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Protection of Soft Vehicles Against ERW

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Protection of Soft Vehicles Against ERW

The author discusses the challenges of protecting aid workers riding in traditional unarmoured vehicles from the dangers of explosive remnants of war. He offers some practical, after-market solutions that provide a high level of protection for much less than the cost of traditional armoured vehicles.

by Thomas Hvidtfeldt [Scanfiber Composites A/S]

Effect from fragmenting mine on a vehicle. Here a car's steel-plate body was ruptured by fragments from a small hand grenade.
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Side Protection and Seat Protection is one product that offers protection from roadside bombs.

Following a conflict, humanitarian organisations are generally the first to enter a country to deliver aid and start to rebuild the country's infrastructure. Aid workers often rely on a 4x4 sport-utility vehicle to transport supplies and people. This type of carrier is viewed as a big, strong vehicle with high mobility, but it offers little protection against landmines and other explosive remnants of war. It is what is known as a "soft vehicle."

The term *ERW* is very wide and covers anything from handgun ammunition to aircraft bombs.[1] The majority of injuries, however, are caused by devices like anti-personnel landmines, anti-tank mines and, as seen recently in Lebanon, air-dropped submunition "bomblets." Apart from being the most numerous, AP mines are directed against people on foot and are normally designed to explode following a relatively small impact—often by the pressure of a foot or the tripping of a wire.

At the same time, small- or large-calibre gun ammunition, aircraft bombs and mortar rounds tend to be more stable—although when they do explode, the results can be much more devastating.

The extent to which AP mines endanger passengers in a soft-skinned SUV depends heavily upon which type of device we're talking about. We can separate the various devices into two groups depending on their primary kill mechanism:

- **Blast ammunition** works by creating a powerful blast wave that destroys objects in close proximity to the explosion.
- **Fragmenting ammunition** works by creating a cloud of high-velocity steel fragments intended to inflict as much damage as possible to anything or anyone in the surrounding area.

Most AP mines inflict injury primarily through the blast effect and normally detonate by pressure. The effect from the blast wave decreases rapidly with distance and it is often a "one kill" weapon. On the other hand, some AP mines and many types of air-dropped bomblets work with fragmentation as the primary kill mechanism. The same goes for almost all mortar rounds and artillery ammunition. Contrary to a blast wave, which loses its power very quickly, the high-density fragments surrounding the explosives maintain their energy for much longer and can inflict injury quite far away from the explosion. Due to this extended range, most types of fragmenting AP mines have the option of trip-wire detonation, which enables the mine to go off when a person or vehicle trips a wire up to 10 metres (33 feet) away.

A person is at risk in two different ways while travelling in an SUV. If the vehicle detonates an AP device that works primarily through blast, the distance from the expected impact point (below a wheel) to the person in the vehicle is normally high enough to create a safe distance. However, if the device creates fragments, the thin steel of the car body will offer almost no protection against the high-velocity steel fragments. The standard car-body steel is 0.8 millimetre (0.03 inch) thick and will not prevent fragments from entering into the cabin.

To express it another way, when we are talking about various AP devices, the main concern for passengers in a vehicle is fragmentation rather than the shock or blast effect from the explosive.

For that reason, in an area with a high risk of setting off fragmenting AP ammunition, fully armoured SUVs are recommended. However, apart from being very costly, excessively heavy and hard to obtain in sufficient numbers, fully armoured SUVs tend to give the wrong impression of the humanitarian workers—namely that they are not willing to take the same risks that the inhabitants must take on a daily basis.

As an alternative to fully armoured vehicles, there are a number of retrofit solutions on the market today that can provide a good level of protection for passengers travelling in soft-skinned vehicles. Although retrofitted vehicles do not provide the same level of protection as factory-armoured SUVs, some can work well against a large number of ERW threats for about one-twentieth the price of a fully armoured vehicle. Consequently, a much higher number of vehicles—and thus passengers—can be protected for the same money. In addition, the retrofit solutions to protect soft vehicles, like ballistic blankets (described below), can be delivered quickly and most can be installed in the field.

Built-in Ballistic Blankets

Most retrofit solutions to protect SUVs are based on aramide fabric, such as Twaron® or Kevlar®, which is the ballistic material used in most body armour. By using flexible armour, it is possible to design solutions that fit into the curved interior and floor of the SUV.

In terms of level of protection, flexible solutions using aramide on the interior and floor of the vehicle generally represent a lower level of protection than those found on the sides of a factory-armoured SUV. Ballistic blankets are available from several sources and are a system of tailor-cut and overlapping blankets that cover as much of the interior of the vehicle as possible up to the windows.[3]

Ballistic blankets offer a good level of protection against fragments coming from below or from the lower sides. They are installed below the carpet and inside the side panels and doors and require a complete stripping of the vehicle. After reinstallation, the interior of the vehicle looks the same as before, with no visible signs of it being protected.

The protection level of the blankets is normally specified according to a North Atlantic Treaty Organization standard STANAG [Standardisation Agreement] 2920[2] and the standard level by most non-governmental organizations is a level referred to as 600 m/sec. It is not possible to connect this level directly to any specific mine or grenade as the actual conditions have an enormous influence on the real threat. However, a level of 600 m/sec can be directly compared to other means of protection; for instance, standard body armour (without vest-insert plates) represents a level of protection of 450 m/sec and contains only about half the amount of ballistic material. A passenger in a vehicle that hits fragmenting ERW is much better off if the vehicle is equipped with ballistic blankets than if he is wearing body armour; in addition to a higher ballistic level, the ballistic blankets will offer protection of the extremities and not only the torso.

Interestingly, compared to a fully armoured SUV,[3] many soft-skinned vehicles equipped with ballistic blankets are better protected against landmines detonating on the ground. The reason for this seeming inconsistency is because most armoured SUVs are designed with a level of floor protection according to an old German standard for armoured limousines known as the "two hand grenades" level. Unfortunately, the specified grenade—the German type DM51—is quite small and contains relatively small fragments that are easily stopped.

In addition to blankets, various systems exist on the market to shield the passengers from fragments.

Ballistic blankets.

New technologies with in-the-field armouring options can be fitted and removed when there is no immediate danger. This type of protection is designed to provide an increased level of protection against ERW and other weapons that explode next to the vehicles. The increased availability of these options improves the safety potential for vehicles working in proximity to ERW. In turn, these options and those developed and implemented in the future will continue to better the working conditions of personnel exposed to such risks.

See Endnotes, page 109

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