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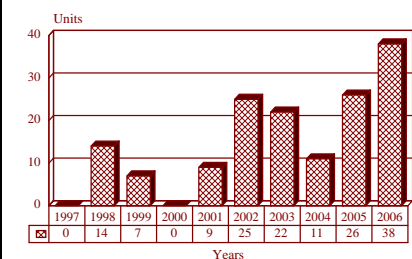
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Puma Armored Vehicle Family - Archived 6/98

Outlook

- Production is forecast for domestic and export sales
- Several variants have been developed
- The vehicle is being heavily promoted on the export market
- There is presently no modernization and retrofit potential

10 Year Unit Production Forecast
1997-2006



Orientation

Description. A family of tracked vehicles

Sponsor. The Puma program is being privately developed by the contractor Krauss-Maffei Wehrtechnik GmbH.

Contractors. The Puma is being developed and, if placed into production, will be manufactured by Krauss-Maffei Wehrtechnik GmbH. Diehl Group GmbH, Ordnance Division is an associate contractor. Both firms are located in the Federal Republic of Germany, in Munich and Nuremberg respectively. Major subcontractors include Kuka Wehrtechnik, Maschinenfabrik Augsburg-Nurnberg, Renk AG, Zahnradfabrik Friedrichshafen and Carl Zeiss.

Licensees. None

Status. The Puma program is in continued development with prototype testing and evaluation ongoing.

Total Produced. As of January 1, 1997, a total of five Puma prototype and developmental vehicles had been manufactured.

Application. A family of combat vehicles based on a modular design with a common chassis. The range of family members is from an armored personnel carrier to a tank mounting a Leopard 1 turret with the Rh 105 105 millimeter cannon. The Puma is being studied to possibly fill the NATO requirement for a multi-role armored vehicle.

Price Range. The unit price of the Puma can vary widely as to the specific family member. In equivalent 1997 United States dollars, the unit price of the infantry fighting vehicle version of Puma is \$1,455,000 in "quantity" buys.

Technical Data

Design Features. The modular design of this vehicle plus the use of commercially proven components means that the Puma can fill a variety of mission areas at a highly competitive price.

Crew. From two to eleven depending on the specific family member; the armored infantry fighting vehicle has

a crew of a commander, gunner and driver plus eight infantrymen.

Armor. The Puma is fabricated from conventional steel armor in a modular configuration. Depending on the configuration, the level of protection can be up to 14.5 millimeter armor piercing rounds all around and 30

millimeter armor piercing rounds over the 60° frontal arc. Additional types of armor, both explosive reactive and passive, are under consideration for integration with this vehicle.

Dimensions. The following data are for the prototype of the mechanized infantry combat vehicle. The combat weight given is representative only; it can vary as to the level of protection required.

	SI units	US units
Length	5.80 meters	19.03 feet
Width	3.25 meters	10.66 feet
Height	1.91 meters	6.27 feet
Combat weight	22.0 tonnes	24.25 tons
Fuel capacity	500 liters	132.97 gallons

Performance. All variants of the Puma can be procured in amphibious form as an option. The maximum speed and range figures are on a metalled road.

Maximum speed	65 kilometers per hour	40.37 miles per hour
Maximum range	650 kilometers	403.65 statute miles
Step	91 centimeters	2.99 feet
Trench	2.15 meters	7.05 feet
Scope	30%	30%
Gradient	60%	60%
Fording	1.20 meters	3.94 feet

Engine. Two engines are offered for the Puma. Maschinenfabrik Augsburg-Nurnberg supplies the model D 2866 KXE supercharged six cylinder diesel engine which is rated at 320 kilowatts (428.95 horsepower). The power-to-weight ratio for the mechanized infantry combat vehicle with this engine is 14.55 kilowatts per tonne (17.69 horsepower per ton). Alternatively, the Maschinenfabrik Augsburg-Nurnberg D 2840 LXE diesel engine, rated at 559.5 kilowatts (750 horsepower) is offered. The power-to-weight ratio for the mechanized infantry combat vehicle with this engine is 25.43 kilowatts per tonne (30.92 horsepower per ton). A nine kilowatt/24-volt direct current electrical system with four 50 ampere-hour batteries is the standard electrical fit.

Gearbox. For installations with the D 2866 KXE engine, Zahnradfabrik Friedrichshafen supplies the 6

hp 600 automatic gearbox with six forward and one reverse gear ratios. For the D2840 LXE engine, an unspecified automatic gearbox from Renk AG or Zahnradfabrik Friedrichshafen is used. The latter firm also supplies the STV600 transfer case and the LGH10000 steering unit.

Suspension and Running Gear. This vehicle uses a torsion bar type suspension with a varying number of hydraulic shock absorbers. Depending on the version, four, five or six dual tired roadwheels are mounted on each side; in all configurations, three track return rollers are used.

Armament. A wide range of armaments, from 7.62 millimeter machine guns to 105 millimeter tank cannon, are planned for the Puma models and variants. The various armament options are described below.

Variants/Upgrades

Variants. The Puma family is modular in concept and envisioned to be developed in three weight classes:

18-25 tonnes. The vehicles in this class will have four dual roadwheels; either of the engines described in the Technical Data above can be fitted.

26-32 tonnes. The vehicles in this class will have the same chassis length but five dual roadwheels. The uprated D 2840 LXE engine will be used.

33-40 tonnes. The vehicles in this class will have a lengthened chassis, six dual tired roadwheels, and the uprated D 2840 LXE engine used in the 26-32 tonne class vehicles.

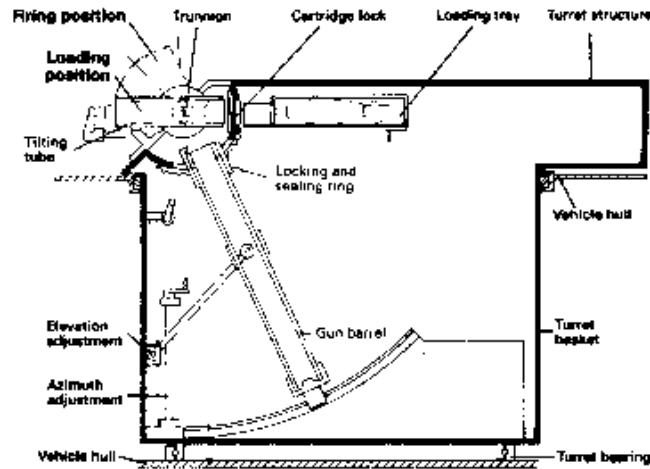
The Puma family is envisioned to be developed into at least 30 distinct models and variants.

120 millimeter Mortar Vehicle. This is the first vehicle developed in the Puma family; it has its basis in Diehl's need for a vehicle to mount its new 120 millimeter breech loaded mortar. A three man crew is required for the 22 tonne vehicle. The mortar is mounted in a new design turret which seats the commander to the left and loader to the right. The turret can be traversed a full 360°, while the mortar can be elevated from 45° to 80°. The fully powered turret is electrically powered. A total of 80 mortar rounds is carried: 20 in the turret, of which 12 are for ready use, and the rest are in the hull.

Secondary armament comprises an MG3 machine gun with 250 rounds for ready use and 3,000 rounds in reserve.

Currently under development is a new lightweight turret for the Puma. Mounting a 120 millimeter mortar, this new

turret can be fitted with automatic laying equipment and equipment for the receipt of digitized fire control data. These components can be adapted for any special needs of the customer.



Puma 120 mm Mortar Mount

Source: Krauss-Maffei

Armored Infantry Fighting Vehicle. This version of the Puma is available in either the short (four roadwheel) or long (six roadwheel) version; either eight or ten infantrymen can be carried in the rear of the hull. In addition to the driver, this model features the Kuka Wehrtechnik E4A1 modular turret with either the Mauserwerke MK25E, Örlikon Contraves KBA 25 millimeter cannon or the Hispano-Suiza HS820 20 millimeter cannon. An MG3 machine gun is coaxially mounted. This turret is electrically driven and is fitted with six 72 millimeter smoke dischargers. A total of 1,100 25 millimeter rounds is carried with 410 in the turret and the rest in the hull. A total of 20 periscopic vision blocks is provided: three for the driver, five for the gunner, six for the commander and six for the infantrymen. The gunner is provided with a Peri Z16 two to six power aiming periscope; a Peri Z59 image intensification telescope is an option. A Zeiss WBGX thermal sight for the gunner and a Phillips 8005 night driving viewer are optional. An alternative turret is the Cockerill CMN 30 which is fitted with a Mauser 30 millimeter cannon. This option has been evaluated by Norway and Switzerland.

Multi-Purpose Combat Vehicle. This version of the Puma features a one-man turret with an externally mounted Mauser MK25E cannon with an MG3 machine gun coaxially mounted; these weapons are on the right side of the turret. Mounted opposite is a launcher for the FIM-92 Stinger or Mistral surface to air missile; reload missiles are carried in the hull.

Armored TOW Vehicle. This variant, with a crew of four and a weight of 19.5 tonnes, features a Kvaerner-Eureka TOW launcher or an ESCO Corporation (formerly Emerson Electronics and Space Corporation and earlier Emerson Electric) TOW launcher, each with two BGM-71 TOW missiles at the ready and five more within the hull. A MG3 7.62 millimeter machine gun with 3,000 rounds of ammunition is also fitted.

Mine Scattering Vehicle. The German Army has taken delivery of the MIWS mine scattering system mounted on the M548 vehicle, a derivative of the M113. However, the crew of the M548 are exposed to hostile fire as well as ballistic fragments and possible nuclear, biological and chemical contamination. Therefore, Krauss-Maffei/Diehl have proposed a version of the Puma mounting the MIWS system; such a vehicle would afford ballistic as well as nuclear, biological and chemical protection for the two-man crew. A total of six mine projectors and 600 AT2 Medusa mines are carried. A MG3 7.62 millimeter machine gun with 3,000 rounds of ammunition is also provided.

Armored Command Vehicle. This member of the Puma family features a five-man crew and extensive communications gear. An armored cupola with a single MG3 machine gun is provided.

Armored Personnel Carrier. Available in the five and six-roadwheel versions, this version of the Puma is fitted with an armored cupola and machine gun similar to the

armored command vehicle described above. In addition to the driver and commander/gunner, a total of 12 combat troops can be carried in the five roadwheel, and 14 combat troops in the six roadwheel version.

Armored Recovery Vehicle. This version of the Puma is fitted with a hydraulically operated dozer blade, hydraulic winch for lifting, another hydraulic winch for towing, and a crane. A crew of four plus an MG3 machine gun are carried.

Anti-Tank/Air Defense Vehicle. This member of the Puma family features an elevating platform which can be raised to a height of 12 meters (39.37 feet). The proposed system can be manned or unmanned and mount several types of anti-tank or anti-aircraft guided missiles. This system is being proposed in light of the 1990 cancellation of the Panther elevating weapons platform.

Air Defense Vehicle. This variant, based on the five roadwheel chassis, mounts the Krauss-Maffei Wildcat autonomous anti-aircraft artillery system. This system, available in six levels of sophistication, is covered in a report in the *Ordnance & Munitions Forecast* book that is a companion volume to this.

Light Tank (90 millimeter). This light tank version of the Puma integrates the five or six roadwheel chassis with any of a variety of two-man turrets mounting several types of 90 millimeter cannon.

Light Tank (105 millimeter). This light tank version of the Puma family, also on the five or six roadwheel chassis as per requirement, integrates one of the growing number of 105 millimeter turrets mounting the new low trunnion pull 105 millimeter cannon such as the Rh105SLR.

Tank (105 millimeter). There has more recently been developed another tank from the Puma heavy chassis. The vehicle integrates the heavy six wheel Puma chassis with the turret and armament of the Leopard 1 tank. This vehicle offers the firepower of the Leopard 1 in a 36 tonne (39.68 ton) chassis, a tank offering a superb level of battlefield mobility; the power-to weight ratio with the 559.5 kilowatt (750 horsepower) engine is 15.54 kilowatts per tonne (18.9 horsepower per ton). Mobility and other trials of this vehicle, fitted with the Leopard 1A5 turret, were first carried out in 1994. As there is a large number of Leopard 1 turrets coming available as a result of recent and still ongoing arms reductions, this tank offers a highly cost effective answer for many nations' need to upgrade their tank inventories.

Program Review

Background. Krauss-Maffei, one of the world's leading and innovative manufacturers of military vehicles, has teamed with the Diehl Group (Ordnance Division) to develop a new family of armored vehicles for the late eighties and nineties. The two firms' extensive market research has turned up a great potential demand for a variety of armored vehicles in the 30 tonne and under class. This class is dominated in the Free World by the ubiquitous and versatile M113, which has been developed into at least 30 distinct models and variants. Krauss-Maffei and Diehl feel that they can meet the demand for a new vehicle to replace the 70,000-odd M113 vehicles in the world today; therefore the two firms have pooled their expertise and have developed, as a private venture, the Puma armored combat vehicle family.

In designing the Puma, simplicity, ease of maintenance and logistics, versatility and a low unit cost were among the prime design criteria. The vehicle is designed to be available in versions to meet all the required mission areas of armored vehicles except that of a heavy tank. As a turreted version was projected, it was decided to have a turret ring diameter equal to the Leopard 1 tank. Therefore, the basic chassis can accept almost any type of turret with the use of adaption rings. The roadwheel stations can number four, five or six depending on the weight of the vehicle. Proven components from the

Leopard 1 (roadwheels, support rollers, instruments, suspension and running gear) and the Leopard 2 (cooling system components, bilge pump, track adjusters, hydraulic components) are used. These are integrated with proven commercial components, mainly comprising the powerpack, to result in a highly cost-effective, versatile design.

Initially, two prototypes of the Puma were fabricated by the contractor and tested in various configurations with various weapons. In 1988, the German Ministry of Defense ordered two prototype Puma vehicles. The first, designated PM-1, is powered by the D 2866 KE diesel engine from Maschinenfabrik Augsburg-Nurnberg; it is rated at 328.24 kilowatts (440 horsepower); it has four roadwheels on each side and is configured as a mortar carrier. It was delivered in late 1988 and it has been extensively tested. The second vehicle, designated PM-2, is powered by the D 2840 LXE diesel engine from Maschinenfabrik Augsburg-Nurnberg; it is rated at 559.5 kilowatts (750 horsepower) and has six roadwheels on each side. The PM-2 vehicle was delivered in July of 1990.

Description. The basic Puma chassis is fabricated from armor steel which affords protection from small arms fire and ballistic fragments; the armor is in modular configuration. The integration of additional passive or

explosive reactive armor is being studied. The armor steel plates are, for the most part, flat so as to ease the fabrication process and allow for armor upgrades with minimal problems. The engine and gearbox are forward to the left with the driver seated opposite. The driver is provided with three periscopes; the center one can be replaced with a night vision device if desired. The driver is also provided with a single-piece hatch cover. The rest of the vehicle is tailored to the specific variant as described above.

Market Advantages. The Puma program is among the leaders in the increasing trend toward the development of armored vehicle families, which are developed as such from the outset. Several important points should be brought out in relation to this program:

1. When two firms, with such well-known and long-established names as Krauss-Maffei and Diehl, undertake the expensive development of a new armored vehicle in the glutted market of nineties, it is fairly certain that some extensive market research has

been done. Obviously, these two firms feel that the Puma is unique enough that it will buck the glutted market conditions.

2. The Puma's market appeal should be attributable to its almost unprecedented level of versatility. This vehicle program can meet the demands of any potential customer for armored vehicles, short of a heavy tank such as the Leopard 2.
3. Complementing the point above, the Puma's proven components, simple design and projected ease of maintenance will appeal to all potential customers in this time of tight defense budgets worldwide.
4. The need to replace the M113 in numerous mission areas is expected to increase in quite a few nations, beginning in the late nineties. While the M113 is a proven performer with many years of life remaining, its mobility and armor are suspect on the modern battlefield, especially when operating with front line main battle tanks. The Puma was designed with this point in mind.

Funding

While the majority of the funding for the development of the Puma has come from the contractors, some support has been provided by the German Ministry of Defense; the latter has procured two Puma prototypes for evaluations.

Recent Contracts

Not available as contractual information is not released.

Timetable

This Timetable relates to the Krauss-Maffei Puma family of vehicles only and not to the IVECO FIAT Type 6634 Puma, a wheel vehicle that is covered in Tab C of this book.

	1983	Concept development began
Apr	1986	First prototype fabricated
Jul	1986	Program unveiled
Nov	1986	First prototype began evaluations in Turkey
Oct	1989	First evaluation vehicle delivered to the German Army
Jul	1990	Second evaluation vehicle delivered to the German Army
	1994-1996	Integration and testing with Leopard 1A5 turret
Mid	1997	Development and prototype testing continues

Worldwide Distribution

Export Potential. Although the Puma is still a very new program, its unique cost effective features have already generated a good level of interest on the export market. Despite the rather restrictive arms export laws of the Federal Republic of Germany, our research on the Puma program indicates that it should do rather well on the export market. The Puma was on the shortlist of Turkey for about 500 new vehicles of this type; it is not known what variant(s) were involved. In any event, the Puma lost out to the FMC Corporation (now a component of United Defense Limited Partnership) Armored Infantry Fighting Vehicle in January of 1988. Norway and Sweden have evaluated the Puma, while Canada, Sweden and several nations of the Gulf Cooperation Council have expressed interest in the Puma. It is also quite possible that one or more Puma variants (especially the mortar vehicle) will be selected for the Federal Republic of Germany's armed forces.

Countries. **Federal Republic of Germany** (two plus three prototypes with the contractor).

Forecast Rationale

Our mid-1997 research into the Puma program finds that the testing by the Bundeswehr is largely complete. The evidence further indicates that an order for at least one member of this highly effective family of armored vehicles will be placed by Germany in a year or so. The Federal Republic of Germany needs to replace portions of its increasingly aging M113 inventory. In point of fact, we forecast that the mortar vehicle has an excellent chance of being procured as a replacement for Germany's 985 52-3 and M106/125 Panzermorser vehicles. Such a procurement should give a healthy push to the program, leading to additional sales on the domestic market as well as opening up the international market.

Regarding the overall potential for the Puma family of tracked vehicles, our latest investigation into the program continues to support a rather sanguine outlook. The Puma

family of vehicles offers a very high degree of cost-effectiveness, especially for the less affluent nations. Even many wealthier front-line nations can find the Puma family an attractive program, especially in this day of increasingly tight defense budgets.

However, despite our still sanguine outlook for the Puma program, the realities of the market in the coming ten years continues to prompt us to make a forecast which is on the conservative side. But we must caution that this program could find a major acceptance in the market; several nations have stated a need for a vehicle in this class and at least one represents a major potential procurement. Therefore, we will continue to monitor this potentially very important program and will update this report on an interim basis if required.

Ten-Year Outlook

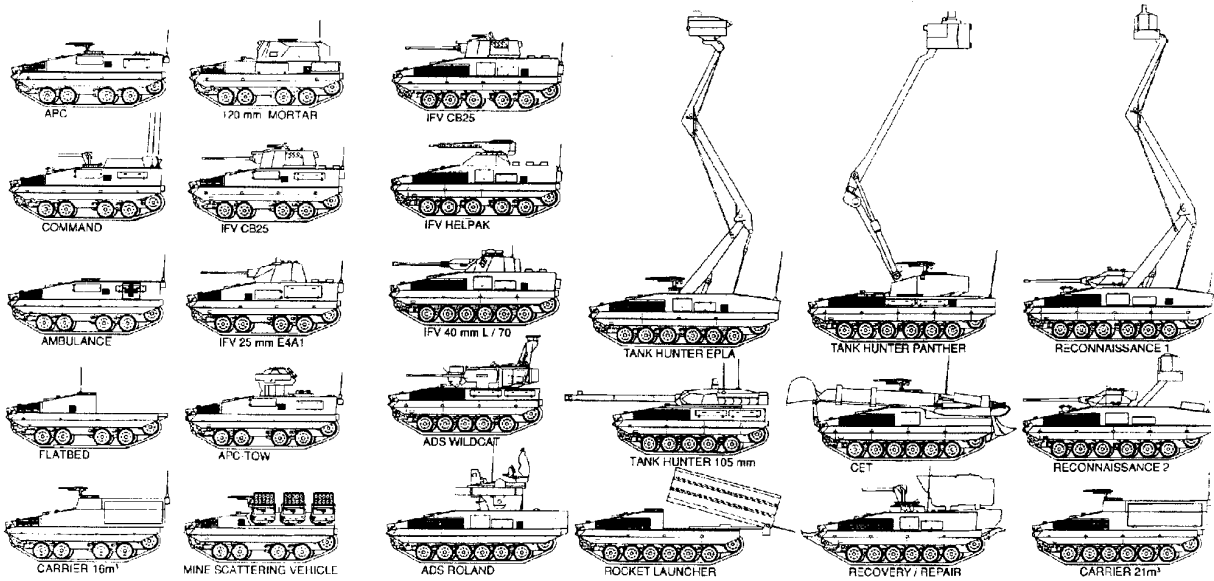
ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level			Speculative				
Vehicle	(Engine)	through 96	97	98	99	00	01	02	03	04	05	06	Total 97-06	
KRAUSS-MAFFEI GMBH														
PUMA MICV ^(a)	D 2866 KXE		5	0	14	7	0	9	25	22	11	26	38	152
Total Production			5	0	14	7	0	9	25	22	11	26	38	152

^(a) The production through 1996 is for the initial prototypes, contractor demonstration vehicles and two prototypes purchased by the Bundeswehr.

18 - 25 t 440 HP / 325 kW

26 - 40 t 750 HP / 550 kW



Source: Krauss Maffei