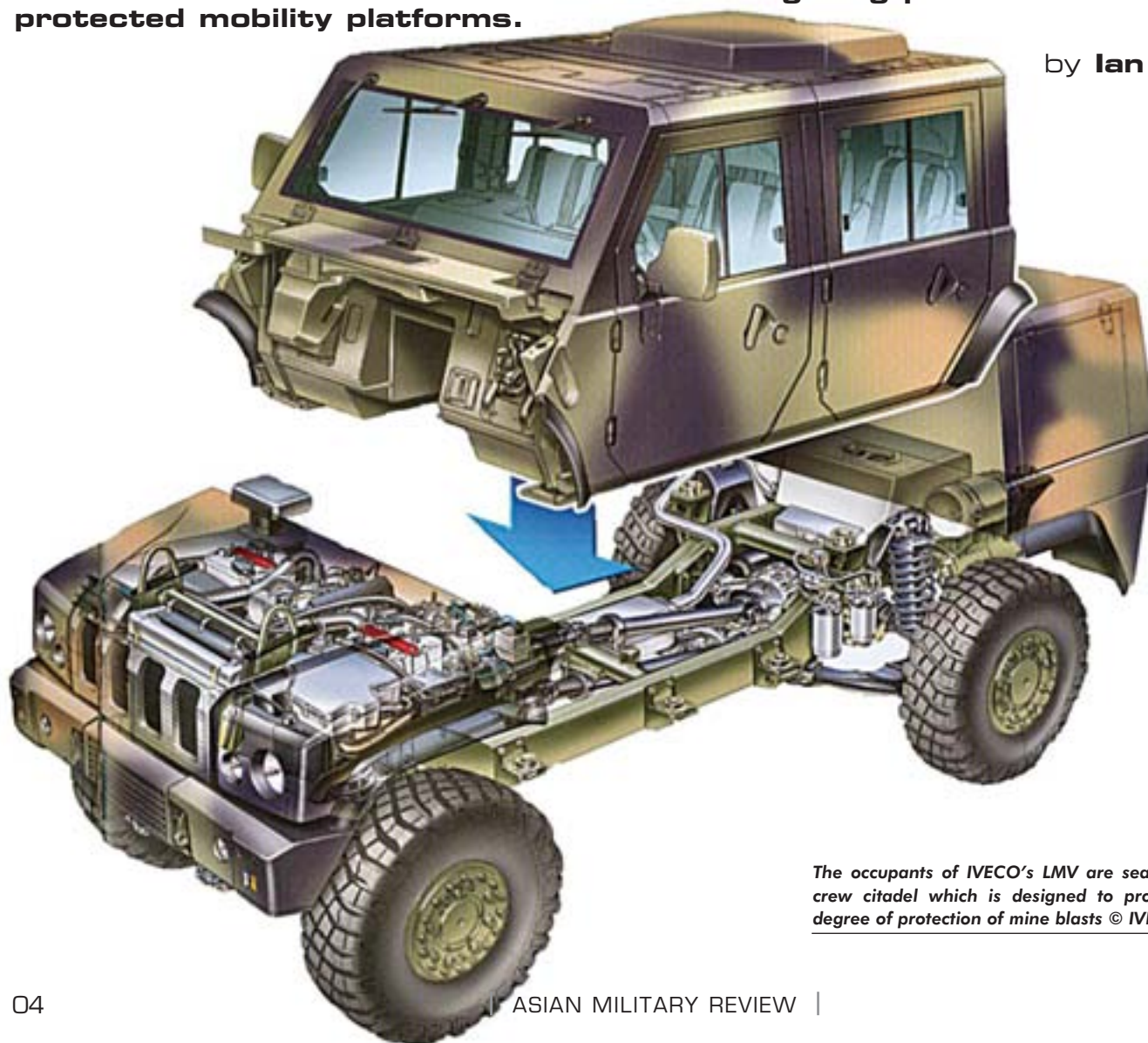


# Light vehicles bulk up

The casualties suffered by NATO and other forces operating in the Former Yugoslavia and Somalia during the 1990s demonstrated the need to replace unarmoured light utility vehicles (LUVs) with multipurpose armoured vehicles able to protect four to eight occupants against small arms fire, shell splinters and land mines. Operations in Afghanistan and Iraq in recent years have added the imperative to provide protection against improvised explosive devices (IEDs). The threat of IEDs, responsible for the majority of deaths amongst Coalition forces in both Afghanistan and Iraq, is arguably the most significant factor influencing the development of light armoured vehicles which are intended to be used not as fighting platforms but as protected mobility platforms.

by Ian Kemp



*The occupants of IVECO's LMV are seated within a crew citadel which is designed to provide a high degree of protection of mine blasts © IVECO*

**T**he German Army was among the first to recognise the importance of enhanced force protection. Krauss Maffei Wegmann (KMW) developed the 4x4 Dingo 1 in the 1990s to meet a German Army requirement for an 'All Protected Transport Vehicle' (Allschutz-Transport-Fahrzeug) for personnel who would otherwise be riding in LUVs. A high level of protection against the threats then being encountered in Former Yugoslavia was the primary design criteria; a slanted blast deflector floor protecting passengers against mines. KMW built 147 Dingo 1s, based on the Mercedes-Benz U-1550L UNIMOG chassis, for the army between 2000 and 2003 and many of these were subsequently deployed with the NATO-led Kosovo Force and the International Security Assistance Force in Afghanistan. Concurrent with Dingo 1 production KMW developed the more capable Dingo 2 based on the longer Mercedes-Benz UNIMOG U-5000 series chassis, which enables the 3.25 m wheelbase version to carry a 3.5 tonne payload, including up to eight personnel, while the 3.85 m variant carries a four tonne payload. With a range of 1,000 km the Dingo 2 can achieve speeds of more than 90 kmph on roads, it can also be carried by the army's CH-53 heavy lift helicopter. The Belgian Army was the Dingo 2's launch customer in December 2004 with a €170 million order for 220 vehicles in three variants - command, ambulance, and radar command and control - with an option, since exercised, for another 132 vehicles. The German Army has ordered a total of 255 out of an expected requirement for 450 vehicles with an additional 82 vehicles planned to carry the new BUR battlefield

**Krauss Maffei Wegmann and Rheinmetall are developing the 5 to 9 ton Armoured Multi Purpose Vehicle (AMPV) family which is intended to meet the Germany Army's GFF 1 and GFF 2 class armoured vehicle requirements © KMW**



**Krauss Maffei Wegmann and Rheinmetall are developing the 5 to 9 ton Armoured Multi Purpose Vehicle (AMPV) family which is intended to meet the Germany Army's GFF 1 and GFF 2 class armoured vehicle requirements; a mockup of the AMPV 1 was displayed at Eurosatory 2008 © Kemp**

## **KMW and Rheinmetall have teamed to develop a five to nine ton Armoured Multi Purpose Vehicle**

radar. Austria has bought 35 Dingo 2s, the Czech Army four vehicles for use in Afghanistan and prime contractor Thales is to supply 48 Dingo 2s for the Luxembourg Army's Protected Recce Vehicle requirement. Luxembourg's vehicles will be equipped with the Kongsberg Protector remote weapon station (RWS), a laser detection system and smoke grenade launchers for protection and an all weather observation suite mounted on a telescopic mast.

Additional Dingo 2s could be ordered for the Geschützte Führungs- und Funktionsfahrzeuge (GFF) 3 portion of the German Army's comprehensive GFF or 'protected command and role-specific vehicle' programme. The Army intends to field several thousand vehicles in four categories: the lightweight, 5.3 ton GFF 1; the 7.5 ton GFF 2; the 12.5 ton GFF 3; and, the heavyweight 25 ton GFF 4. Multiple designs, including both wheeled and tracked vehicles, will be fielded in some categories.

For the GFF 2 requirement General Dynamics European Land Systems received contracts last year for its MOWAG subsidiary to supply 198 Eagle IV vehicles with an option for another 474 vehicles. The Danish Army was the launch customer for the Eagle IV when it ordered



85 vehicles in December 2005 for use as armoured patrol vehicles. Based on the Duro II 4 x 4 chassis the 7,600 kg Eagle IV is able to carry up to five people who are protected against 7.62 mm AP ammunition and a 6Kg TNT mine blast. A 245 hp Cummins turbocharged diesel engine enables the Eagle IV to achieve a top road speed of 110 km/h and negotiate gradients of up to 60 percent. All German vehicles will be equipped with KMW's FLW 100/200 RWS. The first German Eagle IVs were deployed to Afghanistan in July.

KMW and Rheinmetall have teamed to develop a five to nine ton Armoured Multi Purpose Vehicle (AMPV) which will 'fully comply with user requirements' for the GFF 1 and GFF 2 class. A mock-up was displayed at Eurosatory 2008 and a prototype is scheduled to be completed before the end of 2009. The smaller AMPV 1 is intended primarily as a liaison vehicle while the larger AMPV 2 offers a higher level of protection and a heavier payload. Both models will include a patrol vehicle with an unprotected floor in the rear cargo section and an equipment carrier with a 'safety cell' extending to the vehicle's rear.

At Eurosatory KMW presented the first Future Fennek Technology (GP-FT) demon-

### Germany's IDB Deisenroth Engineering developed an innovative modular armour system using appliqué armour panels which are placed between the vehicle's inner and outer skins

strator, since rebranded as the F2, based on the 4 x 4 Fennek Leichter Gepanzerter Spähwagen (Light Armoured Reconnaissance Vehicle) which the company developed to meet the requirements of the Dutch and German armies for a stealthy reconnaissance platform. The €500 million Fennek project covers 612 vehicles in several variants for the two armies. KMW intends to develop two basic models of the F2, optimised for three to six crew members and specific operational roles. Survivability is enhanced by the redundancy of vital components, such as independent drive trains for the front and rear axles; the vehicle can be driven with one or both 150 kW diesel engines and achieve a road speed of more than 100 km/h. The F2 is designed to carry enough stores to be self sufficient for missions of up to five days.

**Panhard has delivered more than 300 PVPs (Petit Véhicule Protégé), seen during the 14 July Bastille Day parade, to the French Army and will increase production to 300 vehicles annually © Panhard**

IVECO Defence Vehicles Division completed the first prototypes of its private venture 4 x 4 Light Multirole Vehicle (LMV) in 2001 and the type has since become the most successful European vehicle in its class with orders from nine European armies. In response to the lessons of the Balkans IVECO developed a crew citadel concept which incorporates a multi-layered undercarriage structure to provide protection against mine blasts which can be boosted to protect against anti-tank mines by fitting a blast shield. Germany's IDB Deisenroth Engineering developed an innovative modular armour system using appliqué armour panels which are placed between the vehicle's inner and outer skins. Users can deploy the LMV as a soft skinned vehicle or with one of three levels of protection ranging from a light kit which provides STANAG 4569 Level 1 (5.56mm and 7.62mm ball ammunition) protection to a heavy kit which increases protection to Level 4 (14.5mm AP ammunition). IDB's Active Defence System can be fitted to the LMV to defeat attacks from rocket-propelled grenades and IVECO is working to enhance protection against IEDs. IVECO offers a standard 3.2 m wheelbase version that carries a 2.3 tonne payload and a 3.5 m/2.5 tonne variant which can be fitted with the standard four-door cab with an extended rear stowage pod or a short two-door cab which allows various modules to be fitted to the rear.

The Italian Army has ordered 1,286 vehicles, under the designation Lince, and has a requirement for up to 2,500 vehicles including command, reconnaissance and liaison vehicles, patrol vehicles, weapon carriers, ambulances and special forces variants. Italian Linces are deployed in Afghanistan and were joined there in May 2009 by the Panther, the designation for LMVs built by BAE Systems Land Systems for the British Army's Future Command and Liaison Vehicle (FCLV) programme. This covers 401 Panthers in 15 role-specific variants for use as: liaison vehicles for armoured reconnaissance and armoured infantry units; command vehicles for infantry anti-tank and mortar platoons, and engineer troops; and, as a radio rebroadcast vehicle. The Selex Galileo Enforcer RWS, mounting a 7.62mm machine gun, is fitted to 326 Group 2 vehicles while the remaining Group 1 vehicles



are fitted for but not with Enforcer. The LMV has also been bought by Austria (150), Belgium (440), Croatia (10), Czech Republic (19), Norway (60), Spain (120) and most recently the Slovak Army which ordered 10 vehicles in July 2009.

A number of firms provide the underlying materials technology to provide the necessary uparmouring balanced by the need for low weight and cost efficiency. TenCate for example provide military vehicle armour and ballistic fabric based protection for a range of platforms used by military, security and law-enforcement personnel, according to NATO standard STANAG 4569. The firm's Ceratego ceramic and fibre based ballistic solutions is optimised against armour piercing ammunition from both assault rifles and heavy machine guns while TenCate's Armourtex BM is half the weight of conventional steel armour but is designed to defeat explosive formed projectiles (EFP) generated by IEDs.

## Nexter Systems unveiled its 2 tonne 4x4 Aravis multipurpose protected vehicle demonstrator at Eurosatory 2008

Panhard General Defense (formed after the 2005 acquisition of Panhard by Auverland) has an established portfolio of 4x4 light armoured vehicles which includes the Véhicule Blindé Léger (VBL) developed in the early 1980s to provide the French Army with a vehicle weighing less than 3,500 kg for use in the reconnaissance role and to carry the MILAN anti-tank guided missile. More than 1,500 VBLs are in French service and the vehicle has been exported to at least 14 countries. The Mk 2 version of the VBL includes many improvements most notably a more powerful 125 hp Steyr and a ZF four-speed auto-

matic gearbox and larger tyres which boost cross country performance. Earlier this year Panhard began delivering 20 Mk 2s to the Kuwaiti special forces. To extend the VBL's versatility, Panhard developed the 11.5 tonne long wheelbase VBR which can carry a 2.5 tonne payload including four personnel; powered by a Tognum AG/MTU Friedrichshafen GmbH Series 106 diesel engine coupled to a fully automatic transmission the VBR has a maximum road speed of about 110 km/h and a range of 1,000 km.

In 2004 Auverland's AVL A4 design was select for the French Army's 4x4 Petit Véhicule Protégé (PVP) requirement for a lightweight multipurpose armoured vehicle; the original requirement for 933 PVPs to be procured through 2012 has expanded to about 1,500 vehicles through 2015. The 5 tonne PVP is powered by a 146 hp diesel engine which generates a maximum speed of about 120 km/h and an operating range

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of 800 km. Deliveries of the first batch of 314 PVPs began in early 2008 and Panhard is contracted to supply 746 vehicles. The company now offers the PVP/HD (Heavy Duty) and the PVP/XL to provide a family of vehicles ranging from 5 to 12 tonnes; the PVP offers 4.5m<sup>3</sup> of interior volume, the PVP/HD 6.5m<sup>3</sup> and the PV/XL from 8 to 11m<sup>3</sup> depending upon configuration.

Renault Trucks Defense produces the Sherpa 3A light armoured vehicle to complement its 4x4 and 6x6 VAB medium armoured vehicle range. The Sherpa 3A is based on the company's Sherpa 3 tactical truck and with basic level protection is able to carry a 2.9 tonne payload including four personnel. The Sherpa 3A Grand Volume has a four tonne payload (basic protection) including up to ten personnel while the more heavily armoured Sherpa 3A High Intensity has a payload of 1.5 tonnes and can be configured to carry four or five personnel. The NATO Maintenance and Supply Agency has chosen the Sherpa 3A to meet its Blast and Bullet Proof Protected Vehicle Rough Terrain tender issued in 2008; this order for four vehicles follows earlier orders for the Sherpa 3.

Nexter Systems unveiled its 2 tonne 4x4 Aravis multipurpose protected vehicle demonstrator at Eurosatory 2008. Based on a Unimog U5000 powered by 218 hp Mercedes Benz 4 cylinder diesel OM 924 engine the Aravis can achieve a top speed of 100 km/h, a range of 750 km and carry a driver, commander and up to six troops with their equipment. Aravis features appliqué armour, a V-shaped anti-mine plate and a spall liner within the crew citadel. Nexter claims that its new Safepro armour technology provides the Aravis with a level of protection which surpasses 'that of all existing 4x4 vehicles'. It describes this as '4-4-4': STANAG 4569 Level 4 ballistic protection able to defeat 14.5 mm threats; Level 4 mine protection able to defeat 10Kg mines; and, all-round Level 4 protection against 155mm artillery splinters. The vehicle can withstand an IED blast, equivalent to 50 kg of TNT, at five metres. Aravis has entered production following an €20 million order from the French Ministry of Defence earlier this year for the delivery of 15 vehicles, equipped with the Protector RWS, which will equip combat engineer units tasked with route clearance.



**Panhard is under contract to supply 746 PVPs (Petit Véhicule Protégé) to the French Army although this number could eventually double © Panhard**

The AM General uparmoured High Mobility Multipurpose Wheeled Vehicle (HMMWV) is the lightest armoured vehicle in US military service but their vulnerability to IEDs led the US Department of Defense (DoD) to acquire Mine Resistant

Ambush Protected (MRAP) vehicles from several manufacturers to replace the HMMWV in Iraq. As the original MRAPs are too heavy and cumbersome to use for off road operations in Afghanistan the DoD is acquiring the lighter 4x4 MRAP-All Terrain Vehicle (M-ATV). TACOM LCMC selected Oshkosh's M-ATV design following the evaluation of six competing proposals and on 1 July 2009 awarded the company an initial \$1.05 billion contract for 2,244 M-ATVs and a month later placed a \$1.06 billion delivery order for another 1,700 vehicles. There is speculation the eventual requirement could approach 10,000 vehicles. By the end of July Oshkosh had built 46 M-ATVs and plans to ramp up production to 1,000 vehicles per month by December. The 15 ton M-ATV is based on the chassis of the Medium Tactical Vehicle Replacement truck, incorporating the TAK-4 independent suspension system, that

**A US Army collage showing the three competing Joint Light Tactical Vehicle designs: Lockheed Martin (top); BAE Systems and Navistar Defense (bottom left); and, General Tactical Vehicles (bottom right). Each team will produce 10 technology demonstrators © US DoD**



Oshkosh builds for the US Marine Corps and carries a 1.8 ton payload including five personnel. An upgraded Caterpillar C7 engine enables the M-ATV to achieve a top speed of 105kmph on roads and the vehicle has a range of 515km. Bolt-on armour allows damaged panels to be easily replaced and will allow new armour technology to be used in future. The first M-ATVs are scheduled to be fielded in Afghanistan in October.

The US Army and USMC launched the Joint Light Tactical Vehicle (JLTV) project, approved by the Joint Requirements Oversight Council in November 2006, to partially replace their armoured AM General High Mobility Multipurpose Wheeled Vehicle (HMMWV) fleets with a purpose built light armoured vehicle; the Army alone has a stated requirement for 140,709 JLTVs at an estimated unit cost of \$418,000. DoD officials stress that the JLTV will not be a one-for-one replacement of the HMMWV, several thousand of which are being produced each year and which are expected to remain in service for decades to come. The JLTV Family of Vehicles (FoV) will consist of three baseline variants categorised by payload:

- Payload Category A will be a General Purpose Mobility (JLTV-A-GP) vehicle able to carry a 3,500 lb payload including four personnel.
- Payload Category B vehicles will carry a

**NATO Maintenance and Supply Agency selected the Renault Trucks Defense Sherpa 3A for its Blast and Bullet Proof Protected Vehicle Rough Terrain tender © Renault**

## The Australian government as stated it will decide in 2010 whether to participate in the System Development Demonstration phase of the JLTV project

4,000-4,500 lb payload and will be fielded in several 'sub-configurations': a six-seat Infantry Carrier, Fire Team (JLTV-B-IC); a six-seat Reconnaissance vehicle (JLTV-B-REC); a four-seat Command & Control On The Move vehicle (JLTV-B-C2OTM); a Heavy Guns Carrier (JLTV-B-HGC) which carries five; a four-seat Close Combat Weapons Carrier (JLTV-B-CCWC); a two-seat Utility vehicle (JLTV-B-UTL); and, an Ambulance (JLTV-B-AMB) which seats three and carries two patients on litters.

- The Payload Category C vehicle will carry a 5,100 lb payload and be produced in two sub-configurations: a two-seat Shelter Carrier/Utility/Prime Mover (JLTV-C-UTL) and an Ambulance (JLTV-C-AMB) with seats for three and four litters.

Most of these variants will be customised to meet the specific requirements of either the US Army or the USMC. A trailer will be fielded in each category

which is to 'have similar payload and mobility as prime movers'.

On 29 October 2008 the army's TACOM Life Cycle Management Command (LCMC) announced the

three teams that were selected for contracts, totalling \$166 million, for the Technology Development (TD) phase: BAE Systems and Navistar Defense; General Tactical Vehicles (GTV), a joint venture between General Dynamics Land Systems and AM General; and, a Lockheed Martin-led team, which includes BAE Systems Mobility & Protection Systems, Alcoa Defense and JWF - Defense Systems.

Australia is contributing 10 percent, about A\$25 million, of the total amount the US DoD has budgeted for TD costs to participate in this phase of the project and is paying for nine of the 30 demonstrator vehicles. The Australian Army is interested in assessing whether the Category A JLTV-A-GP, the Category B JLTV-B-C2OTM and JLTV-B-IC, and the Category C JLTV-C-UTL will meet the requirement for about 1,300 light Protected Mobility Vehicles which forms Phase 4 of Project Overlander (Land 121) to replace the Army's wheeled tactical vehicle fleet. The Australian government as stated it will decide in 2010 whether to participate in the System Development Demonstration (SDD) phase of the JLTV project. In July the JLTV Program Office hosted a meeting with representatives 'from more than a dozen' NATO and non-NATO allies, including Canada, Israel and the UK, to discuss participation in future phases of the project.

During the first 15 months of the 27-month TD phase each team must deliver 10 vehicles (three Category A, five Category B and two Category C) including three in right-hand drive configuration for Australian evaluation, trailers, blast hulls and ballistic panels which will then be subjected to 12 months of government testing. From 2011 two contractors will complete the design and development during the SDD phase before competing for JLTV production contracts. The Marine Corps has raised concerns that the JLTV, with an estimated weight of 20,000 lb, will be too heavy for its concept of expeditionary operations. Another factor which could significantly impact the final shape of the project is the review of the US Army's vehicle modernisation plans following the cancellation of the Future Combat Systems Manned Ground Vehicles and the acquisition of both MRAPs and M-ATVs. [ARM](#)

