

ARCHIVED REPORT

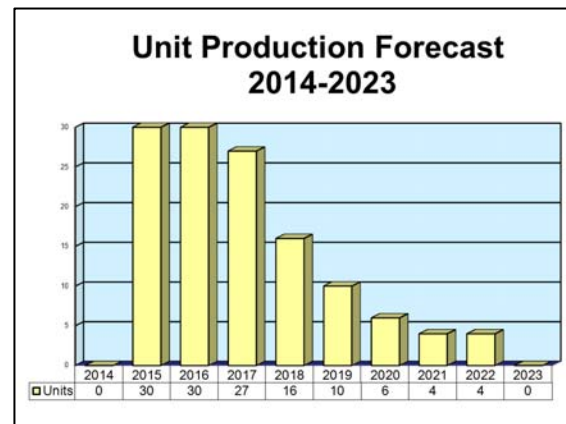
For data and forecasts on current programs please visit

www.forecastinternational.com or call +1 203.426.0800

PT-91 Twardy

Outlook

- Production complete for Polish Army procurement; PT-91 components available in a retrofit package for existing T-72 tanks
- In January 2009, contractor delivered the last of Malaysia's initial order of 48 PT-91 tanks
- Forecast reflects production for contractor's expectations of additional PT-91 procurement



Orientation

Description. A main battle tank.

Sponsor. Poland's Ministry of National Defense sponsored the development and Polish Army procurement of the PT-91 Twardy.

Licensees. None

Status. Serial production line is currently dormant.

Total Produced. Through 2013, we estimate the contractor produced 160 PT-91 Twardy tanks.

Application. Armored mobile weapons systems optimized for high-speed offensive and breakthrough operations, as well as defensive fire support.

Price Range. In 2014 U.S. dollars, the PT-91 Twardy reportedly maintains a unit price of \$4,002,800.

Contractors

Prime

Zakłady Mechaniczne Bumar-Labedy SA	http://www.bumar.gliwice.pl , ul Mechnaikow 9, Gliwice, 44-109 Poland, Tel: + 48 32 734 51 11, Fax: + 48 32 734 65 11, Email: hr@bumar.gliwice.pl , Prime
--	--

Subcontractor

Denel (Pty) Ltd	http://www.denel.co.za , Nellmapius Dr, Irene, 0046 South Africa, Tel: + 27 12 671 2700, Fax: + 27 12 671 2751, Email: marketing@denel.co.za (Tiger New Generation Fire Control System)
Diehl Remscheid GmbH & Co KG	http://www.diehl-remscheid.com , Vieringhausen 118, Remscheid, 42857 Germany, Tel: + 49 21 91 976 0, Fax: + 49 21 91 976 208 (Type 840 I Track)
Sagem	http://www.sagem-ds.com , Le Ponant de Paris, 27, Rue Leblanc, Paris, 75512 France, Tel: + 33 1 58 11 78 00, Fax: + 33 1 58 11 78 50 (SAVAN 15 Fire Control Suite)

PT-91 Twardy

**Zakłady Mechaniczne
"PZL-WOLA" SA**

<http://www.pzl-wola.pl>, 11 Artyleryjska St, Siedlce, 08-110 Poland,
Tel: + 48 22 634 4010, Fax: + 48 22 837 4513, Email: zarzad@pzl-wola.pl
(PZL-WOLA S-1000 Diesel Engine)

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Services/Governments & Industries) or call + 1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. The PT-91 Twardy is essentially a greatly improved version of the Russian T-72M1 main battle tank. The PT-91 features multilayered composite armor, explosive reactive armor (ERA), an automatic loading system for the main armament, a laser warning system, and a more powerful diesel engine.

Crew. Three: commander, gunner, and driver.

Dimensions. The following data reflect the PT-91 mounting ERA. The length includes the long-range fuel tanks; without these tanks, the length is 9.53 meters (31.27 ft). The width includes the armored skirts; the height is without the 12.7x107mm NSV machine gun mounted on the turret roof.

	<u>SI Units</u>	<u>U.S. Units</u>
Length	9.67 m	31.72 ft
Width	3.59 m	11.78 ft
Height	2.19 m	7.18 ft
Combat weight	45.31 tonnes	49.94 tons
Fuel capacity	1,000 liters	265.95 gal

Performance. The performance data reflect use on a paved road. The PT-91 can ford 5 meters (15 ft) of water when mounting its snorkel.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum speed	60 kmph	37.3 mph
Maximum range	650 km	403.7 stat mi
Step	85 cm	2.79 ft
Trench	2.8 m	9.18 ft
Slope	40%	40%
Gradient	60%	60%
Fording	1.8 m	5.91 ft

Engine. S-12U liquid-cooled, supercharged V-12 diesel engine. This four-stroke powerplant generates 632.4 kilowatts (848 hp), with a power-to-weight ratio of 13.96 kilowatts per tonne (16.98 hp/ton). The 27-volt electrical system features four 180-ampere-hour batteries.

The contractor can also integrate the PZL-WOLA S-1000 liquid-cooled, turbocharged diesel engine. This powerplant generates 746 kilowatts (1,000 hp), with a power-to-weight ratio of 16.46 kilowatts per tonne (20.02 hp/ton).

Gearbox. An unspecified hydraulically assisted, manually operated unit, with one reverse and seven forward gear ratios.

Armor. The low-silhouette hull features conventional rolled homogeneous steel, 23 centimeters (9.05 in) thick. The turret is a single-piece casting with a maximum thickness of 45 centimeters (17.72 in). Two patterns of ERA (ERAWA-1 and ERAWA-2) are available to supplement the base armor. The PT-91 may also feature a layer of radiation-absorbing armor in the hull and the turret roof.

Suspension and Running Gear. Torsion bar suspension, with six die-cast, rubber-tired dual roadwheels and three track return rollers on each side. The first, second, fifth, and sixth roadwheel stations feature hydraulic shock dampers. The "live" track features rubber pads.

Armament

Main Armament. 125mm 2A46 D-81TM smoothbore tank gun produced in Poland under license from the Russian Federation. This ordnance features a thermal shield, muzzle reference system, and fume extractor. This ordnance is fully stabilized in two planes. Elevation (+14°), depression (-6°), and turret traverse (360°) are electrically operated, with manual backup.

PT-91 Twardy

This ordnance feeds from a carousel-type automatic loading system. The projectiles store in a horizontal position in the bottom of the tank; the propellant charges store in a vertical position in a ring mounted around the turret base. After firing, the ordnance automatically returns to the index position for reloading. The PT-91 carries 39 rounds of 125mm ammunition.

The 2A46, firing Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) ammunition, can achieve a muzzle velocity of 1,830 meters per second (6,003.9 fps). Available Russian-pattern 125mm ammunition types include:

- 3VBM3, 3VBM6, 3VBM7, 3VBM8, 3VBM13, and 3VBM17 APFSDS
- 3VP6 APFSDS-T
- 3VBK7, 3VBK10, 3VBK16, and 3VBK17 High Explosive Anti-Tank (HEAT)

- 3VOF22 and 3VOF36 High Explosive-Fragmentation (HE-Frag)

The Polish 2A46 D-81TM variant reportedly cannot accommodate the 9M119 Svir (AT-11 Sniper) anti-tank guided missile.

Secondary Armament. One coaxially mounted 7.62x54mm PKT (SGMT) machine gun; one pintle-mounted 12.7x107mm NSV machine gun on the turret roof. Each side of the turret mounts 12 Tellur electrically operated smoke grenade launchers.

Fire Control. The computer-based PCO fire control system (which is reportedly *not* a copy of the 1A40-1 sight group) features passive vision devices for the commander, as well as a laser rangefinder integral with the gunner's primary sight. The gunner's station also mounts the Drawa thermal sight. The PCO system includes the OBRA laser-warning device.



PT-91 Twardy Main Battle Tank

Source: Zakłady Mechaniczne Bumar-Labedy SA

Variants/Upgrades

Variants. The Malaysian PT-91 represents the single available variant of the basic PT-91 design. The signature characteristics of the Malaysian PT-91 variant are as follows:

Powerplant & Drivetrain. The Malaysian PT-91 variant mounts the PZL-WOLA S-1000 powerplant. The gearbox is either an improved semi-automatic version of the existing gearbox or an entirely new automatic unit. The Malaysian PT-91 also reportedly mounts Diehl rubber-bushed track (possibly Type 840 I).

SAVAN 15 Fire Control Suite. While this variant retains some components of the PCO fire control system, the advanced-design SAVAN 15 system from Sagem SA of France serves as the heart of the new fire

control suite. This multi-channel suite features the VIGY 15 three-axis-stabilized commander's sight, a digital computer, a stabilized thermal/day sight with integral laser rangefinder for the gunner, and a sensor suite.

The Malaysian PT-91 mounts a laser warning system with four receivers, as well as the ERAWA-1 explosive reactive armor (ERA) suite.

Modernization and Retrofit Overview. Not generally applicable at this time.

Tiger FCS Upgrade. Under the auspices of Denel (Pty) Ltd, the firms of Lyttleton Engineering Works, Kentron, and Eloptro developed a new "drop-in" modular fire control suite for the T-72 tank series,

PT-91 Twardy

including the PT-91 Twardy. The Tiger New Generation Fire Control System is a hunter-killer suite that greatly enhances the day/night fire-on-the-move capabilities of existing tanks. The Tiger system requires no modifications to the existing turret; second-level maintenance facilities can install the Tiger suite in four to five days.

In 1999, the Polish Army tested the Tiger system in a Polish T-72. Additionally, Poland reportedly completed

integration of the Tiger system with the PT-91 (at least on paper).

PT-91EX. The PT-91EX model is an enhanced variant of the PT-91 designed specifically for export.

The model features an unspecified modern fire control system with full day/night and thermal imaging capabilities and improved power-to-weight ratio. No orders for the PT-91EX have been reported at this time.

Program Review

Background. The T-72, along with the T-64, represents the second generation of Soviet (now Russian) tank development since World War II. The PT-91 Twardy is a Polish variant of the basic T-72 design. For a complete discussion of the T-72 program, see the "T-72" report in this service. In 1989, Zakłady Mechaniczne Bumar-Labedy began redesigning the T-72M1, which it produced under license. The effort culminated in the introduction of the PT-91 Twardy in 1993.

Limited Polish Procurement

The contractor completed development of the first prototype of the new tank (then called the Wolf) from existing T-72 components in 1992. Operational trials began in 1993. The Polish Army ordered 78 new-production PT-91 Twardy tanks. Thereafter, the Polish Army intended to retrofit T-72M1 tanks to the PT-91 configuration in lieu of procuring new-production PT-91 tanks.

Description. While superficially quite similar to the T-72M1, the PT-91 tank is, in fact, a greatly improved weapon system. The tank exhibits the standard T-72 internal layout.

Polish Improvements

The PT-91 integrates an all-new computerized fire control suite and a fully stabilized armament control system featuring a passive image intensification or thermal sight (the Drawa). The tank also mounts the OBRA laser warning system, and is equipped with a new fire detection/suppression system and a nuclear, biological, and chemical (NBC) overpressure protective suite.

The uprated V-46 diesel engine (the Type S-12U) and improved track enhance vehicle performance. The enhanced armor suite features new-pattern ERA (ERAWA-1 and ERAWA-2) on the hull, turret, and forward portion of the armored skirts. The exterior of the turret and other areas of the hull feature radar-absorbing material. Finally, the PT-91 features a new communications suite.

PT-91 Retrofit: a Cost-Effective Option

While the Polish Army has accepted only 78 new-production PT-91 tanks, there may be as many as 226 PT-91 tanks in the Polish inventory. The additional 148 tanks are in actuality T-72M1 tanks that have been retrofitted to the PT-91 configuration.



PT-91 Twardy Main Battle Tank

Source: Zakłady Mechaniczne Bumar-Labedy SA

Related News

Poland Acquires Leopard 2 Tanks from Germany – Poland's Ministry of National Defense has signed a contract with Germany's Defense Ministry for the acquisition of 119 Leopard 2 tanks from Germany. These tanks will arrive in two variants: 105 in the Leopard 2A5 configuration, plus 14 2A4 variants. Delivery is scheduled to run from 2014 through 2015.

The Polish Army already features the Leopard 2 in its armored inventory, having acquired 128 ex-Bundeswehr Leopard 2A4 tanks in 2001 to equip the Polish Army's 10th Armored Cavalry Brigade based in Swietoszw. The ex-German Army Leopards were produced from 1984-1986. Along with its Leopard 2A4s, Poland received 10 Bergepanzer armored recovery vehicles, six Biber assault bridges, 19 M577 command posts, command and control equipment, transport trucks, and 16 M113 armored ambulances for the cut-rate price of EUR22.5 million – just enough to cover the transportation costs for delivery. As part of its long-term national armor program Poland plans to upgrade its existing stock of Leopard 2A4 tanks to a new standard (Leopard 2A7, or the so-called 2PL), which will include modernized fire control, observation, targeting and communications systems, plus the application of additional armor.

With a supplement to its existing stock of Leopard 2 tanks, Poland plans to retire its communist-era fleet of license-produced, Warsaw Pact-legacy T-72 tanks between 2018 and 2021. This not only will leave Poland with a more standardized heavy armor fleet (the only other model in Polish Army service is the advanced T-72 variant domestically built and maintained by ZM Bumar-Labedy, the PT-91 Twardy, which will begin a phased withdrawal from service in 2027), but will bring its principal tank into line with many of its NATO allies in Europe. (FI, 11/13)

Poland's Bumar Group Undergoes Name Change – Poland's principal defense industrial holding company, the Bumar Group, was renamed Polish Defense Holding (PHO) on May 22. The rebranding of Bumar comes as Poland's defense industrial sector continues a consolidation process that has brought some 27 manufacturing and trading companies under PHO's control. These companies are responsible for producing main battle tanks and armored support vehicles (ZM Bumar-Labedy), ammunition (ZM Mesko), anti-tank weapons (ZM Dezamet), assault rifles (Fabryka Broni Lucznik-Radom), and air-defense electronics systems (CNPEP Radwar), among other products. PHO remains openly interested in a merger with artillery producer Huta Stalowa Wola (HSW).

Polish Defense Holding is controlled solely by Poland's Ministry of Treasury. Under the government's "Strategy for Consolidation and Restructuring of Poland's Industrial Defense Potential for 2007-12" plan approved on August 31, 2007, Bumar was to be partially privatized. The Polish Treasury now intends to launch PHO's initial public offering on the Warsaw Stock Exchange in 2015. (FI, 5/13)

Market Intelligence Service Subscribers: For additional news, go to the on-line E-Market Alert page located in the Intelligence Center at www.forecastinternational.com and click on the links to the products you subscribe to.

Funding

Poland's Ministry of National Defense funds the development and Polish Army procurement of the PT-91.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Mid-	1991	Start of PT-91 development
Early	1994	PT-91 completes operational trials
	1996	Contractor completes delivery of 78 tanks to Polish Army
	2000	Supposed integration with Tiger fire control suite
Apr	2002	Malaysia selects PT-91
Dec	2006	Malaysia formally accepts initial six tanks of revised 48-unit order; remaining 42 tanks complete and awaiting delivery
Jan	2009	Contractor delivers last of 48 PT-91 tanks to Malaysia
	2014	Production line dormant, but available for new orders

PT-91 Twardy

Worldwide Distribution/Inventories

Export Potential. Poland is a relative newcomer to the international tank market. However, even though the PT-91 Twardy represents a significant improvement over the standard Russian T-72M1, the glutted condition of the international market – especially in terms of Russian tank designs – is likely to severely limit PT-91 export sales.

Sale to Malaysia. In April 2002, following an evaluation of seven competing designs, Malaysia selected the PT-91 for procurement. The initial procurement specifies 72 tanks; long-term procurement could total 150 additional tanks. Open-source reporting indicates the Malaysian Army formally accepted the initial six production vehicles in December 2006. In January 2009, the contractor delivered the last of a revised procurement of 48 tanks. Follow-on orders are likely. The Malaysian PT-91s are generally referred to by the designation PT-91M.

Although local participation in this contract will likely increase under the auspices of Malaysian firm MMC Defense SDN Berhad, no licensed assembly or coproduction agreement has been finalized.

In addition to retrofitting Polish T-72M1 tanks, ZM Bumar-Labedy retrofitted at least 100 surviving Iraqi T-72M1 tanks to the PT-91 Twardy configuration. The upgrades reportedly include a PZL-WOLA 895-kilowatt (1,200-hp) powerpack, a PCO Drawa computerized fire control system, thermal imaging units and a laser rangefinder, European optics, fully stabilized main armament, and explosive reactive armor. The Polish retrofit program allows the new Iraqi Army to equip three tank battalions from its surviving inventory for service in three regions of the country.

Countries. **Iraq** (at least 100 T-72M1s retrofit to PT-91 configuration); **Malaysia** (one test vehicle and 47 T-91M production vehicles); **Poland** (112).

Forecast Rationale

The initial serial production run of the PT-91 Twardy main battle tank for Polish Army procurement has been completed.

Delivery of 48 T-91M MBTs for the Malaysian Army was completed in 2009.

New Polish Procurement Unlikely

The Forecast International Weapons Group does not anticipate any further procurement of the T-91 MBT by the Polish Army.

Amid Poland's wider effort to pursue closer economic and political integration with the eurozone, the nation's Army has also sought to retire and replace at least some of its inventories of Warsaw Pact-era legacy vehicles with more modern Western designs and indigenous platforms. A major milestone in this effort was the Polish Army's acquisition of 128 surplus Leopard 2A4 main battle tanks from the German Bundeswehr in 2002.

In November 2013, Poland signed a new contract for the procurement 119 additional Leopards of varied build. Delivery of the new Leopards is scheduled to begin in 2014 and be completed by late 2015 or early 2016.

Nevertheless, the contractor maintains an active PT-91 line for modernization and retrofit work, and in anticipation of future sales.

Retrofit Market Opportunities

Reports indicate the Polish Army has retrofitted at least 148 of its more than 400 remaining T-72 MBTs to the PT-91 configuration.

Although the Polish Army appears to be reorienting its procurement policy for new MBTs toward the acquisition of Western designs, retrofit activity on older models will certainly continue as a cost-effective means of maintaining a large, frontline-capable MBT force.

Hurt by a Glutted Market

Beyond retrofit programs and potential follow-on orders from the Malaysian Army, the Forecast International Weapons Group does not foresee a lucrative future for the PT-91 on the export market.

T-72 tanks, including enhanced models such as the PT-91, are among the most heavily proliferated main battle tanks on the international defense market. As a result of this crowded market environment, even a high-quality product like the PT-91 stands little chance of distinguishing itself from the competition to potential customers.

Unless ZM Bumar-Labedy can find a way to make the PT-91 more competitive on the international market, such as the integration of the ubiquitous Rheinmetall 120mm Rh 120 smoothbore tank gun, the Twardy production line may soon fade into dormancy.

PT-91 Twardy

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Zakłady Mechaniczne Bumar-Labedy SA												
PT-91												
	48	0	30	30	27	16	10	6	4	4	0	127
Total	48	0	30	30	27	16	10	6	4	4	0	127