

ARMORED CAR

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The Renault V.I. X8A eight-wheel steering mobility demonstrator.

by Raymond Surlémont.

One of the most attractive armored vehicles unveiled at the French EuroSatory 96 armament show of June 1996 was the brand new X8A of Renault Vehicules Industriels (R.V.I.). RVI introduced it as an 8-wheel steering mobility demonstrator, featuring the most up-to-date Renault technical solutions for wheeled armor.

Design work on the X8A (8x8) started in mid-1933. The use of calculation and simulation tools from the beginning of the project accelerated the development time process, by enabling the very early selection of the best technical choices, aimed at producing Quality-Delivery-Cost targets. Jointly funded by Renault V.I. and the French D.G.A. (Délégation Générale pour l'Armement) the vehicle ran for the first time in September 1995 and, after initial company tests, was delivered to the French Army for full-scale trials in February 1996.

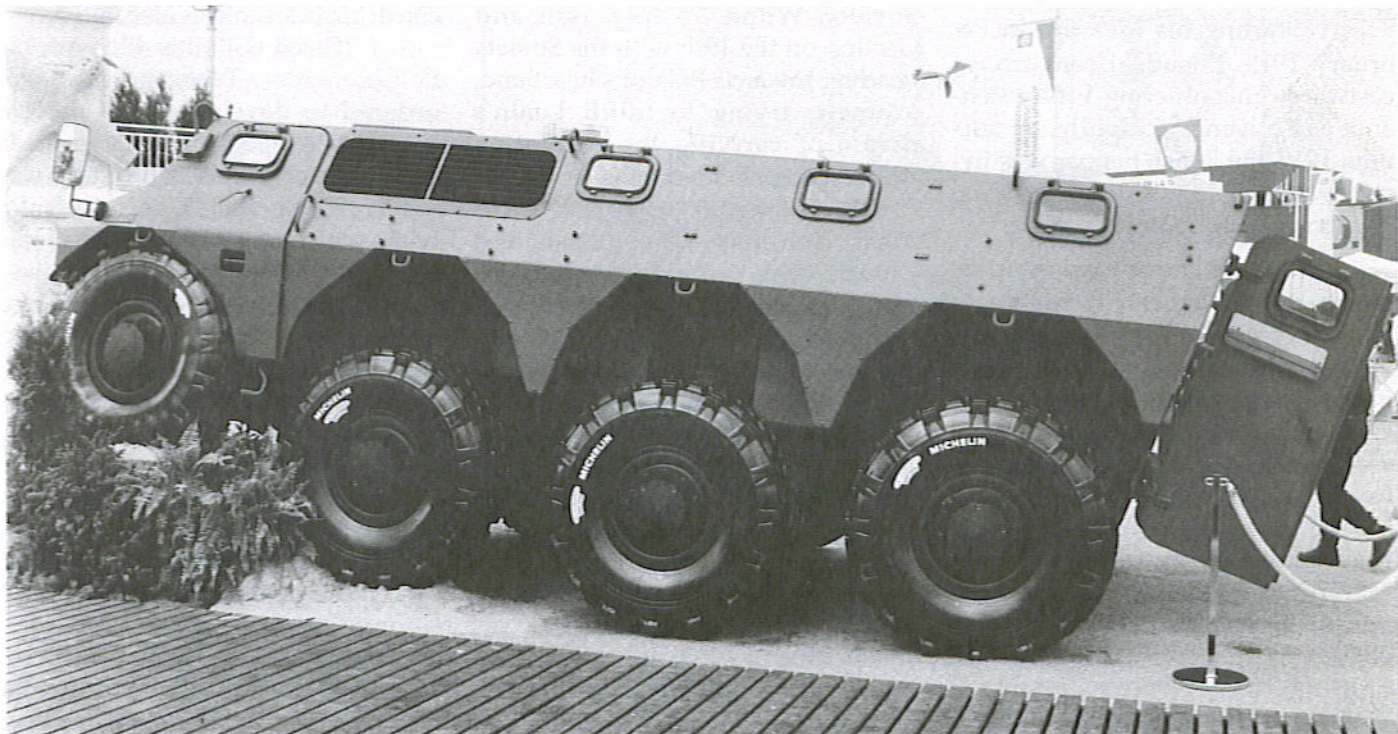


At first glance, the X8A appears to be a VAB (6x6) stretched to an 8x8 configuration. Whenever possible, standard, well-proven commercial components produced by Renault V.I. were incorporated in the design.

The X8A is powered by a Renault MIDR 06.20.45, six-cylinder in line, turbocharged diesel engine, which delivers 450 HP at 2,200 r.p.m. Coupled to a ZF type 6HP 900 fully automatic transmission, this power plant allows the vehicle to reach a maximum speed of 120 km/h (74.5mph) on roads, reduced to 50-60 km/h (31-37mph) across country through a two-speed transfer case. The drive line features central drive axles, originating directly from the Renault V.I. commercial range of vehicles.

...continued on page 7

Below and top of page: Renault V.I., X8A demonstrator at EuroSatory 1996. Photos: Raymond Surlémont.



POLISH FORD-Tf-C ARMORED CAR

by Jochen Vollert

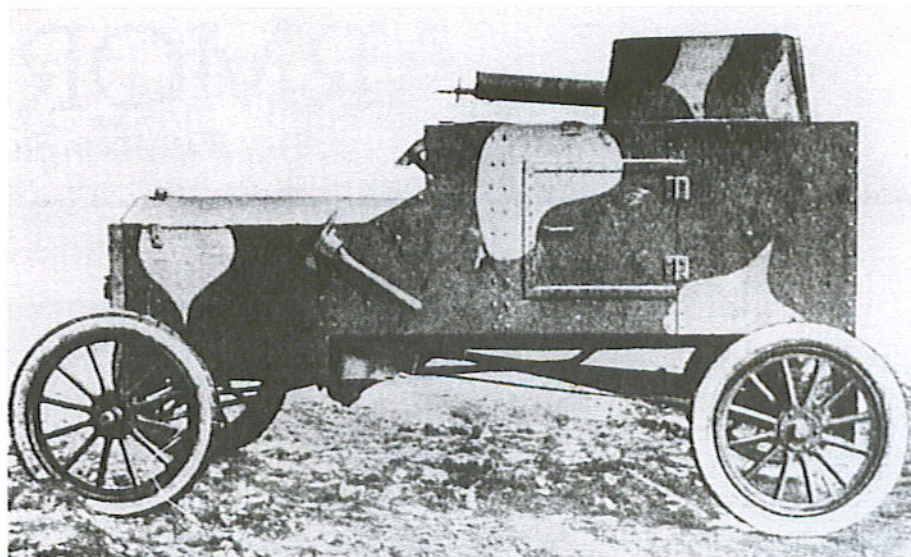
Easily overlooked between the two world wars, the clash between the post World War I Polish Republic and Russia's Bolshevik Regime from February 1919 to October 1920 showed the first signs of future war tactics as well as the birth of one of the most interesting developments in armored car history.

History of the conflict

Shortly after WWI Russia dropped into chaos caused by the famous revolution in 1917, further weakening its defense by internal struggles and political "cleaning-actions" of inner enemies. Meanwhile, the Polish Republic, now reunited and accepted by the western allies after a long period of fighting against aggressors from both the east and west, saw its chance. Turning their attention eastward, Poland's primary military leader and national hero, Józef Piłsudski, looked to re-establish Poland's pre-partition frontiers of 1772, an area which included substantial parts of the Ukraine and Belorussia.

Starting his invasion in February 1919, Piłsudski sent troops eastward. Encountering little resistance and advancing rapidly, by autumn 1919, the Polish banner was flying over large sections of Belorussia, Western Galicia and the Ukraine.

The weakened Russian regime recovered quickly from its revolutionary struggles, forcing Piłsudski to look for an ally, which he found in the anti-Bolshevik Ukrainian General Semyon Petlyra. After failing to accept offers for a frontier settlement from Lenin, Piłsudski started his new big offensive on April 25th 1920. Kiev, capitol of the Ukraine, fell on May 7th without resistance, but the advance found its climax with this objective. Overcoming their internal fighting, Red Army Commissar Trotsky was now able to muster a



Above: Polish Ford Tf-C, colors were mid-green, leather brown, sand. Photo: courtesy of and copyright © to Bovington Tank Museum

sizable and battle-tested Soviet force for action against Piłsudski's army.

Experiencing the same mistakes as Napoleon 108 years before and Hitler 22 years into the future, the Polish leader found his supply-lines deep into Russia overstretched, and a strong dislike for the Poles among the local population.

On June 5th, the Red Forces, led by General Budyonny, crashed into the Polish lines, forcing their immediate retreat westward. Fighting hard, the Poles weren't able to stop the Russian advance. Minsk, capital of Belorussia, fell on July 12th to the Soviets, Wilno on July 14th and Grodno on the 19th with the Soviets heading towards Poland's heartland, Warsaw, trying to fulfill Lenin's dream of carrying the revolution right through Poland into Germany.

Poland urgently asked the West for help. The British and French sent experienced military leaders, who discovered ways to stop the enemy, but recognized Poland's weakened situation in troops and supplies. 370,000 hastily trained and poorly equipped Poles were brought up for the capitol's defense. After bloody fighting, Piłsudski was finally able to gain a victory by August 24th, 1920, forcing the Soviets under Tukhachevsky to retreat. Beating them back as far as Minsk, Piłsudski was finally able to reach at least some of his planned objectives. Armistice was declared October 12th, 1920, fol-

lowed by the settlement of the Polish-Soviet border with the Treaty of Riga 1921.

The Development of the Tf-C

During the offensive in the Ukraine, the Polish Army noted a lack of armored cars able to raid deep into hostile territory and to fulfill long range reconnaissance or close quarter combat with serious numbers of enemy troops. Poland tried to obtain armored cars from abroad, but due to the export restrictions no foreign vehicle was available. Poland's attempts to simply reconstruct old vehicles also failed.

Faced with this dilemma, the Polish engineer Tadeusz Tanski was ordered to develop a new design, based on available American-made civilian Ford-T chassis. The task was to be fulfilled quickly, as the infantry had an urgent requirement for this kind of vehicle. Tanski took the chassis and combined it with an armored body made of scrap-metal, introducing the prototype on June 12th 1920. Accepted by the Polish Army, production was started immediately with the designation "Ford Tf-C" (rarely "Model 1920" or "FT-B"). The approximate production time for one car was 2 weeks, with a total of 16 or 17 vehicles being built.

Combat experiences

The Ford Tf-C armored car was used intensively during a two-month

period in the conflict, proving itself to be a reliable and durable design.

Dzicielewski, commanding officer in the light armored car unit, described it in the following way: During two - months of intensive combat, with daily heavy usage in battle, the Ford fulfilled its task very well. The vehicle is silent, fast, maneuverable, and with a low silhouette giving a small target, especially in ambush situations and a high survivability against small arms fire.

After fighting ended, 12 Fords were still in service with the Polish Army. In 1921, Tanski suggested converting a further 30 Fords into armored cars with an improved, round turret. This model was to be named "Ford II" or "Ford Tj-C", but only 2 prototypes were built.

The remaining Fords were sent to cavalry and training units, with most of finally scrapped during 1927-28. The last mention of the Fords to be detected are in official notes; in 1930 only three vehicles are mentioned, in 1931 only one was still kept in reserve. Nevertheless, rumors indicate that some Fords may have been seen in 1936-39 and may have been used during the German invasion of Poland in September 1939. But this is unconfirmed.

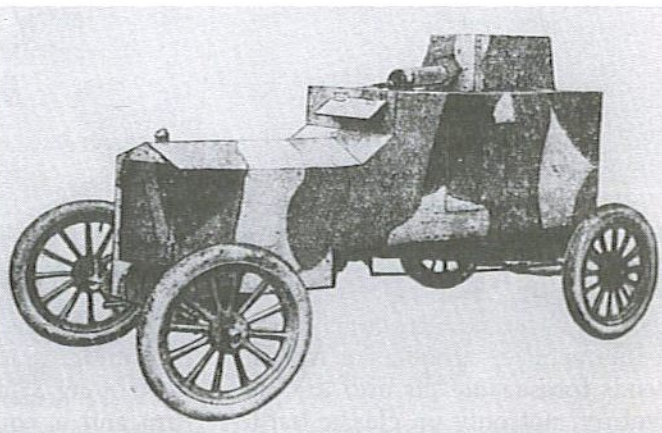
Technical description. To convert the civilian Ford-T into a modern (for its time) armored car Tanski had to mount an armored body onto the chassis. This forced him to modify it by mounting the fuel tank alongside the frame, change the angle of the steering column, reconstruct the exhaust system, strengthen the rear axle, add coil springs to bear the additional weight of about 590 kg (armor, machine gun and ammunition).

The armored body and turret consisted of a skeleton of L-shaped profiles, to which the armor - plates were attached. The body was then fitted as one piece onto the chassis, the vehicles floor was unarmored and protected only by wooden planks! The crew of two were located in the turret (commander/ gunner) and hull (driver). Access and escape

was possible through a side and back door. The two-pieced hatch atop the vehicle was mainly used for ventilation and observation. It was not intended to be used for escape, as the machine-gun mount would have prevented this. Armament consisted of either a German MG Maxim 08/15 or a sMG 05/S (7.9 mm) of Russian

origin, reworked by the Germans. Both weapons were water-cooled and had proved themselves very effective during WW I.

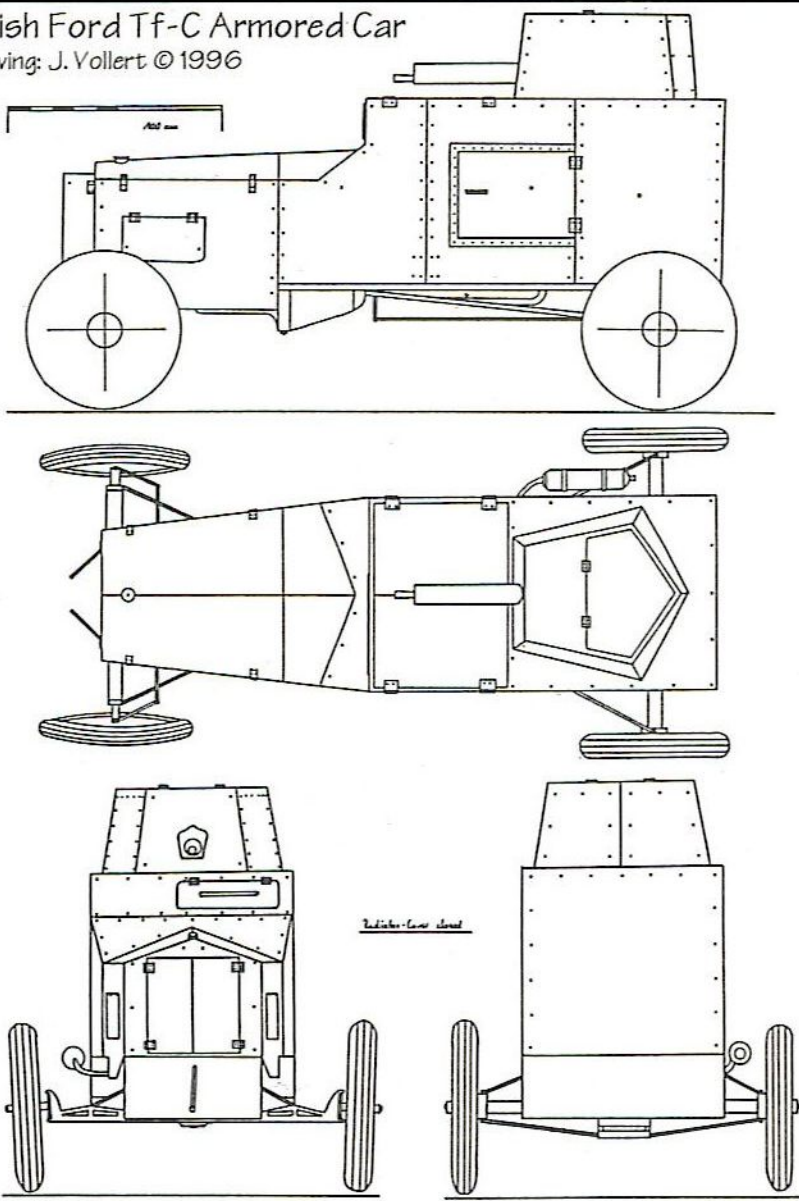
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Right: Polish Ford Tf-C, bottom of the vehicle was unarmored. Photo: courtesy of and copyright © to Bovington Tank Museum

Polish Ford Tf-C Armored Car

Drawing: J. Vollert © 1996



Scale 1/35th side and top view show radiator doors open

In their constant quest for technological innovations and improvements applied to armored vehicles, the Swiss MOTORWAGENFABRIK AG (MOWAG) concern, of Kreuzlingen, have revealed a new wheeled war machine, namely the PIRANHA III. For the company's officials, it is not a substitute for earlier designs which are under a constant process of enhancement, but rather complementary to them.

With their PIRANHA III, MOWAG wanted to produce a multi-role vehicle, suitable for military needs foreseeable far into the next century, not only on classic battlefields, but also for peacekeeping operations, the latter becoming more and more frequent.

The PIRANHA III already exists in six, eight and ten wheel versions, and is easily adaptable as :

- a lightly armed Troop Transporter
- a mobile Command Post
- an Infantry Combat Vehicle
- a heavy Weapon Carrier (such as mortars or anti-tank guns)

thanks to the broad spectrum of equipments and turrets it can accommodate.

The PIRANHA III is conceived following a modular approach, allowing an easy answer to the requirements of potential customers. The aim attained by the manufacturer is to offer a better protected vehicle, even more mobile than its forerunners on difficult terrains, while presenting a more important weight/payload and volume ratio as well as a low Life Cycle Cost.

In its (8x8) version, the PIRANHA III accommodates eleven men: a driver in the front left-hand side, two turret crewmen behind him and eight soldiers seated in the rear compartment, with their backs along the vehicle sides.

Mobility

From the beginning, the MOWAG design bureau team were determined to offer customers a choice between several power plants, which could meet different tactical and economical requirements.

The new PIRANHA III

by Raymond Surlémont

The first proposed engine is an American one, the already classic Detroit Diesel 6V53 TA, that has propelled the PIRANHA series since the beginning. It is a six cylinder unit, developing 350hp (261 kW) at 2,800 rpm and is coupled to an Allison, type MD.3560 P fully automatic six-speed gearbox. This engine allows a power/weight ratio of 28 hp/t for the PIRANHA III (6x6), and of 24 hp/t for the (8x8) version.

A first alternative is offered with a German MTU, type 6V183 TE 22, diesel power plant, itself adapted from the Mercedes-Benz OM441 LA. Developing 400hp (294 kW) at 2,300 rpm, this motor delivers its motive power to the wheels through a ZF, type Ecomat 6 HP 600 transmission, also with six ratios.

A third choice is proposed in the form of another American diesel engine, a Cummins 6CTAA8.3-T350 producing 350hp (261 kW) at 2,200 rpm. It is linked to another Allison automatic gearbox, the six gear MD.3066P

And last, a Caterpillar 3126 power plant developing 350hp, coupled to the fully automatic Allison MD 3066P six-speed transmission. This is the alternative which has been selected by the Canadian Army.

All these engines have a growth potential of 50hp. Their motive power is transmitted to the wheels via a central drive-line system and a two-speed transfer case assembly. These engines and drive-line components can be removed and replaced by new ones within two hours, thus reducing the vehicle's time of immobilization to a minimum.

A fuel tank of 300 liters capacity allows the PIRANHA III a

range of action varying from 500 to 800 km on the roads, according to the selected motive power. The PIRANHA III runs on Michelin tires, either types 12.00 R-20 or 365/80 R.20, with a XML tread. These tires are fitted with a new "Run Flat" solid rubber insert designed by Hutchinson.

In the (8x8) version the vehicle can turn within a 16m (52.5 feet) diameter circle. The PIRANHA III can be made amphibious; in this case, it is fitted with two three-blade propellers at the rear.

Despite a payload raised to six tons and an internal volume reaching eleven cubic meters, the PIRANHA III is still air transportable by C.130 HERCULES aircraft.

Technological enhancements

Applied to wheeled armored vehicles, hydropneumatic suspensions have for long been almost a monopoly of the French Panhard company, with their EBR of 1951, the experimental M2 - M8 series of 1969-73, and the vehicles of the ERC/VCR families of 1977. Another vehicle, the GIAT AMX-IORC was also issued in 1971 with a similar suspension designed by Messier Auto Industrie.

For years MOWAG held fast to robust, but more classical suspension systems, combining helicoidal springs in the front with torsion bars in the rear, which were fully satisfactory on the earlier PIRANHA.

MOWAG's interest in hydropneumatic suspensions began only in 1982, with the development phase for such a device destined for the eight wheeled SHARK armored vehicle. 1986 and 1987 were two years of extensive on and off-road trials for the SHARK with this suspension. The experiences and data collected during this period formed the basis for the development phase of a hydropneumatic suspension specifically destined for the PIRANHA range of armored vehicles, which was, and is still, the MOWAG's master card on the international market. In 1989, MOWAG started to design another hydropneumatic suspension, this time for the tracked TROJAN Infantry Fighting Vehicle. Nearly three

ing Vehicle. Nearly three more years, from 1990 to 1992, were spent in exhaustive trials by both the manufacturer and the Swiss Army, the potential customer for the TROJAN.

The next stage in MOWAG's effort started in 1992 when beginning the design of a new type of hydro-pneumatic suspension, adjustable in height and adapted to the latest company's product, the PIRANHA III, in both (8 x8) and (6x6) versions. This system is also suitable for the (10x10) if requested. After a long process of trial and development, the system is now ready for series production, with all the guarantees of technical reliability.

As conceived by the company's design bureau, the MOWAG hydro-pneumatic suspension evolves three basic operating positions, namely "high", "driving" and "low". The former is used on very broken terrain, where a high ground clearance is desirable. The "driving" position is the normal one when the vehicle runs on the road, while the latter, or "low", can be used to reduce the vehicle height when on the look-out.

But it is still possible to adopt four intermediate positions along the vehicle's longitudinal axis, as follows:



Above: Piranha III (6x6) with a provisional machinegun mount and shield. Photo: Raymond Surlémont.



Above right: Piranha III (8x8) with its tires deflated. Note add-on armor and Delco turret. Photo: Raymond Surlémont. Below: Piranha 10x10 with 105mm NATO standard tank gun and GIAT TML turret during firing trials. Photo: MOWAG Motorwagenfabrik AG.



- the vehicle is nosed up by elevating it to the "high" position over the two front axles, while the rear remains in the "driving" position

- the vehicle is nosed up further by elevating it up to the "high" position over the two front axles, while the rear dives down to the "low" position

- the vehicle can put its nose down by elevating its rear up to the "high" position, while the front remains in the "driving" positions

- the vehicle can be dropped down further by elevating its rear up to the "high" position, while the front dives down to the "low" position.

All these intermediate positions are interesting as they enhance the elevation/depression capabilities of the turret weapons in specific situations.

In the area of mobility, a Central Tire Inflation System (CTIS) allows the driver to deflate or pump up the vehicle tires, in accordance with the nature of the terrain that is to be crossed.

Both these devices greatly contribute to provide the MOWAG wheeled vehicles with a level of mobility comparable with tracked vehicles.

The Anti-locking Brake System

The PIRANHA III discloses another technological advance is the form of an Anti-locking Brake System (ABS). Its function consists in automatically controlling the braking torque on the different axles, or on the different wheels, that leads to the prevention of locking and offers the following advantages:

- the vehicle remains steerable by steering wheel action
- the braking is optimized on its maximum values, without which skid-

ding occurs.

The ABS device includes wheel captors and pressure regulators, controlled by an electronic box.

The purpose of the captors is to measure the number of wheel revolutions, while the regulators act on the cylinders which generate the braking force. The electronics act to substantially reduce this force as soon as the captors detect signs of skidding.

Thus the eight wheels of the PIRANHA III (8x8) have five different braking circuits, submitted to the action of as many regulators.

Distributed on three axles, six wheel captors convey the necessary information so that the electronic box can intervene and regulate the five circuits' braking forces.

Thanks to this ABS device, the PIRANHA III met the drastic rules of the European norm EG 71/320 for the N3 vehicle class.

Protection

The MOWAG design office has also devoted a great effort to give the PIRANHA III a level of enhanced protection, within a weight limit compatible with its high performance.

The vehicle's bodywork has been designed to present flat surfaces suitable for the application of replaceable add-on armor packages, thus adapting the level of protection to mission requirements. These add-on armor packages can be varied in composition of materials and come from various manufacturers, in accordance with the protection needed. They can easily be replaced on the battlefield when damaged.

Applied to the vehicle's front, these add-on armor packages

resist 30mm armor piercing projectiles fired at a distance of 500 meters. The upper part of the hull and the turret are safe against 14.5mm armor piercing bullets fired at the same distance. The lower part of the body is protected against 7.62mm bullets fired horizontally at a range of 30 meters.

The crew compartment is lined with spall liners made of special materials, to stop penetration by fragments that have pierced the armor plate. These ballistic plates are available in different materials, and their choice depends of their specific weight and respective cost.

A special emphasis has been given to the protection of personnel against mine explosions. For this, a mine protection (Kevlar) kit has been developed to increase the inherent PIRANHA under-belly anti-mine protection level.

Last but not least, considerable attention was paid to the design of the hull plate angles, add-on armor spacings and surface coating, to minimize radar reflection and heat radiation. There is a fresh air intake at the right front and top, the outflow being located on the right side.

A congested calendar

The pre-production PIRANHA IIIs have left the MOWAG assembly workshops, respectively on 4 December 1995 for the (8x8) version, and on 9 February 1996 for the (6x6) version.

The manufacturer has already programmed to display their PIRANHA III (8x8) in several demonstrations, covering the whole year 1996, i.e.:

- in May: in Shrivenham, Great Britain



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- in June: at EuroSatory, Le Bourget, France
- in August: at the National Guard Conference, U.S.A
- in September: at the Association US Army, ~Washington, U.S.A
- in October: at the Modern Day Marine, U.S.A

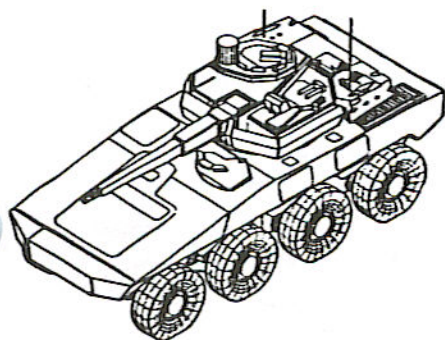
Meanwhile early in March 1996, the PIRANHA III (6x6) left Switzerland for Belgium where it was submitted to extensive tests and demonstrations at the obstacle course of the Brasschaat military camp, near Antwerp, up to the end of June. These trials are in the hope of winning an order for 54 vehicles, a requirement made by the Belgian Army in 1995 for equipping the Belgian Para-Commando Brigade.

Commercial prospects

After a technical assessment study made in 1995 by the Canadian Army, comparing the PIRANHA III to the Swedish CV-90 (tracked), the German TH.495 (tracked) and the French VEXTRA (wheeled), series of vehicles, the brand new MOWAG vehicle was selected. A contract for a first batch of 240 machines is expected by mid-1996. These vehicles will be manufactured under license by the Diesel Division of General Motors of Canada with deliveries beginning in 1998. This company is manufacturing a further Piranha III (8x8) pilot model, while MOWAG is building another one in an amphibious configuration. These machines will be completed later in 1996.

According to the manufacturer, the PIRANHA III already shows itself as an attractive alternative for the awaited bi-national

Below: VEXTRA 8x8 with 45mm cannon



(French-German) VBM/GTK, of which the VEXTRA is a technology demonstrator. For a gross vehicle weight of 25 tons, the latter proposes a payload of 5 tons and an internal space of 11 cubic meters. These characteristics demand an engine of at least 500hp.

The PIRANHA III offers the same advantages for a gross vehicle weight limited to 16.5 tons, and having at least an equivalent level of protection. The reduced weight of the Swiss vehicle is compatible with a less powerful, thus less thirsty, engine (350-400 HP). These economies in motive power and fuel consumption will give the PIRANHA III a lower life cycle cost, for at least equal performance.

At the present time, some 3,500 vehicles connected to the PIRANHA concept are in service all round the world, and 1,250 more are being manufactured or on order.

Renault V.I. X8A continued from page 1

Various special equipment and devices are standard on the X8A, including a V.P.G. (Variation de Pression de Gonflage) central tire pressure regulation system, a wheel load distributing device, and powered steering on the front two axles with an S.B.A.F. (Système de Braquage Additionnel par Freinage) additional skid steering system. The normal turning diameter is 23 meters (75.5 feet), but the driver can make skid turns, 11 meters (36 feet) in diameter, by locking all the four wheels on one side of the vehicle. The eight wheels are independently sprung by an oleopneumatic system which allows great wheel movement. The combination of all these technical improvements provide fairly good mobility performance and permit the vehicle to rush its crew to all theaters of operation in excellent comfort conditions.

...continued on page 8

Technical Data for Piranha III

Version	6x6	8x8	10x10
Vehicle weight, empty	9.5t	10.5t	12.5t
Payload	3.0t	6.0t	7.5t
Total combat weight*	12.5t	16.5t	20.0t
Overall length	6.25m	6.93m	7.45m
Overall width	2.66m	2.66m	2.66m
Height, over hull**	1.985m	1.985m	1.985m
	2.17m	2.17m	2.17m
Ground clearance	0.595m	0.595m	0.595m
Internal volume	9.5m ³	11m ³	14m ³
Tire size	12.00R20 or 365/80R20	12.00R20 365/80R20	12.00R20 365/80R20
Motive power	300-350hp	350-400hp	400-450hp
Power to weight ratio	28 hp/t	24 hp/t	22.5 hp/t
Angle of approach	42°	42°	42°
Angle of departure	37°	37°	37°
Max. speed on roads	100 km/h	100 km/h	100 km/h
Creep speed	3 km/h	3 km/h	3 km/h
Range on roads	500-800 km	500-800 km	500-800 km
Turning circle diameter	15 m	16 m	19 m
Gradient	60%	60%	60%
Vertical step	0.6 m	0.6 m	0.6 m
Trench crossing	2.00 m	2.00 m	2.00 m
Maximum side slope	30%	30%	30%

Renault V.I. X8A from page 7

Vehicle payload is reported to be 8 tons, i.e. just half of its empty weight (16 tons). The large internal volume of the rear compartment and easy access through double rear doors assure the adaptability of the X8A to the different variants which are requested to-date by the French Army; namely a VAD (Véhicule d'Appui Direct) with a 45mm cannon firing telescoped ammunition, a VBCI (Véhicule Blindé de Combat d'Infanterie) with a 25mm automatic cannon turret, and a VPSA (Véhicule Porteur de Système d'Arme) with a 105mm gun turret.

Renault V.I. are the main supplier of wheeled vehicles to the French Army and have produced nearly 5,000 VAB (4x4 and 6x6) light armored vehicles, either for national needs or export. The X8A would be considered a valuable alternative to the VEXTRA technology demonstrator which GIAT Industries had presented at EuroSatory 94, and demonstrated at EuroSatory 96. With their new experimental vehicle, Renault V.I. are evidently attempting to position themselves as a contender, or as a partner at least, in the multinational (French /German /British) VBM /GTK /MRAV* program of wheeled armored vehicles, which could amount to over 8,000 units.

The three nations have yet to settle operational requirements, and a problem in the program will be balancing these. Two years ago, GIAT Industries and Panhard of France teamed with Krauss Maffei and Mercedes-Benz of Germany to contend in this program. The German approach is now to allow industrial teams to form and then deliver proposals by October 1996, with the winner being selected in 1997. Krauss Maffei could also work with Wegmann and Rheinmetall/MaK, amongst others, to issue a proposal for the German GTK requirement, and they will face competition with Thyssen-Henschel. It is known that the latter have teamed with Kuka, Vickers Defence Systems and Alvis Vehicle.

*VBA = Véhicule Blindé Modulaire /GTK = Gepanzertes Transport Kraftfahrzeug /HRAV = Multi-Role Armoured Vehicle.

Book Reviews

Fighting Vehicles of the Patton Museum, by Gordon A Blacker. Privately published, available from the author at 1504 "N" Ave, Le Grande, OR 97850, USA. Price \$8.95 plus \$3.00 US postage.

Every museum needs a good guide book. When Mr Blacker found there was none for the Patton Museum at Fort Knox, Kentucky, he decided to compile one, and the result is this 90+ page, softcover, book. Its main section covers ninety selected items from, mostly armored vehicles, with a few softskins, three helicopters, and two anti tank guns.

For the "Armored Car" reader I found eleven wheeled or halftracked armored types. Each subject has one page devoted to it, with a large clear photo - mostly as it appears in the Museum with a few from other sources - basic details of the item, weights, dimensions etc, and notes giving further details and background.

There are a few errors, but as I have been involved in a small way with publishing I know how easy it is for that to happen. Most are obvious, and as the book is not a history of AFVs I doubt anyone will be seriously misled by them.

By far the book's greatest value, especially to those who are unable to visit Fort Knox, is that it lists what is there. To know that their collection has an example of a rare or even one of the more common AFVs will be very useful to research, and may well inspire you to make that trip to visit after all.

Museum Ordnance Specials 24 pages, black and white photos, line drawings. Available from Darlington Productions Inc, PO Box 5884, Darlington, MD 21034. Price \$7.95 plus \$1 postage in USA or \$2 elsewhere. This series continues to grow at high speed, and wheeled armor enthusiasts will welcome two of these.

No 8, The Battle for Namibia - South Africa's Longest War by Morgan Norval covers a little publicized campaign. Waged over twenty seven years, this pitted the South African Defence Force against Communist backed forces in what was then known as South West Africa. Originally a German colony it came under South African administration following WW1 and after WW2 it wanted to formally join South Africa. This was rejected by the Republic and prevented

by the UN. The growing Marxist movement finally began a guerrilla campaign with aid from the Soviet Block. After various changes of name, SWAPO actions increased after Angolan independence as the guerrillas were now able to operate from a sympathetic base. The full story of the actions in Namibia and Angola is told in the book. Illustrating the account are numerous photos showing a wide range of equipment. This includes the South African Ratel series, the Casspir and Buffel mine resistant troop carriers, and the G-6 self propelled 155mm howitzer. Basic details of all these indigenous designs is included, as well as shots of the Eland license-built version of the Panhard AML series armored cars including the latest Mk 7 series. While not strictly an armored car or vehicle book, this is one which anyone interested in modern conflicts and wheeled armor would find useful.

The other title is **No 11, Schwenker Panzerspahwagen (Sd.Kfz.231) 8 Rad** by Thomas L Jentz. All aspects of the vehicle, from initial design, production, and use in North Africa are covered. Many interesting aspects of the design are described. The vehicle was also known by several different designations, these are listed along with production figures and detailed specifications. As well as the basic Sd.Kfz.231, the 232 series with the large frame aerial is also covered. Full details of the 20mm main gun including its ammunition and performance are here. Perhaps the most valuable part of the text lists the various changes, minor and major, which were made to the design in production. As is usual with the Specials, illustrations are very good. As well as period photos of the 231 and 232, there are close-ups of the vehicle chassis, suspension, steering, engine and gearbox. Detailed drawings of the suspension, power train and hull layout are included. Best of all is the series of close-up views of a surviving vehicle, captured by the British and examined by them and the Americans and now back in Germany at Koblenz. These show the vehicle in detail both inside and out. Although this vehicle appears to be fully restored, areas where non original or inaccurate parts have been used are highlighted. While I am not usually a German armor fan, I found this like all Mr. Jentz's books fascinating. Hopefully other designs will be covered in later Specials.

All reviews by Peter Brown.

ARMORED CAR'S

FIVE YEAR INDEX - ISSUES #1-#30

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ARMORED CAR'S	
FIVE YEAR INDEX - ISSUES #1-#30	
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30

**UN Armored Cars/Armored Reconnaissance Vehicles
(Since the begining)**

Name	Used by	Location
AML 60-12	Nigeria	UNOSOM
AML 60-7.62	Ireland	UNFICYP
AML 60-7.62	France	UNIFIL
AML 60	Morocco	UNOSOM
AML 90	Morocco	UNOSOM
AML 90	Senegal	UNOSOM
AML 90	France	UNIFIL
AML 90	Ireland	UNIFIL
AM M8	Ireland	ONUC ¹
AM M8	Yugoslavia	UNEF 1
BRDM 2	Poland	UNPROFOR
BRDM 2	Zambia	ONUMOZ
Centauro	Italy	UNOSOM
Cougar	Canada	UNPROFOR ²
Daimler Mk I	India	ONUC
ERC 90 SAGAIE	France	UNPROFOR
ERC 90 SAGAIE	France	UNOSOM
Ferret Mk 1	Nepal	UNPROFOR ³
Ferret Mk 1	Nepal	UNIFIL
Ferret Mk 1	Nepal	UNOSOM
Ferret Mk 1	Canada	UNEF 1
Ferret Mk 1	Canada	UNFICYP
Ferret Mk 2	Canada	UNFICYP
Ferret Mk 2	Sweden	UNFICYP
Ferret Mk 2	UK	UNFICYP
Ferret Mk 2	Malaysia	ONUC
Ferret Mk 5	UK	UNFICYP
Ford Mk VI	Ireland	ONUC
Ford Mk VI modified	Ireland	ONUC
Fox	Nigeria	UNIFIL
FV 107 Scimitar	UK	UNPROFOR
FV 107 Scimitar	Belgium	UNOSOM
FV 107 Scimitar	Belgium	UNAMIR
FV Scorpion	Belgium	UNOSOM
OT 65A	UN	UNPROFOR ⁴
Scout Car M3	Yugoslavia	UNEF 1
VEC-TEC 25	Spain	UNPROFOR
Wiesel / 20mm	Germany	UNOSOM
Wiesel / TOW	Germany	UNOSOM

Some armored cars are deployed in UNAVEM (Angola). Type unknown to author.

1 this vehicle captured from Katanga troops.

2 listed as fire support vehicle in the APC section by Jane's.

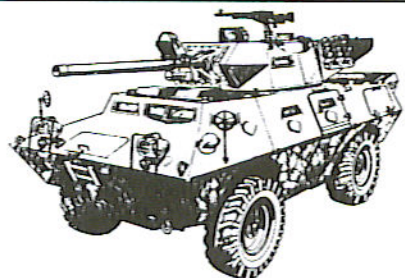
3 out of UK stock in Cyprus.

4 qty of 5 split between different units.

This list has been compiled by Paul Malmassari. It refers to Armored Reconnaissance Vehicles (W&T) only. Although it is as complete as possible, some vehicles (or special field modified vehicles) or users may be missing or wrongly assigned. If so, Paul Malmassari would like to receive an update to complete his manuscript. Any photographs of any vehicle above would be welcome as well, and returned after copy if requested. (See contributor's addresses on page 12).

Saudi Arabian National Guard Motorized Brigades (Part I)

by Lieutenant Colonel
Martin N. Stanton



90mm armed V150 Commando

Wheeled armored organizations are gaining new interest throughout the world as technology allows wheeled vehicles to mount larger guns and perform a more diverse range of missions. Cheaper production and maintenance costs make them attractive to many nations seeking more "bang for their buck." Additionally, although not suited to all terrains, wheeled armor is surprisingly adaptable.

Among the most dynamic and innovative wheeled armored organizations in the world today are the motorized brigades of the Saudi Arabian National Guard (or SANG). These two brigades (expanding to three) are the epitome of a robust force structure built around specific mission requirements, yet adaptable to other roles and missions.

The mission of the motorized brigades is to provide internal security within the Kingdom of Saudi Arabia, particularly for the oil fields. They provide quick reaction forces to the guard mounts and light vehicle-borne patrols that provide actual site security. In addition, the brigades' internal security mission requires them to be able to quickly move anywhere in the kingdom to conduct internal security operations. Lastly, in time of war, the brigades will fight alongside the MODA (Ministry of Defense and Aviation) forces in defense of the kingdom.

A key consideration in the design of the TO&E for the SANG motorized brigades was self-deployability. Saudi Arabia does not have the rail infrastructure to transport armored units quickly within its borders. It does, however, possess a modern road infrastructure supported by many improved dirt tracks. Wheeled vehicle mobility is quite good throughout the country. It followed that in this case, a wheeled armored organization had several key advantages over a tracked one. Wheeled armored vehicles would not require heavy equipment transporters, instead being able to self deploy along the nation's highways. In addition, most of Saudi Arabia's deserts are hard-packed sand, as opposed to dunes. A wheeled armored force can travel over 90 per cent of Saudi terrain with only the worst dunes or most inaccessible mountain regions being untrafficable.

Motorized Brigade Organization

Currently there are two motorized brigades in SANG. The Imam Mohammed Bin Saud Brigade (IMBSB) in Riyadh, and the King Ab-

dul Aziz Brigade (KAAB) stationed in Al Hofuf in the Eastern Province south of Dammam. They are identical in organization and almost identical in equipment the major difference being the anti-tank platoons of the line companies and the artillery battalions' cannon systems (M102 vs M198).

Each of the brigades has over 5,000 soldiers and is organized as a combined arms command with four maneuver battalions—the IMBSB with the 1st, 2nd, 3rd, and 4th Combined Arms Battalions (CABs), and the KAAB with the 5th, 6th, 7th, and 8th. Each brigade has an artillery battalion, the 1st SANG artillery battalion with the IMBSB with M102 105mm howitzers and the 2nd with the KAAB has 155mm M198 towed howitzers. There is no automated fire direction system like TACFIRE; however, all missions are plotted using the Back Up Computer System (BUCS) with a manual computer and check computer. Each brigade also has an organic air defense battery with four platoons of four Vulcan 20mm antiaircraft systems and a newly-formed Stinger platoon. The

CS and CSS units organic to each brigade include a reinforced company (really a small battalion) of combat engineers with heavy equipment, signal company, MP company, and a logistical support battalion capable of supporting the brigade on sustained operations in a desert environment.

The key differences between the brigades (besides artillery systems) is the number and type of weapons systems in the antitank platoons of the line companies. The IMBSB line companies have only two TOW systems; in the KAAB, they have six. In addition the 90mm guns in the KAAB are the more powerful Cockerill type. The IMBSB 90mm are of the less capable Mecar variety. These differences make the KAAB the most potent of the two brigades. In summary, the motorized brigade organization resembles a light cavalry unit with a number of dismountable infantry, over 200 per battalion.

A Family of V150s

The first SANG motorized battalions began fielding in the mid-to-late 1970s. The family of vehicles

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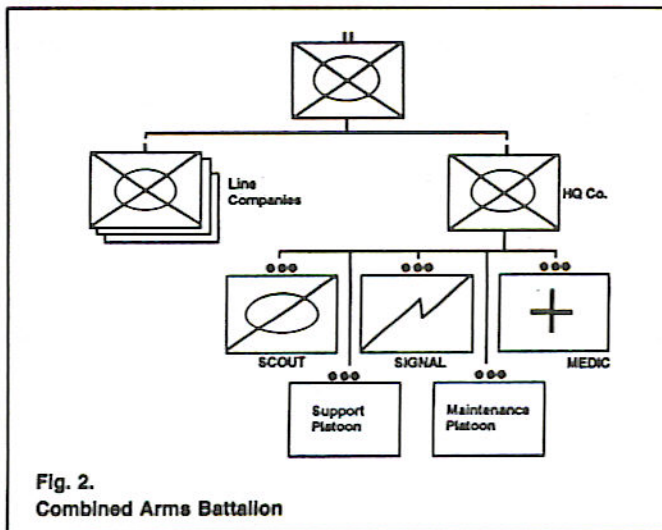
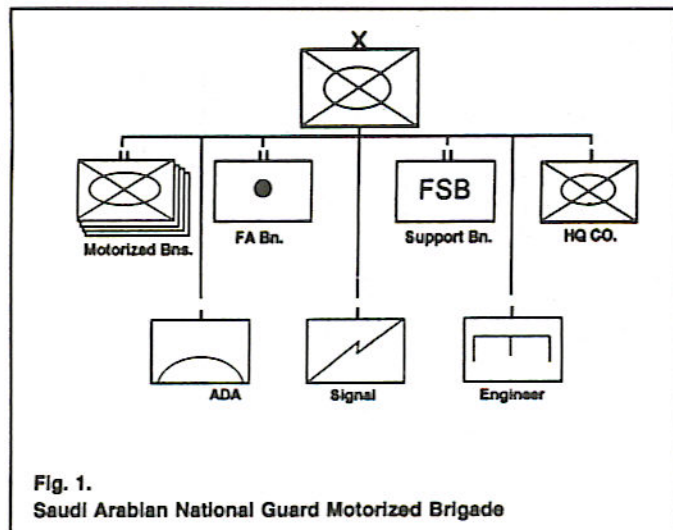
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chosen for the motorized brigades was the Cadillac Gage V150. It was versatile, robust mechanically, fast (50-60 mph across open desert), and easy to maintain. The SANG operated 10 variants of the V150, to include:

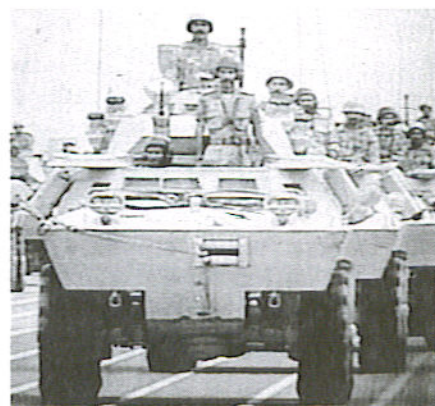
- Armored Personnel Carrier
- 90mm Cockerill cannon turret
- 90mm Mecar cannon turret
- 20mm Oerlikon canon turret
- Dual MG Turret (.50 cal/7.62)
- TOW I (pedestal version)
- 81mm Mortar
- Vulcan Air Defense system
- Recovery
- Command
- Ambulance

With the exception of the turreted systems, the TOW vehicle and the ambulance, all of the V150s carry an M2 .50 cal MG. The Saudi rifle squads carry FN/FAL rifles and FN 7.62 MGs. For antitank weapons, they have Carl Gustavs and later added Armor Piercing Infantry Light Arm Systems (APILAS). Radios were British RACAL, both HF and FM (which caused many interoperability problems with U.S. forces during the Gulf War.)

Tactical Employment Concept

The motorized brigades are capable of performing many of the Mission Essential Task List (METL) tasks of an armored cavalry regiment. The basic METL of the SANG motorized brigades includes: Screen, Delay and Attack.

It was recognized that the brigades did not have the armor or firepower to stand head-to-head with armor units (i.e., perform "No penetration" guard missions). However, at the same time it was felt that the speed and mobility of the organization, along with its TOW and light cannon systems, would make it valuable in a cavalry role. The brigades could screen an extremely wide sector due to the large number of vehicles and the four battalion organization. Employed correctly, the SANG motorized brigades are more than adequate to strip off an enemy's screening or reconnaissance elements, halt an advance guard, and force an enemy to deploy main body elements from march to battle formations. The speed of the V150s would then allow the SANG elements to conduct a quick withdrawal to the



Above: SANG V150 with 1 meter MG turret and German smoke launchers. Photo: via Barry Marriott.

next delay position. Additionally, in favorable circumstances (i.e., augmented with tanks), the brigades could also conduct conventional attack and defend missions.

(This article first appeared as one piece in the March-April 1996 issue of ARMOR magazine, ATTN: ATZK-TDM, Fort Knox, KY 40121-5210. I have added photos and illustrations from ARMORED CAR's files to supplement the text. The rest of this article will appear in issue #37 of AC -editor)

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Technical Data:

Weight: 1.2 - 1.4 tons
 Crew: 2
 Length: 325 cm
 Width: 155 cm
 Height: 173 cm
 Ground clearance: 25 cm
 Wheelbase: 255 cm
 Armament: 1 MG Maxim 08/15
 or sMG Maxim 05/S 7.9 mm - 1250
 Rounds of ammo plus 25 hand grenades
 Armor: Bolted steel-plates, 8 mm Side-Armor 3 mm Top-Armor
 Engine : Watercooled 2890 cc. Approx. 22 hp/1600 rpm
 Bore and stroke 95 mm X 101.5 mm
 Compression Ratio 4.5 : 1. Four cylinders in line
 Gearbox : Two forward speeds and reverse, pedal operated
 Speed : 45 - 50 km/h
 Range : 250km
 Fuel capacity: approx. 8 gallons
 Fuel consumption : 25 - 35 mpg.
 Deep fording ability: up to 45 cm

Letters

LAV-25 25mm Cartridge Ejector Port. I was just rereading issue #32 of AC and on page 12 there is a diagram of the recessed area on the LAV-25 that houses the ejection ports and fan. This fan is what is used to purge the vehicle especially the turret of firing gasses. Though there is a rubberized cloth bag secured by zippers and velcro (which takes care of much of the problem if only a few rounds are fired at a time) covering the entire gun assembly (feeder and receiver) for any amount of sustained fire, the fan needs to be engaged.

Also it was mentioned there are three ejection ports on the left of the turret, this is incorrect. The ejection ports are for 1) coax brass and links together, 2) HE links and 3) AP links. The 25mm "brass" from both the AP and HE rounds exit from the front of the turret through a hole above the main gun barrel, in the barrel housing, which is welded to the mantlet.

Many times this port is mistaken as some sort of "direct sight", what ever that means. The sights for all direct fire weapons are mounted in the turret and plainly visible on top in front of the two crew positions.

Also many times vehicles of

the LAV family are referred to as "LAV-25--". For instance LAV-25 TOW, one model company even refers to a LAV-25 TUA (TOW Under Armor), LAV-25 AD, LAV-25 Mortar, etc., these are all wrong. A LAV-25 is a LAV with a 25mm main gun, that's it.

I've seen this heathen, sinful (to us LAV'ers) vile act in print several times by people who should have known better. Sean Kevany, Unit 61322 Box 852, APO AE 09803-1322.

Photos at the Army Museum in Brussels, Belgium. I have now visited the Blindés section of the Army Museum in Brussels three times, and each time I wasn't allowed to take any photos of the vehicle collection. I think this is the worst way to welcome modelers and historians from the rest of the world. Even in denigrated Italy you can get permission to take your own photos at the Army Collection housed in the Cecchignola Barracks. Perhaps things have changed since I was last there, but the bad impression remains.

Armando Rossi, Casella Postale 43, 41010 Saliceto Panaro, Modena, ITALY.

Notes

If you haven't had a chance to see them, I'd like to recommend that you investigate the following publications.

Tankette, c/o C.E.G. Williams, 15 Berwick Avenue, Heaton Mersey, Stockport, Cheshire, SK4 3AA, GREAT BRITAIN. While slanted towards modelers, there are many drawings and photos.

AFV-News, c/o George Bradford, 10 Brenda St., RR32, Cambridge, Ontario, CANADA N3H 4R7. "Grand Daddy" of AFV pubs., sample \$2.

Tank TV, c/o Peter Cooke, PO Box 9724, Wellington 6001, NEW ZEALAND. An eclectic look at the world of armor, sample \$2.

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- David R. Haugh, Editor-Publisher
- Bryce P. Haugh, Circulation

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