

Compendium

by armada

Infantry Fighting Vehicles & Armoured Personnel Carriers



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The Patria "Next Generation Armoured Wheeled Vehicle" unveiled at DSEI 2013 weighs 30 tonnes, of which 13 are pure payload. The prototype was equipped with a Saab Trackfire mounting a 25 mm cannon. (Armada/P. Valpolini)

Infantry Fighting Vehicles and Armoured Personnel Carriers

With the Afghanistan mission drawing to an end, the demand for Mraps is losing momentum. Where will Western troops be called upon next is anybody's guess, but what is almost certain is that the scenario will again be of asymmetric nature. Part of the lessons learned in Afghanistan might thus be of use, although the terrain, which often dictates tactics and means, might be considerably different.

Paolo Valpolini

The First Gulf War definitely opened a few eyes on deployment requirements, thus vehicle air transportability seems to remain a prime design criterion (apart from a few exceptions), while protection will definitely remain among top priorities for political reasons, since western public opinion is not ready to accept black bags coming back home. With no major

breakthroughs in technology to allow any substantial change in the weight-protection paradigm, though active defence systems may eventually come to the rescue in this department, not many revolutionary vehicles seem to be in the pipeline.

Some lessons seem, however, to have been learned, especially in terms of overall situational awareness and driver view, and this alone might modify the physiognomy of vehicles to come. This being said, approaches on future vehicles designs already show some

strong differences, with Israel and its Rakiya seeking a reduction in weight compared to the current Merkava-based family of vehicles, while apparently future US Army combat vehicles might actually weigh more than current M1A2 Abrams.

Compared to a few years ago, when the wheels were all the rage, 2013 is showing the return of the track, in spite of higher costs in life cycle terms. One programme is definitely the one that might shape the future of tracked IFVs: following the demise of the

Future Combat Systems, the US Army is still looking for a replacement for its Bradley family, which dates back to the 1970s – in other words 40 years – and the Ground Combat Vehicle (GCV) should apparently survive sequestration. The other major American programme is the Armored Multi-Purpose Vehicle (AMPV), which aims at replacing all those support vehicles based on the M113 chassis. However in this case the dramatic choice between tracks and wheels has yet to be made.

Turkey definitely appears a the most active nation in new vehicle development, IDEF 2013 seeing at least one novelty from each of the principal players in view of the new bids that might soon be launched by the Undersecretariat for Defence Industries (SSM). On the other hand few new vehicles are emerging on the European scene, where industry is still waiting to see how rationalisation moves will reshape the market. Overall though, the number of companies able to produce armoured vehicles, especially the wheeled variety, is still increasing, particularly in the Middle and Far East.



Based on a tank chassis, the Terminator is a support vehicle featuring an impressive firepower, developed by Uralvagonzavod (Armada/P. Valpolini)

Back on Track

As said above, the track seems to be making a return, but whether it will ever attract the limelight of yesteryear remains to be seen given the constant progress achieved in suspension and tyre technologies. On a pure subjective impression, the track is always seen as more aggressive, which conflicts with the notion of peacekeeping.

An artist impression of BAE Systems proposal for the GCV. In spite of its resemblance with the Bradley, the new vehicle might have a much higher weight – over 60 tonnes. (BAE Systems)



I GROUND COMBAT VEHICLES ON STEROIDS?

If this Compendium is to start with the heavier and more complex tracked vehicles, its inevitably has to open on the GCV.

The decision to award a Technology and Development (TD) contract worth approximately \$450 million to BAE Systems and General Dynamics Land Systems (GDLS) goes back to August 2011. “Faster, lighter, more fuel-efficient alternatives” to the Bradley was what Gen. Eric Shinseky, the Army Chief of Staff in 1999, stated as the requirements for the new vehicles. Some 15 years on his wish for a lighter IFV have not become true, the current forecast weight for the Ground Combat Vehicle being over twice that of the Bradley in his original version. Moreover, due to the recent defence budget cuts, a decision on the GCV production might still not be made 20 years after Gen. Shinseky’s speech. By that time the first Bradleys will be have had over 35 years of service and, all going well the Army expects its first production vehicles to roll-out in 2017. The decision to delay the TD phase by at least six months, due to budgetary pressure, was announced in late January 2013, pushing the RfP for the Engineering and Manufacturing Development (EMD) phase originally



A series of views of BAE Systems GCV study: the company decided to adopt a hybrid electric drive propulsion based on its Traction Drive System and QinetiQ E-X-Drive transmission. (BAE Systems)

planned for Fall 2013 to the right, to Spring 2014. Another decision, that goes against the Army wish for a competitive bid, is the cut to one single contractor for the EMD phase. However estimates consider that this move might save some \$4 billion in the next five years. What remains are the requirements for a vehicle that should host three crewmembers plus a squad of nine soldiers, be heavily protected and fully networked, with a propulsion system featuring a dramatic reduction in fuel consumption.

For this GCV programme BAE Systems has teamed with Northrop Grumman, and this team actually is the only bidder to have unveiled some details of its proposal. Starting with the weight issue where the first M2 Bradley had a combat weight of 22.6 tonnes and carried a three-man crew and seven dismounts, its BAE Systems proposed successor (according to the company's data sheet), will have a weight of 63.5 tonnes and will carry two more infantrymen in the back.

It is true that the Bradley has been criticised for its relatively low protection, which led to a series of upgrades resulting in the latest Bradley A3's combat weight of 34,3 tonnes. At 70km/h flat out not much extra top speed is available (the M2A3 topped out at 61 km/h), although the new powerplant should provide good mobility. BAE Systems decided to adopt its new hybrid electric drive propulsion. Known as the Traction Drive System (TDS), this was developed with

QinetiQ, which provided a key component in the form of the E-X-Drive transmission. The TDS can be adapted to 20- 40 tonne vehicles and is based on two symmetrical power packages that enhance reliability and provide a degraded mode capability, something that is not available with a mechanical single-engine configuration.

The TDS is considered at TRL 6-7, and BAE Systems published a viewgraph showing some of its performances. The power, 1,500 hp, matches today's main battle tanks ratings (having to cope with similar weights, it must be said!). However, the hybrid drive, in which the final stage is occupied by electric motors, offers a number of advantages. Apart from being less intrusive in the vehicle architecture, fuel savings of 10% to 20% are announced, which means a range of 300 km with a full 965-litre tank (in comparison, the M2A3 runs over 402 km with 662 litres but weighs 50% less). Taking a current 70 tonner as yardstick, this would burn around 55,600 litres of fuel in a 180-day campaign. The new type at the same weight, but running on a mechanical powerpack would consume 39,700 litres, but the same vehicle powered by BAE Systems TDS would use 33,235 litres, in other words nearly 6,500 litres less. This means that three vehicles will save the equivalent of two M948 HEMTT fuel tankers. High torque typical of electric motors improves manoeuvrability at low speeds and during dismounted operations

the hybrid configuration also allows silent operation. As said above, if top speed is not dramatically increased (operationally speaking not a major issue) acceleration takes a 25% boost thanks again to electric motor torque, with the vehicle leaping from 0 to 32 km/h in 7.8 seconds against 10.5 for a conventional 70 tonner.

The QinetiQ E-X-Drive transmission also provides seamless transition between all driving modes. Besides silent operation, another key virtue of the TDS is its 1,100 kW electrical power generator, enough to ensure ample supply to future subsystems. The BAE Systems-Northrop Grumman GCV will feature 7 roadwheels with in-arm hydropneumatic suspensions, and will have 635 mm wide tracks.

Looking at artist impressions provided by the company, the top view clearly shows the two powerpacks on the rear sides, with the centre tunnel allowing infantrymen to dismount using the rear ramp. The driving station on the front left of the all-steel core hull while the vehicle commander's position is on the right, where the engine used to be. Protection levels will be very high, BAE Systems claiming that they will exceed the mine and EFP protection of the RG-33 Mrap, (helped by the 0.5-metre ground clearance). Images clearly highlight the add-on armour installed on the sides, which broadens the vehicle width to five metres, which certainly is not an advantage when moving in urban

canyons considering the nine-metre length of the behemoth (the Bradley MA3 is 3.2 metres wide and 6.5 metres long).

Firepower is by courtesy of BAE System Dynamics' Tactical Remote Turret (TRT) which can accept a dual-feed cannon up to 30 mm calibre. Apparently the turret offered to the US Army is the TRT25. Although remotely controlled, the TRT features a hatch in the roof to provide direct view to a crewmember. A remote control weapon station is installed on top of the turret and is used by the mission commander, who will not necessarily use its firepower but its sighting system for increased situational assessment. Equipped with open architecture vetronics the vehicle is ready to receive the plug-in sensors and systems that will form its C4ISR suite.

GDLS, for its part, does not communicate on its GCV proposal.

With some estimates pushing the GCV weight up to 84 tonnes and others saying that the issue is still wide open, one will have to wait at least until next year to have a clear idea of what the US Army IFV of the 2020s might look like.

I AMPV

The other programme that might add a new tracked vehicle to the US Army inventory is the Armored Multi-Purpose Vehicle (AMPV). Based on existing and proved technologies, the programme aims at replacing the M113-based support vehicles in the following five mission roles: mission command (MCmd), medical treatment (MTV), medical evacuation (MEV), general purpose (GP), and mortar carrier (MCV). Current vehicles are unable to manoeuvre at the same speed as first line vehicles like the Abrams tank and the Bradley IFV. The AMPV should be a relatively low-cost programme, the average unit manufacturing cost having been set at \$1.8 Million (FY12), that is six times less than the previously described GCV.

With priority put on soldier protection, networking capacity, mobility and growth potential, underbelly protection requirements therefore specify a mobility comparable to that of the M1/M2 vehicles and a protection comparable to that of combat vehicles against most likely direct fire, indirect fire and underbelly threats.

Today a US Army Armored Brigade Combat Team (ABCT) has 114 M113 derivatives ensuring support functions, which represent 32% of the total number of vehicles.



For the AMPV programme BAE Systems offers a vehicle based on the Bradley chassis, many of which are available in Army depots. (Armada/P. Valpolini)



General Dynamics UK Specialist Vehicle Mobile Test Rig was exhibited at DSEI 2013 in the Protected Mobility Reconnaissance Support configuration, fitted with a Kongsberg Protector armed with a 12.7 mm machine gun. (Armada/P. Valpolini)

In detail there are 41 M1068A3 MCmds, 19 M113A3 GPs, 31 M113A3 MEVs, 8 M577 MTVs vehicles and 15 M1064 MCVs. The new AMTV will be distributed in a slightly different manner, and precisely each ABCT will field 39 MCmds, 18 GPs, 30 MEVs, 8 MTVs and 14 MCVs, for a total of 109 vehicles, to which are added five Operational Readiness Float vehicles, two mission command and one of each remaining type, for a total of 114 AMPVs per ABCT.

The Army wants at least 57% commonality of parts/components within

the AMPV fleet. The intention is to receive the vehicles by Brigade sets, getting 2-3 BCTs per year at full production rate. A draft Request for Proposal was issued on 21 March 2013, an Industry Day having been organised one month later, the RfP having been released on 28 June. The cost plus incentive fee Engineering and Manufacturing Development (EMD) contract should be awarded on 28 May 2014 to a single competitor, instead to two competitors as stated initially, for a duration of 42 months, \$65 million being available for FY14, 145.5

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A US Army Bradley equipped with the Urban Survivability Kit III. The Army is eyeing the Ground Combat Vehicle as a replacement for this vehicle, which was fielded in the early '80s. (BAE Systems)

for FY15, 109.9 for FY16 and 67.4 for FY17. Three LRIP options, with a fixed-price incentive firm contract, will follow with three option years. With funding of about \$350 million per year. Quantities for those three options are 52 AMPVs for Option 1, 105 for Option 2 and 130 for Option 3, for a total of 287 vehicles, that is about 10% of the total forecast number of 2,897 AMPVs, detailed quantities being shown in the table.

General Dynamics Land Systems, AECOM, Lockheed Martin and Mack Defence and are the most likely contenders for the AMPV bid.

BAE Systems is expected to maintain its Bradley-based proposal. A first prototype of the so-called Reconfigurable Height Bradley (RHB) was prepared in Fall 2011, featuring a roof behind the driver's position. This can be removed in less than one day to reconfigure the vehicle according to mission requirements

	ABCT Total	TRADOC / Test	Total Vehicles by type
General Purpose	462	58	520
Mortar Carrier	348	36	384
Mission Command	899	92	991
Medical Evacuation	736	52	788
Medical Treatment	194	20	214
Total			2897

The DoD offers the option of an exchange agreement with existing vehicles of the Bradley, M113, M1064, M1068, and/or M577 vehicles types.

Five companies showed up at the late April Industry Day, namely BAE Systems,

(the Medical Treatment vehicle for instance requires higher than standard headroom).

The powerpack is the as the M2A3's, namely that is the 600 hp Cummins coupled to an L-3 CPS HMPT-500 transmission, but suspensions are upgraded. Fuel tanks are

moved to the outside, on each side of the rear powered ramp, improving safety as well as increasing internal space. NBC and air conditioning are installed, except for the mortar carrier that will have an open roof. In terms of protection, the latest explosive reactive armour tiles adopted on Bradleys as well as a floating floor developed by BAE Systems will increase crew survivability, especially against mines and roadside bombs.

BAE Systems who is upgrading over 1,500 Bradleys to the A3 standard, is currently fighting against the potential shut down of the Bradley Fighting Vehicle production line for at least three years as of mid-2014, and the AMPV contract would be a possible solution to keep it open.

At AUSA 2012 General Dynamics Land Systems unveiled a new proposal for the AMPV programme, based on the Stryker, the Stryker + Tr, a tracked vehicle concept derived from the Double-V hull Stryker. The tracked Stryker prototype is 203 mm wider and has a weight of about 30 tonnes, with a growth potential up to 38 tonnes considered. A second prototype should be readied in early 2014, though its dimensions and weight might be increased as well as its tracks width to lower specific ground pressure. GDLS proposes a 625 hp powerpack. Although mobility considerations seem to favour a tracked solution, GDLS does not excludes to propose a wheeled proposal based on its latest Stryker versions should this better cope with the final RfP requirements.



One of GDLS answers to the AMTV programme is the Stryker +Tr, a tracked version of the Stryker unveiled in 2012, with a weight of 30 tonnes and an 8-tonne growth potential. (Armada/P. Valpolini)



Unveiled at IDEF in 2013 the Tulpar might become the new Turkish Army's tracked infantry fighting vehicle. It would operate alongside the Altay tank in armoured formations. (Armada/P. Valpolini)

Besides the two mentioned companies, other showed up at the last Industry day. While Lockheed Martin confirmed that it is not considering its participation in the AMPV programme, not much is known about Mack Defence and AECOM intentions.

TRACKS FROM TURKEY

One of the most active countries in the tracked vehicles field is currently Turkey. At least three tracked vehicles were unveiled at IDEF 2013 last May in Istanbul.

A winged horse only for warriors, the Tulpar, gave its name to the Otokar tracked infantry fighting vehicle. The Turkish Army currently operates an evolution of the M113 the mobility of which is however inferior to that of the new tank. Considering that these units will soon need a vehicle with higher mobility, protection and firepower, Otokar decided to invest company funds in this new vehicle. Last year's prototype will be followed by an undisclosed number of other test vehicles (testing of the current vehicle started in the wake of IDEF in May 2014).

In order to reduce costs and risks and to optimise logistics, some of the subsystems of the Tulpar are directly derived from those of the Altay, although they may not be necessarily identical. The engine bay of the Tulpar was designed from the outset to accommodate two different propulsion packs. The current one is a 810 hp Scania DI 16 Turbo intercooler common rail engine coupled to an SG-850 automatic 32-speed mechanical transmission build by SAPA Placencia in Spain. This powerpack would be maintained should the current 32-tonne vehicle weight grow to 35 tonnes. For higher weight configurations, or for customers operating in very hot climates, Otokar is proposing a 1,100 hp MTU mated

to a Renk transmission that would cope with a 42-tonne Tulpar.

The new AIFV is equipped with the Mizrak-30 remotely controlled turret unveiled two years ago by Otokar and already installed on its Arma 8x8. Electrically driven, this turret is now equipped with an ATK Mk44 30 mm dual feed cannon with 210 ready rounds and a 7.62 mm coaxial machine gun with 500 rounds. It features dual-axis independently stabilised day/night gunner and commander sights with thermal imager and laser rangefinder. The Mizrak-30 allows to preserve the rear compartment internal volume, accessible via a rear ramp by troops, commander and the gunner which operates within the vehicle chassis. The reduced need for turret protection allows for a lower centre



The ACV30 was developed by FNSS to answer the Turkish Army requirement for an amphibious air defence artillery system. Weighing in at 30 tonnes, the vehicle is necessarily huge to allow proper flotation. (Armada/P. Valpolini)

of gravity – the Tulpar being able to cope with 40% side slopes. No information on the chassis protection level were given, the modular armour package being defined as “up to current higher standards”, the package development being made in cooperation with IBD Deisenroth, though manufacture is planned to remain in Turkey.

As for active defence solutions, Turkey is looking at a local developments through international cooperation. Initially aimed at the Altay MBT, these would be scalable to suit other vehicles. The Tulpar is obviously a candidate if it is to operate alongside the national Altay. A tender for the active system should be soon launched by SSM, the Turkish defence procurement agency. Company officials consider the Tulpar to be a match for top players like the Ascod, the CV-90 and the Puma, although the Turkish vehicle has 10-tonne growth potential. Mine protection was a key design parameter with a 450mm ground clearance and energy absorbing seats, but no information is given on the mine protection package.

The vehicle meets the requirement of the Turkish Army for a 13 m³ internal volume including the driver compartment, which is not separated from the rear compartment. The overall internal volume is very smooth and continuous, allowing all the crew and infantry squad to have direct eye contact. The Tulpar was designed to roll into the Airbus Military A400M, of which ten have been ordered by Turkey. Among the options offered for the Tulpar is an auxiliary power unit, that might become key in some configurations, such as command post or ambulance, to name but two of the many variants proposed by Otokar.

FNSS had two tracked vehicles on show at IDEF for the first time. Although not part of



the IFV category the ACV30 is worthy of a few words here as it is a new tracked support vehicle developed specifically for the Korkut 35 mm self-propelled air defence artillery system that is being procured by the Turkish Army under prime contractorship of Aselsan. FNSS leveraged experience from the M113-derived vehicles to give birth to this steroid-pumped M113 – its impressive volume resulting from the amphibious requirement for the Korkut. The 30 tonner uses two hydrojets to reach a maximum speed of 6 km/h. A command and control prototype equipped with a radar has also been produced, a potential order for 13 firing units each made of a C2 and three gun vehicles being awaited. The ACV30 should also be used as the chassis for the T-Malamids medium-range air-defence missile system.

More relevant to this Compendium was the second tracked vehicle exhibited for the first time by FNSS. At first glance the Kaplan (Tiger) tracked reconnaissance vehicle has a well known look, that of a derivative of the M113 due to its five roadwheel chassis. However this first impression is quite misleading, as in fact the recce version of what is also known as LAWC-T (Light Armoured Weapon Carrier concept - Tracked) has a wholly different architecture. The hint of that is given by the front section, which features a full width periscope system showing that the driver and commander seat side by side. This layout is derived from that of the FNSS wheeled vehicle family of Pars 6x6 and 8x8, and provides optimal situational awareness allowing to drive with hatch closed

A light tracked reconnaissance vehicle, the Turkish Kaplan has been developed by FNSS adopting some features of its wheeled PARS family, such as the glass windscreen. (Armada/P. Valpolini)

even in those situation characterised by heavy car and people traffic that military units find during stabilisation missions.

The field of view in the front cabin exceeds 180° and is thus also a key factor in allowing the crew to pick up combat indicators. The engine has been moved to the back and on the right, leaving a small access way that ends into a clamshell door in the rear of the Tiger, while the transmission is located at the very front of the chassis. In that small corridor a jump seat is available for a fifth soldier, two other being located behind the driver and commander. The weapon system might be of different kinds, the LAWC-T being able to host manned or unmanned turrets with weapons from 25 up to 40 mm calibre, as well as antitank missile turrets or ISTAR turrets of up to 1.8 tonnes. At IDEF the Tiger was shown with a still unnamed remotely controlled turret developed in cooperation with Roketsan, armed with a 12.7 mm machine gun and four Omtas medium range missiles, a side-development of the Umtas long range missile equipped with a similar imaging infrared sensor. Four to six spare missiles are hosted inside the vehicle. The sight includes a day TV camera, a thermal imager and a laser rangefinder. The Tiger adopts an FNSS vetronic system derived

from that of the Pars, based on a Cambus, that allows plug & play installation of electronic systems. The prototype shown at IDEF had front, back and side day/night cameras, with the front ones being used as driving aids while the remaining ensure all-round situational awareness. The crew accesses the vehicle via two side doors. Protection is Level 4 against kinetic energy threat, that is 14.5 mm AP at 200 metres, and Level 3a against mines, 8 kg under track. With a ground clearance of 400-450 mm, the vehicle features a shallow “V” underbelly. The current gross weight is nine tonnes although the chassis can accept 14 to 15 tonnes, thus a considerable growth margin is available to further increase protection. No data were available on the engine but FNSS states that the power-to-weight ratio must be greater than 25 hp/t, implying a 250 hp engine at ten tonnes. The current prototype will be followed by a second, which will be amphibious, a must for a recce vehicle and a double-must considering that the Turkish Army requires amphibious capabilities in all new projects. According to FNSS designers the rear engine and the centre of gravity located close to the flotation centre will considerably improve the behaviour afloat. Moreover the low centre of gravity also allows to cope with 40% side slopes. FNSS plans to start LAWC-T/Tiger trials in early-mid 2014. In June 2013 Turkish SSM announced a bid for 184 tracked armoured weapon carriers, a role that perfectly fits the Tiger. Beside the national market the company looks positively to South-East Asia, where the low ground pressure of the vehicle – 6 tonnes/m² at 10 tonnes – would allow the Tiger to cope with muddy, soft soils and rice paddies, which might make it in a way the successor of the CVR-T series. How much the LAWC-T Kaplan will be used as the base for the development of a new family of tracked vehicles for Indonesia, as part of the agreement between the two countries signed at IDEF 2013 that involves PT Pindad for Indonesia and FNSS for Turkey remains to be seen, the Kaplan performances fitting well the Indonesian operational scenarios.

EUROPEAN TRACKS FOR EUROPEAN CONTRACTS

Two European nations, Denmark and Poland, are about to replace a considerable part of their armoured vehicle fleets. The former need to replace its M113 APCs. the Danish Defence Acquisition and Logistics Organisation FMT (Forsvarets Materieltjeneste) has already

shortlisted the competitors, keeping in play both tracked and wheeled solutions. Some 206 to 450 vehicles may be involved in six different variants. Poland, for its part needs to replace its Russian-built BMP infantry fighting vehicles as well as its T-72 and P-91 tanks. The requirement specifies Universal Tracked Platform (UTP) platform with a combat weight capability expected to be in excess of 25 tonnes to serve as the basis for around 1,000 IFVs and 500 for the light tanks.

The Danish shortlist includes three tracked solutions: the BAE Systems' Armadillo, the FFG Flensburger's Protected Mission Module Carrier (PMMC) G5 and the General Dynamics European Land Systems Ascod 2. The Polish bid timeline is slightly to the right of the Danish one, and what is established is that production will be carried out locally by Polish Defence Holding (formerly the Bumar Group), the deadline for first deliveries being 2018. A national development solution does not seem viable, and thus a Polish solution created with the support of international partners heavily based on an existing products is more probable. The end of the



In the latest iterations of the CV90 only the name of the original vehicle remains, the newly produced IFVs being technologically way ahead of those entered in service in the '90s. (BAE Systems)

programme is planned for 2022.

As shown in the Armoured Vehicle Protection Compendium published with Armada 2/2013, the CV90 is largely a new vehicle compared with the original delivered to the Swedish Army 20 years ago. Over 1,200 are currently in service with five other nations, Denmark, Finland, the Netherlands, Norway and Switzerland which with Sweden are all part of the System Development Board, in other words the "CV90 users club" that feeds back operational experiences acquired downrange.

Mobility improvements include a semi-

active suspension that provides a much more stable platform (reducing pitch acceleration by 30 to 40%) and rubber tracks. The former increases weapon accuracy to MBT levels and the latter reduce acoustic signature, thereby limiting the effectiveness of acoustic seismic sensors. In Afghanistan those tracks, produced by Soucy of Canada, proved to reduce noise by 10 dB, but also had beneficial effects on fuel consumption as well as on road damage, an important factor in stabilisation operations. In addition, the newest vehicles proved to outperform the Bradley in light snow thanks to the higher sprocket and better

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At MSPO 2013 in Poland BAE Systems and Polish Defence Holding unveiled the PL-O1 concept support vehicle based on the Universal Tracked Platform. (BAE Systems/PDH)

angle of the track, as well as in the passage over the 1.2 meters step. The CV90 engine is a militarised version of those used on Scania trucks that has seen its power increase from the mere 370 kW of the earlier prototypes to the 600 kW of the latest MkIII version. Combat weight has grown from 20 to over 35 tonnes, mostly because of the constant improvement in armour protection, as the latest vehicles feature a mine protection well in excess of Stanag 4A/B. Increased power and running gear improvements allow the CV90 to sport a 120 mm smoothbore gun.

The latest CV90 versions are fully digitised. This major step results from the Swiss requirement necessitating a reduction of maintenance personnel training time from 15 to 5 months, which implied the adoption of digitised health and usage monitoring systems. The electronic architecture is the other major improvement in the latest version of the CV90. Not only does this allow easy integration of new sensors, local situational awareness systems, reactive armour, on board simulation systems that allow to increase crew performances in the build-up phase, but it also decreases crew reaction times.

Further potential upgrades are proposed, such as BAE Systems' hybrid-electric drive technology that promises to cut fuel consumption by 25-30%, a figure that might increase up to 45% if coupled to rubber tracks.

In addition to the MkIII, the CV90 also evolved into the Armadillo, a sans turret version with a higher internal volume and a six-tonne payload capacity to suit a number

of needs, armoured personnel carrier to name but one.

The constant upgrading of the CV90 brought its results: after 18 years of production the two Swedish plants where it was manufactured went still. The lull in production was used by BAE Systems to optimise its production scheme, reunifying all the production in the Örnsköldsvik plant while modernising it in order to increase efficiency. This plant is now used to produce all tracked vehicles, among which the CV90, which is again starting to roll off the assembly line following the contract signed in 2012 by Norway to the tune of €590

million. This includes the upgrade of the current fleet, namely 103 vehicles, and the acquisition of further 41 new vehicles and some extra chassis, to provide the Norwegian Army with 74 infantry fighting, 21 reconnaissance, 15 command, 16 engineering, two driver training vehicles and 16 multirole vehicles, the latter for different roles such as mortar carrier or logistics. The new vehicles will encompass most of the protection, survivability, situational awareness, intelligence and interoperability improvements so far developed. Production is being carried out in Sweden while a Norwegian industry team led by Kongsberg is responsible for the integration work.

More markets might open up for the Swedish vehicle. Besides the Armadillo, down-selected by Denmark, CV90-based solutions are also eyeing the Canadian Close Combat Vehicles (CCV) programme that involves 108 vehicles plus an option for 30 more. The programme seems to be confirmed after an attempt to dump it by some Army circles. The CV90 has also been tested for the American GCV programme.

In late May 2013 BAE Systems Hägglunds announced an agreement with Polish Defence Holding (PDH) was announced aimed at the UTP, and in September the two companies unveiled the PL-O1 concept direct support vehicle at MSPO in Kielce. This will be the first member of the UTP-based family and heavily draws on CV90 experience.

The tracked platform, which can be equipped with steel tracks with rubber pads or with full rubber tracks, features a high



The Protected Mission Module Carrier G5 developed by FFG Flensburger is one of the vehicles downselected by Denmark for the M113 replacement programme. (FFG)

capacity compact powerpack that takes away a relatively low volume within the hull, which accommodates three crew members. The hull is mine and roadside bomb resistant, armour being based on a multilayer composite ceramic-aramid package, while an active protection system increases crew safety together with other passive solutions such as new blast absorbing seats. The PL-01 has an unmanned turret that can be armed with a 105 or a 120 mm gun, both being able to fire standard ammunition or antitank guided missiles. A lighter remote-control weapon station on the turret top will be armed with a 7.62 or 12.7 mm MG or with a 40 mm AGL, a coaxial 7.62 mm MG completing the weaponry. The number of crew members implies the presence of an autoloader, located in the turret rear. State-of-the-art optronics will provide sighting and situational awareness, the commander being provided with a panoramic sight for hunter-killer missions. Navigation and IFF will also be part of the vetrionic suite. The modular design will allow the direct support vehicle to be adapted to various missions. A first prototype, build at Gliwice by Obrum, a PDH company, should be available by 2016. First deliveries are expected in 2018 with completion by 2022.

The second tracked contender for the Danish programme is the Protected Mission Module Carrier G5 (PMMC G5), developed by Flensburger Fahrzeugbau Gesellschaft (FFG) of Germany, a company with a strong experience in the development and upgrade of military tracked vehicles –the M113 and the Polish Opal amongst others. Grossing at 26.5 tonnes with further growth potential, the G5 features six roadwheels with a front sprocket. The 560 hp MTU 6V199 TE21 engine lives front right, with the driver on the left with full access to the rear compartment. He can thus enter his position either through the top hatch or from the back. To provide him with a good situational awareness the vehicle is not equipped with typical tracked APC episcopes, but with an elevated dome with windows on 180°, ensuring good visibility front and left and lesser visibility on the right. Armoured glasses are protected by steel slats. This allows the driver to remain protected while keeping a driving position similar to that of an M-113 head-out position.

A day/night camera is also located at the front. The engine is coupled to a ZF LSG 1000 automatic transmission that drives rubber tracks provided by Soucy. The G5 has a very high internal protected volume, 14.5



Outside and inside view of the PMMC driver's position, which features a glass windscreen allowing good situational awareness and a view of into the troop compartment. (FFG)

m³, its payload capacity being 6.5 tonnes. It can carry a maximum of 12 soldiers, a proposed layout being that with the driver, the vehicle and tactical commanders seated towards the front with a screen showing the BMS as well as the image captured by the front camera and eventually other sensors (should an RCWS be mounted on the roof), and eight dismounts seated on two rows of four energy absorbing seats looking inwards.

As mentioned initially the PMMC G5 has been developed following a modular concept, thus the vehicle is based on a standard mine protected chassis, powerpack, driveline, suspension system, air conditioning and heating, driver and commander stations and interfaces. The vehicle can then be rapidly fitted with different mission modules, which are decoupled from the chassis floor, to meet various mission requirements such as troop transport, command post, ambulance, medical treatment, and cargo, although mortar carrier, patrol and other versions have also been considered. Shifting module

requires few hours. This allows to keep the logistical footprint as small as possible. Modules can be transported and stored inside standard ISO-containers, making their handling very cheap and easy. According to FFG the PMMC G5 was designed with the aim of minimising life cycle costs. FFG has built three G5 prototypes, which are optimized versions of the first one produced and that have logged approximately a combined 20,000 km to date. The G5 is currently under field testing by Denmark and, according to FFG contacts have been established with numerous interested parties from several countries. In 2011 FFG and Krauss-Maffei Wegmann announced an agreement aimed at supporting the modernisation of the Brazilian M113 fleet.

ASCOD

Selected as the preferred bidder in March 2010, the General Dynamics UK proposal for the British Army SV Scout vehicle had by July received the contract for the demonstration

phase that included the development of seven Ascod tracked vehicle evolution prototypes equipped with a Lockheed Martin turret armed with the CTAI 40 mm gun. The turret body, it is worthy of notice, is based on Rheinmetall's Lance turret.

The latest step was the completion of cold-weather trials on the mobile test rig, which followed those of the cooling system under full load in extreme heat, thus ensuring an 80°C operational envelope. Tests were carried out in a cold climatic chamber in Spain. The mobile test rig was submitted to a whole series of punishments, including operational and tactical mobility trials, covering over 10,000 km. The Critical Design Review is expected by the end of 2013 while a decision on production might be taken in 2014-15.

The Ascod 2 has also been down-selected as one of the competitors for the Danish Army M113 replacement programme.

I PUMA CLOSE TO DELIVERY

Of the 350 Pumas ordered by Germany to Projekt System & Management (PSM), the 50-50 Joint Venture between Krauss-Maffei Wegmann and Rheinmetall Landsysteme purposely made for managing the programme, nine have been produced and are currently undergoing extensive verification and qualification trials.

The Bundeswehr had originally ordered 405 Pumas, but following reorganization decisions, the German defence authorities and PSM agreed on a reduction to 350 vehicles in July 2012 (with a 342 infantry fighting vehicle and 8 driver training vehicle split), and on the

extension of the qualification trial period to September 30 2013.

Compared to the early prototypes, production vehicles have a new running gear featuring six roadwheels instead of five. Also the first Pumas had a wider gap between the third and fourth and between the fourth and fifth roadwheels, while now the spacing is even between each axle providing better performances on rough terrain and a higher stability. Space has even been found in the running gear side modules to add more fuel to bring this capacity to 900 litres from 800. Another major change can be seen on the unmanned turret, which now features a pyramidal and ventilated weapon housing that ends close to the muzzle. According to PSM this further increases the accuracy of the fully stabilized 30 mm MK30-2/ABM automatic cannon. The grenade launcher functionality – part of the Muss active protection system – has also evolved, with launchers now being trainable. The four IR/laser sensors installed around the turret provide 360° coverage, data being fed into the central electronic system that ensures that the infrared jammer and the grenade launcher are oriented in the optimal direction before firing to maximize protection against an incoming missile. For the German Army a launcher for two antitank missiles will be installed, the integration of the Spike-LR missile system being currently under development.

The Puma has already undergone an extensive qualification and verification programme. Numerous individual tests and trials have been conducted and successfully

concluded, road behaviour, performance, ergonomics, fire control system, functionalities of turret and weapon systems, while in parallel, it successfully underwent a three-month cold climate trial in the Arctic Circle of Norway in early 2012. Further integrated verification and system qualification trials will continue until the end of 2013, numerous activities being planned.

As for logistical qualification trials, since May 2013 German Army personnel from the Technical School for Land Systems and Army Technical College for Technology in Aachen is carrying out maintenance and repair tests on the Puma. This includes the verification of the main elements of the logistical training programme including a comprehensive theoretical and practical understanding of maintenance activities and testing of special tools, as described in the interactive electronic technical documentation, as well as conducting practical maintenance on level 2 and 3.

Tactical qualification trials have begun in May 2013 and were expected to be concluded by mid- August 2013. The trials, carried out with a single vehicle as well as with a platoon size unit of four vehicles, are conducted by the German Army Armour Corps School in Munster and include operations with mounted or dismounted infantry, maneuver combat, high elevation firing in urban areas, platoon size exercises and combined arm exercises together with main battle tanks. By the time these lines are read, the Puma should have completed two or three months of hot climate trials in the United Arab Emirates.

The German Puma, developed and produced by the KMW/Rheinmetall JV known as PSM, has undergone some modification and is now closing the production phase. (PSM)



Lockheed Martin UK should start the production of the Warrior Capability Sustainment Programme in 2016, critical design review being planned for 2014. (Lockheed Martin UK)



Once the user verification certificate is obtained, based on the results of all conducted tests, 2014 the production rate will increase to about 50 Puma per year until final delivery in 2020. Handover of the first Pumas to the German Army is planned for 2014. The Puma is also being promoted on the export market, Canada and Australia being currently the high priority programmes for PSM.

I WARRIOR & CO

In Britain Lockheed Martin is pursuing its effort on the Warrior Capability Sustainment Programme. In November 2012 a new motion test rig was installed for turret stabilisation testing, turret servo testing, human factor assessments, training and shakedown testing. It can accommodate payloads up to eight tonnes replicating typical automotive dynamic loading conditions. The Lockheed Martin UK WCSP is based on the refurbishing of the Warrior turret which is being rearmed with the 40 mm CTAI gun. Mobility, protection and C2 improvements are also part of the package. In 2013 the Performance Design Review was carried out successfully, awaiting the Critical Design Review in 2014 that will bring to the completion of the demonstration phase. Production should start in 2016 with an IOC scheduled for 2018.

Meanwhile Lockheed Martin UK is also waiting for the down-selection for Kuwait Desert Warriors upgrade programme that should take place in late 2013. Although equipped with a different turret and gun (the



South Georgia is one of the latest countries to enter the armoured vehicles production arena; the Lazika 14 tonnes APC can carry up to seven dismounts and three crew members. (Internet)

ATK 25 mm M242 dual-feed cannon that will quite probably be selected), LM UK will have the advantage of experience gained with the WCSP against its contenders, Raytheon Network Centric Systems teamed with BAE Systems and General Dynamics Canada.

I A NEW ENTRY

The Republic of Georgia is one of the latest entries among tracked vehicles producers, having unveiled an remote-control turret-equipped armoured personal carrier in late February 2012. Armed with a 23 mm 2A14 cannon and a 7.62 mm machine and known

as the Lazika, it has a combat weight of 14 tonnes. Protection is basic Level 4 front and flank protection, Level 2 at the rear. Add-on armour up to Level 5 is available, while mine protection is given as Level 4a/b. It carries a crew of three and up to seven dismounts that debus via a rear ramp. Designed by the Delta military-scientific technical centre, it is being produced by Tbilisi Aircraft Manufacturing. The 300 hp engine is located in the front right and allows the Lazika to reach a maximum speed of 70 km/h, the stroke of the five roadwheels being entrusted to a torsion bar suspension.

Armour on Wheels

Should the US Army AMPV contract go to a tracked vehicle, as it seems quite probable, the wheeled armoured infantry fighting vehicles and armoured personnel carriers market of the coming years will be much less American-oriented than the tracked vehicles market, the main wheeled acquisition programme remaining the US Marine Corps Marines Personnel Carrier.



At the Russian Expo Arms exhibit in Nizhny Tagil, Ural Vagon Zavod and Renault Trucks Defense announced the new Atom 8x8 infantry combat vehicle aimed at the Russian market. (UVZ-RTD)

Still in North America, but in Canada, the Close Combat Vehicle programme has shortened its contender list to Nexter's VBCI equipped with the 25 mm turret, and the GDLS Piranha 5.

Interestingly, Denmark is considering the same vehicles for the "wheeled option" for its M113 replacement programme (q.v.). In Europe, the major programme was that for the Spanish Ejercito de Tierra, which plans to transform eight brigades into multirole brigades (Brigada Polivalente), the frontline equipment being an 8x8 platform in combat, reconnaissance and command versions, to be later followed by mortar carrier, antitank, recovery, ambulance and engineer versions. However the nation's current financial situation has heavily pushed any modernisation plan to the right, a replacement of currently available equipment



BAE Systems teamed with Iveco DV for answering the US Marine Corps requirement for the Marine Personnel Carrier; the vehicle is a derivative of Iveco's SuperAV. (BAE Systems)

being foreseen in the 2020-40 timeframe.

A requirement for a 6x6 vehicle is surfacing in Turkey, that for an 8x8 seems still far away, while in the Middle East the United Arab Emirates requirement for around 700 8x8 vehicles is still there, other neighbouring countries being interested by similar platforms. The Far East and Latin America are also looking for wheeled IFV/APC solutions.

Brazil is also looking at an 8x8 vehicle armed with a 105 mm gun, with the aim of replacing both the EE-9 Cascavel and the Sk105 light tank, an RfI having been issued to turret companies. Four companies answered the request, namely Oto Melara with the Hitfact 105, Elbit Systems' Brazilian subsidiary Ares Aeroespacial e Defesa with the MT 105BR, CMI Defence with the CT-CV 105HP, and Tarobá Engenharia with an undisclosed proposal. An RfP should be issued in late 2013, when the Brazilian Army is expected to file a development contract with Iveco Latin America for an 8x8 derivative of the 6x6 Guarani.

THE MARINE PERSONNEL CARRIER PROGRAMME

The fate of the MPC programme remains doubtful in the light of the US sequestration. The US Marine Corps Commandant, Gen. James Amos, was clearly saying that the top priority vehicle for the Marine Corps is the Amphibious Combat Vehicle. Thus the Marine Personnel Carrier might become a "nice to have" item. September 2013 might see the conclusion of the amphibious and ballistic and blast tests, and participating companies await for a debriefing in late

For the Marines Personnel Carrier programme Lockheed Martin is teamed with Patria of Finland and proposes a version of the Armoured Modular Vehicle. (Lockheed Martin)



October, early November. What will then happen remains a mystery. Will the MPC be a gap filler should the ACV slip too much to the right? Will it be a back-up solution should the ACV fail?

Should the ACV succeed will it be acquired if funding is available? Rumours about a possible round of ground mobility testing in 2014 followed by an RfQ in early 2015 leading to an engineering and manufacturing development contract for two competitors only have also been heard.

While two of the four proposals have been widely advertised, namely the Havoc (an AMV-based vehicle from Lockheed Martin and Patria, with Armatec Survivability Corporation also part of the team), the SuperAV by BAE Systems-Iveco DV. The other two are more discreet though: the ST Kinetics Terrex 8x8 seems to be the standard vehicle adopted by Singapore. As for the GDLS proposal, a Youtube posted movie shows what looks like a modified-body Piranha 3C with 12-inch wheels and an increased height to ensure sufficient floatability, but no official information are available.

I RUSSIA: THE NEW FRENCH CONNECTION

In February 2013 Ural Vagon Zavod and Renault Trucks Defense started a co-operation aimed at developing an 8x8 replacement for the numerous BTRs in service in the Russian Army. The mock-up of that vehicle, named Atom 8x8, was unveiled in late September 2013 at the Russian Expo Arms exhibit in Nizhni Tagil. With a 32-tonne gross weight, the Atom is 8.2 metres long, 3 metres wide and 2.5 metres high. Powered by a Renault diesel engine yielding over 600 hp linked to an automatic gearbox, it has a weight/power ratio in excess of 18,7 hp/t, is fitted with independent suspensions, and has a maximum speed of 100 km/h and a range of 750 km. An amphibious kit is available. Fitted with a rear ramp and four hatches, its maximum transport capacity is of two crew members plus 10 dismounts in APC guise armed with a remote-control 12.7 mm station, while an IFV version, fitted with a two-man turret armed with a 57 mm gun can carry up to eight dismounts. Highly modular, an air defence version of the Atom, also armed with a 57 mm gun, is forecast with

a crew of three. The two companies are considering the development of command post, engineer and ambulance versions, as well as that of a self-propelled howitzer version armed with a 120 mm turreted barrel. Ballistic protection is at Level 5, but no details on antimine protection having been announced, except that ground clearance is 0.6 metres. The Atom can be transported airlifted by on Il-76 and An-124. The two companies estimate the potential Russian market at around 2,000 vehicles.

I HAVOC AND AMV

The Havoc is a straight derivative of the Armoured Modular Vehicle with identical dimensions. AMV sales to seven countries, Finland, Poland, Slovenia, Croatia, South Africa, United Arab Emirates and Sweden have reached the 1,400 mark. Launched in 2004, the AMV saw its first operational deployment in 2007 in Afghanistan where it currently is operated by more than one country. Developed to provide optimal modularity of components and to be adaptable for a wide range of versions without changes in basic vehicle systems, the



A view of the inside of the Havoc, the AMV-based vehicle proposed by the Lockheed Martin-Patria team for the USMC MPC programme. (Lockheed Martin)

AMV offers protection against APFSDS rounds up to 30 mm in the front sector and underbelly protection against IED's, EFP's as well as TNT mines of up to 10 kg.

The various versions are based on two chassis lengths, respectively 7.7 and 8.2 metres, while width and height remaining the same at 2.8 and 2.3 metres respectively. Both chassis are available for all the versions developed. The basic model provides the platform for the armoured personnel carrier, infantry fighting vehicle, command vehicle, ambulance, recognition vehicle, anti-tank guided missile vehicle, armoured repair and recovery vehicle. A high-roof model provides extra space at the back of the vehicle, for command, C4I-, ambulance-, or workshop vehicles. A heavy weapon platform has been optimised to carry large-calibre weapon systems such as the 105 mm cannon (MGS) and for the 120 mm Patria Nemo mortar system.. In March 2013 Patria delivered the first of the 113 AMVs ordered by the Swedish Defence Forces, in other words the latest generation vehicle of the AMV product family.

In 2012 Patria, the Ministry of Defence of the Republic of Slovenia and Rotis Plus signed a settlement agreement concerning the AMV contract for Slovenia, the local fleet of AMVs consisting of the 30 Svarun already delivered, closing the rest of the project that would have brought the total to 135 vehicles.

Things are going much better in Poland, that country having announced in July 2013 that in the next five years it will build 307

further Rosomak APCs. Poland also extended the production and selling rights for 10 more years, Africa being one of the areas targeted. In Poland the Rosomak is built by Wojskowe Zakłady Mechaniczne at Siemianowice.

As for South Africa, the defence minister signed the Hoefyster (Badger) contract in February 2013, however Armscor, the technology and acquisition agency for the South African Government, transferred it to Denel only in September. Worth some €680 million, it includes the production of some 238 vehicles in five different configurations; heavily based on Patria's AMV, the Badger will feature numerous modifications aimed at answering local requirements. Amongst these

is a new flat-bottom mine protection based on the Land Mobility Technologies' Flat Floor Technology (the same company is also, by the way, responsible for the new interior). Other equipment produced locally will help increase national content, the vehicle being assembled in South Africa by Denel Land Systems who will also provide the two-man turret for the support variant.

Currently known as "New Vehicle Concept", (the actual name will apparently be unveiled at Eurosatory 2014), the new 8x8 does not look much different at a first glance (see the title picture at the very beginning of this Compendium). Nevertheless the Finnish company considers it a fully new vehicle although not many technical details were provided. First of all the vehicle is longer, 8.4 metres versus the original's 7.9, the curb weight remaining in the order of 17 tonnes, which suggests the use of improved efficiency materials. Gross weight grows to 30 tonnes versus the AMV's 27, yielding a 13-tonne payload capacity. Mobility is increased thanks to the adoption of improved suspensions and a new powerpack. The driveline was revised to cope with the new in-line six cylinder's 450 kW (instead of the original's 405 kW) and higher torque. The type was not specified but it should remain part of the DI 12 Scania Diesel family. The maximum operating radius is increased from 800 to 1,000 km, which might result from an increase in the fuel tank capacity and a better efficiency of the new engine.

The armour package is provided by IBD Deisenroth and should be tailored to customer needs, according to the modularity concept that remains the base of the Patria philosophy. The driver has a full 180° view



A Patria AMV on the move; the Finnish vehicle is constantly being upgraded, deliveries of the latest generation vehicle to Sweden having started in 2013. (Patria)

Iveco DV and Oto Melara are proposing the VBA to the Italian amphibious troops. It mates the SuperAV with Oto Melara Hitfist Plus turret. (Armada/P. Valpolini)



capacity thanks to five periscopes provided by GUS, these being installed in a way that ensures better protection if hit by a projectile coming at high angles. The vehicle can carry a crew of three plus 10 dismounts that access through the rear powered ramp door. Amphibious, it features a state-of-the-art 530 A generator that ensures sufficient electric power to cope with future needs. The prototype shown at DSEI had already carried out a series of trials, which the company declined to describe, and was fitted with a Saab Trackfire remote-control weapon station armed with a 25mm cannon and a 7.62mm machine gun. According to Patria the new vehicle will be able to carry weapons up to 120 mm calibre, both indirect fire such as the Patria Nammo or direct fire high-pressure guns. Company officials underlined that the advent of the new vehicle will not mean that the AMV will disappear from the company portfolio.

■ THE ITALIAN WAY

The VBA (Veicolo Blindato Anfibio) amphibious vehicle, from which the Marine Personnel Carrier version is derived, is currently in qualifying phase in Italy. The first development phase was concluded in December 2012, with the demonstration of the vehicle's amphibious capabilities to the Italian MoD. The VBA is the common proposal by Iveco DV and Oto Melara for an

amphibious infantry combat vehicle equipped with the Hitfist, the chassis-only proposal maintaining the SuperAV name.

In terms of rolling gear, the VBA is deeply related to the VBM "Freccia", the Army 8x8 having displayed an availability of over 90 per cent in two and a half years in Afghanistan. The VBA powerplant is however different, being based on a cots engine, the Cursor 13 used on Iveco trucks. The first immediate feeling on the field is a significantly lower acoustic signature. The engine also drives the two shrouded propellers located at the back of the vehicle, which ensure a swimming speed of 5.4 knots. To reduce weight the crew and passenger cell is of limited width, to which add-on elements providing further protection against IEDs and buoyancy are added, giving the vehicle its distinctive shape. A double antimine "V" shield using nanomaterial technologies is used to protect the crew and dismounts from underbelly blast. The Oto Melara turret was hitherto armed with a 30 mm ATK gun, though the Italian Army chose the 25 mm for standardisation reasons. On the presentation day the sea was calm, the previous day we could witness the vehicle's behaviour in Sea State 2-3. A shore-to-shore simulation was carried out, the vehicle fighting its way into the sea against waves until it reached the 2.6-metre floating depth. Further work on the propellers and bow section might increase

swimming speed to reach the swimming speed required by the Italian Navy.

In the MPC version the turret was replaced by a Crows II station, while the vehicle has been stretched to 8.1 metres versus the VBA's 7.92. Width increased by 5 cm while the vehicle is 30 cm higher at 2.6 metres, in order to meet the 95 percentile requirement of the Marine Corps. The height increase is also partly due to the new wheels, as the MPC adopts 16.00R20 tyres instead of the VBA's 14.00R20 to increase mobility. Engine-wise, the MPC maintains the Iveco Cursor 13.6-litre turbocharged and intercooled 560 hp unit.

As said above, the VBA fully exploits the experience acquired with the Freccia deployed since 2010 in Afghanistan by the Italian Army first medium brigade, two of its three infantry regiments being now fully equipped with the 8x8 IFV. Currently some 223 Freccia are on order, subdivided in three batches. Iveco DV - Oto Melara consortium (CIO) delivered the 50 plus 71 Freccia in the combat version of the two first batches as well as the 24 antitank vehicles, the latter based on the combat version with a Spike missile launcher integrated on each side of the turret. The mortar carrier version, equipped with the Thales 2R2M mortar system boasting a 120 mm rifled barrel is currently being qualified, and the CIO looks forward to deliver all 12 on order by late 2013.

The industrial consortium delivered the



Length: 7.70 metres
 Width: 2.80 metres
 Height: 2.30 metres
 Combat weight: 26 tonnes
 Crew: 3 + 9
 Maximum speed: 100 km/h
 Operating radius: 800 km
 Fuel capacity: 415 litres
 Amphibious: yes (<22 tonnes)
 Engine: 405 kW Scania

AMV

Patria, Finland

Seven customers have bought almost 1,400 in 6 x 6 and 8 x 8 forms. The type is used as the basis for South African Hoefysters. Poland's mount a Hitfist turret.



Length: 6.35 metres
 Width: 2.70 metres
 Height: 2.44 metres
 Combat weight: 18.5 tonnes
 Crew: 2 + 8
 Maximum speed: 105 km/h
 Operating radius: 700 km
 Fuel capacity: 350 litres
 Amphibious: yes
 Engine: 336 kW

Arma 6 x 6

Otokar, Turkey

Unveiled in 2010 the Arma 6 x 6 personnel carrier has already chalked up two export orders from undisclosed countries. A roadside bomb clearance version was presented in 2011.



Length: 8.30 metres
 Width: 3.13 metres
 Height: 3.13 metres
 Combat weight: 22 tonnes
 Crew: 3 + 7
 Maximum speed: 100 km/h
 Operating radius: 800 km
 Fuel capacity: 290 litres
 Amphibious: yes
 Engine: 375 kW 2B-06-2C

BTR-90

JSC Arzamaz, Russia

A 'beefed up' and more powerful BTR-80, introduced in 1995, the BTR-90 features a BMP-2 turret with Konkurs AT missiles, but it is also available with 100 mm and 30 mm turrets.



Length: 6.80 metres
 Width: 3.20 metres
 Height: 2.80 metres
 Combat weight: 32 - 35 tonnes
 Crew: 3 + 7
 Maximum speed: 70 km/h
 Operating radius: 600 km
 Fuel capacity: 840 litres
 Amphibious: no
 Engine: 600 kW

CV9035 Mk III BAE Systems Hägglunds, Sweden

Developed for the Swedish Army with a 40-mm gun the CV90 has been sold to Finland, Norway and Switzerland with a 30-mm gun, and Denmark and the Netherlands with a 35-mm gun.



Length: 6.51 metres
 Width: 2.67 metres
 Height: 2.08 metres
 Combat weight: 16.5 tonnes
 Crew: 3 + 8
 Maximum speed: 105 km/h
 Operating radius: 750 km
 Fuel capacity: 250 - 300 litres
 Amphibious: yes
 Engine: 221 or 335 kW

Pandur 6 x 6 LWB

GDELS-Steyr, Austria

It has been totally overhauled mechanically and electronically, the 6 x 6 II can carry a 90-mm turret as maximum calibre.



Length: 7.36 metres
 Width: 2.67 metres
 Height: 2.09 metres
 Combat weight: 24 tonnes
 Crew: 3 + 4
 Maximum speed: 105 km/h
 Operating radius: 700 km
 Fuel capacity: n.a.
 Amphibious: yes
 Engine: 335 kW Cummins ISC

Pandur II 8 x 8

GDELS-Steyr, Austria

Following the sale of the 330 Pandur I 6 x 6s to six customers, the 8 x 8 Pandur II is being produced for the Czech Republic and Portugal. It can be armed with a 105-mm gun.



Length: 7.27 metres
 Width: 2.96 metres
 Height: 3.12 metres
 Combat weight: 25 tonnes
 Crew: 2 + 9
 Maximum speed: 100 km/h
 Operating radius: 530 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 261 kW Caterpillar C7

Stryker

GDS, USA & Canada

The Stryker programme now focusses on the Stryker 'Double-V Hull' (DVH), which increases the vehicle protection against mines and roadside bombs to Mrap levels.



Length: 7.78 metres
 Width: 2.97 metres
 Height: 2.46 metres
 Combat weight: 24 tonnes
 Crew: 1 + 12
 Maximum speed: 105 km/h
 Operating radius: 600 km
 Fuel capacity: 400 litres
 Amphibious: yes
 Engine: 298 kW Caterpillar C9

Terrex

ST Kinetics, Singapore

Entered production for the Singaporean Army in October 2009; equipped with a battlefield management system that allows it to connect with other land and air platforms.



Length: 7.70 metres
 Width: 2.70 metres
 Height: 2.44 metres
 Combat weight: 24 tonnes
 Crew: 2 + 10
 Maximum speed: 105 km/h
 Operating radius: 700 km
 Fuel capacity: 400 litres
 Amphibious: yes
 Engine: 336 kW

Arma 8 x 8

Otokar, Turkey

As Turkey currently has no 8 x 8 acquisition plans, Otokar is turning to those countries that do not produce this category of vehicle to export its four-axle Arma.



Length: 6.99 metres
 Width: 3.15 metres
 Height: 1.76 metres
 Combat weight: 30 tonnes
 Crew: 3 + 8
 Maximum speed: 70 km/h
 Operating radius: 500 km
 Fuel capacity: 860 litres
 Amphibious: no
 Engine: 530 kW MTU

Ascod 2

GDELS, Austria/Spain

The common chassis adopted for the SV family is an evolved version of the Ascod's used in the Ulan/Pizarro.



Length: 7.99 metres
 Width: 2.99 metres
 Height: 2.67 metres
 Combat weight: 30 tonnes
 Crew: 3 + 8
 Maximum speed: 105 km/h
 Operating radius: 800 km
 Fuel capacity: 300 litres
 Amphibious: no
 Engine: 405 kW Iveco

Freccia

Iveco/Oto Melara, Italy

Based on Centauro running gear. Italy has ordered 54 of an expected total of 249 in various configurations, all with the Sicona system to integrate the Soldato Futuro.



Length: 6.80 metres
 Width: 3.04 metres
 Height: 2.54 metres
 Combat weight: 24 tonnes
 Crew: 2 + 10
 Maximum speed: 100 km/h
 Operating radius: 700 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 335 kW

Fuchs 2

Rheinmetall, Germany

Following the success of the original Fuchs 1 in the NBC reconnaissance role with the German, British and American (as the Fox) armies, production of the Fuchs 2 was launched in 2007 with the sale of 32 to the UAE.



Length: 6.78 metres
 Width: 2.82 metres
 Height: 2.35 metres
 Combat weight: 24.5 tonnes
 Crew: 2 + 8
 Maximum speed: 100 km/h
 Operating radius: 700 km
 Fuel capacity: 450 litres
 Amphibious: no (yes)
 Engine: 360 kW

Pars 6 x 6

FNSS, Turkey

Developed to fulfil the Turkish Land Forces Special Purpose Tactical Wheeled Armoured Vehicle programme currently on hold, the Pars 6 x 6 is now proposed by FNSS on the export market.



Length: 7.97 metres
 Width: 2.82 metres
 Height: 2.35 metres
 Combat weight: 30 tonnes
 Crew: 2 + 12
 Maximum speed: 100 km/h
 Operating radius: 700 km
 Fuel capacity: 450 litres
 Amphibious: no (yes)
 Engine: 373 – 448 kW

Pars 8 x 8

FNSS, Turkey

Apart from the two prototypes manufactured in Ankara, the first Pars-based 8 x 8s, although deeply redesigned, are to be produced by Deftech in Malaysia.



Length: 7.55 metres
 Width: 2.55 metres
 Height: 2.73 metres (OH)
 Combat weight: 27 tonnes
 Crew: 3 + 10
 Maximum speed: 110 km/h
 Operating radius: 700 km/h
 Fuel capacity: 348 litres
 Amphibious: no
 Engine: 596 kW

Titus

Nexter, France

To close a gap in its offer Nexter developed a 6x6 vehicle with an eye on acquisition and operational costs, adopting a high mobility chassis and coupling it with MRAP protection and IFV features.



Length: 7.23 metres
 Width: 3.40 metres
 Height: 2.68 metres (OT)
 Combat weight: 32 tonnes
 Crew: 3 + 9
 Maximum speed: 70 km/h
 Operating radius: 600 km
 Fuel capacity: -
 Amphibious: no
 Engine: 596 kW

Tulpar

Otokar, Turkey

Otokar anticipated the Turkish Army need for a new infantry combat vehicle, unveiling its Tulpar at IDEF 2013. Armed with a 30 mm cannon, the vehicle is designed to adopt a more powerful powerpack for export purposes.

M OF IFVs & APCs



Length: 6.72 metres
 Width: 3.15 metres
 Height: 2.30 metres
 Combat weight: 22 tonnes
 Crew: 3 + 7
 Maximum speed: 70 km/h
 Operating radius: 600 km
 Fuel capacity: n.a.
 Amphibious: yes
 Engine: 478 kW UDT 32

BMP-3 Kurganmashzavod, Russia

The BMP-3 has undergone a number of varying upgrades over the years and a la carte upgrades are being offered by Kurganmashzavod.



Length: 7.39 metres
 Width: 2.99 metres
 Height: 2.37 metres
 Combat weight: 33 tonnes
 Crew: 3 + 8
 Maximum speed: 103 km/h
 Operating radius: 1050 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 530 kW MTU V8 199

Boxer Artec, Germany/Netherlands

After a protracted development which saw Britain withdraw, deliveries of 272 vehicles to Germany started in 2009. The Netherlands have 200 on order.



Length: 5.00 metres
 Width: 2.50 metres
 Height: 1.80 metres
 Combat weight: 9 tonnes
 Crew: 5
 Maximum speed: 70 km/h
 Operating radius: 600 km/h
 Fuel capacity: 300 litres
 Amphibious: yes
 Engine: > 165 kW

Kaplan FNSS, Turkey

The Kaplan is a light tracked reconnaissance vehicle with a conventional look but a series of unconventional technical solutions aimed at improving situational awareness and mobility. It is armed with a machine gun and antitank missiles.



Length: 6.98 metres
 Width: 2.83 metres
 Height: 3.00 metres
 Combat weight: 20.5 tonnes
 Crew: 3 + 7
 Maximum speed: 100 km/h
 Operating radius: 450 km
 Fuel capacity: 300 litres
 Amphibious: no
 Engine: 250 kW Caterpillar 3126

LAV III GDLS, USA & Canada

The LAV III largely is a Piranha III (q.v.) modified and built by General Dynamics Land Systems in Canada to originally meet a Canadian Army requirement. Later used as the basis for the Stryker.



Length: 8.00 metres
 Width: 2.99 metres
 Height: 2.34 metres
 Combat weight: 30 tonnes
 Crew: 3 + 8
 Maximum speed: 100 km/h
 Operating radius: 550 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 430 kW MTU

Piranha Cl. 5 GDELS-Mowag, Switzerland

To meet Middle East requirements General Dynamics European Land Systems developed a desert-oriented version of its Piranha Class 5.



Length: 6.25 metres
 Width: 2.97 metres
 Height: 2.46 metres
 Combat weight: 26.5 tonnes
 Crew: -
 Maximum speed: 72 km/h
 Operating radius: 600-700 km
 Fuel capacity: 616 litres
 Amphibious:
 Engine: 412 kW

PMMC G5 FFG, Germany

The Protected Mission Module Carrier G5 features rubber tracks and an armoured glass windscreen for the driver; this vehicle is one of the tracked contenders for the Danish Army M113 replacement programme.



Length: 6,70 metres
 Width: 2,55 metres
 Height: 2,20 metres
 Combat weight: 20 tonnes
 Crew: 2 + 10 (APC)
 Maximum speed: 105 km/h
 Operating radius: 890 km
 Fuel capacity: 300 litres
 Amphibious: no
 Engine: 254 kW

VAB MkIII Renault Trucks Defense

Renault Trucks Defence proposes the latest version of its VAB in 6x6 configuration only, the vehicle having been improved in all areas while remaining a cost-attractive solution for replacing older APCs.



Length: 7.80 metres
 Width: 2.98 metres
 Height: 2.26 metres
 Combat weight: 26 tonnes
 Crew: 14
 Maximum speed: 100 km/h
 Operating radius: 750 km
 Fuel capacity: 450 litres
 Amphibious: no
 Engine: 410 kW Renault

VBCI Nexter, France

The French Army began replacing its tracked AMX10P with the 8 x 8 VBCI IFV (550 planned) and command (150) vehicles in 2008. The army is planning further specialist variants.



Length: 6.55 metres
 Width: 3.28 metres
 Height: 2.97 metres
 Combat weight: 30.4 tonnes
 Crew: 3 + 7
 Maximum speed: 61 km/h
 Operating radius: 400 km
 Fuel capacity: 662 litres
 Amphibious: no
 Engine: 447 kW Cummins VTA-903T

Bradley M2A3

GDLS, USA

Due to the cancellation of the Future Combat Systems the Bradley is still the frontline US tracked fighting vehicle thanks to constant upgrading. Its chassis is being proposed for the AMPV programme.



Length: 7.76 metres
 Width: 2.93 metres
 Height: 3.04 metres
 Combat weight: 21.9 tonnes
 Crew: 3 + 6
 Maximum speed: 100 km/h
 Operating radius: 690 km
 Fuel capacity: n.a.
 Amphibious: yes
 Engine: 316 kW various types

BTR-4 Parus

Kharkiv Morozov, Ukraine

Exhibited at IDEX 2009, sporting a BM-7 Parus turret; offered with Russian YaMZ-7511.10 and Cummins QSM11 (298 kW), Iveco Cursor 10 (320 kW) and Deutz TCD2015V06 (365 kW) engines. Ordered by the Ukrainian Army.



Length: 7.82 metres
 Width: 2.85 metres
 Height: 2.32 metres
 Combat weight: 28 tonnes
 Crew: 3 + 9
 Maximum speed: 100 km/h
 Operating radius: n.a.
 Fuel capacity: 350 litres
 Amphibious: no
 Engine: Cummins 373 kW

Lazar 2

Yugoimport, Serbia

An evolution of the Lazar, the Lazar 2 was unveiled in 2013 and features a higher protection for the crew, better access and egress for the dismounts, and an improved situational awareness and reaction capability for transported troops.



Length: 7.72 metres
 Width: 2.54 metres
 Height: 2.34 metres
 Combat weight: 27 tonnes
 Crew: 3 + 8
 Maximum speed: 100 km/h
 Operating radius: 700 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 336 kW Cummins

Mbombe

Paramount, South Africa

This South African vehicle does not feature a V-shape bottom although it has a Level 4 mine protection, while its glass windows provide optimal situational awareness. It can be armed with medium caliber turrets.



Length: 7.33 metres
 Width: 3.71 metres
 Height: 3.05 metres
 Combat weight: 43 tonnes
 Crew: 3 + 6
 Maximum speed: 70 km/h
 Operating radius: 600 km
 Fuel capacity: 800 litres
 Amphibious: no
 Engine: 800 kW MTU 892

Puma

PSM, Germany

The new German army structure now envisages only nine mechanised infantry battalions, thus only 350 Pumas will be needed compared to the original number of 410.



Length: 7.78 metres
 Width: 2.80 metres
 Height: 2.36 metres
 Combat weight: 33 tonnes
 Crew: 3 + 8
 Maximum speed: 100 km/h
 Operating radius: 700 km
 Fuel capacity: 427 litres
 Amphibious: no
 Engine: 390 kW Deutz 2015TCD

RG-41

BAE Systems OMC, South Africa

The heavier member of the RG family adopts a modular concept that allows quick and easy repair even of heavily damaged chassis. The vehicle has been submitted to tough summer tests in the Middle East desert.



Length: 6.91 metres
 Width: 2.70 metres
 Height: 2.34 metres
 Combat weight: 17.5 tonnes
 Crew: 3 + 8
 Maximum speed: 105 km/h
 Operating radius: 600 km
 Fuel capacity: n.a.
 Amphibious: yes
 Engine: 282 kW Iveco Cursor 9

VBTP-MR

Iveco, Brazil

Brazil launched the replacement programme for its EE-11 Urutu and EE-9 Cascavel and chose the Iveco VBTP-MR as its future 6 x 6 personnel carrier and fire support armoured vehicle, that will be produced in country.



Length: 6.34 metres
 Width: 3.03 metres
 Height: 2.79 metres
 Combat weight: 25.4 tonnes
 Crew: 3 + 7
 Maximum speed: 75 km/h
 Operating radius: 600 km
 Fuel capacity: n.a.
 Amphibious: no
 Engine: 410 kW Perkins V-8 Conдор

Warrior

BAE Systems, UK

Developed in the late 1970s and in service since 1984, the British Warrior is undergoing a lifting operation as part of the Warrior Capability Sustainment Programme, including a new 40-mm gun.



The Italian Army is launching the third batch of the Freccia programme, which will allow to equip the first Medium Brigade. (Armada/P. Valpolini)

studies for the command post vehicles, and in early June those were not yet approved as some modification are still required due to the new radios to be installed. The Italian Army decided some years ago to change its concept of command post, splitting this between a command element, resting on a classical turretless chassis of similar height as the combat vehicle, and in a tactical element, which will look like the standard combat vehicle but will be equipped internally as a command post, hosting a three-man command team.

In June 2012 the contract for the third batch was signed, which included 51 combat and 11 antitank vehicles, as well as spares for refitting the two vehicles that the CIO send to Russia for testing. One of those was equipped with the standard Hitfist 25 turret, deprived of radios, BMS and add-on armour, while the second was equipped with a Hitfist 30 Overhead Weapon Station, the unmanned version of the Oto Melara turret. An additional contract is underway to upgrade the first and second batch vehicles with new software-defined radios, last generation C-IED jammers, new on-board computers and a 360° situational awareness system. A logistic package is also included. To complete the vehicles needed by the three infantry regiments and by the HQ battalion of the "Pinerolo" medium brigade a further batch is needed; this should include 18 command

post vehicles and eight more mortar carriers, and might also include the study and the prototype of a scout version.

The CIO also proposed a recovery and a pioneer vehicle, but apparently the Italian Army is not yet considering those options. The overall cost of the vehicles for the first brigade, financed by the Ministry of Economic Development will be of about €1,450 million, in line with what was forecast in 2005. The CIO is obviously looking at the export market. The financial situation in Spain has apparently forced the Army to cancel its plan to acquire an 8x8 armoured IFV. The company proposed a leasing scheme, but also this was turned down. Australia and India are considered most interesting: the Land 400 programme is worth \$10 billion and should include a mix of some 600 wheeled and tracked cars, for which the CIO is seeking alliances with local companies; the initial need for India is around 100 vehicles, the competition being considered very open although if the bid is based on cost, European contenders might find it difficult challenge.

Also based on the well-known Centauro H-drive is the Nuova Blindo Centauro (New Centauro armoured car), also known as Centauro 2. This vehicle is designed to provide direct fire support to the new medium brigades and is equipped with the Oto Melara Hitfact 120 turret armed with the



General Dynamics Land Systems Canada is continuously upgrading the LAV fleet, increasing protection while maintaining mobility. (GDLS Canada)

newly developed 120 mm light smoothbore gun. A first contract worth E1.5 million signed in 2010 allowed Iveco to develop the engine, a 20-litre V8 Vector derived from a railway propulsion unit that has been militarised and equipped with a commonrail. The new engine produces 720 hp, which will bring the power-to-weight ratio to 24 hp/t, and the powerpack is now ready. The MoD filed a second contract that will finance half of the development of the New Centauro, the remaining half being financed on CIO funds (MoD money being provided according to a



Nexter VBCI in production (left) and on show. The 8x8 fighting vehicle in use by the French Army in Afghanistan is seeking its first export success. (Armada/P. Valpolini)

milestones/deliverables concept). Prototype delivery is expected in 2014 and that of a first serial vehicle in 2016, all 72 New Centauros for three regiments (one for each of the Medium Brigades currently planned) being delivered by 2018.

PIRANHAS, LAVS & CO

Although no details have been given on the US Marine Corps MPC proposal, the wheeled family of GDLS/GDELS vehicles is fighting its way through a number of bids. In Canada GDLS Canada is proposing the Piranha 5 for the CCV programme, fitted with Rheinmetall's Lance Modular Turret armed with a 30 mm cannon. The Piranha 5, equipped with a lighter RCWS, is also offered by GDELS for the Danish M113 replacement programme; to this end GDELS teamed-up with Falck Schmidt Defence Systems of Denmark, a company with considerable experience in retrofit and overhaul work that might thus well assemble the vehicles.

In late January 2013 GDLS Canada delivered the first upgraded Light Armoured Vehicle III to the Canadian Armed Forces.

Some 550 plus 66 vehicles in total will be upped to that standard, the last 66 aimed at improving the reconnaissance and surveillance capability.

One week earlier GDLS Canada received a \$24 million contract for the production of 13 newly build LAV-A2 for the US Marine Corps. The Corps ordered a total of 253 such vehicles that add to the over 800 first generation LAVs in service since the 1980s. January was a fruitful month for GDLS Canada as it also marked the signature of a contract for 24 LAVs by the Colombian Ministry of National Defence. The vehicles acquired are of the latest standard, that is the LAV III version with double-V hull technology and add-on armour. They will be equipped with a Rafael RCWS and deliveries should be completed by May 2014.

COMBAT-PROVEN FROM FRANCE

While numerous VBCIs are operating in Afghanistan, Lebanon and Mali with French Army units, the Délégation Générale pour l'Armement accepted on June 28 2013 the 500th vehicle of this type of 630 ordered.

Importantly, since January 2013 vehicles are delivered with the Félin kit. The vehicle designed and produced by Nexter with Renault Trucks Defence (RTD) providing the automotive components is now well proven in its current configuration. Though developed to French specifications, Nexter decided to optimise performances and costs in order to make the vehicle more appealing on the international market, and within its "Le Grand Large" plan launched in early 2011 with the aim of reducing company product costs by 25%. The VBCI was thus the subject of a deep revision in order to provide customers with the performances they needed, avoiding over-performances, and at the same time optimising costs along the whole subcontractor chain, involving some re-engineering work to obtain the desired results.

According to Nexter officials the VBCI is now very competitive in terms of acquisition and life-cycle costs. In the meantime the vehicle has evolved in terms of weight. Current VBCIs are operating at 29-30 tonnes, though company vehicles being tested and proposed in numerous bids are now hovering over the 32-tonne mark. This allows to increase protection, reaching for example



Nexter plans to add numerous versions of its VBCI to the current AIFV and command post versions: from left to right these scaled models of the recovery, AIFV with Eastern Europe ordnance, and the mortar carrier versions. (Armada/P. Valpolini)



An inside view of a German Boxer in the Command Post version; the production for Germany is nearing completion while the Netherlands should start receiving their first operational vehicles in 2014. (Armada/P. Valpolini)

4a/b for mine protection (a lesson learned from Afghanistan), as well as payload capacity for the installation of heavier turrets. The French Army is already considering an upgrade of part of its fleet, say 100-200 vehicles, a decision being awaited for late 2013-early 2014. The 32-tonne vehicle carried out a successful three-week testing in the desert. The automotive components remain mostly unchanged, the 550 Hp engine as well as axles and transmission being untouched with the exception of the shorter final gear that will lower top speed. The export version is equipped with an OpSys vetronic architecture and a 360° situational awareness system is installed, video distribution in the rear compartment being also available. As for power generation Nexter considers the current output sufficient for today needs, and is not considering any short term upgrade. The 32-tonne version was qualified two years ago and has since been demonstrated to some potential customers such as Canada and Denmark.

For Canada Nexter proposed in-house solutions for increased ballistic and mine protection, installed all along the vehicle. The requirement is for 108 vehicles plus an option on a further 30. In case of success most of the work will be carried out in Canada, since RTD being in a position to produce in Canada via a company that is part of the Volvo group.

In Denmark, 206 vehicles are initially at stake with an objective target of 360 over a maximum number of 450 vehicles. In case of success 50% work will be carried out in France.

As for the United Arab Emirates numbers are much higher and production will be partly carried out locally, the unconfirmed target number being around 700 vehicles.

The UAE are however not the only target for Nexter in the Middle East, another undisclosed nation also tested the vehicle and is about to launch an request for proposals. Although not required by France, which ordered only the combat and the command post versions, numerous support versions are being offered to the export market by Nexter, such as engineer, mine-clearing and repair/recovery vehicles.

THE GERMAN BOXER

Developed and manufactured by Artec, a joint venture between Rheinmetall MAN Military Vehicles and Krauss Maffei Wegmann, the Boxer 8x8 has been operating in Afghanistan since mid-2011. Some 40 vehicles are deployed downrange in the three operational versions ordered by the Bundeswehr, namely the GTFz A1, the FÜFz A1 and the sgSanKfz A1, that is the personnel transport, command and medical versions. As we can see all the vehicles in operation are characterised by the

designation A1, thus all of them have been produced at the latest standard developed following the first operational experiences by the German Army.

Although Artec is not able to detail all the modifications, those that can be unveiled are the elevation of the remote control weapon station to improve its field of view and, by virtue of the increased depression thus created allow to operate the weapon at very close range. A re-arrangement of internal stowage compartments and other minor issues also regarding storage have also been implemented. Modifications to communications and protection elements remain classified. According to Artec sources the A1 version has a higher, though confidential, gross weight than the A0 version, the new limit remaining undisclosed.

Germany ordered 125, 65 and 72 vehicles of the three above-mentioned versions, production of the A0 versions having been limited respectively to 40, 16 and 7 units. In June 2013 106 GTFz were delivered as well as all command vehicles and 16 ambulances; a fourth version, the FahrSFz or driving training vehicle was also ordered, and all 10 are already in service in Germany.

The Bundeswehr carried out hot climate tests in Australia in 2010, prior to its deployment to Afghanistan, and will test it in winter conditions in Norway in late 2013. Further upgrades are under development, following experience gained in Afghanistan but the company remained tight-lipped on those upgrades.

The other Boxer customer, the Dutch Army, received its first vehicle, a driver training vehicle, in August 2013. A total of eight such vehicles were ordered together with 52 ambulances, 27 cargo vehicles, 60 command posts and 53 pioneer vehicles, the Dutch Army using the Boxer as a support vehicle. The delivery of the first ambulance is planned for January 2014 while the other versions will be roll off from 2015 onwards.

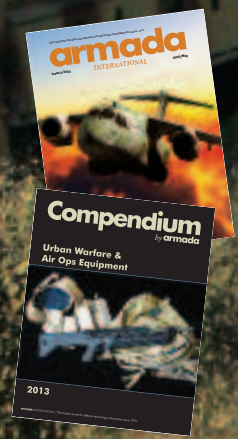
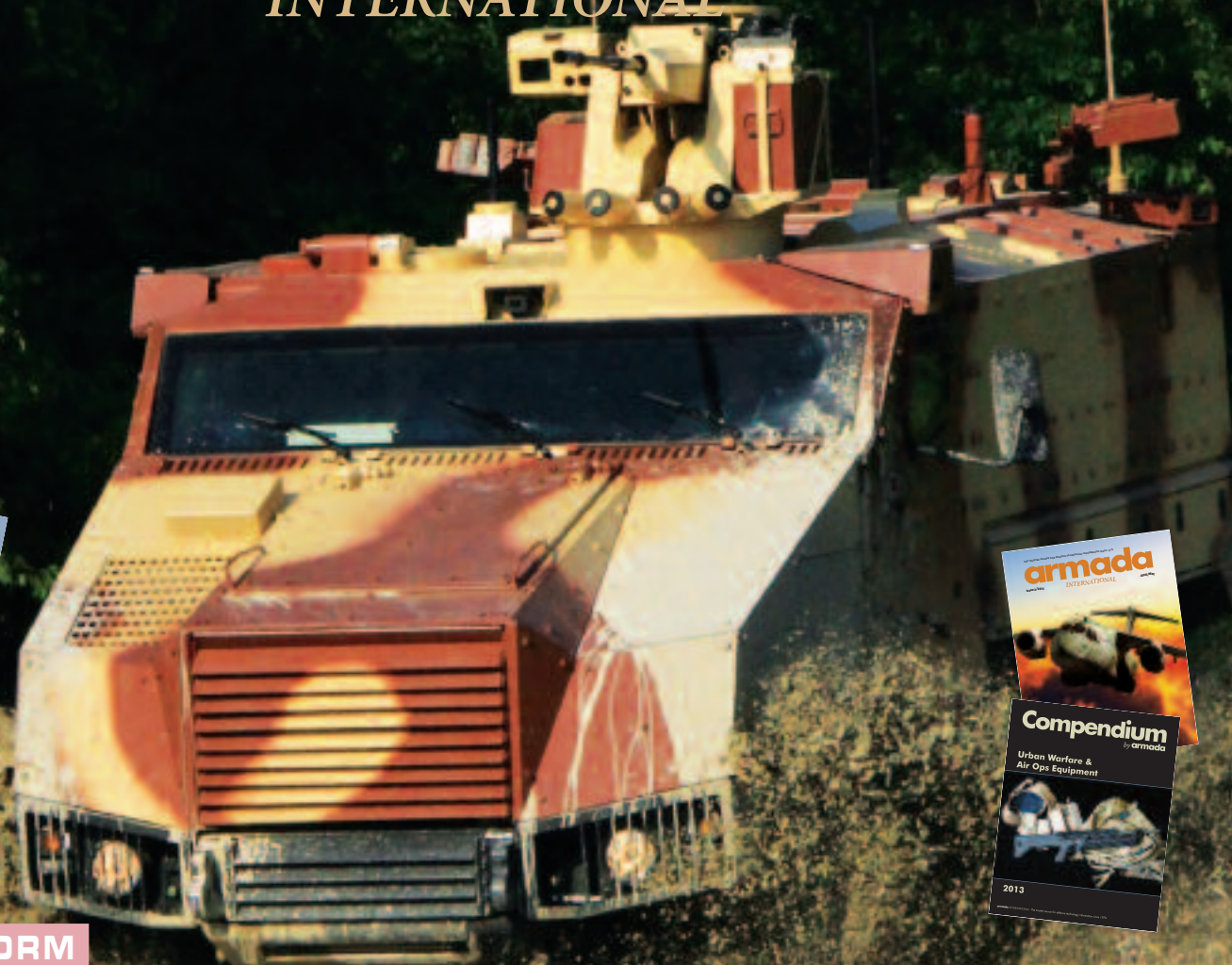
Artec is developing further mission modules in order to gain benefits from the modular design of the vehicle that allows to limit design and engineering to the module, as this is installed on the common drive module, which remains the same for all variants.

A NEW LAZAR FROM SERBIA

In 2013 Yugoimport unveiled its Lazar 2 multi-purpose 8x8, with the objective of merging Mrap protection capabilities with the virtues of a multi-role vehicle in terms

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Two views of the recently unveiled Lazar 2, developed by Yugoimport. The vehicle features considerable improvements over the previous Lazar. (Yugoimport)



The inside of the Lazar 2 troops compartment; soldiers have a direct view of the surrounding scenario and can use their individual weapons from inside the vehicle. (Yugoimport)

of operational flexibility, in other words erasing the weaknesses of the original Lazar BTR-SR-8808. The all-steel hull provides a basic ballistic protection at Level 3, which increases at Level 5 with add-on armour, maintaining the double-floor solution for mine and IED underbelly protection; basic mine protection is Level 2a/b that can be increased up to Level 4a/b. An innovative solution was adopted for accessing the infantry compartment: soldiers can ingress and egress using the two doors built into the rear ramp or lower that ramp. All seats are now roof hanged and those in the infantry compartment are foldable. The ten dismounts are seated back to back and can observe the outside world through large individual armoured glasses (wider than in

the previous model). They can fire their assault rifles through firing ports, five per side and one in each rear door, giving the vehicle a considerable self-defence capability in urban terrain for example. The Lazar 2 weighs 28 tonnes in combat, which is considerably heavier than the previous version but compensated by a more powerful engine located at the front, to the right of the driving station. Suspensions are independent, with progressive springs and hydraulic shock absorbers, with CTIS fitted as standard. In the IFV role the Lazar 2 is equipped with a Yugoimport-SDPR remote-control weapon station armed with an M86 30 mm automatic cannon and a 7.62 mm coaxial machine gun located over and behind the main weapon, with respectively 200 and 2,000 rounds. The gun has a maximum elevation of 60°, the fire control system being equipped with day/night sights and laser rangefinder. The station can also be equipped with antitank missiles.

■ TURKEY ON WHEELS

The Turkish industry is very active in the wheeled armoured vehicle field, although for the time being no such vehicles have yet been adopted by the national customer, if not in the mine protected vehicles niche. With no 8x8 home requirement about to materialise, both Otokar and FNSS are looking at the export market for their Arma and Pars 8x8s.

While the Arma has not yet found a customer in its 8x8 configuration, the same is not true for the Pars, which in its AV-8 derivative has been adopted by Malaysia, a \$559 million contract having been signed in February 2011 with DefTech for the design, development, production and logistical support of 257 combat vehicles.

User tests are underway in Malaysia with

the first prototypes equipped with an FNSS Sharpshooter 25 mm one-man turret, while an AV-8 with the Denel 30 mm two-man turret is completing qualification tests in Turkey. FNSS is also closely following a couple of Middle East bids. As both the Pars and the Arma are also turned into 6x6 versions (although the Pars features numerous differences between the two stablemates, the most striking being the absence of the 8x8's hydrostatic suspensions), they offer us a natural transition to the six-wheeler world, below.

■ TURKEY: A 6X6 ARENA

As seen above, while no home contract is foreseen in the short term for an 8x8, Turkey is on the other hand expected to issue a tender for a 6x6 reconnaissance vehicle in Q3 2013, adding to another tender for 76 weapon carriers issued in late June 2013. RfPs having been sent to Otokar and FNSS, although this may also involve a 4x4. Command and control, radar carrier and CBRN recce vehicles might also become a requirement in the short term.

Otokar has already scored on the export



The AV-8 is the Malaysian 8x8 vehicle being built by DefTech, that is heavily based upon the FNSS PARS 8x8 armoured infantry fighting vehicle. (FNSS)



An FNSS PARS 8x8 sporting the company's one-man Sharpshooter turret; a derivative of this infantry fighting vehicle has been sold to Malaysia equipped with a Denel 30 turret that is still being developed. (Armada/P. Valpolini)



No 8x8 acquisition seems to be planned at short term in Turkey, thus Otokar is strongly pushing its Arma on the export market. (Armada/P. Valpolini)



The PARS 8x8 features semi-automatic computer controlled pneumatic suspensions that allow to compensate lateral inclination. (Armada/P. Valpolini)

market with its Arma 6x6, at least two contracts having been signed with undisclosed customers, the second (from a Gulf state) being worth \$63.2 million. Another Turkish 6x6 export winner is the Nurol Makina Ejder, with 76 purchased by Georgia which might soon file a follow-on order. For the Middle East market Nurol Makina has developed an upgraded version fitted with add-on armour of undisclosed protection level and Nexter's Dragar one-man turret armed with the French company's M811 dual-fed 25 mm cannon. Other turrets with armament up to 90 mm can be fitted, the Middle East version weighing 21 tonnes while the baseline Ejder II grosses at 18 tonnes.

The Ejder II will not take part in the bid that will soon be launched by Turkey. Nurol is a sister company to FNSS, and it was decided that the group's champion for that contract will be FNSS Pars 6x6. This will fight against the Otokar Arma 6x6 as well as with a new vehicle of the same category being currently under development by Hema.

At IDEF 2013 the Hema stand showcased a mock-up vehicle provided by the Streit Group though a Streit 6x6 vehicle known as the Veran was unveiled at IDEX a few months earlier. It was 7 metres long, 3 metres wide and 2.25 metres high, with a combat weight of 18 tonnes (a 16-17 tonnes amphibious version is also offered). It is powered by an ISL 400 8.9L turbocharged six-cylinder kicking 500 hp to an Allison 3200 SP transmission. Independent suspensions is on coil springs and shock absorbers, while protection is Level 4 ballistic and antimine. The Veran features a double floor with a 365 mm ground clearance. With a crew of three it can transport up to 10 dismounts that enter the vehicle via the rear door which can be replaced by a ramp.

The Veran mock-up was present at IDEF mostly to show the co-operation between the UAE and Turkish companies. The actual Hema vehicle will be quite different, being co-developed by the two firms. Hema is a renowned mechanical company that produces automotive subsystems for many international customers and is engaged in the development of a national powerpack solution for Turkish military vehicles up to



Nurol being a sister company of FNSS, its Ejder will not compete for the Turkish Army 6x6 bid. (Armada/P. Valpolini)

MBTs; this allows it to produce most components in-house and thus keep costs under control, a major asset for incoming bids. Hema has however no experience in armour, Streit thus providing the armour concept and solution.

I GUARANI STATUS

On the other side of the Globe, in Brazil, June 2013 marked an important step in Iveco's production capacity in that country with the inauguration of the new \$46 million plant dedicated to defence vehicle in Sete Lagoas. The new plant is pivotal in the production of the 6x6 VBTP-MR Guarani for the Brazilian Army. The production rate of that vehicle is set at 100 units per year, the facility being able to double that number if needed (the total number of vehicles that should be ordered by Brazil amounts at 2,044 over a 20-year period). Over 60 per cent of the Guarani production value is Brazilian. August 2012 marked the start of the production of a first batch of 86 that will be used by the Brazilian Army for doctrinal evaluation, before launching full-rate production. At 18 tonnes combat weight the Guarani is powered by a 383 hp Cursor 9 diesel, and its dimensions allowing it to roll into the new KC390 aircraft

being developed by Embraer. Iveco Defence Vehicles has started a marketing campaign throughout Latin America, Chile, Ecuador and Columbia being among the targeted nations, and a first export success was already scored in Argentina. Some 14 Guarani have been acquired by the Argentine Army following tests carried out using a Brazilian Army prototype vehicle, the VBTP-MR being

provided to Argentine troops deployed within UN peacekeeping missions.

I TITUS FROM FRANCE

A entirely new entry landed with panache in the 6x6 arena at DSEi in September 2013 under the auspices of Nexter of France. The Titus, as it is named, is a new proposal for armies needing a fighting vehicle or a



Following two successes on the export market Otokar is proposing its Arma 6x6 to Turkey for the 6x6 upcoming bid. (Armada/P. Valpolini)

personnel carrier to be used in hybrid conflicts. Nexter claims that his new 6x6 can cover all the missions of an APC and 85 % those of an IFV in a hybrid situation.

Although it could be taken for an Mrap, its performances are however much closer to those of a wheeled APC/IFV as indeed Nexter's engineers took several parameters into account, namely the evolving operational environment, the lessons learned from Afghanistan, and through-life costs. This and high mobility being paramount, the chassis choice fell on Tatra, which is reputed for its tube-encased swing-axle chassis providing long stroke independent suspensions. Nexter asked the Czech company to develop a new high-performance chassis from the 6x6 used for trucks. To maximise mobility the French company wanted the axles to be evenly spaced, with a wheelbase of 2.55 metres between each axle, which implied that the rear axle had to be steerable (which also dramatically reduced the turning circle). From 0 to 10 km/h the rear steers at the same rate as the front, but obviously in the opposite direction. However, and for obvious reasons this steering angles is progressively reduced between 10 to 45 km/h, speed at which it locks in straight-on position.

The powerpack is located at the front and includes a Cummins 440 hp engine and an Allison transmission, but Nexter is already looking at a 550 hp solution for further improving mobility in sandy areas. As wheel dimension is also a factor of mobility, the Titus is shod with 16.00R20 tyres, while road usability is enhanced by its width limited to 2.55 meters, which besides maintaining the vehicle within European standard vehicle dimensions, makes it is air transportable on board an A400M.

The entire crew cell is built in steel providing Level 2 base protection; the vehicle features a single-piece front windscreen, the driver and the commander/gunner each having their own a side-door with an armoured glass window. Base glass protection is Level 1, the same as the engine bonnet. Just behind the two front seats, in the centre of the vehicle, is the tactical commander seat; this allows him to maintain full direct frontal view over a 120° arc and control the BMS computer screen and a secondary screen. Turning on his right he can see the dismounts sitting of the right row of individual energy absorbing seats, four or five depending on configurations, the same number seating on the left side of



In Turkey Hema aims at the upcoming bid for a 6x6 personnel carrier with a new vehicle that will be designed in cooperation with the UAE Streit Group. (Armada/P. Valpolini)



The mock-up of the Veran shown by the Streit Group at IDEX 2013; this 6x6 will weigh some 18 tonnes in combat and will transport up to 13 soldiers. (Armada/P. Valpolini)

the aisle. Both tactical and vehicle commanders have their own overhead hatch, while a remote-control turret is being located in semi-centreline at the front of the roof (the vehicle can accept up to a 20 mm gun systems such as the Nexter ARX20). The overall internal volume is 14.4 m³,

height being 1.37 metres, soldiers having a further 2.4 m³ of internal space behind their seats. The front windscreen allows dismounts to keep a certain situational awareness, although the Titus can be fitted with three glass windows and firing ports on each side of the troop compartment. Two



Unveiled at DSEI 2013 by Nexter, the Titus is a 6x6 vehicle based on a Tatra chassis with independent swing axles. It offers high protection and mobility at competitive cost. (Armada/P. Valpolini)

rear hatches allow to install light machine guns at the rear corners of the vehicle roof for self protection. Soldiers access the vehicle through a powered rear ramp designed to allow really smooth ingress and egress. Three trunks on each side of the vehicle provide a further 1.5 m³ of external storage space.

The Titus is built as a fully modular vehicle allowing the adoption of mission kits and add-on armour. Typically when used as a fighting vehicle transparent armour and bonnet ratings will climb to Level 3, the rest of the vehicle being brought at Level 3 or 4, IED protection growing from 50 kg to 150 kg blast.

With a dry weight of 17.5 tonnes and a maximum gross weight set at 27 tonnes, the growth margin is considerable. Nexter proposes a series of kits to be added to the APC version in order to tailor it to public



order, crew riot control, conventional combat, counter-insurgency and urban combat missions, with the weight rising up to 24 tonnes for the latter application. Support versions such as ambulance, command post, engineer, logistic, light recovery and artillery observation are also foreseen, always based on the standard vehicle. Only the heavy mortar carrier equipped with a Thales 2R2M 120 mm rifled automatic mortar system would be based to a highly modified vehicle.

Not only will the customer be given a wide choice of mission kits, he will also be able to decide how much modularity he wants in the vehicle and thus get only what he needs. With the Titus Nexter fills the gap between the Aravis and the VBCI with a 6x6 that has a mobility and performances akin to those of an 8x8 but at a substantially lower acquisition and through-life cost, although no figures were given by Nexter. A second prototype is being built, which will incorporate a number of detail modifications resulting from the first field trials with former military personnel. The company aims the Titus at armies that need to replace their APCs, and sees a market for around 1,000



EBRC

Nexter is proposing a new 6x6 for the French Army EBRC programme, aimed at replacing the AMX-10RC and Sagaie 6x6 armoured cars. Not many details about the chassis are available although the company has developed a scale model of the 6x6 vehicle, which will be equipped with the company T40 two-man turret armed with CTAI 40 mm CTAS cannon. The author showed the model to the author, but was not allowed to photograph it. However this picture is now circulating on the Internet, hence the poor quality.

units. The vehicle will be ready for production in early 2014.

■ TYPHOON-K FROM RUSSIA

Among the most recent entries in the 6x6 world is the Kamaz-63969, a three-axle vehicle developed and manufactured by the Russian company as part of the Tayfun programme, a 4x4 version being also planned. The new APC can host a crew of two and 10 dismounts, all of them protected at Level 4, mine protection being at Level 3a/b. An RCWS developed by Elektromashina is mounted on top of the vehicle and can be armed either with a PKT 7.62 mm machine gun or an AGS automatic grenade launcher. The Kamaz-63969 is a monocoque design with independent suspensions and features an armoured glass windscreen providing some lateral vision, the troop compartment being deprived of direct vision systems. Access is through a door on the right side and the rear ramp.

■ THE FUCHS SAGA CONTINUES

The Rheinmetall Fuchs 6x6 success seems never ending, the last contract on the scoreboard involving 25 TPZ1A8 for the

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ANTICIPATE TOMORROW ●●●●



SAAB

The Russian Kamaz 63969 is a 6x6 boasting a wide windscreen. Based on a monocoque hull with independent suspensions, it can accommodate up to 10 dismounts and the crew. (Internet)

German Army. This is only the latest of a series of upgrade contracts filed since 2008 aimed at providing German troops with vehicles featuring a protection level sufficient to counter the Afghan threats. A Level 4 armour package is added as well as the German Army C2 system. Filed in April 2013, the contract was preceded by another concerning 7 Fuch KAIs (for Kampfmittelaufklärung und Identifikation). This configuration route clearance variant is equipped with a 10-metre manipulator arm, and deliveries are planned for late 2014. Rheinmetall currently has 177 TPz1Z8s under contract, including the 52 standard vehicles ordered by Algeria, which has expressed an interest for acquiring a much higher number.

I VAB: A NEW LEASE OF LIFE

Replacing medium and multirole armoured vehicles such as existing VABs, M113s, BTRs, Fahds, etc, and proposing a new light infantry combat vehicle, this was the aim of



Renault Trucks Defense (RTD) when it started working on its VAB MkIII. The MkII, unveiled in 2010, attracted some interest. The vertical sides increased the protected volume, but it was soon clear that RTD had to push its development a stage further to really convince the market. The

MkII thus remained at prototype stage and was superseded by the MkIII, which sees its maximum combat weight growing from 16 to 20 tonnes. Moreover while the MkII was offered in both 4x4 and 6x6 guises, the MkIII is only available as a 6x6. Compared to the original VAB 6x6 layout the rear wheels

A heritage of the Cold War Era, the Fuchs TPz1 is still alive, the Bundeswehr having upgraded numerous vehicles while the Fuchs 2 has already scored on the export market. (Rheinmetall)



are moved backwards while only the front axle is steerable with a view to keeping it simple and reducing cost, although a steerable rear axle can be had.

The chassis was lengthened 500 mm ahead of, and behind, the front axle, the now larger front doors offering easier access. The engine remains behind the driver, leaving a passage on the right side between the forward cabin and the infantry rear compartment. The standard powerpack is based on a Renault Dxi7 Euro 5 engine, providing 340 hp (320 hp in the Euro III version) and thus a 17 hp/t ratio, linked to an automatic gearbox. A 400 hp engine is available on request. The entire powerpack including engine, automatic gearbox and cooling system can be replaced in two hours, thanks to the redesign of the engine bay. The independent suspension MkIII can ford up to 1.5 metres, can climb a 47% gradient, cope with a side slope of 40%, overcome a 0.9 metres-wide trench and a 0.5 metre-high vertical obstacle. The basic hull is protected at P4 ballistic level, however this is merely intended to carry the add-on armour that can bring protection up to Level 4 according to STANAG 4569. The windscreen is divided in two by a narrow centre pillar which does not hamper crew vision; two separate glasses allow to preserve vision if one



The latest version of the VAB is the MkIII, that can host 10 dismounts plus crew in a 13 m³ volume protected up to Level 4 ballistic and 3b antimine. (RTD)

his hit and makes it easier to install armoured glass with high protection levels. According to RTD mine protection is up to Mrap-like Level 3B , with an add-on plate under the floor, minimum ground clearance being 370 mm. RPG protection can also be added, RTD having established a co-operation with Plasan Sasa of Israel. The VAB Mk III protected volume is 13 m³, the vehicle hosting two crew

members plus 10 dismounts in the APC configuration. Its width is limited to 2.55 metres to allow it to move easily in urban scenarios. Dismounts access and egress through the rear compartment manually operated doors although an electrically operated ramp being available as option. Three windows per side provide a good situational to the infantrymen in the back.

The MkIII version of the VAB is produced only in the 6x6 version due to the increase in combat weight. Numerous versions are being proposed by Renault Trucks Defense. (RTD)



The NBC protection system has been moved in the rear left sponson, the right one being used to accommodate equipment. Armament-wise, the 7.5-tonne payload capacity allows one to install a one-man or remotely controlled medium calibre turret up to 30 mm calibre and 1.4 tonne, the combat vehicle version carrying a crew of three plus seven dismounts. A version with a 120 mm mortar system carrying 40 rounds and a crew of two-plus-two is also envisaged as well as versions fitted with anti-tank and/or anti-aircraft missiles, command post with a two-plus-four crew, ambulance with two crew members (two seats in the back and four stretchers). A hypothetical ISTAR version would carry a crew of two-plus-four with a day/night surveillance system on a telescopic mast, a laser targeting system, a battlefield surveillance radar, a minidrone with datalink, a satcom system and obviously

a battle management system. To cope with all those versions and mission-oriented kits the VAB MkIII is equipped with RTDs' Battlenet Inside vetric architecture and features a 300A alternator, although an even higher rating is already considered.

Following the first prototype shown at Eurosatory 2012, which by June 2013 had completed about 85% of endurance tests, RTD build a second MkIII that is now completed and differs in many aspects from the previous vehicle. The braking system has been completely upgraded, the oleopneumatic system is housed in the "V" between the first and second axles on the right side, the left side being occupied by a 300-litre fuel tank. Moreover the ceiling of the second prototype is ready for heavy turret integration, the first candidate being BAE Systems TRT-25. A chassis has also been built for ballistic and blast tests, these

being scheduled for late 2013/early 2014. In the second half of 2013 RTD plans to carry out numerous customer tests. Offering the higher-spec car to western countries, the MkIII is seen as a possible "emergency alternative" to the French VBMR programme should this be delayed due to lack of development funds. For export on the other hand, lighter protection might be required, a Level 2 being foreseen for the Middle East. RTD hopes to clench its first deals in late 2013, one of its selling mottos being that the MkIII is able to deliver 80% of 8x8 capabilities for half the price. Production is anticipated for Q3 2014 and the company is already contemplating an amphibious version with a combat weight limited to 16 tonnes. Hydrojet propulsion would be mechanically coupled to the vehicle's transmission. Interestingly though, most VABs are 4x4s.

Canada, Afghanistan and Colombia are the last three customers that acquired Textron 4x4 Commando vehicles in their different configurations. (Textron)



A Canadian Tactical Armoured Patrol Vehicle equipped with Kongsberg Protector Dual RCWS; it is based on the Elite version, the highest standard among Textron vehicles. (Textron)



■ TWO-AXLE APCs

With a minority of VAB 6x6 in service, the 4x4 upgrade market remains of great interest for Renault Trucks Defense, especially with 5,000 still in service. France will keep only 1,700 of its 4,000, thus 2,300 vehicles might be available for export. Upgraded vehicles would sell at one third of the cost of a MkIII. The higher standard for the French Army is the VAB Ultima, which incorporates all the improvements adopted over the years, namely V-shape antimine underbelly protection, energy absorbing seats for dismounts, Protector RCWS integrated with Metravib Pilar, etc. Some 120 Ultima have been ordered, while three further conditional tranches of 30 vehicles are awaiting notification.

■ TEXTRON COMMANDO

Another 4x4 that has recently chalked up successes, notably the TAPV Canadian competition and the order for 135 additional Mobile Strike Force Vehicles for the Afghan National Army (ANA), is the Textron Marine & Land Systems Commando. The ANA has already ordered 499 vehicles in four contracts, 352 with enclosed turret, 142 with gunner protection kit and 23 ambulances, the



The Select variant of the Commando family is the base for the Afghan National Army Mobile Strike Force Vehicle, part of which are equipped with the CMI 90 turret. (Textron)

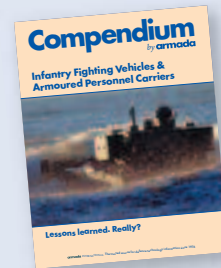
latter order bringing the total to 534. Over two thirds of the first vehicles batch have been delivered, the remainder (135) being planned by end-February 2014.

Recently the Commando Elite was tested in the United Arab Emirates where it logged over 3,000 km in four different types of sand and managed to overcome 100% of the tests. According to Textron M&LS the 4x4 vehicle succeeded where 6x6 and 8x8 vehicles failed. Its versatility and its high survivability – the Elite reaching Mrap and above mine and IED levels – allow it to position itself among the bestsellers in the light APC category. Although the rear engine does not allow for a rear door or ramp, the side doors provide a smooth exit and entry albeit offering less protection than a rear access. While the base version, the Advanced, has maximum

carrying capacity, two crew members and ten dismounts, the highly armoured Elite is being developed as a weapon carrier platform, a CMI 90 mm two-man turret armed with the Cockerill low pressure gun being part of the offers, and even a 105 mm turret is now envisaged. The CMI 90 turret has been selected by the ANA for its Mobile Strike Force vehicle based on the Commando Select variant. Textron M&LS is already thinking at other support options (including a 155 mm system), while reconnaissance and mortar carrier versions are already available. According to Textron negotiations are underway with two additional customers that might lead to further orders. In late August 2013 the Colombian Army acquired 28 more Commando Advanced APCs equipped with 12.7 mm or 40 mm AGLs RCWS. The service already operates 39 since 2010, the \$31.6 million contract including also the repair of two damaged vehicles. All vehicles should be delivered within April 2014. □

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ON THE COVER: Armoured fighting vehicles and personnel carriers increasingly are challenged not only by the incredible variety of weapons aimed at them, but also by the immensely varied nature of the terrain in which they are required to operate. From hot deserts to cold mountains, and even as seen here photographed by the author, at sea.

Infantry Fighting Vehicles and Armoured Personnel Carriers

Supplement to **armada** Issue 5/2013
Volume 37, Issue No. 5, October/November 2013

armada INTERNATIONAL is published bi-monthly by Media Transasia Ltd.

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Publishing Office: Media Transasia Ltd, Room No. 1205 Hollywood Centre 223, Hollywood Road, Central, Hong Kong. Tel: (852) 2815 9111, Fax: (852) 2815 1933

Editor-in-Chief: Eric H. Biass

Regular Contributors: Roy Braybrook, Paolo Valpolini, Thomas Withington

Chairman: J.S. Uberoi

President: Xavier Collaco

Sr. Manager International Marketing: Vishal Mehta

Manager International Marketing: Yusuf Azim

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Creative Director: Bipin Kumar

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Visualiser: Sujit Singh

Production Manager: Kanda Thanakornwongskul

Group Circulation Manager: Porames Chinwongs

Chief Financial Officer: Gaurav Kumar

Advertising Sales Offices

- AUSTRIA, BENELUX, SWITZERLAND
Comelius W. Bontje
Ph: +41 55 216 17 81, comelius.bontje@armada.ch
- FRANCE
Promotion et Motivation, Odile Orbec
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- SPAIN
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Ph: +34 91 448 76 22, macarena@viaexclusivas.com
- UNITED KINGDOM
Zena Coupé
Ph: +44 1923 852537, zena@expomedia.biz
- RUSSIA
Alla Butova, NOVO-Media Ltd,
Ph: (7 3832) 180 885 Mobile: (7 960) 783 6653
Email: alla@mediatransasia.com
- EASTERN USA – EAST OF THE MISSISSIPPI RIVER
Margie Brown, Ph: (540) 341 7581, margiespub@rcn.com
- WESTERN USA – WEST OF THE MISSISSIPPI RIVER
Diane Obright, Ph: (858) 759 3557, blackrockmedia@cox.net
- ALL OTHER COUNTRIES
Vishal Mehta, Tel: (91) 124 4759625, Mobile: (91) 99 999 85425, (44) 11 5885 4423, E-Mail: vishal@mediatransasia.com

Annual subscription rates:

Europe: CHF 186. + 36. (postage)
Overseas: USD 186. + 36. (postage)

Controlled circulation: 24,351,

certified by ABC Hong Kong, valid from 1st April 2012 to 30th June 2012.

Printed by Media Transasia Thailand Ltd.

75/8, 14th Floor, Ocean Tower II, Soi Sukhumvit 19, Sukhumvit Road, Klongtoeyue, Wattana, Bangkok 10110, Thailand.
Tel: 66 (0)-2204 2370, Fax: 66 (0)-2204 2390 -1

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WORLDWIDE AGENT: DEFENCE WORLDWIDE ASSOCIATES (DWA)
 12th Floor, Westminster Tower, 3 Albert Embankment, London SE1 7SP,
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ASIA COORDINATOR: INTERNATIONAL EXPO MANAGEMENT PTE LTD
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