

# The survivability concept: IBD develops its product range for improved protection

■ BY PAOLO VALPOLINI\*

## KEY POINTS

- IBD's latest protective products range has been expanded for use against EFP-type IEDs
- Add-on armour packages have been developed in passive and active versions

Germany's IBD Deisenroth Engineering has recently expanded its product range and is researching new materials to provide improved counters to current threats and to be ready to address future requirements. Although the technologies remain closely held, further details of the IBD survivability concept were presented at the Defence IQ Light & Medium Armoured Vehicles 2008 conference in London in late January.

Faced with the prevailing improvised explosive device (IED) threat, IBD has developed a series of products to allow both light and medium armoured vehicles to withstand the effects of the various types of IED currently met on operations. The company's preferred approach has been to develop solutions in accordance with threat inputs and requirements provided to it by those of its customers whose units are deployed in the most dangerous theatres, rather than simply adhering to the STANAG 4569 IED standardisation process currently under way within NATO, whose parameters it does nonetheless cater for.

## The rise of EFPs

Initially, the user focus was on mitigating the blast and fragment effects of IEDs; this was valid until 2005 when explosively formed penetrator (EFP)-type IEDs began to proliferate, initially in Iraq and then in Afghanistan. IBD conducted a series of tests using home-made EFPs in several configurations, among them one based on a steel casing with a steel liner, with increasing diameters and explosive charges (up to 3.3 kg), able to penetrate over 80 mm of standard rolled homogeneous armour (RHA). A second category,



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■ IBD's Leopard 2A4 Evolution demonstrator incorporates add-on AMAP-R roof armour with an aerial density of 120 kg/m<sup>2</sup>, giving protection against both bomblet SC and EFP attack. Its turret and hull armour is designed to defeat tandem-warhead weapons such as the RPG-29, large-calibre KE rounds, fragmentation and EFP IEDs, as well as heavy mines.

using plastic cases in combination with copper liners and filled with up to 4.6 kg of explosives, manifested a 50 mm to 120 mm RHA penetration capacity, both categories generating slugs of some 100 g with velocities often well in excess of 1,500 m/s.

According to IBD founder Dr Ulf Deisenroth, the tail and tip speeds of the multifragment penetrator stream of one category vary between 1,800 m/s and 2,200 m/s, while other multislug types can be even more severe, with peak speeds approaching 3,000 m/s.

Company tests demonstrated that the active element of its Advanced Modular Armour Protection (AMAP) product range, originally known as AMAP-ADS (active defence system) and now simply as ADS, could also be effective against some forms of

EFP attack, as well as conventional shaped-charge (SC) rocket and kinetic-energy (KE) penetrator attack. IBD started generic research into hard-kill defensive aid systems in 2001 and first carried out a TRL 6 (technology readiness level) test of its ADS solution on a tracked vehicle in 2005. Since 2007, development and production has been transferred to subsidiary company ADS Gesellschaft für aktive Schutzsysteme mbH (ADS GmbH), set up in 2006, in which Rheinmetall has since taken a 25 per cent holding. One of the objects was to further improve system effectiveness in terms of reaction time and slug-neutralisation effects.

The introduction of ADS enables the crews of even relatively light vehicles to be given significant protection against a wide spectrum

of weapons, both improvised and non-improvised, notably when ADS is used in combination with a version of IBD's passive add-on IED armour (AMAP-IED). ADS, with a system weight of between 150 kg and 400 kg – depending on the platform vehicle's dimensions and integration requirements – has its effects on SCs and EFPs, while AMAP-IED, which is based on armour layers with composite support and has a weight of less than 100 kg/m<sup>2</sup>, gives protection against the remains of the EFP slug, as well as against blast and fragment effects of first-generation IEDs. In the latter category, tests were carried out with explosive charges and with up to seven 155 mm artillery projectiles staked together, although

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distances were not disclosed.

Some IBD customers sought an all-passive solution against the most recent IED threats and the company has responded with a dedicated add-on armour solution. However, this is of considerably greater weight (around 300 kg/m<sup>2</sup>) and cannot be installed on all vehicle surfaces because of its thickness of between 200 mm and 300 mm. Armour geometry is particularly constrained in wheel arches, which IBD considers one of the most critical areas since most IEDs are buried in the ground and their effect is thus directed upwards towards the flanks of the vehicle and can easily hit the sections behind and over the wheels.

## Combined protection

Such a solution provides combined protection against EFPs, fragmentation, blast and SCs, conforming with the company design philosophy of devising integrated solutions so as to minimise weight. EFP protection can be further extended to the vehicle underbelly using AMAPS-M, the company's mine protection kit designed to give protection against both blast, SC and EFP mines.

One of the first nations to take advantage of IBD's more recent developments has been Canada, which adopted an IED protection kit on its LAV III, Coyote and Bison vehicles deployed in Afghanistan. IBD responded to Canada's urgent operational requirement (UOR) by delivering the first kits into theatre within six weeks and completing fleet conversion (some 400 units, representing some 500 tons of material) within 6 months. It also carried out IED testing in theatre with the Canadian Forces' Leopard 1C2 tanks. IBD had upgraded these in the mid-1990s, but the tests showed that, although the IED problem had not come into consideration at the time, the existing armour package could withstand EFP threats.

IBD's latest tank upgrade package, dating from 2007, is designed to allow the Leopard 2A4 to be protected against tandem-warhead weapons such as the RPG-29, large-calibre KE rounds, fragmentation and EFP IEDs, as well as heavy mines. The Leopard 2A4 'Evolution' package was released as a product in late January 2008.

IBD is also fully involved in the development of the passive modular armour package for the German Army's Puma armoured infantry

fighting vehicle, which at its higher protection level will be able to counter anti-tank missiles, medium-calibre KE rounds with high multi-hit capability, as well as fragmentation and EFP IEDs, although the latter threat was not initially considered in the requirements.

IBD's product catalogue has seen a number of recent additions to the AMAP family. Apart from the aforementioned AMAP-IED, IBD has developed a light solution for roof protection (AMAP-R) against the bomblet/EFP threat, even on light-medium armoured vehicles, providing that the base vehicle steel armour has a thickness of between 5 mm and 8 mm; the AMAP-R has a weight of only 25 kg/m<sup>2</sup>, five to seven times less than the solution adopted on the Leopard 2A4, which also provides protection against heavier threats such as top-attack anti-tank missiles.

A technology being thoroughly explored by IBD engineers is that of nanomaterials. These promise new solutions in different fields, including ballistic protection in which they will permit material properties to be tailored to prevailing needs, providing greater flexibility and allowing a decrease in weight. Although it is not so high a priority on the requirements list, signature management – listed as AMAP-S in the company portfolio – is another field that will profit considerably from research into nanomaterials,

the aim being to include signature management mechanisms, against optical, radar and thermal systems, within the armour package itself.

Since many light vehicles armoured against current threats are now engaged in theatre and most of them feature wide glass surfaces, transparent armour is another priority in the IBD technical bureau. The company considers that armoured glass has reached its development limits; further increasing its ballistic resistance would incur an excessive weight penalty and also visibility problems arising from changes in colour and from distortion. Next-generation AMAP-T (transparent) products are therefore based on see-through ceramics. Company scientists and engineers are addressing the two principal outstanding problems: that of dimensions, with a view to raising the current 300x300 mm production size limit to equal the size of a full glass shield; and that of cost. IBD estimates that its new range of AMAP-T solutions should be available in late 2008 or early 2009.

## Suspended seats

Another add-on to IBD's portfolio is AMAP-MPS (multipurpose seat), mainly for mine and IED protection; these suspended seats are equipped with foot rests to decouple the crew and dismounting infantry from the chassis as much as possible, thus considerably

reducing accelerations and injuries. They have been qualified on board Canadian vehicles and are also being introduced on the latest Norwegian M113s.

While IBD remains responsible for development, engineering and prototyping, the production of its passive armour solutions is carried out at Chempro GmbH, the Bonn-based company in which Rheinmetall also acquired a 51 per cent stake in January 2007. Chempro has taken over the premises previously occupied by IBD prior to the latter's move to a new facility at Lohmar, 20 km south of Cologne. This has allowed the company to improve its work flow in order to increase flexibility in response to numerous UORs. In 2007, Chempro delivered some 2,500 armour kits (with a combined protected area of more than 10,000 m<sup>2</sup>) for light and medium vehicles, raising turnover by 30 per cent compared with 2006. These results were obtained as a result of an increased order book and the restructuring, the aim of which is to be able to handle up to five or six different types of production at the same time in what company sources define as a "chaos working capability". To be able to respond to UORs, Chempro finds that it needs to maintain material stocks valued at 20 per cent of its turnover, as the supply of expensive long-lead procurement items could otherwise take between eight and 20 weeks. Chempro also undertakes customer training at its own facility or at customers' home bases and, when needed, in theatre.

The Lohmar-based ADS GmbH plans to launch its first small ADS series-production batch shortly, in order to affect delivery by the year end. According to ADS GmbH sources, the solutions adopted by the various customers – thought to include France, Greece and the UK; other candidates include Canada, Italy and Sweden – are obtained using the same technologies but are adapted to customers' requirements in terms of threat reduction. ■



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■ An IVECO LMV 4x4 vehicle fitted with the IBD AMAP-ADS active defence system in 'roof rack' configuration. In this instance, the ADS suite comprises 16 sensor and focused-blast effector modules with a combined system weight of 145 kg and a cost of around EUR100,000 (USD147,000).

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