish army and the Polish defence industry.

The military engineering equipment developed at OBRUM was also used at home at the time of catastrophic natural disasters. The KŁON engineer tank was used with success when fighting the oil well fire in Karlino at the stage of borehole plugging. WZT-3 recovery vehicles were used in damage elimination operations after the great forest fire in Rudy Raciborskie near Gliwice.

It is difficult to list all the subjects and areas of issues covered by OBRUM's research and development works carried out for fifty years. OBRUM has always been ready to respond
to any signs from the Polish army regarding the needs for new equipment or for modernization of the existing equipment. Not all of the results of projects submitted in the form of technical and commercial offers were appreciated. A number of OBRUM's studies resulting from the analysis of the state of the art and its own statutory work remained at the concept stage. The research and development projects and programs implemented by OBRUM have always been carried out with due diligence, using the latest knowledge, in order to provide modern, competitive products to the Polish Armed Forces.

9. REFERENCES


