

Written evidence submitted by Christopher Rose, proprietor, Anglo Engineering Concepts.

Background

The author was the Electrical Design Engineer for Alvis of Coventry when Stormer-HVM and Stormer VLSMS were designed for the British Army, and contributed to the early TRACER studies, and also held the position of Lead Engineer for Lockheed Martin on their AVA light armoured vehicles programme.

Since 2009 Anglo Engineering Concepts has worked to produce designs for a family of light armoured vehicles suitable for British Army rapid reaction forces. A description of the concept is available online, hosted by Think Defence: <https://www.thinkdefence.co.uk/anglo-engineering-concepts-back-systems-thinking/>. Briefings have been given to DE&S, Army HQ, ATDU, DSTL, UKTI EST, TRADOC and a broad spectrum of potential UK industry partners between 2010 and present; briefing material has also been sent to MPs, MOD and the Defence Committee.

Questions

1. **Does the Army have a clear understanding of how it will employ its armoured vehicles in future operations?**

As the fleet of armoured vehicles in service is a given, this is a function of fitting the platforms into force structures where they offer best advantage. Hence we have an almost entirely wheeled Strike Brigade with tracked Ajax as its only medium calibre gun carrier, this 40mm armament being the biggest direct fire punch within the Strike formation. The self-deployment advantages of a wheeled force are thus neutered by tracked firepower that would need low-loader transport (HET) to cover long distance road transits.

Emergency deployment of Strike assets by air has been degraded because neither Ajax nor Boxer can be transported by A400M in combat-ready configuration. They exceed the RAF limits for A400M cargo and would need transport by C-17 if required to arrive ready to fight. UK has few C-17s, and they are always in high demand.

In terms of consistency Armoured Infantry fares better, its combat equipment fleet being entirely tracked and therefore of near equivalent mobility. Its role is better understood than that of Strike.

2. **Given the delays to its programmes, will the Army be able to field the Strike Brigades and an armoured division as envisaged by the 2015 SDSR?**

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This is unlikely, with slow progress on both Warrior CSP and Ajax development. Mechanised Infantry Vehicle (MIV) Initial Operational Capability (IOC) is years away, and MRV-P is still indeterminate, as are upgrades for Challenger and AS-90.

3. **How much has the Army spent on procuring armoured vehicles over the last 20 years? How many vehicles has it procured with this funding?**

Focussing on just one programme, CVR(T) Replacement, the figures are damning. The first replacement study, commissioned in the late 1980s, was the Family of Light Armoured Vehicles (FLAV) study. It came up with more modern versions of the basic CVR(T) which were of modest cost and could have been bought in large numbers, but the MOD decided it needed a more radical way forward. FLAV was replaced by the Future Family of Light Armoured Vehicles (FFLAV) study, with a broader scope looking at rationalising the Army's entire light/medium armour fleet. Proposals were offered by the competing teams, but FFLAV was a study not a programme. It was taken no further.

Personnel changed in both the Army and the MOD, ideas became more ambitious, and avaricious eyes focused upon the US Army's Future Scout & Cavalry System (FSCS) effort for an M3 Bradley replacement (M3 Bradley is the US Army's Warrior-sized cavalry/reconnaissance asset). The Tactical Reconnaissance Armoured Combat Equipment Requirement (TRACER) programme was initiated by MOD, and formal agreement was reached with the USA that TRACER and FSCS would be variants of the same vehicle. This was a proper technofest with remote turret, mast mounted sensors, hybrid drive, crew in an armoured citadel and as many advanced concepts as could be assembled into one project. Two teams, SIKA and LANCER, each progressed far enough to trial prototypes. The US Army decided it needed a more ambitious solution of far broader scope than just reconnaissance assets, so terminated the FSCS programme. The replacement Future Combat System (FCS) programme did not align with UK needs. TRACER struggled on in isolation, but without US impetus quickly ran out of steam.

A new programme was started, Future Rapid Effects System (FRES) which returned to the FFLAV concept of light armour capable of C-130 transport, augmented by some of the smart ideas TRACER brought forward, such as active defensive aids. FRES was a programme with hopelessly fluid goals. With operations in Iraq and Afghanistan showing the need for heavy protection (largely because the Army's tasks in those theatres were patrols and convoys on predictable routes – ideal for IEDs), FRES protection requirements became far more onerous and its size and weight grew rapidly, forcing the removal of the requirement to be transportable in C-130, revising the size and weight limits to the payload criteria of the yet to enter service A400M.

There was in addition the introduction of 'new systems engineering thinking' where a broad array of independent Technology Demonstrator Programmes (TDPs) were contracted to competing defence

companies under a bewilderingly complex System of Systems Integrator (SOSI) contractual matrix to develop different aspects of innovative AFV technology. The TDP contracts let were: electric armour; chassis options (x2); electronic architecture (x2); defensive aids; integrated survivability; stowage options; gap-crossing assessment. Clearly there was overlap between some TDP packages and conflict between others, but the TDPs were kept absolutely separate. After years of funded study these programmes were terminated having produced a lot of paperwork but no hint of a coherent AFV design.

FRES lasted three more years before finally being unceremoniously shut down; Quentin Davies MP proclaiming to the Defence Committee on 15 December 2009 that “FRES is dead” and lambasting the colossal volume of study material that absolutely failed to define the Army’s ideal AFV. In place of FRES there would be a Commercial Off-The-Shelf (COTS) solution. General Dynamics (GD) bid ASCOD, and BAE Systems bid CV-90 Recce. The selected offering was ASCOD. This was announced in 2010. Since then there has been a massive redesign programme turning ASCOD, first fielded in the early 1990s, into what is now called Ajax – this is of course hardly COTS.

Meanwhile, other programmes were having their own issues. In 2003 the UK pulled out of the Multi-Role Armoured Vehicle (MRAV) wheeled APC programme because at 32t the Boxer as it was named had become too heavy. Four years later under the banner of FRES-Utility Vehicle (FRES-UV) Trials of Truth, the Boxer was back to be trialled against the French VCBI and GD’s Piranha V, all three of these being 8x8 wheeled vehicles in the 30t weight class. MOD selected the Piranha V despite it not actually existing (an earlier generation Piranha being trialled in its place) and then famously fell out with GD over Intellectual Property ownership. FRES-UV died.

In terms of costs, Peter Flach wrote in a RUSI paper in 2010: “According to some respected commentators, this brings the total expenditure on FFLAV, MRAV and TRACER to something in the region of £650m.” In 2011 the NAO reported FRES-UV as having cost a total of £133m, and expenditure on FRES-SV at that time as being £187m but still rising. ASCOD to Ajax development was originally contracted at £500m but an additional £100m uplift was subsequently agreed. Making allowances for inflation on the costs and taking the funding for FLAV, FFLAV, FSCS-TRACER, TRACER, FRES, MRAV, FRES-UV and the ASCOD to Ajax development as a whole, the bill comes to approximately £1.7bn – this does not include procurement costs for the Ajax fleet, nor for the MIV programme’s Boxer procurement, the very same MRAV vehicle that the UK decided was not suitable for UK forces back in 2003. Nor does it include industry’s own wasted R&D funds, a factor which surely weighs heavily on industry’s willingness to put its cash into future MOD initiatives.

At a meeting with DSTL looking at the Anglo Engineering Concept designs of light armoured vehicles (these being much along the original FFLAV and early FRES concept lines), an officer from Royal Armoured Corps stated they had assessed the cost of UOR armoured vehicle procurement that would have been unnecessary had the promised family of CVR(T) replacement armoured vehicles been delivered as originally intended. The Public Accounts Committee in 2011 declared this cost to be £2.8bn. Most of the UOR assets have since been sold off at a tiny fraction of their acquisition price.

So the accumulated cost of the decades of AFV design studies and of failing to get CVR(T) replacements in place when they were originally required has reached £4.5bn without production contract costs, and still Ajax is not in front-line service. Indeed there have recently been concerns voiced about its basic armour structure and its turret design, issues if valid that may in their resolution add further delays. Similarly the MRAV/FRES-UV/MIV fleet of Boxer vehicles has yet to be delivered. It is currently three and a half decades since the start of the CVR(T) replacement task.

The Times (6 September 2020) stated Ajax spend to date is £2.75bn not £600m, which would raise total accumulated cost to £6.65bn. The Times however does not define what is included in its figure.

4. **What other capabilities has the Army sacrificed in order to fund overruns in its core armoured vehicles programmes?**

This is a question for the Army to answer.

5. **How flexible can the Army be in adapting its current armoured vehicle plans to the results of the Integrated Review?**

It has no option. There are fleets of vehicles (armoured and soft-skin) that will be in service at the time when the review applies. Within the 5-year window of the review's applicability it is highly unlikely funds will be available to commission additional gap-filling vehicle family procurements, nor that such procurements even if funded would complete within the 5-year term. The only option is to move the available platforms into force structures that best meet the Integrated Review's demands, or fall back on UOR stopgap purchases.

6. **By 2025 will the Army be able to match the potential threat posed by peer adversaries?**

Name your peer. By some measures (functionality of equipment, professionalism of soldiers, robust effective tactics) the British Army would be a peer of China or Russia, but absolutely not if combat mass is the measure. Taking both capability and mass in the round, our peers may not be as impressive as we would hope.

3.

7. **Is the Army still confident that the Warrior CSP can deliver an effective vehicle capability for the foreseeable future?**

Clearly a question for the Army. Although from the outside the Ajax family and Warrior CSP are very similar platforms but with virtually no common support. This does not seem to constitute efficient use of funds.

8. **To what extent does poor contractor performance explain the delays to the Warrior and Ajax programmes?**

Before answering, a swift analogy. In the 1970s the British car industry was the laughing stock of the western world. Every week another strike, every week some new demand to keep unproductive staff on full pay, every week the union shop stewards putting blame on the management. Was this dire state of affairs solely the result of union unilateral anti-management warfare? Or was there a lack of sound management, a lack of investment, a lack of direction that allowed poor working practices to flourish in outdated worn-out factories producing poor quality vehicles of compromised design?

Looking then at the Warrior CSP and Ajax programmes, where the contractor has taken poor decisions or diverted effort to aspects of limited or dubious worth, wouldn't good management identify the issue and redirect the contractor to more productive more successful activities? Sadly a major proportion of poor contractor decisions are taken with the best of intent, putting significant effort into attempts to rectify some perceived deficiency flagged (officially or unofficially) by an MOD or Armed Forces representative. Rabbit-holes, my American colleagues called them. Added to the combination of parochial tasking and hands-off management, there are enablers required from the customer to keep projects moving; the lack of timely delivery of Government Furnished Equipment (GFE) or Information (GFI) has undoubtedly held back progress. Clearly some elements of poor performance may be down to contractor management issues, and where these are wilfully concealed from MOD oversight then the contractor deserves blame. But poor contractor performance is far from the only cause of programme delays or missed targets.

9. **Should the UK have a land vehicles industrial strategy, and if so what benefits would this bring?**

Arguments have previously been submitted to members of the Defence Committee for a fundamentally different procurement structure (AEC document "Intelligent Procurement", dated December 2015) in which it was strongly advocated that MOD DE&S function change from hands-off auditor to industry-embedded decision-maker, the aim being to cut out reporting chain and decision loop delays, and to enable full programme visibility removing the need for grand quarterly programme reviews.

3.

Competitive procurement has failed to either speed programmes or reduce their cost. No surprise when the MOD a) will only engage with Prime Contractors backed by significant capital – which means the same few bidders in each competition – and b) has an extended multi stage bidding process that requires significant investment from bidders over many years (sometimes more than a decade) with the most likely outcome of not getting a production order.

It is time for MOD to cease its lordship over commercial organisations (it refers to itself as The Authority, which speaks volumes as to MOD's view of its intellectual superiority over mere industry). In place of the remote customer that expends all efforts trying to prove by audit that the contractor is failing to meet expectations, the MOD should join industry teams as peers, embedded in the decision making process, taking real-time responsibility for programme direction just as does the management of any commercial business. Delays dramatically reduced, visibility of issues plain and clear, programmes kept on track and focused on efficiently meeting User need.

This is not greatly different from Cost-Plus, a system that at face value should have provided first rate government-owned designs. Cost-Plus failed because MOD insisted on operating by remote report and audit and lofty directives rather than by getting directly involved in project development, a management model inevitably resulting in a series of expensive project failures.

10. **What sovereign capability for the design and production of armoured vehicles does the UK retain?**

The UK has expert businesses in the design and production of armour, of drivechain components, of suspension systems, of sensors and sights, of electronic architecture systems. There is still expertise in armoured vehicle design. There is also a wealth of capability in the automotive sector (EV, battery and hybrid systems may be especially valuable for leverage into AFV programmes). It may be difficult to declare these 'sovereign' as many businesses are now under off-shore ownership, and their masters may choose to move the business abroad. There will still be components made abroad fitted to locally designed and built platforms, but that has been the case since the 1940s. All the same, the expertise currently exists to design and build armoured vehicles in this country. Political will however is lacking.

11. **Does it make sense to upgrade the Challenger 2 when newer, more capable vehicles may be available from our NATO allies?**

The physics of armour does not change with passing fashion. Just because a tank is physically newer does not ensure its protection is superior. Suspension design has not significantly changed. Diesel engines though have moved on, becoming electronically controlled and suffering emissions control measures (both of which reduce battlefield survivability) and there are better sensors and IT systems now available. But whether a new British design is manufactured, or Challenger is upgraded, or an

imported tank such as Leopard 2 or Abrams is bought and upgraded (along FRES ASCOD 'COTS purchase' lines), the costs would be much the same and the resulting capability would be much the same. Only British designed and built products though have export potential.

12. What other key gaps are emerging within the Army's armoured vehicle capability?

With the loss of CVR(T) and FV430 series, there will be no small agile combat armour capability. This is the gap the Anglo Engineering Concepts family of light armour has been designed to fill.

13. Has the Army learned from previous failures such as FRES to ensure new vehicles are acquired effectively?

There is little evidence that either vehicle key capability determination nor methods of procurement have been addressed or upgraded in the light of past programme performance. The mantra would appear to be to do exactly the same but with more rigour. There is a well known saying: To keep doing exactly the same thing over and over, each time hoping for a fundamentally different outcome, is the definition of insanity.

10 September 2020