

Original article

## Wheeled armored personnel carrier Ryś and Irbis

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### INFORMATION

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### ABSTRACT

The article presents the characteristics of the Ryś and Irbis wheeled armored personnel carriers (Polish abbrev. KTO) designed in Poland. They constituted a deep modernization of the Czechoslovakian SKOT medium wheeled armored transporter. The paper presents the genesis of works on these vehicles and their main contractor, Military Automotive Works No. 5 in Poznań, which has dealt with repairs and modernization of combat vehicles since the 1950s. In the following part, the tactical and technical data of the basic version of the Ryś wheeled armored personnel carriers and special-purpose vehicles based on it are discussed, with particular attention paid to the versions that are of interest to the Ministry of National Defense. Next, the Irbis wheeled armored vehicle, and the special-purpose versions built on its chassis are characterized and presented to the International Defense Industry Exhibition in Kielce.

### KEYWORDS

vehicles, wheeled armored vehicle, Ryś, Irbis



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## Introduction

In the mid-eighties, due to the progressive aging of the SKOT armored vehicle structure, the problem of its successor emerged. Various variants were considered. The first idea was to modernize the existing armored carriers and extend their service life by the subsequent 20 years, i.e., by the end of the first decade of the 21<sup>st</sup> century. Another proposal submitted by Czechoslovakia was to develop a new vehicle of the same class. The replacement of SKOT transporter with the Soviet BTR-80 armored vehicle was also considered, but none of these ideas were accepted. Political changes in Europe, the introduction of the provisions of the CFE disarmament treaties, and the disintegration of the Warsaw Pact caused that in the 1990s, the Polish Armed Forces withdrew from armament most of the SKOT carriers in an armed version. However, a relatively large group of support vehicles remained on the equipment, which could be the object of potential modernization. The Military Automotive Works No. 5 in Poznań, which dealt with current repairs of SKOT transporters, recognized the possibility of their modernization, which resulted in projects to build the next generation of combat vehicles on their basis. In this way, two new vehicles called RYŚ and IRBIS appeared, which were

supposed to be the base for the whole family of vehicles designed to perform various tasks on the modern battlefield. The research aimed to describe the history of these constructions and their tactical and technical characteristics in a comprehensive way using the analysis method and the literature review. The intention was justified by the considerable dispersion of information about the tested vehicles, which were selectively included in various studies. Materials obtained from the Military Automotive Works Joint Stock Company in Poznań<sup>1</sup> and articles published in the specialist press and on Internet portals were used for analyses.

## **1. History of construction of RYŚ and IRBIS armored personnel carriers**

In 2000, the Military Automotive Works No. 5 (WZM) in Poznań, where the SKOT armored carriers were overhauled, proposed solutions for its modernization. It was decided that the modernized vehicle could be used as a base for the installation of special versions, which, along with the new generation of armored carriers, would meet the current needs of the Polish Armed Forces [1, p. 19]. At that time, the Armed Forces had about 400 SKOT transporters in various versions, some of which, due to their level of exploitation, qualified for repair or removal. The bodies of these vehicles, due to the applied construction and technological solutions, still met contemporary requirements, allowing the operation of the modernized vehicles for the next 20 years. According to the constructors of WZM No. 5, the primary advantages of the SKOT transporter included: relatively high payload, the considerable usable volume of the hull interior, appropriate shape of the armored plates ensuring a right level of ballistic protection, resistant armoring, high possibilities of overcoming the terrain and water obstacles, and significant susceptibility to modernization. The main deficiencies of the vehicle were listed as follows: uneconomic and unreliable engine, lack of air conditioning system, high unreliability of engine and vehicle heating systems and electrical, hydraulic and pneumatic installation, as well as significant labor intensity of maintenance and low level of ergonomics of the transporter's utility part.

When determining the scope of vehicle modernization, the focus was on the elements of the driving system, power transmission, and interior equipment. Among the fundamental changes, the following ones were proposed: replacement of the engine with a modern drive unit, changing the gearbox to automatic or semi-automatic, changing the intermediate gearbox, integrating the drive unit to ensure its quick replacement in field conditions, strengthening the remaining elements of the power transmission system. The needs were also recognized for giving up mechanical control of the gearbox, switch box, and intermediate gears, changing the suspension, introducing an integrated air-conditioning system, engine heating, and heating, replacing electrical, pneumatic, and hydraulic systems and introducing an automatic water removal pump module. It was assumed that it would be necessary to change the location of crew members' positions, taking into account current world trends. To improve ergonomics and enable the installation of modern equipment, the shape of the hull was altered, increasing its volume. In view of the assumptions made, in 2001, a demonstrator of the modernized armored carrier was prepared in WZM no. 5, which was named WR-02 RYŚ, in the version of a command and reconnaissance vehicle. In the same year, the vehicle was demonstrated at the International Defense Industry Exhibition (Polish abbrev. MSPO) in Kielce. The great

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<sup>1</sup> In 1 January 2008, the Military Automotive Works No. 5 was transformed into the Military Automotive Works Joint Stock Company.

interest of visitors in the new vehicle caused that WZM No. 5 decided to continue works on the design of the base vehicle from own resources [2, p. 26-7]. The main impulse for further works was the interest in the modernization concept on the part of the Land Forces Command and the heads of types of troops using SKOT armored vehicles [3, p. 22].

In 2002, a prototype of the RYŚ armored personnel carrier was built as a base vehicle. Compared to WR-02 RYŚ, the engine of this vehicle was moved from the middle of the hull to its right front part, which caused the steering, combat, and landing compartments to become connected. In the process of modernization, about 30% of the SKOT carrier's construction elements were used. In 2003, two new versions of the vehicle were presented to the public. It was RYŚ E-8 armed with a 30 mm cannon dedicated to the air-mobile troops and RYŚ M98 acting as a fire control vehicle and means of transport for three 98 mm mortars [4, p. 12-4]. In the same year, works on further versions of vehicles based on RYŚ-Med were also launched. They were the AZALIA command and staff vehicle, the KAKTUS universal command vehicle, and the RYŚ-Med medical evacuation vehicle. Prototypes of these vehicles were built in 2004 [5, p. 16-9; 6, p. 11-2]. In June of that year, WZM no. 5, on its initiative, undertook work on a six-wheeled version of the RYŚ armored personnel carrier, in which the rear part of the vehicle was designed from scratch. The decision to work was based on analyses of the demand of the Polish Armed Forces for wheeled combat vehicles in the 6×6 configuration with a weight not exceeding 15 tons, which allowed for their easy transport by air. The vehicle was to be used as a means of transport for soldiers and as a carrier of various weapon systems, which was in line with the needs of the Armed Forces in increasing deployment capacity. The technical design and executive documentation were completed in February 2005, and in September at the MSPO in Kielce, a prototype of an armored personnel carrier, which was called IRBIS, was shown in the version of a general reconnaissance vehicle [7]. In 2007, works were undertaken on a new version of the RYŚ armored carrier, based on which a family of radio-electronic combat vehicle codenamed KAKTUS was created for the level of the tactical unit [8, p. 36, 38].

## **2. The manufacturer of the RYŚ and IRBIS wheeled armored personnel carriers**

The manufacturer of the RYŚ and IRBIS wheeled armored personnel carriers was Military Automotive Works No. 5 in Poznań. The history of these plants begins during the Second World War. In February 1945, the Military Unit No. 2123 was established in Poznań. It was a subunit for the repair of vehicles owned by the Armed Forces. The unit was based in buildings of the former company *Polski Fiat*. It employed 60 army workers, 60 students, and 100 German prisoners of war at that time. There were only 40 soldiers in the unit, who served as guards [9]. In 1947, the unit was dissolved, and the Central Workshop of Passenger Car Repair No. 42 was established on its basis. The Workshop performed major repairs of passenger cars and trucks, as well as motorcycles. Among them, there were: GAZ, Skoda, Opel, Olympia, and Mercedes as well as Harley Davidson and Jawa motorcycles [10]. In August 1952, the Workshop was renamed to Military Automotive Works No. 5. Then, these works employed over 400 employees. The plants' activity profile was extended to include repairs of various types of passenger and truck cars and amphibious vehicles<sup>2</sup>.

<sup>2</sup> The report of Lieutenant Colonel Hetmanowski from WZM No. 5 in Poznań.

In the 1960s, WZM No. 5, apart from repair works, undertook serial production of engine heads, pistons, sealants, and radiators and small spare parts for cars. In 1967, the construction of new plants at Dąbrowskiego Street in Poznań started. The initial stage of works was completed in 1969. The 1970s were the period of further expansion of the company. The construction of new plants was continued. In 1973, due to the dissolution of Military Mechanical Works in Poznań, their assets and employees were taken over by Military Automotive Works No. 5. That merger significantly changed the production profile. The major part of the tasks now consisted of major repairs of armored vehicles and finished product production. These undertakings were carried out in close cooperation with military repair workshops in Czechoslovakia and the German Democratic Republic. In 1971, WZM no. 5 concluded agreements with VEB Reparaturwerk in Neubrandenburg concerning cooperation in the armored repair of BRDM-1 reconnaissance vehicles. A year later, a similar contract for the repair of BWP-1 infantry fighting vehicles was concluded with Opravský Zavod 026 in Štřebenberk [9]. Since 1973, in addition to BRDM-1, SKOT, and TOPAS armored vehicles, PT-76 tanks, the plants also started repairing FUG reconnaissance vehicles and then BWP-1 infantry fighting vehicles. In later years, the maintenance works were extended to include new types of combat vehicles such as BRDM-2 armored reconnaissance vehicles, MT-LB multipurpose armored vehicles, and ZSU 23×4 Shilka self-propelled anti-aircraft guns, and 2S1 Gvozdika self-propelled howitzer<sup>3</sup>. In 1975, the first stage of construction of new plants was completed. In addition to the repair of entire vehicles, the repair of individual units such as engines, gearboxes, and side transmissions was undertaken. The production of various finished products was also expanded, including molds, rubber products, and specialized tools. These products were exported to many countries such as Czechoslovakia, Bulgaria, Egypt, Yugoslavia, German Democratic Republic, and the Federal Republic of Germany and the USSR [9].

In 1980 the construction of new plants was completed, and the entire production and services were moved there. In 1982, the plant was granted the status of a defense industry company [9]. A year later, they were involved in implementing the T-55AM Merida tank modernization program. As part of this program, agreements were concluded with Opravský Zavod 025 in Nový Jicin, Czechoslovakia, the VEB Reperaturwerk plant in Neubrandenburg, Germany, and the MRK 'CHAN KRUM' plant in Targowiszczce, Bulgaria [11]. In 1982, the plants rebuilt the BRDM-2 armored reconnaissance vehicles to the R-5 command version. In 1985, WZM commenced a comprehensive modernization of T-55 tanks, rebuilding several hundred vehicles of this type until 1990<sup>4</sup>. In the middle of the 1980s, the main overhauls of basic tanks type T-72A Jaguar and anti-aircraft rocket launcher 2K12 Kub were undertaken in the plant. These works were carried out in cooperation with the plants in Czechoslovakia and the German Democratic Republic [9]. In the years 1987-88, another modernization was carried out, this time of PT-76 light amphibious tanks. These tanks were equipped with an armament stabilization system adopted from a medium T-55 tank. Simultaneously, modification works were carried out on the BRDM-2 armored reconnaissance vehicles to the version of chemical reconnaissance vehicle, which was completed in 1989.

At the beginning of the 1990s, Military Automotive Works No. 5 underwent a profound restructuring, reducing the scope of tasks and thus employment. In the years 1990-1992, the modernization of the 2S1 Gvozdika self-propelled howitzer was carried out in terms of

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<sup>3</sup> Ibidem.

<sup>4</sup> Ibidem.

improving its buoyancy. These vehicles were equipped with additional floats and hydraulic water thrusters. After the reconstruction of a small number of vehicles, these works were discontinued for economic reasons. Since the mid-1990s, the activity of WZM No. 5 focused on repair works of the following types of vehicles of armored and mechanized troops: BRDM-2 armored reconnaissance vehicles and derivative vehicles, BWP-1 infantry fighting vehicles, T-72 basic tanks, 2S1 Gvozdika self-propelled howitzer, and derivative vehicles, and engines for those vehicles. In addition to these works, the plant produced equipment for the repair of armored equipment, repair kits for military units, and spare parts and test stands for the diagnosis of assemblies. WZM no. 5, together with OBRUM in Gliwice, was a manufacturer of SJ-09A vehicles for driving instruction. In 1997, the plant also participated in the preparation, together with the Gliwice center, of the prototype of modernized BWP-1 infantry fighting vehicle, on which the United Defense turret was mounted. This vehicle was presented at the International Defense Industry Exhibition in Kielce<sup>5</sup>.

### 3. Tactical and technical characteristics of the RYŚ wheeled armored personnel carriers and its versions

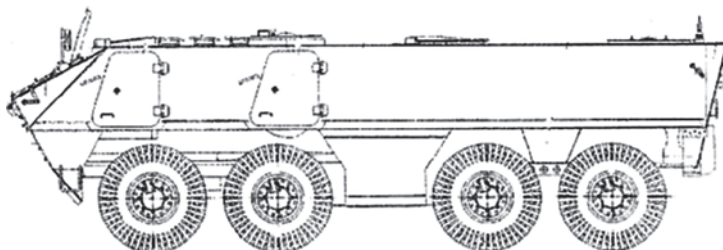
The RYŚ wheeled armored personnel carrier was a profound modernization of SKOT medium wheeled armored transporter. In the first demonstrator, marked WR-02 RYŚ, the general design of its predecessor was preserved. More considerable changes occurred during the development of the basic version of RYŚ, which introduced modern solutions used worldwide in this type of vehicle. The “transformation” of the SKOT vehicle into the RYŚ carrier included modernization of the power transmission system and equipping the vehicle with a quick-change power unit module, modernization of the vehicle suspension, installation of a new power supply system, installation of air-conditioning, replacement of electrical installation, installation of automatic bottom pumps, and installation of an independent heating system. The modernized vehicle underwent a series of technical and field tests conducted in the Military Institute of Armored and Car Technology in Sulejówek and the Military University of Technology in Warsaw. At the latter, among other things, climate tests were carried out in a low-temperature chamber, where the vehicle was cooled to  $-40^{\circ}\text{C}$ , and then attempts were made to start the engine. That enabled elimination of many shortcomings and defects and introduction of more optimal technical solutions [12, p. 22; 13, p. 20].

**The RYŚ base vehicle** was to provide a platform for the construction of several special-purpose versions, which would complement the Polish defense industry’s offer in terms of armored vehicles for the Polish armored and mechanized troops. The designers’ primary assumption was to maximize the use of the SKOT transporters owned by the Armed Forces and thus achieve significant savings in the costs of purchasing new-generation vehicles. The transporter was to be available in three versions: low (Fig. 1) – for the construction of combat versions, medium – for the construction of command and sanitary vehicles, and high (Fig. 2) – for the transport of fire support means.

**The general construction of the wheeled armored personnel carrier.** The most crucial design change was the new functional division of the hull. In the front part, on the right-hand side, there was a drive compartment, and on the left-hand side, a steering and command

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<sup>5</sup> Ibidem.



**Fig. 1.** Ryś armored personnel carrier in the low base version  
*Source: [14].*



**Fig. 2.** Ryś armored personnel carrier in the base high version  
*Source: Photo by WZM S.A.*

compartment. On the left side of the hull, there is a new door for the vehicle commander. In the ceiling of the hull, there were two separate hatches for the driver and the commander. The new arrangement of the propulsion compartment made it possible to connect the steering compartment with the combat-assault compartment, which increased the safety level enabling free movement of crew members inside the vehicle and leaving it in case of danger [15, p. 14]. The patent application covered the adopted solution. The possibility of installing additional metal-ceramic armor in the form of panels of a total weight of 1.5 tons applied to the hull, and anti-mine shields were provided. In place of the rear door, a loading ramp could be optionally installed [14].

**Driving system, power transmission, and suspension system.** The base transporter was equipped with an eight-cylinder 352 hp IVECO Aifo diesel engine integrated in a quick-exchange power unit with a semi-automatic ZF Eurotronic gearbox with 12 forward and 2 reverse gears. The engine exhaust system was equipped with a new silencer with air intake system to reduce exhaust temperature. The power transmission used a two-speed IVECO gearbox and reinforced drive shafts to handle higher loads. The track width increased by 260 mm and new springs and shock absorbers were fitted, 4 of which were on the front bridge and 2 on the others. Wheels with 365/80 R20 pneumatic tyres with adjustable air pressure by means of an adjustment system from 0.5 MPa to 0.24 MPa. Hydraulic, dual-circuit,

air-operated disc brake system. Pneumatically controlled auxiliary disc brake mounted at the rear drive output from the transfer box [16; 17].

**Observation instruments.** The vehicle commander was equipped with a new generation daily observation device of the type OPO-120F, which was a periscope with a large viewing angle of 150° in the horizontal plane and 50° in the vertical plane and has an optical system absorbing laser rays [18]. Moreover, it had a day-night observation device of the commander type POD-72 Liswart. It was a binocular, passive instrument with an image intensifier in the night track. Its field of view was 9.8° during the day and 7.5° at night and 5× magnification [19]. The driver also had the OPO-120F day observation device and a night observation device of the type PNK-72 *Radomka*. It was a two-eyed night vision instrument with the field of view up to 30° with two image amplifiers [20].

**Equipment of the armored carrier.** The vehicle had an internal communication system and a digital UKF radio station. The carrier could be equipped with a heating system, filtering and ventilation system protecting against contamination, the ASS-1 *Tafios* contamination warning system, the *Obra* laser radiation defense system with smoke grenade launchers, the *Deugra* fire fighting and explosion protection system, land navigation system with GPS receiver, air conditioning and electric winch with pulling power up to 5.4 tons. Two hydraulically driven thrusters were used for propulsion while swimming. Water removal from the interior of the vehicle was carried out by means of two bilge pumps.

Based on the base version, many special-purpose vehicles were built, which are a potential offer of WZM No. 5 for the Polish Armed Forces and other countries using the SKOT armored vehicles. Among the proposed types of the RYŚ armored carrier there were a reconnaissance vehicle, infantry fighting vehicle, infantry carrier, medical evacuation vehicle, radio-electronic combat vehicle, universal command vehicle, command vehicle for artillery, fire control vehicle, engineering reconnaissance carrier, and engineering support carrier.

**The WR-02 RYŚ reconnaissance vehicle.** It was the first profound modification of the SKOT transporter. It used a new propulsion system including the IVECO *Cursor 8* engine of 310 hp. It was a linear, six-cylinder engine with a capacity of 7690 cm<sup>3</sup>, turbocharged, obtaining maximum torque of 1500 Nm at 1125 rpm [21]. The carrier had a wide range of specialist equipment, such as the Thales observation and reconnaissance system (including a battlefield radar, TV and thermal camera, rangefinder and goniometer) mounted on an lifting mast, the PIT navigation system providing satellite and inertial navigation, the ASS-1 *Tafios* integrated protection system against weapons of mass destruction, the communication system with the radio stations of UKF Zakłady Radmor, KF Thales and *Fonet* internal communication system, the IT system with WB Electronics computers, passive observation instruments and a power generator [22, p. 26-7].

**The RYŚ E-8 infantry fighting vehicle.** The vehicle had a one-man E-8 turret produced by the German Rheinmetall concern with a 30 mm automatic Mauser MK30 cannon coupled with a 7.62 mm machine gun mounted in the front of the combat-assault compartment. It was equipped with the STN Atlas fire control system integrated with the commander's observation device and the turret remote control system operated from the commander's position, *Fonet* internal communication means, UHF radio station, UNZ-70 navigation system and IFF *Biff* self/non-self identification system. The accessories included the *Obra-3* radiation protection system with smoke grenade launchers, the ASS-1 *Tafios* contamination warning system, and the fire and explosion protection system.

**The RYŚ-KOBUZ infantry armored carrier** (Fig. 3). The vehicle is equipped with the ZSMU Kobuz module remote-controlled armament with the 12.7 mm large-caliber WKM-B machine gun or optionally ZSMU Kobuz with 7.62 mm UKM-200C machine gun with barrel lift angles from  $-5$  to  $+60^\circ$  and turret rotation speed of 2.8 rad/s. Both versions are equipped with a day-night targeting system. The crew consisted of 11 soldiers, including a commander, a deck shooter, a driver, and 8 soldiers from the landing [17].



**Fig. 3.** Ryś-Kobuz infantry armored carrier  
*Source: Photo by WZM S.A.*

**The Ryś-Med medical evacuation vehicle** (Fig. 4). The vehicle is designed for taking the injured from the battlefield, providing them with first aid and evacuation to the assembly point. It is equipped with medical equipment such as the oxygen system and oxygen cylinders, 4 standard stretchers, a pick-up stretcher with orthopedic board, orthopedic collars, Kramer immobilization rails and, vacuum rails. The car had a modified electrical installation



**Fig. 4.** Ryś-Med medical evacuation vehicle  
*Source: Photo by the author.*



to connect medical equipment such as a defibrillator or infusion fluid heater. The transporter was equipped with a special automatic loading system for injured. In addition, it was equipped with two hoistable searchlights allowing for lighting the area. The carriage was adapted to evacuate 4 wounded in the lying position or 8 wounded in the sitting position. The crew of the vehicle consisted of 4 soldiers, including a commander, a driver, and 2 paramedics. The vehicle's weight was over 17 tons [23, p. 2, 25; 24].

**The KAKTUS universal command vehicle.** It was equipped with a modular system of building communication and data transmission devices, which allowed for a quick change of destination depending on the level of command at which it was to be used. One of the variants of equipment included the set of 3 RRC-9500 digital radio stations, the Harris Falcon II RF-5800H radio station, a digital radio line, the DD 9620 on-board terminal, the BFC 201 terminal, the MK 16A communication module, the cryptographic device, the ŁK 24A switch – multiplier, the *Fonet* on-board set of communication devices, a 12 or 24 m aerial mast, and a power generating unit from Armpol Company [25, p. 53].

**The KAKTUS electronic warfare vehicle.** It was developed by WZM No. 5 in cooperation with the Military Communication Institute in Zegrze and the Military University of Technology in Warsaw. It was publicly presented during MSPO in 2008. The vehicle was a component of the Automated Recognition and Disturbance System, which included five types of vehicles: an HF/VHF/UHF (1-300 MHz) electronic combat command vehicle, HF radio frequency interference tracker, VHF/UHF range of frequency interference station vehicle, and ARO KU radio reception vehicle. The specialist equipment of the radio remote control vehicle consisted of the HF/VHF/UHF radio remote control, the RRC-9500 digital radio stations, the KP-1500 on-board computer and the *Fonet* on-board communication equipment set. The vehicle had an 18 m high German company Gero type 18SPM6 antenna mast and an Armpol generator set. To stabilize and level the vehicle during the tracking device operation, special supports on hydraulic cylinders were used [26, p. 62-3]. A new 6-cylinder SCANIA DC 1257 A type 6-cylinder diesel engine with the turbocharger of 11,700 cm<sup>3</sup> capacity and the maximum power of 448 hp, the ZF Ecomat gearbox and metal-ceramic modular armor providing ballistic protection in front of the hull at the level 4 according to STANAG 4569 and on the sides and at the back of the vehicle at the level 3 was installed in the carrier. The vehicle weight was 18 tons. The crew consisted of 5 soldiers, including a commander, a driver and 3 service soldiers [8, p. 36, 38; 27].

**The AZALIA command vehicle** (Fig. 5). It was a command vehicle for the squadron of self-propelled 155 mm *Krab* gun-howitzer. The vehicle was equipped with the Azalia fire control system including: the DD 9620 deck terminal and the BFC 201 terminals from WB Electronics, a set of three RRC-9500 digital radio stations from the UKF Zakłady Radmor, a radio line, the ŁK 24A digital switch – multiplier, and a cryptographic device. Besides, the vehicle had the LITEF navigation system, an air conditioning system, and the *Eberspracher* heating system, the Deugra explosion and fire protection system, and the 12.5 kVA power unit. The vehicle could be connected to an external Ethernet network for data transmission [5, p. 16-9].

**The RYŚ M98 fire control and mortar transport vehicle.** The vehicle had an enlarged loading section allowing for transporting 2 or 3 M-98 type 98 mm mortars. A hydraulically opened ramp was used in the rear part to facilitate their unloading. The vehicle was equipped with the commander's on-board computer, on-board terminals, digital radio stations, the Sagem *Sigma 30M* navigation system, and the IFF *Biff* system. The on-board armament of the vehicle



**Fig. 5.** AZALIA command vehicle

*Source: Photo by the author.*

was a manually guided 12.7 mm large-caliber machine gun of NSW or WKM-B type. The *Obra-1* type laser radiation protection system with smoke grenade launchers was also used [22, p. 26-7].

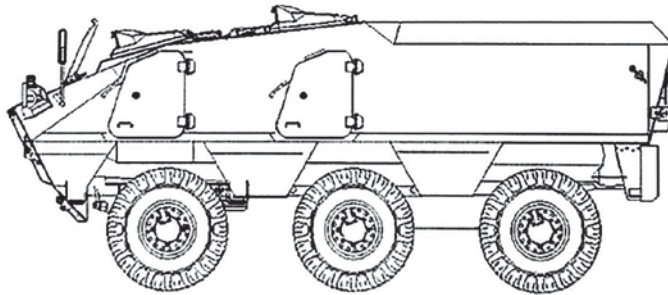
**The KTRI TUJA-K wheeled engineering reconnaissance carrier.** The engineering vehicle developed in cooperation with the Military Institute of Engineering Technology in Wrocław and the Military Institute of Armored and Motor Technology in Sulejów. Ballistic and anti-mine resistance according to STANAG 4569 was increased to level 4 in the front part of the hull and level 3 in the side and rear parts. The useful capacity was increased by superstructure of external loading containers. Due to the increased weight of the transporter up to 19 tons, the Scania D1 1256 AO3 PE diesel engine with turbocharger with a capacity of 11,700 cm<sup>3</sup> and maximum power of 483 hp at 2100 rpm was used. It is locked to the ZF 7HP902S Ecomat automatic transmission with 7 forward and 1 reverse gears. The vehicle was armed with the ZSMU-1276C1 Kobuz armament module with a 12.7 mm machine gun. The main engineering equipment consisted of the PMW type multifunctional, inductive mine detector enabling detection of mines in a 4.5 m wide band at a depth of up to 10 cm, an observation head on a telescopic jib with TV and thermal imaging camera and laser rangefinder, a radiolocation station, and a hydro-acoustic echo sounder. The crew of the vehicle consisted of 5 soldiers, including a commander, a driver, a communications sapper and 2 reconnaissance sappers [28, p. 54, 56, 58; 29, p. 7].

#### **4. Tactical and technical characteristics of the IRBIS wheeled armored personnel carrier and its versions**

The IRBIS armored carrier was a six-wheeled version of the RYŚ carrier. This vehicle was developed by WZM No. 5 in Poznań. The carrier of much smaller dimensions was to be a platform on which the construction of many special versions was planned. Its main advantages included lower purchase costs, cheaper operation, and usefulness for expeditionary forces connected with easy air transport.

**The IRBIS base vehicle** was a version of the RYŚ armored carrier with a shortened hull designed for special constructions and various weapon systems. It was assumed that the vehicle would be able to perform various tasks filling the gap after the withdrawal of the BRDM-2 wheeled armored vehicles. The degree of unification of IRBIS with RYŚ was nearly 80% [30, p. 30]. The vehicle was to be available in two hull versions: a standard one with a low hull adapted for mounting various weapon systems in a rotary turret (Fig. 6) and a lifted one with an enlarged interior allowing for mounting command systems, means of communication, or specialist equipment (Fig. 7).

**The general construction of the wheeled armored personnel carrier.** The vehicle had a self-supporting hull made of armored sheets and a 6×6 drive system. The IRBIS base armor was to provide protection at the level 1 according to STANAG 4569 (resistance to 7.62 mm anti-tank missiles and shrapnel of artillery bullets up to 155 mm). The possibility of strengthening the armor up to level 3+ according to STANAG 4569 (resistance to 12.7 mm anti-tank missiles) was foreseen by installing composite armor panels and anti-fracture liners developed by the Military Institute of Armament Technology in Zielonka. In the landing compartment there are 6 individual armchairs for soldiers with weapons and equipment. Above the compartment there was a hatch with a bipartite cover opening to the sides, and shooting holes



**Fig. 6.** Irbis wheeled armored personnel carrier in the base version with a lifted hull  
*Source: Illustration by WZM S.A.*



**Fig. 7.** Irbis wheeled armored personnel carrier in the base version  
*Source: Photo by the author.*

in the side walls. A hydraulically lowered landing ramp was mounted, which was equipped with a manually opened single-leaf door, in the rear part of the hull.

**Driving system, power transmission, and suspension system.** The liquid-cooled six-cylinder turbocharged IVECO Cursor 8 liquid-cooled diesel engine with a capacity of 7,900 cm<sup>3</sup> and 350 hp at 2100 rpm constituted the driving system. It was also envisaged to mount a diesel engine IVECO Cursor 10 with a capacity of 10,800 cm<sup>3</sup> and power 430 hp at 2100 rpm or a power unit from the Rosomak vehicle, i.e., the D1 12 56A03PE engine with a capacity of 11,700 cm<sup>3</sup> and power 490 hp at 2100 rpm. Fuel tanks had the capacity of 350 liters. The power transmission system included the ZF Eurotronik semi-automatic transmission with 12 forward and 2 reverse gears and a two-speed IVECO distribution box. The engine together with the transmission was integrated in a quick-change unit. The drive axles were arranged at equal distances, which allowed for an even load distribution. Wheels were suspended independently with 13.00-18 tyres with off-road tread. There were disc, hydraulic, dual-circuit, pneumatically actuated brakes, equipped with ABS and the pneumatically controlled disc parking brake [31].

**Observation instruments.** The vehicle commander had the POD-72 Liswart passive day-night observation device, the driver had the PNK-72 Radomka day-night observation device, and the soldiers of the landing were equipped with TNPO-170 optical periscopes.

**Equipment of the armored carrier.** The vehicle had a standard heating and ventilation system and the WB Electronics *Fonet* internal communication system and the UKF digital radio station. The filtering and ventilation system and the ASS-1 *Tafios* contamination warning system were used as means of protection against contamination. The vehicle had the Deugra fire and explosion protection system. The land navigation system with GPS receiver was used to provide orientation in the field. Optionally, the Webasto air conditioning system could be installed. Additional equipment was a single drum electric winch with pulling power up to 5.4 tons. While swimming, the drive was provided by two thrusters with four-winged bolts and rudders moved using pullers [32].

On the base version, the construction of specialist variants was assumed, including an armored carrier, a reconnaissance vehicle, a combat reconnaissance vehicle, a self-propelled tank destroyer, an anti-aircraft vehicle with Grom rocket launchers, a contamination reconnaissance vehicle, a medical evacuation vehicle, a command vehicle, the NUR-26A short-range radiolocation station carrier and the Przebiśnięg electronic reconnaissance system carrier. In practice, only four versions were prepared, including three reconnaissance vehicles with different weapon systems.

**The IRBIS RCWS 12.7. armored carrier.** The vehicle with the RCWS 12.7 remote-controlled armament module with a 12.7 mm large-caliber machine gun. Alternatively, the ZSMU Kobuz armament module with a 12.7 mm WKM-B or NSWT Utios large-caliber machine gun could be used (Fig. 8). The vehicle had standard equipment of the base version, such as the *Fonet* internal communication means, the UKF digital radio station, the navigation system, and anti-contamination measures. The crew consisted of 8 soldiers, including a commander, a driver, and 6 soldiers of the landing [33].

**The IRBIS reconnaissance vehicle.** It had the ZSMU-127 B1 Kobuz remote-controlled armament module from the Research and Development Centre for Mechanical Equipment in Tarnów, with a 12.7 mm WKM-B or NSWT Utios large-caliber machine gun mounted in



**Fig. 8.** Irbis-Kobuz infantry armored carrier

*Source: Photo by WZM S.A.*

the front of the transport compartment. Ammunition is supplied by means of a flexible sleeve from a box with a capacity of 150 cartridges placed inside the vehicle. The vehicle was equipped with internal and external communication means, navigation system, and means of protection against contamination. The crew consisted of 4 soldiers [34, p. 23].

**The IRBIS RCWS-30 combat reconnaissance vehicle.** It was equipped with the RCWS-30 unmanned turret of the Israeli company Rafael Advanced Defense Systems with a 30 mm ATK Mk 44 Bushmaster II automatic gun and a 7.62 mm M240 machine gun coupled with it. The stock of cannon ammunition was for 200 pieces, and of the machine gun for 460 pieces. Angles of barrel lifting ranged from  $-20^{\circ}$  to  $+60^{\circ}$ . The turret rotation speed was of 1 rad/s. there was the electric weapon stabilization system. The vehicle had a day-night fire control system. The crew consisted of 5 soldiers, including a commander, a driver, a gunner and 2 spotters [35; 36].

**The IRBIS ORCWS-30 combat reconnaissance vehicle** (Fig. 9). It was a vehicle with the Israeli ORCWS Elbit Systems turret equipped with the 30 mm ATK Mk 44 Bushmaster II automatic cannon coupled with a 7.62 mm M240 machine gun. The cannon ammunition stock was for 200 pieces, including 50 anti-tank ones, and for the machine gun for 690 pieces. Angles of raising the weapon ranged from  $-16^{\circ}$  to  $+60^{\circ}$ . The cannon's quick firing rate was 200 rpm. The armament had a stabilization system in two planes. There was the fire control system with day/night aiming devices. The crew consisted of 5 soldiers [37; 38].

The versions of RYŚ and IRBIS wheeled armored personnel carriers presented by WZM No 5 in Poznań met with limited interest of the Ministry of National Defense. The decision to purchase a license for the Finnish Armored Modular Vehicle (AMV) was associated with the prospect of developing numerous specialist versions on its basis. As a result, it was decided to purchase only 6 units of RYŚ carriers in the version of the RYŚ-Med medical evacuation vehicles. It was associated with an urgent operational need to secure the requirements of the military contingent in Afghanistan. These vehicles became the only version of RYŚ that came to the equipment of the Polish Armed Forces. In this situation, further construction works on RYŚ and IRBIS carriers in WZM No. 5 in Poznań were completed. These constructions,



**Fig. 9.** Irbis ORCWS-30 combat reconnaissance vehicle

*Source: Photo by the author.*

however, were an inspiration for modernization programs of other combat vehicles, in which it was possible to apply selected solutions, originally envisaged for RYŚ and IRBIS.

## **Conclusion**

The work on the RYŚ and IRBIS armored carriers is another example of the longstanding efforts of the construction offices of the Polish defense industry to offer the Polish Armed Forces their own combat vehicles, which would be standard equipment of armored and mechanized troops. The offer proposed by Military Automotive Works No. 5 in Poznań was of a comprehensive nature, as it included vehicles of various purposes, adapted to the current needs of the Armed Forces. The equipment packages of subsequent versions included the most modern equipment and systems presenting the world level and ensuring that the armored carriers equipped with them perform their tasks on the modern battlefield. Individual vehicles developed over the next few years and presented at the International Defense Industry Exhibition in Kielce aroused justified interest of specialists, who positively evaluated the results of the Poznań constructors' work. The validity of research and development works resulted mainly from significant shortages of this category of combat equipment owned by the Polish Armed Forces and the declared interest of the Ministry of National Defense in such constructions. Unfortunately, the effort undertaken by WZM No. 5, often connected with its own financial outlays in the development of individual versions, did not find recognition of the Ministry of Defense's Department of Armament. Once again in the post-war history of Poland the decision to purchase an armored carrier license from a foreign contractor was adopted. Thus, construction works on RYŚ and IRBIS became only a form of gaining new experience, which was partly used in the following years to improve the combat vehicles possessed by the Armed Forces.

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## **Conflict of interests**

The author declared no conflict of interests.

### Author contributions

The author contributed to the interpretation of results and writing of the paper. The author read and approved the final manuscript.

### Ethical statement

The research complies with all national and international ethical requirements.

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## Transportery opancerzone Ryś i Irbis

### STRESZCZENIE

W artykule zaprezentowana została charakterystyka opracowanych w Polsce transporterów opancerzonych Ryś i Irbis, które stanowiły głęboką modernizację konstrukcji czeskosłowackiego transportera opancerzonego SKOT. Przedstawiono genezę prac nad tymi pojazdami oraz ich głównego wykonawcę Wojskowe Zakłady Motoryzacyjne nr 5



w Poznaniu, które zajmowały się remontami i modernizacją wozów bojowych już od lat pięćdziesiątych XX wieku. W dalszej części omówiono dane taktyczno-techniczne wersji podstawowej transportera opancerzonego Ryś oraz wozów specjalistycznych na jego bazie, ze szczególnym zwróceniem uwagi na wersje będące obiektem zainteresowania resortu Obrony Narodowej. Następnie scharakteryzowano transporter opancerzony Irbis i zbudowane na jego podwoziu odmiany specjalne, które zaprezentowano na Międzynarodowym Salonie Przemysłu Obronnego w Kielcach.

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**SŁOWA KLUCZOWE** pojazdy, transportery opancerzone, Ryś, Irbis

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