

# Comment: Armoured Vehicle Design

For some three decades, the UK has been agonising about procuring new armoured vehicles to replace the FV-430 and CVR series. We have had a number of programmes, including FLAV, FFLAV, the NATO MNAV, a still-born national programme, the European collaborative MNAV, national TRACER, the UK/US TRACER/FCS and now FRES. But this latest manifestation, FRES, originally due in service in 2008, has been postponed to 2009, then to 2012, and is now unlikely to see operational service before 2015, as was predicted several years ago. As a result, we have had unsuitable armoured vehicles on operations and have had to buy interim vehicles through UOR procedures. William Owen questions whether this is due to a lack of logic and leadership in MoD and the Army.

## LOGIC AND LEADERSHIP IN ARMoured VEHICLE DESIGN

by William F. Owen

*William F. Owen is a freelance writer and military/warfare theorist living in Israel. He suggests that the stated need for a medium-effect armoured vehicle system has served as a block to effective thinking and that the failure over 20 years to address the simple and obvious requirement is a failure of military thought.*

Recent delays in UK armoured fighting vehicle (AFV) programmes, resulting in the denial of capability to the Army may be symptomatic of a failure in UK military thought, compounded by a confusion caused by the use of words such as 'system', 'medium' and 'effects'.

This article will argue that certain logical fundamentals seem to have been ignored in the search for a silver bullet that does not, and can never, exist. In addition, the use of words such as 'capability' and 'effects' seem to have become blocks to effective and useful thinking when it comes to UK MoD's fielding of AFVs.

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### Complex and Uncertain Threats

The idea that designing armoured vehicles is now more demanding because the contemporary operating environment is more 'complex' is both a limiting belief and a fallacy. Threats to current armoured vehicles have remained largely static over

the last 15 to 20 years. The improvised explosive devices (IEDs) and anti-armour weapons encountered on current operations are generally no more threatening or innovative than those encountered somewhere in the world well before 2001 and, in many cases, well before 1991. The claim that threats, previously thought to be unlikely, are now encountered more commonly on operations is not really a basis for allowing the design requirements of an AFV to become a confusing and complex issue. Risk-taking is required. The fact that things were previously ignored to save money and/or size and weight should not create an area of doubt once the need to address the threat is eventually conceded and recognised.

For example, the UK's light reconnaissance tracked vehicle, CVR-T, entered service with an extremely low level of ballistic protection in order to provide a lightweight vehicle, designed primarily for reconnaissance with a prepared swimming capability. The level of protection was traded against mobility, both tactical and operational. Bearing in mind the nature of operations during the Cold War in Germany, this was entirely logical for a design originally limited to the reconnaissance role. Like the Carden-Lloyd and Universal carriers of the late 1930s, the technology of the time was balanced against a reasonably useful level of performance, cost and reliability. The exact same parameters of military judgement that existed in the 1930s or 1970s still exist today. Far less has changed than is commonly supposed.<sup>1</sup> Making the right choices requires solid judgement and intellectual leadership to utilise the large body of empirical evidence that supports current and historic AFV design, both good and bad. The alleged complexity involved in modern operations is primarily that of rules of engagement and the precise and discriminating use of proportional force. This should have little or no impact on vehicle design.

### Learning from the Past

The design of the FV-430 series reflects the unchanging basics of armoured vehicle design, as does the design of the earlier M-113, as shown by the fact that the upgraded FV-430,



The space required for carrying ten infantrymen has wider utility today than it did in 1963 [William F. Owen]

Bulldog, is in service and the M-113 is both still available<sup>2</sup> for production and continues in service. This is not to say that the FV-430, as it entered into service in 1963, would be useful for contemporary operations. It would not. However, the broad design characteristics, as also seen in the M-113, are strongly indicative of a thesis that suggests that the vast majority of effective AFV designs are descended from armoured personnel carriers (APCs). Indeed, almost every family of multi-role armoured vehicles since 1934 has descended from APCs, or vehicles modified to become APCs, such as CVR-T and FV-600. For an army that still holds the bayonet as being effective, it is somewhat odd that the UK MoD believed, regardless of the evidence, that the basics of armoured vehicle design had somehow developed to the degree where this fact could be ignored.

Almost everyone associated with armoured vehicle design knows that a section APC provided the effective and useful basis for a large family of armoured vehicles capable of a wide variety of roles. As of 2001, there was simply no basis or evidence to assume that this has changed. In fact, there was and is a wealth of evidence to support the contention that

nothing had changed. Logically, the requirement was for an improved tracked and/or wheeled APC, and not a 'medium effects system' for 'complex' operations.

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#### **The Changes**

The assumptions that underpinned the design of Cold War APCs are not generally different from the assumptions that underpin any APC for 21<sup>st</sup>-Century expeditionary operations. The actual areas of change are pretty easy to ascertain, and predict.

With armies getting smaller, but the world remaining the

same size, it is logical to suggest that any UK APC would have to operate across an area substantially larger than the old 1st British Corps area, in Germany, and possibly far from the UK home base. The operational area might well be austere and have a limited road network. If it happens to be quite the opposite, then this is all for the better. The weapons most likely to be encountered would probably remain hand-held anti-tank (AT) types (the RPG-7 plus derivatives), and the 7.62mm x 54R AP round. As IEDs come in all shapes and sizes, they are impossible to predict and thus the prevailing AT mine threat assessment would probably suffice. That provided by STANAG 4569 Level 4 is and was probably sufficient.<sup>3</sup> Effectively defeating the RPG requires some form of reactive or 'active' armour, be it explosive or electric. Such armours have a high aerial density, but their fitting to both tracked and wheeled APCs is both common and well understood.

Suffice it to say that an APC designed to withstand 14.5mm heavy machine gun (HMG) fire, should not be difficult to adapt to a higher performing armour pack. Add to this the benefits of Active Protection Systems (APS) and the challenge of defeating the RPG-type threats is not as tortuous as some suggest.

**Transportation and Deployment**

It would seem that an 8–10 person APC can form the basis of a usefully versatile multi-role AFV. The exact number of men is derived from anthropomorphic data and levels of required protection, within size and weight constraints – it has nothing to do with the size of the infantry section!<sup>4</sup> A STANAG Level 4 degree of ballistic protection would seem to suffice, especially if some form of reactive armour or APS can be fitted. In fact, unless constraints exist, a very much greater level of protection is possible. Constraints are not bad. Physical, rather than cost, constraints in AFV design are de facto capabilities.

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The most critical constraints seem to be weight and width. For example, a tracked APC less than 6m in overall length and with the outside edges of the road wheels no greater than 2.438m, and weighing under 30,400kg, can be transported by any flatbed truck capable of moving a 20ft ISO container.<sup>5</sup> This means tracked vehicles do not need heavy tank transporters to undertake long road marches, for deployment or moves between operational areas. ISO-capable carrier vehicles are easily sourced worldwide. Wheeled APCs are not particularly challenged by long road moves, so wheel track widths of up to



*The IMI Wildcat was developed from a commercial truck chassis. It has near identical performance and capability characteristics to the US M-1127 Stryker, and includes an active protection system [IMI]*

2.8m are acceptable, unless there exists a need to transport by air, such as the much-touted C-130 envelope.

It is hard to see a need to air-deploy anything other than specialist or especially light<sup>6</sup> or small numbers of armoured vehicles, yet air deployment<sup>7</sup> was one of the ideas at the heart of the poorly reasoned 'medium weight' concept. While useful in providing a design constraint, it is more or less useless as an operational concept. In fact, it could be argued that it has served only to confuse.

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Size and weight constraints are useful, as it is both possible and sometimes desirable to provide APCs with very high levels of protection, especially when operating with main battle tanks (MBTs). Israel has addressed this requirement with the Namera APC, based on a Merkava tank chassis. This ensures extremely well-protected vehicles with MBT levels of mobility. For Israel's needs these are optimum choices. For the UK, they are not. MBT levels of protection and mobility require an MBT chassis and power plant.

Indications are that it is possible to design a 2+8 tracked APC that falls within the 20ft ISO footprint and weighs less than 15,000kg, with a capable armour fit, and possibly level 4a and 3b mine protection for the crew. Small AFVs such as this have a number of advantages that should be obvious to all concerned.<sup>8</sup> COTS wheeled APCs with this capability already exist.

### Growth Potential

The need for 'growth' is often cited as being both a requirement and a challenge. The need for growth assumes that current levels of protection will become inadequate, and the required solution will weigh more, so it essentially suggests that you should be able to tell the future. Vehicles will enter service with a level of armour protection known to be inadequate, but unavoidable. For example, Warrior FV-510s that deployed to the Gulf in 1991 were up-armoured to face Iraqi threats, all of which commonly existed in the Soviet Army when the vehicle won the contract in 1980. Had the armour packs, which existed in 1991, existed in 1980, then that level of protection would, one hopes, have formed part of the original vehicle. Viking ATV-P is now operating in Afghanistan at 2.1 tonnes above the specified GVW for a level of threat the vehicle was never designed to face, and for which it would have been impossible to meet the amphibious design requirement for the Royal Marines. Having said that, when it entered service it was better protected and possessed greatly superior mobility to the original CVR-T, but operations in Afghanistan moved the vehicle way beyond its intended role of providing a degree of effective protected all-terrain mobility for light infantry. Bearing in mind the very challenging and tight parameters of the original mobility requirements, the ATV-P fleet's performance has been outstanding, though now no longer able to cope. Had FV-430 levels of mobility been the original goal, then the design could have delivered very high levels of protection.

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Whether for armour packs or spare electrical power for defensive aid suites, growth is a margin of error pertaining to capability and requirements. Growth assumes you can predict the future threats and the future solution. Evidence suggests that we have been poor at this. The fact that historically in-service vehicles have lacked a degree of effective protection and have to be up-armoured should not form a template to continue making the same mistake. Why not deliver the highest degree of protection possible within constraints? The size, effectiveness and triggering mechanisms used by IEDs are all outside our control. IEDs have killed MBTs. A reactive armour pack capable of defeating a generic RPG in 1991 would still be of use today. In addition, armour packs are generally becoming lighter for the same level of performance.

### Conclusion

What has been indisputably obvious for the last 20 years

is that the UK needed a new tracked and/or wheeled APC, capable of carrying 8–10 men, and protected to the level of threats that could potentially be encountered across the globe. Failure to address this simple and obvious requirement is a failure of military thought, and arguably there has, at some point, been a failure of intellectual leadership. It is not the purpose of this article to say who failed or when that failure occurred, but we must acknowledge that such a failure did occur. Writing the requirement for a replacement APC is a process that should have taken weeks, not years.<sup>9</sup> Even a poor requirement could have proved useful once subjected to rigour and military judgement. When a clear, concise requirement failed to appear, it should have caused significant concern to those associated with the process. Current evidence is that it did not. By any measure, this has resulted in a failure to provide a useful vehicle for current operations. ■

### NOTES

- <sup>1</sup> Analysis of the 2006 Lebanon conflict done by this author (and subsequently confirmed by the IDF) indicates that nearly all the casualties caused to either the crews of AFVs, or infantry mounted in them, are accounted for by only 9 incidents in the entire 31 days of fighting. You had to be unlucky to actually get hit by an ATGM in the Lebanon, and even unluckier to die from it
- <sup>2</sup> BAE Systems' MTVL is the current available improved M-113, capable of lifting 10 men and a GVW of 18,000kg
- <sup>3</sup> It should be noted that the FV-600 Saracen design of 1952 specified an under-wheel explosive weight of 20lbs or 9kgs, so just 1kg short of the 10kg specified by Level 4a
- <sup>4</sup> Contrary to what is often stated, the size of the UK infantry section is the product of opinion, loosely supported by the selective use of data and thus cannot really be used to justify the absolute number of seats in an APC
- <sup>5</sup> The Alvis Stormer (FV-4333) seems to have accidentally adhered to this footprint, because of a 1950 design requirement that informed both FV-600 and CVR-T to fit between the trees in rubber plantations in Malaya!
- <sup>6</sup> Light for the purposes of this article are AFVs with a GVW of under 11,000kg – so capable of being lifted by CH-47
- <sup>7</sup> While it is theoretically possible to fit 6 x Stormer-type vehicle with a Level 4 Ballistic Armour in a C-17, they would almost certainly exceed the maximum payload of the aircraft. A likelier C-17 payload is 4 or 5. However, a cargo configured Boeing 747 may be able to lift as many as 6
- <sup>8</sup> Small logistic footprint. Greater variety of MLC routes and bridges. Lighter recovery and fitter equipment. Smaller signature
- <sup>9</sup> It is worth noting that the Royal Marines, never having operated an APC, were able to gain the capability from decision to delivery with a brand-new vehicle in five years