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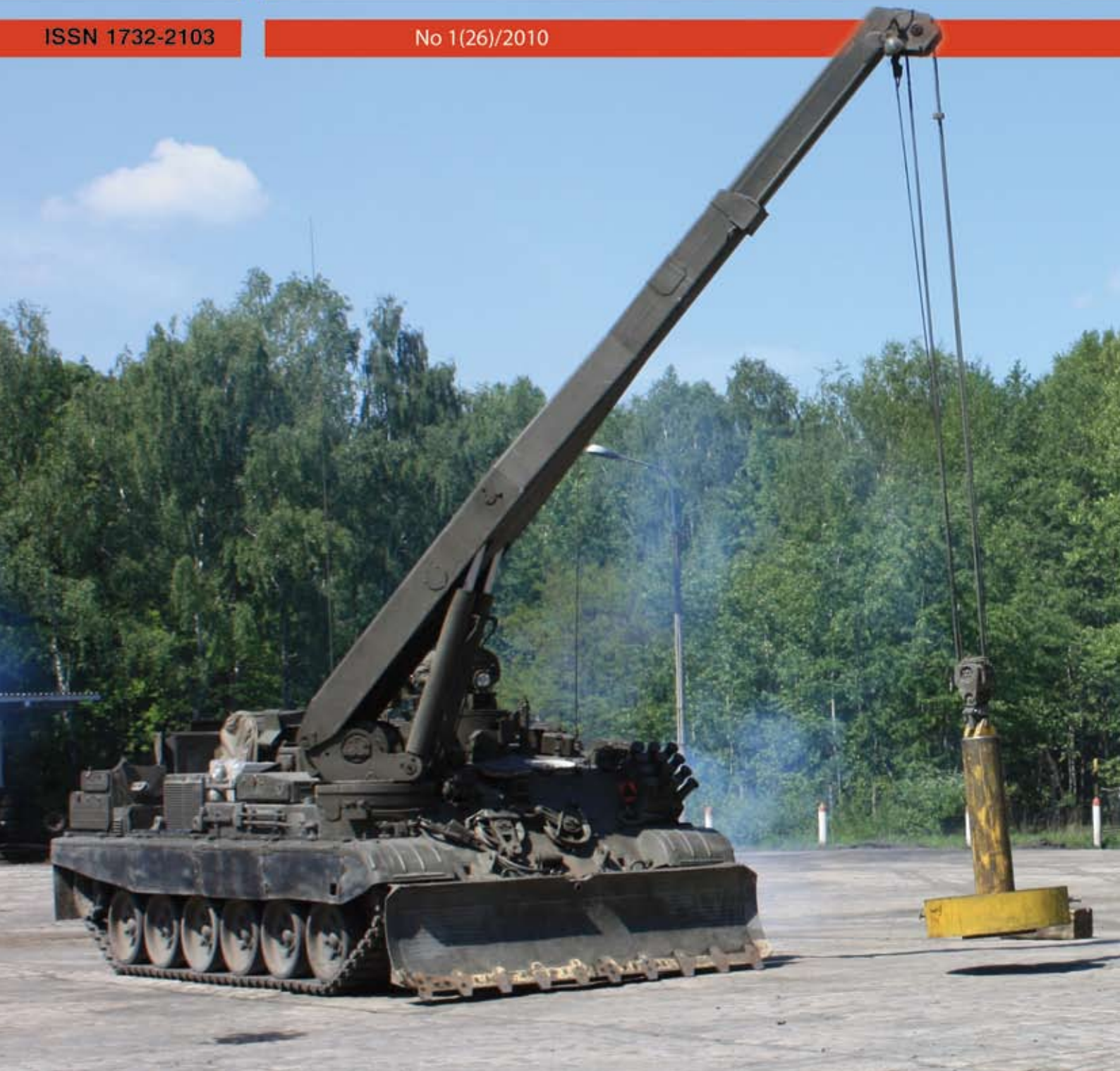

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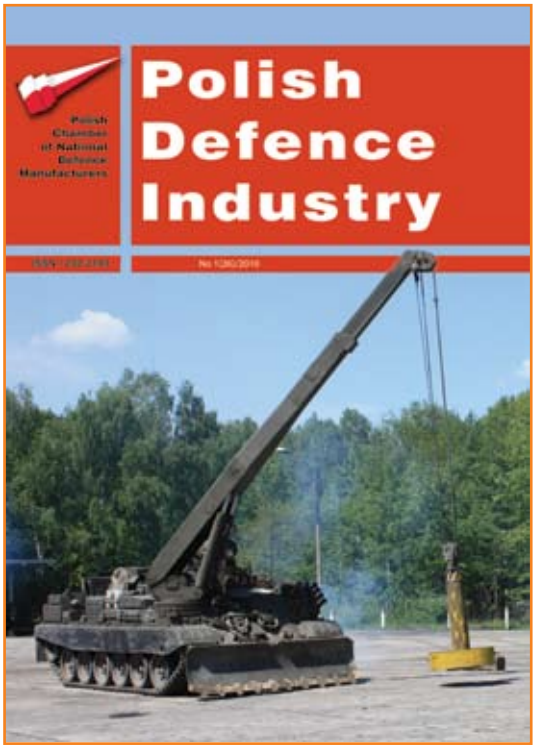

ARV-4 Armoured Recovery Vehicle

Each modern armed forces are not able to operate on modern battlefield without technical support. Such support is also needed for tanks. For securing its operability it is necessary to cooperate with vehicles with similar mobility, range, protection and specialised equipment for fulfilling the following tasks:

- Maintenance and combat operability recovery
- Technical service, conducting engineering and rescue tasks
- Air-defence
- Conducting specialised works.

Such tasks are being fulfilled by Armoured Recovery Vehicle ARV-4 (WZT-4) – fast, armoured, tracked vehicle.

ARV-4 (WZT-4) is a high mobility vehicle, equipped with special equipment for crew and devices protection against explosion wave and penetrating radiation during nuclear explosion and also protecting crew members against nuclear radiation, chemical and biological weapon.

The vehicle is also equipped with device for allowing deep water crossing driving on the bottom (WJPW), smoke grenade launchers and thermal smoke device (TAD) for placing smoke-screen, fire protection device (UPP) for extinguishing fire outside the vehicle and navigation system.

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CONTENTS

PZL-130 Orlik in Indian tender.

India issued request for proposal for deliveries of 75 propeller basic training planes. One of the construction is PZL-130 Orlik produced in Poland.

India issued request for proposal to airspace factories around the world. Among them are Brazilian Embraer (producer of EMB312 Tucano), Swiss Pilatus (PC-7/-9), US Raytheon (T-6 Texan II), Italian Finmeccanica (M-311), German Grob (G-120TP), Spanish EADS – producing PZL-130TC-II in Poland and Korean KAI (KT-1). Delhi is waiting for response till March 17th, 2010.

First batch of 12 training planes has to be delivered in 24 months from the moment of signing contract. It is expected that ordered planes will stay in service in Indian Armed Forces for at least 30 years. India plans to buy totally 181 propeller planes of basic training.

PZL W-3 Sokol helicopter for Philippines.

WSK PZL Swidnik is negotiating contract for deliveries of 8 PZL W-3 Sokol helicopters for Philippine Air Force. The contract will include integrated logistic support (ILS) for delivered helicopters.

Information about winning the tender announced in the middle of 2008 for deliveries of 8 multitask Combat Utility Helicopters, Philippine Department of Defence sent to WSK PZL Swidnik on November 26th, 2009. Up till now contract is being prepared, the company is obtaining permissions, financing etc. Contract might be signed in several weeks.

As per above mentioned notification, signed by acting Philippine Secretary of Defence Norberto B. Gonzales, value of the WSK PZL Swidnik offer was 61 459 454,31 USD.

Lubawa tents for China

Joint venture Xin Jiang Uniforce-Lubawa Technology company established in Chine announced receiving new orders for 150 tents.

To the previous year contract for 48 specialist pneumatic tents, the company added order for another 102 tents. Planned turnover of the company where Lubawa has 49% shares, for the 2010 shall reach 14-15 mln USD, 6 mln USD of which should be the income of the first contract, which was moved for current year due to insurgency in area where Polish-China JV is working. Estimated income of the company for 2010 should reach approx 1,1-1,5 mln USD.

Recipients of the company products are mainly companies dealing with natural resources searching, which placed orders for 48 pcs of TNP/2008 tents for equipment storage and maintenance.

Next order for 102 pcs of TNP/2008 tents was placed also by the company dealing with natural resources. In China those tents will be used as mobile logistics resource during searching for oil, gas or other minerals. Each tent has its own power supply, heating or lighting plus transport container for fast and safe transportation of the tent.

TNP/2008 tents are being in use by the Polish Army in Afghanistan for technical support and maintenance of Rosomak armoured vehicle.

Xin Jiang Uniforce – Lubawa Technology Ltd. Will produce pneumatic tents of different kinds with using experience and technology of Lubawa S.A. and materials from Poland.

7 another companies in Bumar

Bumar joined another 7 defence industry companies. The Group was joined by: BZE Belma from Bydgoszcz, FUMiS-Bumar from Wadowice, OBR SM from Tarnow, OBRUM from Gliwice, PIT (TRI) from Warsaw, PPPE Dolam from Wroclaw and FTE Cenzin from Warsaw.

Minister of Treasury transferred 85% of shares of 6 state owned companies and Agency for Industrial Development JSC contributed one company in exchange for shares in the Bumar. In the same time Bumar's share capital increased for 100 mln USD up to approx 380 mln USD totally.

Transferring shares of another companies to Bumar Capital Group has to led to improving financing and realisation of technically advanced programmes. Consolidation will have influence on strengthening Bumar's status as a partner of the biggest defence industry companies in the world.

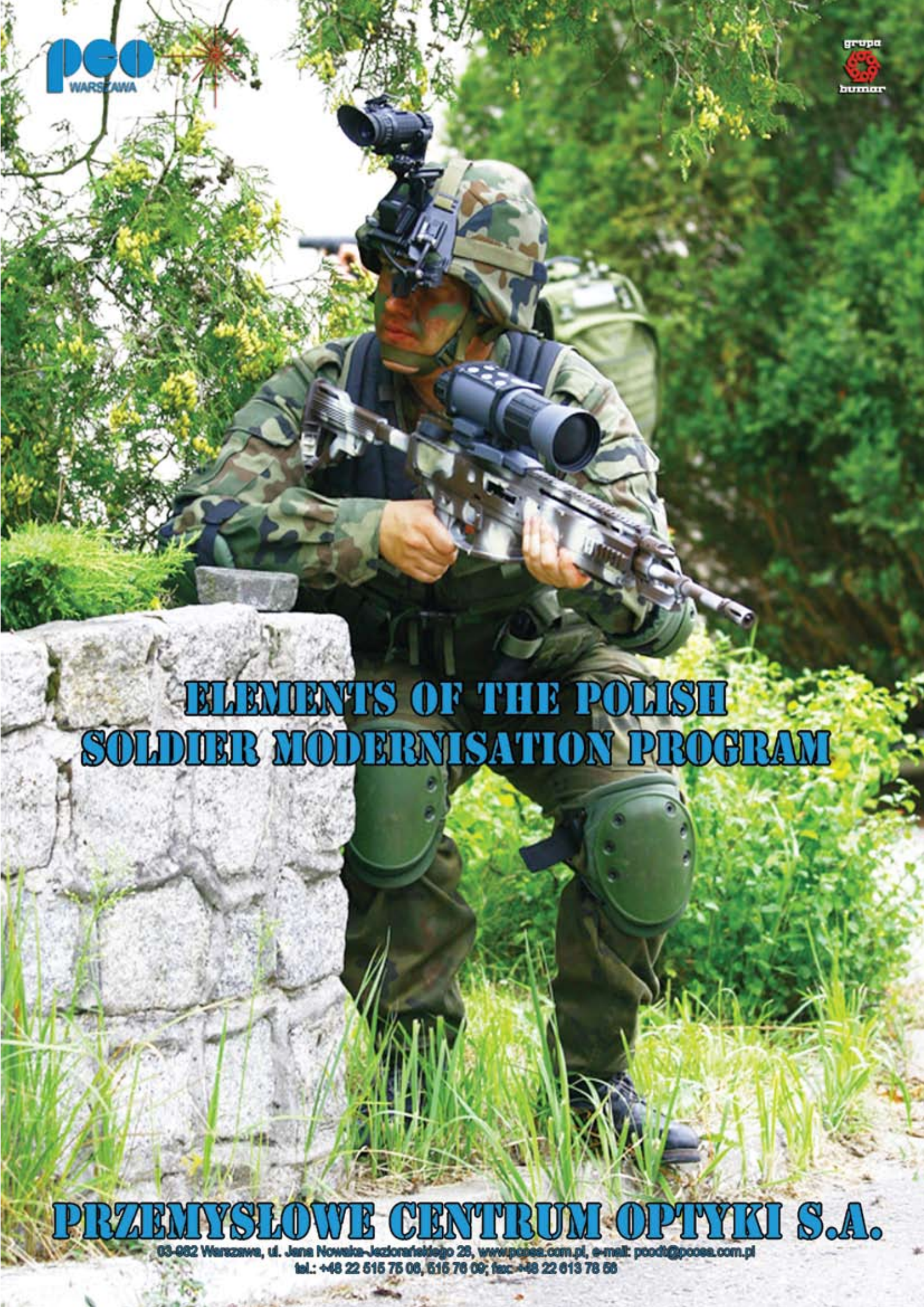
According to Bumar Group strategy 2008-2012 companies will be subordinated to appropriate product divisions of the Bumar Group.

Altogether Bumar Group joined 2000 new employees. Currently the Bumar Group employs approx 10000 employees. Bumar Group consist of 26 dependant companies, where Bumar has 44% up to 100% shares, and 2 associate companies. Hitherto 40% share of Bumar in Polish MoD order will increase up to 45%.

Novelties from Huta Stalowa Wola S.A. (Stalowa Wola Steelworks JSC)

Military Production Centre of HSW (CPW HSW) introduced for production its newest product – command vehicle on 122mm SP Howitzer 2S1 Gozdzik chassis for regiment of 155mm SP Howitzers Krab.

It's a vehicle on a completely changed body, equipped with new powerpack with 350 hp MTU engine delivered by the German FFG. The vehicle has max.



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Weight of 16t, but theoretically there is still reserve of load-bearing capacity of 2t, which in the future might allow for armouring the hull. Despite quite low weight, vehicle is not able to swim, however it has paddle capacity up to 170 cm.

In the future, the company is thinking of creating new floating platform weighting up to 25t. This platform will be a part of universal platform which is being created by OBRUM (on its base e.g. light tank would be created) with mass up to 32t.

CPW HSW is preparing for production of MAHSW 120mm SP automatic mortar on tracked chassis, being created as a part of Rak programme.

Lewiatan ZS – Polish Unmanned Assault-Reconnaissance Vehicle

Cooperation between WB Electronics, Hydromega and Military Technical University has led to creation of remotely controlled vehicle - Lewiatan ZS in reconnaissance (ZS-R) and armed (ZS-U) version.

Lewiatan ZS has big ability for moving in different terrain type and its big loading allow for installing necessary components and modules. This vehicle is able to drive on asphalt roads as well as off-road. Driving platform has 2200 kg weight, max speed of 55 kph, 1500 kg payload and is able to tow up to 2200 kg trailer. This small vehicle (length – 3500 mm, width – 2000 mm, height – 1950 mm) has 4 cylinder, 2800 ccm petrol engine with 92kW at 3600 tpm.

Lewiatan base version is a 6 wheel platform, which construction allows for overcoming trunks, trenches and swamps. Wide, low pressure tires allows for low pressure on the ground (approx 20 kPa). Thanks to it, the vehicle is able to drive in boggy or muddy terrain. Driving platform of Lewiatan has many advanced systems.

Steering, control and data transmission concept of Lewiatan ZS system was split into two systems: placed on a vehicle and on the base station. Information transmitted between vehicle and base station are using Harris military data link. This radioline secures range up to 50km in open terrain and up to 1 km in urban terrain (depending on building density). For observation and for steering Lewiatan is equipped with several CCD cameras, thermal cameras, GPS receiver and sensors such as e.g. laser scanners. For combat purposes, as a specialist device, 12,7mm machine gun and smoke grenade launcher were installed. Due to the fact that driving platform has 1500 kg payload it is possible to adapt other sensors or devices (it is also facilitated by the module communication system of the vehicle).

Up till now Lewiatan ZS is adapted to being remotely controlled by operator (or operators) from the base station basing on information coming from vehicle sensors. It is planned that further work will go into direction of creating vehicle being able to conduct mission fully autonomous.

JAKUSZ company control posts.

Jakusz SZB offered mobile, armoured control points to the Polish Army: one-person Jodla, 4-people Grab.

Grab control post is weighting 6,7t. Its integral part are foldable pillars of 1,5m max height. Optional equipment e.g.: lighting, ventilation system, A/C, alarm system, monitoring, heating, communication and (on customer's request) shooting holes.

Smaller – Jodla – is designed for one person. Its weight, without additional equipment or armour is 2t. Jodla and Grab might be transported with commonly available vehicles.

In basic version, with using armour (partially double) and armoured glass 10 centimetres class, protects against 7,62mm sniper rifle and with using anti-armour ammo. In case of Grab, its construction is also resistant to 400kg TNT explosion at 15m distance. Dome of the smaller Jodla proved that it is resistant to 82mm mortar grenade. Roof of Grab is resistant to 152mm fragmentation shell or rockets of BM21 system.

Control points might be equipped with bar armour, protecting against High Explosive ammo. In such configuration would be resistant to RPG-7.

Company representatives counts on export orders. Main potential recipients are countries of Middle East, Asia or Western Europe. Polish Army is also interested in these products. It is possible to mount control points on trucks. In this case they will fulfil role of armoured containers protecting against up to 6kg TNT mine explosion.

Bumar and Nammo cooperation

Bumar and Nammo AS of Norway, signed Strategic Cooperation Agreement. The agreement was signed by Mr Edgar Fossheim – President of Nammo AS, Mr Edward E. Nowak – President of Bumar and Mr Krzysztof Pawlak – Director of Bumar-Ammunition Division.

The main scope of the agreement is close cooperation on modern technology transfer of small, medium and large calibre ammunition, missiles and its components and joint production of wide scope of missiles' engines.

Nammo AS expresses interest to create together with Bumar, one of the leading missile engine factory in Europe. This investment will be conducted as joint venture. In Strategic Cooperation Agreement also includes joint activities on the Polish and foreign markets on field of production, trade and development. Nammo is interested in transfer of modern technology of small, medium and large calibre ammo and missiles and its components to Bumar Group companies.

Bumar and Nammo creates alliance, which will promote interests and products of both companies not only in Poland and Norway, but also on the world market

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PERSPECTIVES OF CO-OPERATION BETWEEN POLISH AND INDIAN INDUSTRY ON THE FIELD OF ARMAMENT

By Sławomir KUŁAKOWSKI

Polish-Indian co-operation started in the early 1960s.

Till 1980 export of armament and military equipment reached 115 mln USD. During all this years Poland exported to India 300 T-55 and T-54 tanks, 100 wheeled armoured fighting vehicles SKOT, 4 landing crafts, 50 planes TS-11 ISKRA and arms and spare parts for armoured, naval and air military equipment. Poland also maintained planes sold to India.

Payment for air and naval equipment was made as a part of multiyear, low interest, governmental credit, and the payments were done in cash.

Years 1981-1988 were the golden age for Polish-Indian cooperation. During this time Poland outdistanced many competitors on the Indian market. Export from Poland to India reached 250 mln USD.

During this period India has bought in Poland 162 pcs. of armoured recovery vehicles ARV-3 (Polish designation: WZT-3), 2000 pcs of ant-tank guided missiles 9M14M ,,MALUT-KA", 12 000 pcs of 122 mm GRAD ammunition, 100 engines for T-72 tanks, 50 AV-LB (Armoured Vehicle -Launched Bridge) BLG-60M, R-123M Radio stations and R-124 communication systems. Poland was still supplying spare parts for military equipment and was maintaining TS-11 ISKRA.

Additionally Poland supplied to India full technological lines for production of small calibre ammunition and took part in T-54/T-55 tanks modernisation programme. Poland also took part in starting licensed production of T-72 tanks in India.

After 1988 deliveries of new weapons and military equipment from Poland to India rapidly shortened. Only already contracted supplies were continued.

Main factors of lowering of turnover were:

- change of the form of agreements from clearing to foreign currency settlements
- reduction of competitiveness of Polish offer in compare to other suppliers
- reduction of Indian funds for military purchases
- reduction of purchases of final products from abroad by India in favour of domestic production based on licenses or own projects.

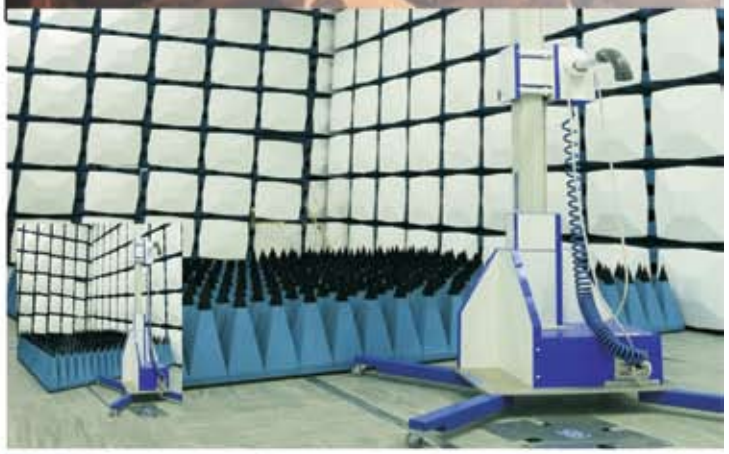
In 1990s Poland made attempts to interest Indians with joint modernisation of T-72 tanks, joint production of self-propelled howitzers cal. 155mm, radio location systems, landing crafts, or aerospace programs. Only some of them were realised.

In the middle of 1990s India showed interest in making Polish-Indian joint ventures, producing modern weapons and military equipment for Indian Armed Forces and for export. Common readiness for revitalisation of defence industries and technical-scientific co-operation of both countries has created opportunity for frequent visits of military and governmental delegations from Poland and India in appropriate countries.

More intensified contacts between Poland and India on the field of defence resulted in increase of export of Polish arms to India and start of joint production programs. In 2001 Poland won a tender for supplying armoured recovery vehicles ARV-3. In 2002 Poland won a tender for supplying fire control systems for part of Indian T-72 MBT, next part of ARV-3 and parachutes for Special Forces. Construction and modernisation services of TS-11 ISKRA were still a leading product.

There are also positive effects of Polish-Indian defence industry cooperation started by Polish Defence Consortium (joint initiative of PZL Mielec, Huta Stalowa Wola and Bumar Labedy). Przemystowy

MILITARY INSTITUTE of ARMAMENT TECHNOLOGY



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- *The main compound - Zielonka n. Warsaw,*
- *Dynamic Testing Centre - Stalowa Wola,*
- *Dynamic Testing Centre - the range in Drawsko Pomorskie.*

Main fields of Institute's activities are:

- *scientific - research and development work;*
- *prognosis and expertises reports;*
- *functional tests;*
- *standardisation and unification;*
- *software for the command and fire control systems;*
- *certyfication of weapon systems;*
- *training on handling the explosive materials.*

In following domains:

- *fire arms;*
- *rockets and missiles;*
- *artillery;*
- *radar systems;*
- *service and maintenance of weapon systems..*

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Instytut Telekomunikacji (Telecommunication Research Institute) - producing e.g. passive detection systems - together with Bharat Electronic Limited (BEL) from

Bangalore made new radio-location station on BEML chassis, for Indian Armed Forces. Thanks to cooperation between BUMAR and Bharat Enginery Marat Ltd., supplies of WZT-3 for India became possible.

Are there chances for mutually beneficial cooperation between India and Poland? Of course there are. Poland, after transformation in 1990s is specialised in modernising of Soviet / Russian -origin weapons or produced on licences and Russian technologies. We offer to Indian partner our experience and modernisation projects of T-72 MBT and of other products basing on T-72 chassis. We lead in modernisation of KRUG, KWADRAT and NEWA missile systems, recon¬naissance vehicles BRDM-2 and infantry fighting vehicles BMP.

Polish companies (together with Indian partners) are taking part in very important tenders in India for deliveries of internal communication systems and armoured vehicles.

Recently, Polish companies, successfully finalised contract for 20 mln USD.

We believe it would be possible to start cooperation in producing ammunition (e.g. 125mm sub-calibre ammunition) on the world market as there is big need for large quantity of such products. It would be also reasonable to cooperate in production of new family of antitank missiles, which are in use by the Polish Armed Forces since 2005.

Polish offer could also include such systems like: 122mm missile ammunition FENIKS, portable antiaircraft missiles GROM and 35mm antiaircraft guns. Polish missiles, “cousins” of Russian Igla, which effectiveness isn't worse than STINGERs'. Oerlikon guns (for which Poland bought license) are standard equipment of many NATO countries. Another interesting solution, on the world's scale, is antiaircraft system LOARA, currently being introduced to the Polish army. We’re also able to offer WR-40 Langusta MLRS and KOBRA – anti-aircraft system, which was successfully offered to Indonesia. Another interesting proposal might be armoured recovery vehicle ARV-4, successor of the ARV-3, the whole family of modern helicopters or armoured vehicles.

Fire control and command artillery systems also could be the opportunity for bilateral cooperation. Modernisation of C4I systems also becomes the most important priority for army and air forces. There are already available some solutions in Poland for air forces and mobile systems for the army, made by RADWAR and military facilities in Czernica and Zegrze.

Poland is open for co-operation in shipyard, aerospace and electronic branch. We're leading producer of landing crafts, logistic ships and mine destroyers. In 2002 we started building modern corvettes for Polish Navy. In aerospace industry, opportunity for Polish-Indian cooperation could concern reconnaissance planes PZL-28 BRYZA and transport PZL-28 SKYTRUCK and joint production of its successor IRYDA. We could offer also radiolines and modern battlefield communication systems. Our strongpoint is offer of supplies and joint development of logistics equipment, including soldier's personal equipment.

Above examples do not fulfill all opportunities for Polish-Indian cooperation on field of armament. It would be also important to start some joint projects of export to third countries. The most important factor in planning of the cooperation on field of armament is realisation, that goal of modernisation programs are similar in both countries and join investments in armament production programs may increase chances, for our producers, for receiving more orders. It is also positive in terms of sustaining sufficient level of employment. Optimal way for increasing effectiveness in armament production is consolidation and making international structures. Our countries should reach common approach to this problem.

Currently some Polish companies try to create some new Joint Ventures with Indian partners.

A few years ago Polish-Indian Joint Working Group on Military Cooperation has been established. The last meeting of the Group took place in 2008 in New Delhi. Polish delegation to this meeteing was led by Mr Zenon KOSINIAK-KAMYSZ – Deputy Minister of Defence of the Republic of Poland.

Establishing this steady working group for exchange information on defence cooperation shows our approach toward India as a strategic partner and very important player in the world.

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Armoured Recovery

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- Maintenance and combat operability recovery
- Technical service, conducting engineering and rescue tasks
- Air-defence
- Conducting specialised works.

Such tasks are being fulfilled by Armoured Recovery Vehicle ARV-4 (WZT-4) – fast, armoured, tracked vehicle.

In particular it allows to:

- Evacuate tracked vehicles from the battlefield
- Recover of tracked vehicles in different terrain conditions
- Towing of damaged tracked vehicles
- Conducting ground works with dozer (making: trenches, battle stations for tanks, passages through-ramparts and anti-tank slopes and other ground works)
- Conducting assembly and disassembly works with its own crane
- Conducting works related to fixing hull using welding equipment and necessary spare parts
- Vehicle maintenance thanks to being very well equipped with tools and other equipment.
- Conducting first aid for crews as well as Combat Medevac
- Sustaining two way communication between vehicles thanks to two radios placed in each vehicle.

ARV-4 (WZT-4) is a high mobility vehicle, equipped with special equipment for crew and devices protection against explosion wave and penetrating radiation during nuclear explosion and also protecting crew members against nuclear radiation, chemical and biological weapon.

The vehicle is also equipped with device for allowing deep water crossing driving on the bottom (WJPW), smoke grenade launchers and thermal smoke device (TAD) for placing smokescreen, fire protection device (UPP) for extinguishing fire outside the vehicle and navigation system.

Crew of ARV-4 (WZT-4) consists of 4 people.

Main parts of the vehicle are: armoured hull with load-carrying body, propulsion system in form of powerpack, driving system, hydraulic system, electric equipment, communication system, day and night vision systems, NBC weapon protection system, fire fighting system, electric welder, power transformer, acetylene-oxygen device, evacuation pipe, towing device, main winch, auxiliary winch, crane, dozer, armament (12,7mm machine gun), navigation system (LNS), battlefield management system (BMS), air conditioning and auxiliary power generator.

In each vehicle there is a set of equipment e.g.: spare parts, tanks' and own ARV's instruments' set, tools and crews' equipment and equipment for combat medevac.

Inside of the vehicle is split into several compartments: crew, transport and propulsion. Crew compartment is located in front of the vehicle.

In the middle of the vehicle transport compartment is located. Floor of this compartment are fuel tanks. Transport compartment is for transport of bigger components necessary for maintenance or for wounded soldiers transport (there is ability for transport of 3 wounded in laying position on a stretchers being part of the vehicle equipment). Propulsion compartment is located in the back of the vehicle and is separated from the transport compartment with hermetic divider. Covers over compartment create bottom of the carrying

Vehicle ARV-4 (WZT-4)

platform and thanks to stiffening ribs allows for installing and transportation of large size spares and components for maintained vehicles including powerpack.

ARV-4 (WZT-4) construction bases mainly on components of PT-91 M Main Battle Tank securing maximal parts unification. There were directly adapted the following parts and components:

- Power transmission system consists of powerpack with 1000 hp engine with air, cooling, oil and exhaust system, steering wheel and automatic gearbox
- Driving wheel suspension (including suspension lock of firsts and 6ths driving wheels)
- Driving system equipped with DIEHL tracks with rubber covers
- Filter-ventilation system and NBC weapon protection system
- Fire suppression system and anti-explosion system
- Communication system
- Air conditioning
- 12,7mm Anti-aircraft machine gun
- Smoke grenades launcher
- LNS navigation system
- Battlefield management system
- Auxiliary power generator

ARV-4 (WZT-4) in compare to its predecessor ARV-3 (WZT-3) has many modern systems, equipment and technical solutions which place them in the same line with the most modern vehicles of this kind in the world. Below is comparison between ARV-4 (WZT-4) and ARV-3 (WZT-3):

ARV-3 (WZT-3)	ARV-4 (WZT-4)
Propulsion: • In the system are: engine, transmission, two gearboxes • 625kW (850hp) S-12U engine • Gearboxes: 7 forward gears, 1 reverse gear • No ability for turning around its own axis • Max speed: 60 kph	Propulsion system providing better traction and manoeuvrability: • As a powerpack (shorter replacement time in compare to ARV-3 (WZT-3)) • 735kW (1000hp) S1000R engine • ESM350-M automatic gearbox steered with RENK/SESM steering wheel: 8 forward gears, 3 reverse gears • Ability for turning around its own axis • Max speed: 65kph
Crane: • TD-50 with 15t lifting capacity • Placed on same side as exhaust	Crane: • K-20 with 20t lifting capacity • Placed on the opposite side to the exhaust facilitating exploitation of the crane
Main winch: • Drum, hydraulic • Single rope traction force: 280kN (28t) • Traction force with pulley block: 840kN (84t)	Main winch: • Drum, hydraulic • Single rope traction force: 300kN (30t) • Traction force with pulley block: 900kN (90t)
Hydraulic system: • Conventional	Hydraulic system: • load sensing
Auxiliary power unit: • No power generator	Auxiliary power unit: • Engine power 15kW • Electric power 3,9kW
Air condition: • No A/C	Air condition: • Power approx. 8,0 kW (6,880kcal/h)
Driving system propulsion: • Torsion bars, hydraulic shock absorbers, mechanical bumbers	Driving system propulsion: • Strengthen torsion bars, frictional shock absorbers, elastomeric bumpers
Navigation: • GPK-59	Navigation: • Sagem LNS „Epsilon15”
Communication: • R-173Radio • R-173Receiver • R-174 Intercom	Communication: • Thales VHF TRC9310-3 (F@stnet) radio • Thales HF TRC 3630-3 radio • Thales SOTAS intercom
Battlefield management system: • No battlefield management system	Battlefield management system: • Sagem BMS

PZL M28 Bryza 1R Bis

By Mirosław WRÓBLEWSKI

After over 7 years since the first test flight. Modernised patrol-reconnaissance and ASW PZL M28 Bryza1R Bis (An-28B1R Bis) was introduced into the service in the Polish Naval Aviation..

The plane came from Polskie Zakłady Lotnicze Mielec to mother airfield of 44th Navy Aviation base in Siemirowice. After short break, Bryza Bis started – together with older M28 Bryza R1 – training flight over the sea in Łeba region. This was the symbolic introduction of Bryza Bis into service.

Programme of increasing BryzaR1 abilities, was started several years ago. On January 29th, 2003 the plane has test flight. The changes were: placing Maritime Reconnaissance System SRM-800, integrating e.g.: ARS-800 observation radar with approx 185km range and following over 100 targets in the same time, MAG-10 magnetometer (placed in "sting" behind the plane's tail) and HYD-10 hydro acoustic buoys. It will allow for detection of submarines, the task which was impossible to do by Polish Navy Bryzas before. Similar novelty is using passive ESM-10 Lemur-10 system.

Also abilities to conduct SAR mission will increase. Except more effective radar (having almost twice bigger range, and which is less interfered than ARS-400 thanks to use of divertible undercarriage leg and foldable front wheel), CHELTON castaways search and location system ahs been used. The plane is also prepared for throwing rescue raft.

Under lengthen hull's nose AN/AQQ-22 Star Safire II header able to follow 8 objects in the same time, equipped with daylight CCD-TV camera, thermo vision camera and laser rangefinder has been placed.

Bryza Bis crew consists of 6 people: two pilots, mechanic and three special systems operators.

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- Logistics Systems
- Safety and Reliability
- Unmanned Aerial Vehicles
- Training Systems, including e-learning
- Air Armament
- Airfield and Road Infrastructures
- Alternative Fuels, Working Liquids and Lubricants
- Biocomponents in POL's Engineering Products
- Designing and Integration of Aeronautical Systems

Integration of avionics systems

THE UPGRADING OF AIRCRAFT, INCLUDING HELICOPTERS

OBJECTIVE:

Introduction of the new integrated avionics systems and airborne instruments to meet the requirements of the modern battlefield.

Aerial weapon tests

THE SCOPE:

- Precise navigation based on INS, GPS, VOR/DME/ILS/MRK/ TACAN, and Air Data Unit (ADU)
- Head-up display (HUD) with a rear-cockpit repeater, and multi-function displays (MFD)
- Real-time and rotary digital map
- Communication systems, including the wide-band radio station
- Armament management systems extended with some selected components of simulated air weapons
- The whole system integrated with MIL-STD-1553b airborne digital data bus employed
- Remote flight monitoring system (including on-line transmission of selected flight data to a ground station)
- Modified cockpit architecture and a new cockpit-abandoning system with modern ejection seats

The stationary terrain surveillance system

AFIT ***MEANS PROFESSIONALISM IN THE FIELD OF SAFETY AND RELIABILITY OF AERONAUTICAL ENGINEERING***

KRAB - 155 mm
self-propelled howitzer

By Grzegorz CHUDEK

In 1994, in the Polish Armed Forces, together with withdrawing old M 20, M 30 towed guns and with perspective of withdrawal 2S1 Goździk self propelled howitzers, it was assumed that it is necessary to design 155mm self propelled howitzer in Poland, with foreign partner. In 1996 MoD issued RFP to Huta Stalowa Wola (Stalowa Wola Steel Mill), which produced 122mm 2S1 Goździk howitzers, for preparing tactical-technical parameters of concept project of six 155mm self propelled howitzers squadron module with all supporting systems and for conducting tender for turret. In the first tender in 1997 – cancelled due to financial reasons – to the last stage several systems were qualified: Zuzana T, T-6 (both on T-72 MBT chassis), AS-90 and PzH-2000 (the last one, on the modified Leopard 2 MBT chassis). In the second tender, which was conducted a year later, competed: AS-52 Braveheart (AS-90 with L52 barrel) and again Zuzana T and PzH-2000. Tender concern coproduction of complete artillery system – foreign partner was supposed to secure transfer of technology of the turret. In 1998 all three offers were analysed (according to unofficial information, the favourite was PzH-2000, smaller chance had Slovaks due to the Zuzana T barrel not complying with JBMoU (Joint Ballistic Memorandum of Understanding) and constructional solutions of Zuzana turret). To the final stage were qualified German and British offer; it is worth to stress that both of them were compliant with Polish tactical-technical requirements. MoD decided that the life firing tests will be crucial for making a choice. They were conducted in June 1999. The British offer was chosen – AS90 Braveheart (with courtesy it was translated to Chrobry – one of the Polish kings) turret, 52 calibres long ERO (Extended Range Ordnance) barrel. In July 1999 agreement between Huta Stalowa Wola and GEC Marconi (now BAE Systems) which concern transfer of technology for the production of autonomous turrets of the AS52 Braveheart artillery system and marketing cooperation related to possible export of the system to the third markets, was signed. The contract included transfer of technology of the gun production, turret with fire control system, accessories delivery, spare parts deliveries, technical support, license rights and six turrets produced in the UK deliveries. The first squadron module (consist of 6 howitzers, 2 vehicles (of squadron commander and his deputy),

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Ośrodek Badawczo - Rozwojowy Urządzeń Mechanicznych „OBRUM" sp. z o. o. specializes in defence research and development, modernization and project implementation. We leverage on more than 40 years of experience in designing and building special-purpose high-speed track vehicles.

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- **self-propelled anti-tank mine layers,**
- **infantry fighting vehicles,**
- **training stations for crews of the tank T-72/PT-91, including the comprehensive simulator BESKID 3,**
- **training simulators for the armoured personnel carrier ROSOMAK,**
- **shooting training systems.**

The OBRUM company embarks upon the implementation of new projects for the Polish Armed Forces relating to the maintenance and improvement of national defence and security standards and to the participation of the Polish Army in NATO operations.

The OBRUM company is also involved in programmes aiming at the development of modern military equipment meeting requirements of the battlefield of the future.

2 vehicles of battery commander and fire platoon leader, ammunition vehicle and evacuation tractor) called Regina (it's the name for the whole 155mm artillery system with fire, command and logistic subsystems) was transferred for military trials in 2003.
The first Krab howitzer prototype was finished in June 2001 and till the end of November 2001 passed the first stage of live fire trials. Tests of the complete Regina system were conducted till the end of 2003. After that, the whole programme was frozen till the year 2006 when it was resumed. There is a contract signed for deliveries of KRABs to the Polish Army.

Technical Description

Crew of the 155mm Krab howitzer consists of 5 people: commander, gunner, 2 loaders and driver. Chassis bases on modified seven wheel tracked SPG-1 Kalina chassis. Driving system – 12 cylinder turbocharged PZL Wola S-12U diesel engine, 625 kW (850 hp) at 2000 rpm. It has 38880 cm3 end transmission system using mechanical gearbox with hydraulic support.
Main Krab armament is 155mm calibre gun, 52 calibre long (approx. 8997mm) and 3027 kg weight, British made adapted from AS-52 howitzer, with semi-automatic loading.
Ammunition supply carried inside the howitzer is 60 pcs of bullets and propellant charges of which 31 bullets and 33 propellant charges are located in turret niche and 29 bullets and 27 propellant charges are located in the storage at the back of the hull. Krab might use ammunition used by NATO (JBMoU): Blast Fragmentation, cluster munition, guided, long-range with Base Bleed gas generator.
Krab has 3 computers, helping with conducting fire: steering terminal (hurry and automate aiming, loading and firing processes), aiming (after receiving ballistic data, shows settings and steers the turret turning mechanisms) and howitzer commander's computer (ballistic – shows tactical situation on digital map, conducts ballistic calculations, preparing settings for shooting). Aiming and shooting is also supported by Weibel Scentics MVRS-700 bullet escaping speed doppler radar and Avinco laser rangefinder with 20 km range (for target following and shooting straight).Both devices are connected with ballistic computer. According to assumptions, the Krab crew should be able to shoot the first round (even while on the move) after less then 30 seconds after receiving orders. External voice communication and data transmission is secured by the RRC-9500-3, internal communication between crew members is secured by Fonet digital internal communication system. It is also possible to mount TROP battlefield command system on the vehicles (not only on howitzers). Howitzer is also equipped with land navigation system with laser gyrocompass and GPS receiver.

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Organisation

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Co-organisation

Polish Chamber of National Defence Manufacturers

Co-operation

Media Auspices

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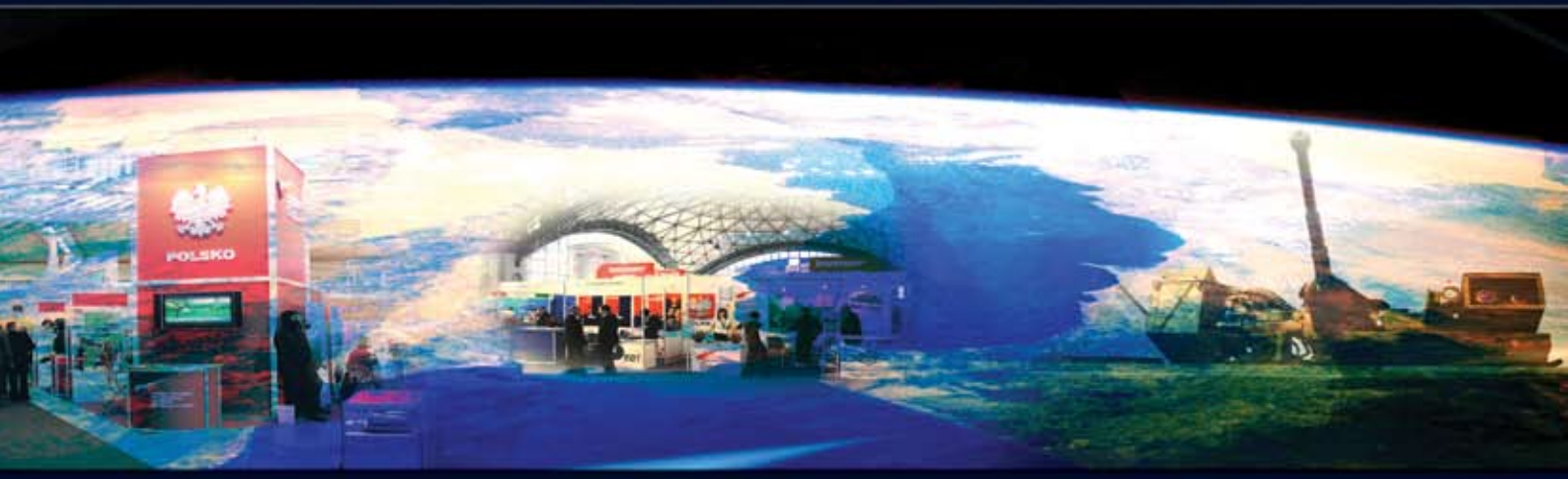
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EFFECTIVE PARTNER

Polish Chamber of National Defence Manufacturers was established on September 11th 1995 and is the eldest self-governing economical organisation in Poland in defence branch. The Chamber represents economical interest of its members on field of their production, service and commercial activities, especially in front of the governmental bodies. Because of its range, status and achievements the Chamber is still the organisation, which represents matters of defence companies the best.

The statue's obligation of the Chamber are: initiating activities for improving technological level and quality standards of products manufactured by the companies - national defence suppliers, activating co-operation efforts, inspiring efforts aimed at increasing of the domestic defence production and export, inspiring and supporting process of restructurisation and modernisation of the domestic defence industry and its preparations for integration with European structures. Important part of the Chamber's activities is expertise and opinion-making and conducting training for representatives of Polish defence industry and facilitating their contacts with foreign partners. There is also conducted exchange of technical, organisational and commercial experiences.

Currently the Chamber has over 140 members, including private as well as state-owned companies. Among them are potentates as well as small enterprises.

Since 8 years the Chamber co-ordinates majority of joint appearances of the Polish defence industry on international exhibitions (in years 1999- 2009 the Chamber organised 30 national stands of the Polish defence industry) and the Chamber was the organiser of many economic missions (e.g. to India, Indonesia, Norway, Malaysia, Singapore, USA, Australia, UK, Greece, Turkey, Romania, Moldova, UAE).

The Chamber is the initiator of the military-industrial co-operation among Visegrad Group. Its part were two editions of Forum of Defence Industries of Poland and Czech Republic (1999 and 2001), 1st Forum of Defence Industries of the Visegrad Group (2001) in Warsaw, 2nd and 3rd Forum (2002-2004) in Trencin, Slovakia.

Except co-operation agreement with Ministry of Defence (12th August 1999), the Chamber formalised contacts with defence industry associations of some other countries by signing separate agreements with them (e.g. with France, India, Malaysia, Indonesia, Czech Republic, Slovakia, United Kingdom, Norway, Romania, Spain, Portugal, Italy, USA, Indonesia, South Korea, Australia).

In 1999 the Chamber published Polish Defence Industry Catalogue, its next edition is currently in preparation. Additionally the Bulletin is published frequently, bimonthly "Polish Defence Industry" and quarterly "Economic-Defence Review" and extraordinary promotional publications (e.g. in Polish, English, Czech and Slovakian language) are also published.

In 1998 the Chamber was selected for representing Polish defence industry in NATO Industrial Advisory Group (NIAG) and since December 2000 is actively taking part in the Group meetings. The Chamber was appointed Point of Contact between European Defence Agency (EDA) and Polish defence industry.

Since August 22nd, 2005 the Chamber introduced Internal Control System according to law on turnover of the products, technologies and services important for national security and also for keeping international peace and security and received ISO 9001:2009 and IQNet certificate . On October 20th, 2005 the Chamber received license of Polish Ministry of Internal Affairs and Administration for special equipment turnover (No. B-062/2005), on December 27th, 2005 the Chamber received NATO Commercial and Government Entity Code (N-CAGE) No. 1082H. ■

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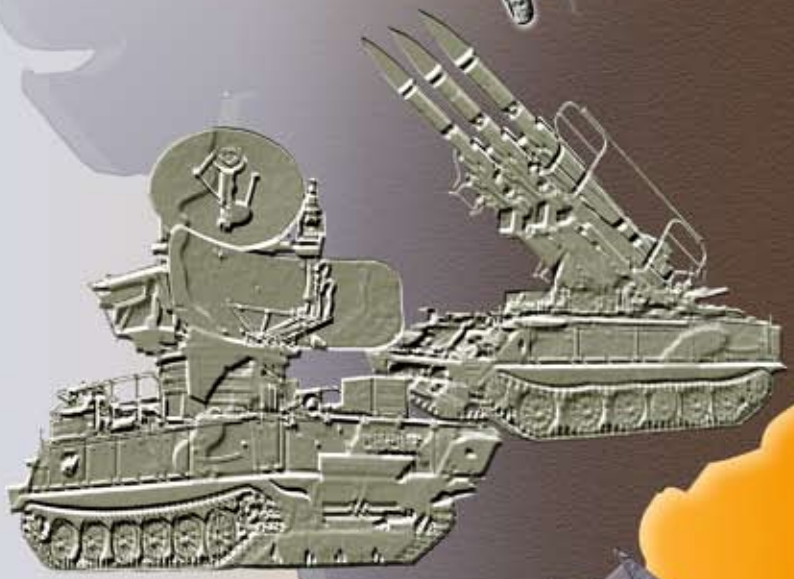

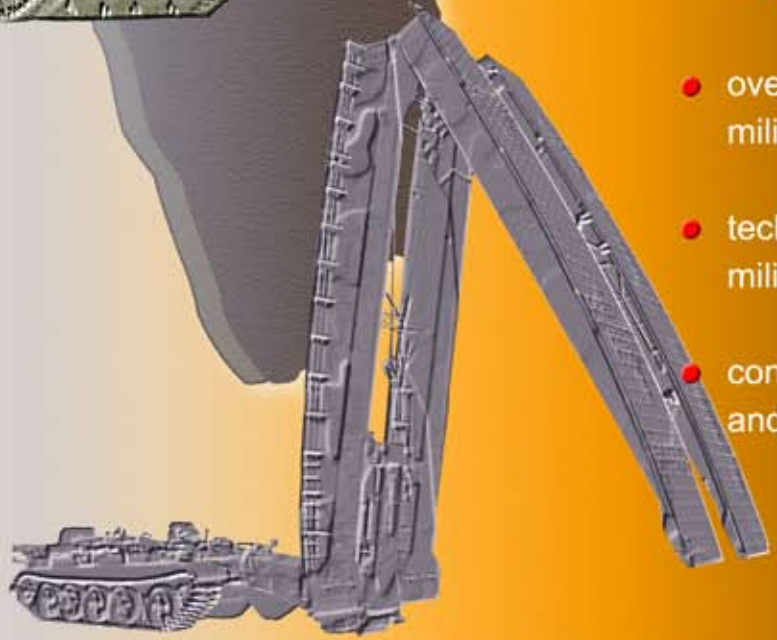

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