Written evidence submitted by Nicholas Drummond
“Progress in Delivering the British Army’s Armoured Vehicle Capability.”

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(Disclaimer: In addition to being a defence industry analyst and commentator, the author of this document presently acts as an advisor to KMW, Germany. While every attempt has been made to provide an impartial and independent view of the topics discussed below, there is potential for a conflict of interest. In particular, comments relating the Challenger 2 Life Extension Programme (LEP) may be viewed as being compromised by the author’s relationship with KMW, especially as KMW believes its own Leopard 2A7 MBT is a superior solution to the Challenger 2 LEP. The same may also be true for Boxer, as KMW is part of the ARTEC consortium responsible for delivering it to the British Army, although Boxer is no longer in competition with other vehicles. To avoid confusion, readers may prefer to view this written evidence as an industry insider view, rather than an independent view, even though the author’s comments are not guided or endorsed by KMW.)
Section 1- Introduction

Armoured vehicles are as important to the British Army as warships are to the Royal Navy and combat aircraft to the Royal Air Force. If there is one major difference between the three services, it is that ships and planes cannot seize and hold contested territory; but boots on the ground can. Armoured vehicles were invented during the First World War to facilitate manoeuvre under fire. Protected mobility is relevant today because it still enables troops to deploy safely wherever needed and to be effective when they get there.

Modern armoured vehicles need to be reliable across multiple dimensions. They must withstand the kinetic effect of weapons designed to eliminate them, as well as environmental extremes. Bringing armoured vehicles into service inevitably takes time and effort. Typically, it takes 10 years to develop and perfect a new vehicle type. Once acquired, a platform will stay in service for 20 to 30 years - and sometimes longer. Consequently, the acquisition process has to be comprehensive and uncompromising.

In considering how the Army can improve the way it purchases vehicles, this written evidence seeks to be objective, constructive and fact-based. The progress of current programmes has been evaluated within the context of three over-arching questions:

A. Have we learned from past mistakes?  
B. How will this inquiry influence the 2020 Integrated Review?  
C. How will it support the Army’s urgent need for modernisation?

The perspectives that follow are based on insights gained from discussions with serving Army personnel, Ministry of Defence insiders, academic experts, industry colleagues, and fellow defence analysts. The author would like to thank all those who have provided their input.

A. Have we learned from past mistakes? In 2011, the National Audit Office (NAO) published a report on “The cost-effective delivery of an armoured vehicle capability.”1 This was a response to four consecutive programmes conducted over a 10-year period (FFLAV, MRAV, TRACER, and FRES), all of which failed to deliver a single new vehicle to the Army, and after £321 million of taxpayers’ money had been spent. The report was scathing in its criticism of the Army and Ministry of Defence, blaming cancellations, delays and extra costs on seven major factors:

• Bloated and complex requirements which were insufficient to cope with rapidly evolving needs and that created unacceptable delivery timelines
• An unwillingness to compromise on key requirements when issues arose
• Inefficient processes for managing programmes including scrutiny, assurance and approvals
• Development schedules that were unachievable without major technological breakthroughs
• Poor planning and management of resources
• Constant changes to the financial profile of programmes due to cost-overruns
• A cycle of annual budget resets that forced less important programmes to be cancelled or delayed, often reducing the final quantity of an item being acquired.

The NAO noted that the Army’s standard acquisition process was unnecessarily bureaucratic and unwieldy, and that the method of delivering Urgent Operational Requirements (UORs) for equipment used in Iraq and Afghanistan had been more effective, because it was leaner and better

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able to accommodate compromise. The report recommended that the UOR process be used to establish a fresh approach to vehicle procurement.

Almost a decade later, the Army has successfully delivered a range of new and upgraded vehicles through core vehicle programmes and urgent capability requirements, including Foxhound, Jackal/Coyote, and Viking. These have provided the Army with more than 1,000 platforms. Today, the Army is running six flagship vehicle programmes, including three that were initiated before the 2011 NAO report was published. Despite £2.75 billion being spent on the Ajax Reconnaissance Vehicle, only a handful have been delivered. Upgrades for the Warrior Infantry Fighting Vehicle and Challenger 2 Main Battle Tank have been in-development for more than a decade, but no production contract has yet been awarded. In February 2020, the NAO released its Equipment Plan 2019-2029 report. This identified a potential £13.0 billion funding shortfall across the Ministry of Defence’s Equipment Plan. While some of these extra costs relate to other services, e.g. the Navy’s Carrier Strike and submarine programmes, there is no escaping from the fact that half of the Army’s vehicle programmes are over-budget and late.

B. How will this inquiry influence the 2020 Integrated Review? On 6 September 2020, in an opinion piece for The Sunday Times, the Secretary of State for Defence, Ben Wallace MP, said: “For too long we have had a sentimental attachment to a static, armoured-centric force structure anchored in Europe, while our competition has spread out across the globe.” While this view may suggest a likely reduction in heavy armour, his underlying purpose was to signal the need for the Army to change the way it fights. For more than half a century, the bulk of the Army was based in Germany to address the threat posed by the Soviet Union. This singular focus was a necessary strategic priority, but wasteful and limited the Army’s ability to be used elsewhere. Today, the UK faces not one but several major threats. Therefore, a core objective of the Integrated Review is to re-configure the Army so that it is flexible yet capable of responding across multiple scenarios.

Whenever defence reviews are held, this inevitably leads to a debate about whether tanks are still relevant, but, at its core, this discussion is not about vehicle types, but strategic choices. With a smaller army and fewer resources, we cannot do everything, but whatever we do choose to do, we must do well. Therefore, it is necessary that armoured vehicle programmes, especially those that were started a decade ago, are reviewed to ensure they are still relevant to the way the Army would actually fight if deployed. The reality is that the Army’s doctrine and thus its capabilities do need to move on from redundant Cold War thinking. Recognition of this has been a driving force behind the Army 2025 plan that will make it “expeditionary by design” and is the inspiration for the Strike Brigade concept.

We should absolutely question the ongoing relevance of individual platform types, but an underlying assumption of this document is that heavy armour armour has an enduring utility. The history of major conflicts (including WW2, Korea, Vietnam, Iraq, Afghanistan and, most recently, Ukraine) unequivocally shows that troops who deploy under armour suffer fewer casualties than those who deploy on foot or in unprotected vehicles. A 2017 article in the US Institute For National Strategic Studies about Mine Resistant Ambush Protected (MRAP) vehicles reported that they had reduced US Army operational casualty rates from 22% to 6% versus Humvees. In Iraq, the vulnerability of the British Army’s Snatch Land-Rover to improvised explosive devises (IEDs) caused a political storm that raged until a suitable replacement was fielded. This should leave the

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2 “We must sacrifice tanks and sell more arms to fund hi-tech warfare, warns defence secretary.” The Sunday Times, article by Tim Ripley & Tim Shipman, 6 September 2020. https://www.thetimes.co.uk/article/we-must-sacrifice-tanks-and-sell-more-arms-to-fund-hi-tech-warfare-warns-defence-secretary-76wb7kwx8


4 Tell-Tale MRAPS, Dr. Christopher Lamb, Institute For National Strategic Studies. https://inss.ndu.edu/news/Article/1428853/tell-tale-mraps/
House of Commons Defence Committee in no doubt that the protection offered by armoured vehicles used by frontline troops has a direct impact on their survivability and thus their capacity to achieve mission objectives.

C. How will it support the Army's urgent need for modernisation? A third contextual strand is how the British Army has evolved since the end of the Cold War to the present day.

The “Peace Dividend” resulting from the dissolution of the Soviet Union allowed money that would have otherwise been spent on defence to be diverted elsewhere. A lack of investment since 1991 has caused the Army to atrophy. The one major attempt to re-set its post-Cold War structure was the 1998 Defence Review. Unfortunately, its ambitions were thwarted by 9/11 and the resulting War on Terror that led to UK deployments to Iraq and Afghanistan. By the time the drawdown occurred in 2014, much of the budget allocated for modernisation had been consumed by urgent operational requirements. Many of the new armoured vehicles acquired prior to 2014 were sub-optimal, either because the capabilities they offered were not rounded, or because they were worn-out after continuous use in a harsh and unforgiving environment.

To make matters worse, the 2010 Strategic Defence & Security Review was not concerned with an objective, financially-neutral recapitalisation of the Army, but balancing the Government’s budget after the Global Financial Crisis of 2008. The resulting cuts diminished the Army both in size and combat power, despite the fact that it was fighting two wars simultaneously. Today, the Army is suffering from the cumulative effect of chronic underinvestment and lost capabilities at a time when Britain is faced with an increased number of existential threats. Although the 2020 Integrated Review promises to align UK Defence commitments with foreign policy, it may have been overtaken by events. With Covid-19 threatening the economy just as we prepare for a future beyond the European Union, the need for further belt-tightening may lead to a defence strategy driven more by what we can afford to do, than by what we believe we ought to do.

In terms of modernisation, successive governments have kicked the can down the road to the point where the Army is now facing block obsolescence across a broad array of capabilities. This includes armoured vehicles, but also artillery and communications systems. So, there is a need to conduct an extensive range of modernisation initiatives simultaneously at a time when resources are stretched to the limit. This presents the Government with a significant challenge.

While resources are expected to be constrained in the short-term, further postponement of Army regeneration is likely to impact morale and therefore recruitment and retention. Contrasting, the impending arrival of new capabilities, e.g. Boxer, can positively influence recruitment and retention. We must be realistic in recognising that we cannot do everything immediately, which may force us to gap certain capabilities. Long-term, however, we must establish a credible and affordable vision that can be achieved over time.

HCDC questions:

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

   The short answer to this question is: yes. The Army has a very clear understanding how to employ its armoured vehicles in future operations.

   Traditionally, the utility offered by armoured vehicles was measured by the three elements of the “iron triangle:” **Firepower, Protection, and Mobility**. Today, the Army recognises that three

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https://commonslibrary.parliament.uk/research-briefings/rp98-91/
additional factors have become equally important: **Connectivity** (vehicle C4I systems that enable information to be shared across units); **Adaptability** (the flexibility of a vehicle to perform multiple tasks with minimal reconfiguration); and **Sustainability** (vehicle operating costs and ease of support). These factors define a "capability matrix" where choices are made by making trade-offs, usually determined by cost, complexity, combat utility and crew factors. The Army's appreciation of these attributes underpins its doctrine and tactics.

The issue is that heavy armour - main battle tanks (MBTs), infantry fighting vehicles (IFVs) and self-propelled guns (SPGs) have become extremely large, heavy, sophisticated, expensive and difficult to deploy. The challenges associated with transporting a tracked armoured infantry brigade (5,000-6,000 soldiers) are so significant that getting to the fight has become as challenging as the fight itself. But, to compete, you have to be present. If heavy armour cannot deploy quickly enough to influence the outcome of a battle, then the money spent to acquire it will have been wasted.

The Army used to think about vehicle mobility simply in terms of on-road versus off-road performance, with tracked vehicles optimising cross-country agility and wheeled vehicles maximising on-road speed. The Army now thinks in terms of Strategic, Operational and Tactical mobility. Strategic mobility is how a force deploys from the UK to a destination country. Operational mobility is how it deploys from the port of entry to the area of combat operations, usually via a Forward Operating Base (FOB). Tactical mobility is ease of movement around the area of combat operations.

As the Army aligns its vehicle requirements around revised strategic priorities, there are voices that suggest heavy armour is obsolete, because it has become too heavy. With a combat weight of 75 tonnes, Challenger 2 presents a problem not only getting to the battlefield but moving around it, because so few bridges can support such weight. However, no other vehicle can provide the shock effect, weight of firepower, resilience and survivability of a MBT. In some situations, it will be the only effective means of dislodging a firmly entrenched enemy. Used in conjunction with infantry fighting vehicles and artillery, tanks can prevail in a way that no other armoured vehicle can. As a senior Australian officer responsible for AFV procurement noted in 2019: "Tanks are like dinner jackets. You don’t need them very often, but when you do nothing else will do."

We also need to remember that according to the IISS Yearbook 2019, there are approximately 77,000 tanks that remain in service across the globe. Of those, around 24,000 belong to potential adversaries and could be ranged against us. While anti-tank guided missiles (ATGMs) are highly effective in neutralising tanks, typically an AFV will carry 2-4 such missiles, while a tank will carry at least 20 rounds of armoured-piercing ammunition. Our allies and potential enemies alike are investing in new or upgraded tanks. Thus, investing in heavy armour is not a vanity project; it reflects the enduring relevance and supremacy of vehicles that combine high levels of lethality and survivability.

The need for greater expeditionary mobility is well understood by the Army. The deployment of UN forces to Kosovo in 1999 established the need for a lighter force that could respond quickly, while at the same still possessing heavy weapons. This gave birth to the US Army’s Stryker Brigade concept⁶ that has since become a blueprint for medium weight forces across NATO and the basis for the British Army’s own Strike Brigades.

The core of Army 2025 is the duality of tracked Armoured Infantry brigades and wheeled Mechanised Strike Brigades. Tracked Armoured Infantry Brigades take longer to deploy but are highly resilient. Wheeled Mechanised Strike Brigades are agile and rapidly deployable, but less resilient. The two type of formations complement each other, providing commanders with flexible force structures to suit the task at hand. In addition to Strike and Armoured Infantry Brigades, an additional range of light armoured vehicles will be acquired to provide an array of platforms to suit

different missions and terrains. This will ensure that at least 12 out of 32 infantry battalions have protected mobility. Few would question the mix of vehicles the Army wants. The question is whether the overall structure they are part of is affordable when resources are so constrained?

From a political perspective, it is easy to understand the military value contributed by a Navy ship or RAF jet, and while a tank’s utility can also be easily explained, it never operates in isolation, but as part of a highly sophisticated combined arms battle group. Like an orchestra, Army Brigades and Divisions rely on multiple elements to deliver effect. A brigade with 500 armoured vehicles is likely to cost £3-£5 billion to equip. This is difficult to explain to non-Army audiences. The fundamental issue here is not the Army’s understanding how to use such vehicles, but justifying the required force structure and cost.

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

It should be noted that the aspiration of the 2015 SDSR was to field a single war fighting division with four brigades, not an armoured division. The intention is to generate two Mechanised or Strike brigades and two Armoured Infantry brigades.

To achieve a Full Operating Capability (FOC), it is assumed that the industry partners for the Army’s major vehicle programmes would need to manufacture and deliver all contracted vehicles by January 2025. This baseline will be used to evaluate whether the Army will be able to field Strike and Armoured Infantry Brigades. There are six programmes as follows:

A. Warrior IFV Capability Sustainment Programme
B. Challenger 2 MBT Life Extension Programme
C. Ajax CRV Programme
D. Boxer MIV Programme
E. MRVP Package 1 - JLTV
F. MRVP Package 2 - Eagle or Bushmaster
A. Warrior IFV Capability Sustainment Programme. The Government’s Infrastructure & Projects Authority, Major Projects Report 2019\(^7\) has, for the second year running, suggested that the Warrior Capability Sustainment Programme (CSP) is undeliverable. Until a production standard that fully meets the requirement has been achieved, it cannot be said with any degree of certainty whether Warrior 2 can be fully delivered by 2025. Reliability Growth Trials are ongoing. Assuming a successful conclusion in Q2 2021, Lockheed Martin should be expected to commence production within 36 months of being awarded a manufacturing contract. However most of the recommended changes will only be implemented when the vehicle goes into production. They will need to be tested before upgraded vehicles can be delivered. If suggested modifications do not work as expected, they will require further modifications to be made, which could delay delivery further. In any event, implementing changes during production introduces additional programme risk.

Other risk factors include increased platform weight, creating a requirement for a driveline upgrade. This is presently unfunded. Another concern is whether the budget allows for the platform deficiencies identified in 2010\(^8\) to be addressed:

- Underfloor protection (fuel tank relocated to mitigate the effect of an underfloor blast)
- Engine compartment bulkhead design (risk of fire spreading rapidly to the crew compartment)

\(^7\) Infrastructure and Projects Authority, Annual Report on major projects 2018-2019

• Loss of interior space due to turret basket intrusion and ammunition stowage (cramped interior)
• Internal ammunition stowage (risk of fire in case the vehicle is hit).  

Warrior CSP is a programme that has been running for almost a decade, with an estimated total of £431.1\textsuperscript{10} million spent to date, without a production contract being awarded and without a single vehicle being delivered. The original budget to upgrade 380 vehicles was approximately £750 million. This increased to £1.31 billion and then to £1.55 billion. It is understood that the final figure may now be closer to £1.8 billion. If this is correct, the value-for-money case for a vehicle that is expected to have a service life of 10-15 years will be hard to substantiate. Ultimately, Warrior itself may now be technically viable, but the Treasury could decide the cost is unacceptable. The above figure does not include through-life support costs.

In comparison, five other new IFV solutions are readily available. The BAE Systems/ Hagglunds CV90 is a thoroughly proven platform with known costs (£3.5 million basic price per chassis excluding turret). Rheinmetall’s KF41 Lynx is a next-generation platform being purchased by Hungary and evaluated by Australia. This has been produced to meet stringent cost requirements. Hanwha’s AS21 Redback will enter South Korean service having been developed for Australia. General Dynamics has announced the Griffin III platform to meet the US Army’s Optionally Manned Fighting Vehicle (OMFV) requirement. KMW’s Puma IFV was recently acquired by the Bundeswehr. Assuming an acquisition cost of £6 million each for 380 vehicles, a budget of £2.3 billion would allow Warrior to be replaced with a brand new vehicle. Acquiring any of the above IFVs would cost much more than the Army has budgeted for Warrior CSP; however, all would offer a much better value-for-money through a 30 to 40-year lifespan, lower through-life support costs, and commonality with other NATO allies. The total lifetime cost for a new IFV over 20 years is likely to be less than that for Warrior.

For the above reasons, a better solution could be to gap the Army’s IFV capability for 3 to 5 years, focus on other vehicle priorities, and then commence a new-build tracked IFV programme when an increased budget is available. However, is it not acceptable to delete this capability without defining a replacement schedule. Doing so would reduce the total number of protected mobility platforms available to the Army compromising the safety and security of British troops engaged in high intensity peer warfare.

B. Challenger 2 MBT Life Extension Programme.

Challenger 2 has not been upgraded since it entered service in 1998. In fact, the upgrade was planned as early as 1990, but took 8 years to deliver, so is closer to 30 years in age. Since the tank was already obsolete in 2016, the scope of the LEP has been increased to address lethality and survivability concerns. The addition of a new turret, new 120 mm smoothbore gun, new ammunition type, new turret electronics, and an upgraded driveline effectively transform the LEP from being an obsolescence management exercise into a new tank programme. As both Warrior and Ajax programmes show, new armoured vehicles take 10 years to bring into service. This was equally true for KMW’s MBT, the Leopard 2, which took a decade to perfect. Assuming a production contract is awarded in 2020, KMW’s subjective view is that Challenger 2 LEP is unlikely to be delivered before 2030. Concern about this programme’s deliverability was independently expressed by the Infrastructure and Projects Authority in its 2019 report.

\footnote{The Daily Mail, by Ian Drury, 8 March 2012 https://www.dailymail.co.uk/news/article-2111812/Afghanistan-soldier-deaths-Did-6-pay-lives-flaws-Warriors-armour.html}

The original LEP budget was approximately £771 million. This has now increased to £1.3 billion.\(^\text{11}\) This figure does not include through-life support costs, which are likely to be at least two times the acquisition cost over the vehicles lifecycle. At the moment, there is no transparency on this.
It is strongly recommended that the House of Commons Defence Committee investigates the total support costs of the Challenger 2 fleet since 1998. This will establish the value-for-money case beyond reasonable doubt.

If Challenger 2 is to remain in service, the proposed series of upgrades are essential to maintain a credible UK MBT capability. Unfortunately, increased programme scope within a finite budget is likely to reduce the total we can afford to upgrade. Of the current fleet of 227, we may only be able to life-extend 150-170. This translates into two regular tank regiments plus one reserve unit.

This raises the question of what is a minimum credible number of tanks? An armoured infantry brigade typically has one or two tank regiments. The US approach allows for square brigades with 2 x MBT regiments and 2 x IFV regiments. So, ideally the UK ought to have 4 tank regiments. Assuming 56 MBTs per regiment, this equates to a requirement of between 230. Prior to 2010, the Army had 386 Challenger 2s. Regenerating such a capability is obviously unaffordable within the current resource envelope, but 230 ought to be affordable.

The Army believes that two regular MBT regiments plus a training and reserve regiment, or 170 tanks, is sufficient. Most of our NATO allies have 200 MBTs, so 170-200 really is a rock bottom number. If we cannot afford to resource this minimal MBT requirement, some defence analysts believe the capability should be gapped until such time as the budget allows it to be properly regenerated. This is not acceptable. If a major crisis required NATO to deploy armoured forces to counter a peer or near-peer adversary and Britain turned-up with ATGM-equipped Jackals, we would quickly be overmatched and lose all credibility as a Tier 1 Army.

The Franco-German next generation tank programme, Main Ground Combat System (MGCS) is expected to result in a new tank being available from 2035. Since the UK has yet to join this programme, it is unlikely to be able to acquire a new MBT before 2040, possibly later. If the Army were to gap its MBT capability, it could be 20 years before a new tank is purchased. There is also the issue of what happens if MGCS is delayed, cancelled or fails to meet UK requirements. We could find ourselves in a position of needing to fund a second Challenger 2 LEP.

Like Warrior CSP, the Treasury will want to determine whether the Challenger 2 LEP offers value-for-money. If it arrives in 2030 but will be obsolete by 2035, then its utility will be limited. For these reasons, it may be worthwhile to evaluate whether potential alternatives to the LEP, including a new tank purchase, are a better means of covering the gap between 2035 and 2045.

A supplementary issue is that if we want the Army’s MBT fleet to be deployable, then it must acquire a sufficient number of Heavy Equipment Transporters (HETs) to move them from a theatre entry point to forward areas. HETs are also needed to move other tracked vehicles, including IFVs and SPGs. The Army presently has a fleet of 90 HETs (of which 70 are understood to be serviceable). It probably needs around 200 if it is to deploy Challenger 2, Ajax and Warrior.

**C. Ajax CRV Programme.** This is a replacement for the Army’s CVR(T) Reconnaissance Vehicle family, which has been in service since the 1970s. Ajax started life prior to 2010 as the FRES SV programme. From the outset, this was an ambitious project to develop a sophisticated, fully digitised armoured vehicle platform. The project was started at a time when it was thought that developing a bespoke platform was preferable to buying an off-the-shelf solution.

BAE Systems offered CV90. General Dynamics Land Systems (GDLS) offered the ASCOD 2 IFV platform. GDLS won the competition in 2010. The contract award was made in 2014 with deliveries

scheduled for 2018. After difficulties were encountered, the programme was re-based with delivery rescheduled to 2020. Assuming all outstanding issues have been resolved, it should be possible to achieve a full operating capability by 2024.

As GDLS UK has reported, delays are due to issues with the 40 mm CTAS cannon ammunition handling system and Lockheed Martin turret. GDLS UK says that delays were partly attributable to issues with the vehicle tracks (made by William Cook) but these have now been addressed. The other delaying factor is the sheer amount of time it takes to establish the safety case for the vehicle’s many systems.

There is potentially a more fundamental issue with Ajax, which is mixing tracks and wheels in a single formation. Ajax lacks the operational mobility to keep-up with Boxer on 2,000 km road deployments. The mechanical complexity of tracked platforms means that they generally have a higher Mean Time Between Failure (MTBF) rate than wheeled vehicles. The fire support that Ajax offers is definitely needed within Strike Brigades, but a wheeled reconnaissance/fire support vehicle would be preferable to a tracked one.

One option to overcome issues with both Warrior and Ajax is to re-structure the Ajax order so that more of the Ares personnel carrier variant are acquired. Ares could then be used by infantry battalions in conjunction with MBTs as an alternative to Warrior. Since Ajax and its stablomates are based on an IFV platform, refocusing the order around infantry needs should be feasible.

D. Boxer MIV Programme. Boxer started life via the Multi-Role Armoured Vehicle (MRAV) programme in 1998. This was a joint initiative by Britain, Germany and France and based on a significant number of UK requirements. If we had not left the programme, Boxer could have entered British Army service in 2009. The decision to withdraw from MRAV was based on a requirement for the vehicle to fit within a C-130 Hercules aircraft, which had a payload capacity of 20 tonnes. It was not possible to achieve the level of protection mandated by the Army within this weight envelope. When the programme resumed, as FRES UV, the weight limit was dropped. Ultimately, it has been a long and tortuous process to acquire an 8x8 medium weight capability, but the Mechanised Infantry Programme will finally deliver it. The German Bundeswehr first acquired Boxer in 2009 and deployed to Afghanistan from 2011. Not a single soldier was injured in one and no vehicle was lost.

This type of wheeled platform uniquely combines off-road and on-road performance with very high levels of protection. Highly modular by design, Boxer allows a range of swappable mission modules to be exchanged easily and quickly so that the platform can perform multiple roles. It will give the Army unprecedented flexibility allowing units to simply get in and go wherever they are needed. It is suitable for low, medium and high intensity operations. It has a reduced logistical footprint. More than any other new vehicle being acquired by the Army, Boxer will transform its operational capabilities.

A manufacturing contract for Boxer MIV was awarded in December 2019. Production is ramping-up with the first vehicles expected to be delivered in 2022. Given that ARTEC (the consortium responsible for Boxer and comprised of Rheinmetall and KMW) has delivered Boxer to Germany, the Netherlands, and Lithuania according to the schedule, there is every chance that UK deliveries will also be on-time. Besides, a production schedule that requires only 50 vehicles to be delivered per year over 10 years, spread-out over four production sites, is not particularly onerous.

There are a couple of concerns with Boxer. One is that the 523 vehicles being acquired are only sufficient to equip a single Strike Brigade, when the aspiration is to field two. Second, we are only acquiring four basic versions when additional variants are needed, including Repair & Recovery, Mortar, Anti-tank, Reconnaissance, Artillery, Air Defence, Engineer, and Bridgelayer. Moreover, the basic infantry carrier will only mount a 12.7 mm heavy machine gun, while the operational experience of similarly equipped units has seen them upgraded with medium calibre cannon (30-
40 mm) turrets. Fitting more potent weapons to Boxer has to be a priority if it is to compete versus peer adversaries.

**E. MRVP Package 1.** This is a requirement for a 4x4 Command & Liaison Vehicle and Tactical Support Vehicle to replace Panther and Husky with a single platform. The Oshkosh JLTV was chosen to meet this requirement without a competition via a Foreign Military Sales (FMC) contract with the US Army. Although the failure to hold a competition was a major blow to UK firms that felt well-positioned to meet this requirement, JLTV is an undeniably good platform. The key driver of the decision to acquire it is the comparatively low price (approximately £291,000 per vehicle) when most competitors are likely to cost around £900,000.12 However, the integration cost and additional engineering work that may need to be done to meet emission standards and fit UK communication equipment, could push-up the price to a point where it becomes comparable to alternative UK platforms.

The acquisition of JLTV is not without its detractors. Given the impact of Covid-19, there is now a stronger case for supporting UK industry by opting for a locally-produced MRVP option. However, it is unlikely that any alternative vehicle would be produced at a lower cost, since the US Army has ordered an initial quantity of 16,901, while the US Marine Corps has requested 9,091. The UK's MRVP Package 1 contract allows up to 2,747 JLTVs to be purchased in a $1.04 billion (£800 million) deal.13 While US manufacturing costs cannot be matched, it would help UK industry if JLTV could at least be supported in the UK by a local firm. Therefore, it is strongly recommended that a UK Through-Life Support (TLS) partner is mandated so that spare parts are readily available and vehicles do not need to be returned to the USA for base overhauls.

The MRVP Package 1 programme is currently in the Demonstration Phase, which is designed to ensure that UK equipment required to be used with the vehicle is compatible.14 This programme appears to be on-track. Given the success of JLTV in the USA, there is no reason why this platform, like Boxer, cannot be delivered according to the schedule.

**F. MRVP Package 2.** This is a requirement for a 4x4 or 6x6 Battlefield Ambulance and Troop Carrying Vehicle. A competitive evaluation was conducted and a decision is pending on which of two contenders, the GDELS Eagle 6x6 or the Thales Bushmaster 4x4, is the winner. Both of these platforms are excellent. Both are already in service with other armies. (Some 24 Bushmasters are already in limited UK service). With known costs and a straightforward production ramp-up, programme risks are low. The next step would be for the winning bid to move forward to a Demonstration Phase, like JLTV, to ensure UK equipment is compatible. As with other, Military Off-The-Shelf (MOTS) platforms, it should be expected that production could commence within 36 months of contract award. Unlike JLTV, both Eagle and Bushmaster would be UK-produced.

It is understood that MRVP Package 2 has now been delayed by 24 months, but there has been no official announcement. This programme is an example of a less important programme being deferred to make-up for a shortfall in the budget. Many of this vehicle's roles will also be performed by Boxer (Troop carrying and Ambulance) except that Boxer offers much higher levels of protection, mobility and firepower at a higher cost. MRVP Package 2 was designed to ensure that more British troops would benefit from having protected mobility. If this programme were cancelled, it would create an operational risk for troops deploying in unprotected vehicles. If the original delivery schedule were retained, it should be entirely possible to deliver all vehicles by 2025.

**Perspectives on the above vehicle programmes in terms of the extent to which they reveal an improved acquisition approach**

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12 Based on the cost of the GDLS Foxhound with 400 purchased for £370 million. Source: UK MoD
14 Ibid
While each of the above vehicles carries programme risk to a greater or lesser degree, what makes the Army’s overall acquisition process more challenging for all programmes is that the Ministry of Defence’s vehicle procurement arm, Defence Equipment & Support (DE&S), is running six programmes simultaneously. It is not clear whether it has sufficient resources to manage them as efficiently and thoroughly as it would ideally like. In particular, DE&S did not have the bandwidth needed to run competitions for MIV and MRVP Package 1. Single-source programmes can streamline acquisition, but tend to result in more expensive vehicles being purchased.

The most significant factor delaying and adding cost to the above vehicle programmes has been unexpected development issues. Technical challenges are inevitable when introducing new capabilities, especially when they include advanced technologies. When serious issues arise, delivery is “pushed to the right” so that a new capability isn’t fielded until it actually works, but also so that the Army spends within its year-on-year budget cap. The problem is that when obsolete vehicles are not replaced according to an agreed timeline, the cost of sustaining them in service beyond their original out-of-service date (OSD) adds further cost. This was previously highlighted by Sir Bernard Grey when he was Chief of Defence Materiel in 2010.\(^\text{15}\)

Institutionally, all three UK armed services are not good at managing programmes with significant development requirements, because they consistently underestimate the time and cost to get it right. One view is that they do this deliberately so that programmes gets initial approval. If the Government knew beforehand just how much would ultimately be needed to deliver certain capabilities, it might never approve them. The desire for bespoke “gold-plated” capabilities when perfectly adequate equipment types are available off-the-shelf is a continuing frustration. Unfortunately, the services are equally bad at purchasing equipment off-the-shelf, because they invariably want to customise whatever they buy around their own unique needs.

Another factor influencing delivery is that the Army tends to change specifications after a contract has been agreed. This delays delivery and allows contractors to increase the price. It also creates a grey area in case problems occur. Contractors will use contract revisions to blame any delay on changes made, while the customer will blame a delay on poor contractor performance. Sometimes, officers who are new to a programme will reverse decisions made by their predecessors. They may also delay taking key decisions for fear of making a mistake. When these things happen, they inevitably delay the schedule, increase the price, and can even impact final product quality.

Historically, the lawyers used by DE&S teams do not appear to be as good at drafting contracts as those used by its suppliers. The lack of penalty clauses or options to void a contract in the event of an unacceptable delay, sub-standard products, and non-delivery, prevents the Army from making contractors liable for errors or poor management. Ultimately, the Army needs to be better at recognising the point at which a contractor is in default and when a contract needs needs to be rescinded.

Poor contractor performance can be an issue, but it usually results from overly aggressive price negotiation on behalf of the customer, rather than a lack of technical competence. It is not always a smart move to award a contract to the lowest bidder, especially as some suppliers will underbid simply to win a contract, believing they will always be able to eek extra cash from the customer. A good supplier will detail exactly what is included for the price, but few suppliers ever state what isn’t included. In other words, if it’s not in the contract, it is not included. Razor thin margins do not incentivise contractors to go the extra mile. Instead, they are encouraged to cut corners and take risks.

The approvals process is also a barrier to streamlined acquisition. Gaining programme approval presently requires scrutiny from DE&S internally, Army HQ, Ministry of Defence Main Building and HMT. Simply scheduling meetings for each of these entities to evaluate a proposed programme can delay it six months. There has be a more efficient way of doing this.

The practise of serving Army officers gaining acquisition experience over two-year appointments at DE&S has mixed benefits. Such positions are necessary to build and sustain good acquisition practices across the organisation, but the constant rotation of positions of responsibility within key programmes can compromise delivery. Despite such disadvantages, Army officers are equipment users as well as buyers, so provide vital input that supports the acquisition process. Sadly, most leave a project just as they become valuable to it. Given how important acquisition has become, perhaps acquisition should become a dedicated Army career track? There is a case for recruiting more retired officers into DE&S, placing them in senior programme management positions and leaving them in post until a capability is delivered. Increasingly, three-year acquisition postings are becoming routine for majors and above. While civil servants provide continuity, only the Army can provide fully qualified and experienced professionals. The Army’s Project Castle is looking at extending officer appointments in the capability and acquisition field to the age of 60. Encouraging senior officers and officers on the verge of retirement to move into capability development roles will only help improve the overall approach.

Two other noteworthy contributory factors to delay are when the Treasury is slow to release funding and Government Ministers, particular Ministers for Defence (MinDP) procurement, deferring decisions. Boxer was delayed 18 months by two separate MinDPs. (It does not help that there have been seven different MinDPs since 2010.) The piecemeal or delayed allocation of budget, even when it is for justifiable reasons, compounds the basic problems described above, because they may stall a programme. Stopping and re-starting programmes increases supplier costs to deliver, reducing profit margins. When small firms depend on consistent income streams to survive, doing business with the Ministry of Defence can be risky and frustrating. This underlines the importance of developing trust and mutually beneficial relationships between customer and supplier. Many industry partners feel bruised by recent programmes, because there is no Land Industrial Strategy that sets and manages expectations on both sides. Unless this changes, there is a risk that suppliers will decide the cost to serve the MoD is too great and target non-governmental sectors instead.

Finally, the impact of Covid-19 also needs to be mentioned. This is likely to retard all existing programmes by at least 3-6 months. This is because project teams, particularly engineers, need to collaborate in person, physically fitting, testing and refining vehicle components.

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?

Fully audited figures for the Army’s spend on armoured vehicles are available from the Ministry of Defence. This topic was also covered in detail by a previous HCDC inquiry. The following summary of armoured vehicle expenditure over the last 20 years is based on publicly available information and company information, but may not be complete.16 These figures should therefore be regarded as guideline:

A. MRAPs for Iraq and Afghanistan. These include Mastiff (410), Ridgeback (164), Wolfhound (124), Foxhound (398), and Husky (323). Given the lives they saved, they represent money well spent. Moreover, with intense combat usage, any vehicle life expectancy beyond 20 years should be viewed as a bonus. It is not right to include these vehicles within the Army’s equipment plan budget. Instead they should be considered to be part of the overall cost of the UK’s involvement in

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16 The Trojan Armoured Vehicle Royal Engineers (AVRE) and Titan Armoured Vehicle Launcher Bridge (AVLB) are not included, because they were funded before 2000 despite being delivered afterwards.
Iraq and Afghanistan. This is estimated to be about £20 billion, based on the Government's own figures. Of this, approximately £3.2 billion\(^\text{17}\) was spent on MRAP vehicles.

**B. Jackal & Coyote HMT.** The Army has acquired 444 Jackal 4x4 and 71 Coyote 6x6 over the last 20 years and they remain in service. A further undisclosed quantity of vehicles are used by UK Special Forces. Although the High Mobility Transport (HMT) platform has underfloor protection, it is not a true armoured vehicle, but provides combat mobility across extreme terrains. The total spend on these platforms is less than £180 million,\(^\text{18}\) so they represent only a small percentage of the total budget spent.

**C. 8x8 Wheeled medium Weight Capability.** The Army has spent more than 20 years trying to acquire an 8x8 armoured vehicle. Future Family of Light Armoured Vehicles (FFLAV), Multi-Role Armoured Vehicle (MRAV) - which was the original Boxer programme - and FRES UV, were all failed programmes that consumed approximately £321\(^\text{19}\) million without a single vehicle being fielded. They have been well documented elsewhere,\(^\text{20}\) but were definitely not our finest hour.

**D. FV432 Bulldog upgrade.** The FV430 platform, which entered service in 1963, was upgraded for service in Iraq at a cost of £160 million.\(^\text{21}\) Additional armour was added and the driveline was modernised. Given its 60 year service life, this platform has almost certainly delivered a better return on investment than any other British Army armoured vehicle in its history. However, it is now so old that it can no longer be deployed on operations because the basic hull cannot be further modified to counter likely threats. Some 893 vehicles remain in service.

**E. Terrier.** This is a tracked armoured engineer platform, not a true combat vehicle. A total of 60 were acquired at a cost of £350 million.\(^\text{22}\) This remains in service and is an important asset for supporting Armoured Infantry brigades. It has not been without problems and fleet availability is poor, requiring additional support costs to rectify problems.

**F. BAE Systems/ Hagglunds BVS10 Viking / ST Kinetics Warthog.** Viking and Warthog are All-Terrain Vehicles (ATVs) used for troop transport, command, logistic and other roles. Viking, along with the BV206, is primarily used by the Royal Marines. With the Army relying on an increased number of wheeled combat vehicles, this platform will become increasingly important in ensuring it retains mobility for operations in extreme terrains. A number of Vikings were lost in Afghanistan as the platform proved vulnerable to IEDs. The ST Kinetics Warthog was acquired in an attempt to provide an up-armoured ATV for use in this theatre. The UK MoD spent an estimated £150 million between 2001 and 2012 and now has 99 Vikings in service. It spent an additional £150 million on 100 ST Kinetics Warthogs, which have now been retired.

**G. FRES SV / Ajax.** Ajax has been dubbed the Army’s Carrier Strike platform. It is the most significant programme in terms of cost with a £3.5 billion initial contract and a £390 million supplementary contract for 589 vehicles of which 245 will be turreted variants. Prior to Ajax, the Army invested in the Tracer reconnaissance vehicle programme in partnership with the USA. When the US Army decided to go in a different direction, Britain was left with no alternative but to

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\(^{18}\) Source: Supacat


\(^{20}\) The British Army’s Medium Weight Capability, Think Defence Blog. https://www.thinkdefence.co.uk/british-army-medium-weight-capability/

\(^{21}\) Source: BAE Systems

\(^{22}\) Source: Army Technology. https://www.army-technology.com/projects/terrier-vehicle/
pursue an alternative platform. The extra cost of these aborted programmes is included in the FFLAV, MRAV and FRES UV discussion above.

**H. Warrior CSP.** Warrior has been in service since 1988. The Capability Sustainment Programme was well overdue, even in 2010. The original CSP budget was £750 million, as noted above. The final budget has not yet been confirmed, but the last Government estimate was £1.55 billion with £431.9 million spent to date. The total number of vehicles is 380 of which 245 will be turreted variants.

What is significant about Warrior is not the money spent acquiring it, but the money that was not spent upgrading it. Like Challenger 2, this vehicle has received no major investment to extend its life since it went into service. Had it been upgraded in 2000 or even in 2010, it would not need such an extensive upgrade today.

**I. Challenger 2 LEP.** The original budget was reported to be £774 million. The total budget is now £1.3 billion to upgrade 150-170 tanks, suggesting a unit cost of £7.65 to £8.67 million. This appears to be attractive, but support costs are likely to result in much higher overall lifetime costs.

**J. MRVP.** The final quantity of vehicles and budget for both MRVP Packages has yet to be confirmed, but is expected to be approximately £750 million for 1,050 vehicles with 800 for Package 1 and 250 for Package 2, although further tranches are likely to follow.

**K. Boxer MIV.** A total of 523 Boxer MIVs will be acquired for £2.3 billion.\(^24\)

The Army has spent approximately £7.7 billion on armoured vehicle acquisition from 2000 to date and will spend a further £5.9 billion to deliver its ongoing flagship programmes by 2025. **It will spend at least two times this amount supporting these vehicles over their lifecycles.**

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

It is misleading to suggest that the Army has deliberately “sacrificed” other equipment priorities in order to be able to afford the armoured vehicles it wants. Many current platforms are so old and worn out that, without replacement, they create an operational risk. FV432 Bulldog is approaching 60 years of service, CVR(T) is 50 years old, while Warrior and Challenger are 40- and 30-years old respectively (although the latter received a new turret in 1998).

In terms of missing capabilities, the Army’s artillery systems are in urgent need of modernisation. The AS90 155 mm self-propelled gun is obsolete. The L118 105 mm Light Gun is obsolete, but also worn-out. The Rapier air defence missile system is being replaced by the Sky Sabre / CAMM / Giraffe AMB air defence missile system, but only 24 launchers are being acquired. At least double this amount of launchers is needed to provide adequate coverage for deployed brigades. (The RAF also needs this capability to protect its airfields.)

Many armies are starting to consider **Unmanned Ground Vehicles (UGVs).** These can operate autonomously or via remote control. Where such vehicles operate ahead of advancing formations, they can provide useful weapon platforms for both direct fire and indirect fire weapons. With a smaller footprint, UGVs can be ideal for intelligence, reconnaissance, and surveillance roles. In many situations, they promise to reduce the risk to manned platforms when moving through high threat areas. A third application is logistical resupply missions. With other armies investing in

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UGVs and research into other robotic technologies, the British Army recognises the need to do the same.

The Army needs **new bridging equipment**, although Project TYRO, a programme designed to address this requirement is ongoing.

Beyond its conventional capabilities, the Army needs to invest in new areas such as **Cyber Warfare, Electronic Warfare, and Hybrid Warfare**. This suggests a wider role for the Corps of Royal Signals and Special Forces and includes a requirement to conduct operations below the threshold of conflict.

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

The Army invariably manages to operate within whatever financial and other constraints are placed upon it. The issue is not flexibility, but how effective it will be if forced to radically change or prune its modernisation plans.

Even before the impact of Covid-19, the original Army 2025 plan (2 x Armoured infantry Brigades, 2 x Mechanised or Strike Brigades and 1 x Air Assault Brigade) appeared as if it were no longer affordable. Consequently, the Army may have already accepted the need to reorganise itself around a single deployable division with three brigades instead of four (not including a further independently deployable air assault brigade). The question is what should the composition of the revised force be and what does it mean for vehicle acquisition?

As noted above, the Army believes that Armoured Infantry should be the focus of its future force structure, as this is what will most enable it to operate in partnership with the UK’s NATO partners. Yet, Warrior, Challenger and Ajax are its most problematic programmes. They are also the most expensive platforms to support. Money could certainly be saved by reducing or cancelling them, but the considerable amount of cash already spent would need to be written-off. There is also the risk of terminating these programmes at the very point a turnaround has been achieved.

To make the overall Equipment Plan affordable, either complete armoured vehicle programmes will need to be sacrificed, or the total number of vehicles purchased within each programme will need to be trimmed. The question is whether token quantities of individual platform types will deliver sufficient capability to field a credible force? The salami slicing of individual platforms to save money is a false economy when it leads to a lack of critical mass. It is far better to focus on fewer capabilities and deliver them well.

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

The Army’s ability to match the threat posed by peer adversaries depends on the overall effectiveness of brigade formations generated as a result of its vehicle programmes. It has been unequivocal in stating the need for heavy armour to ensure effectiveness in high intensity warfare at scale to counter peer adversaries. This is not just about the need for MBTs and IFVs, but also key enablers such as artillery systems, engineer, bridging support, logistics, medical and C4I assets. The risk of cutting an entire programme is that the loss of one vehicle type could prevent other vehicle types from being effective. For example, if Warrior were cancelled, for example, the Army would still need an Infantry Fighting Vehicle capability. The second risk is reducing the quantities of each platform type acquired. This kind of “salami slicing” reduces the number of vehicles within a formation. A loss of critical mass can reduce the combat utility of a formation. It can also make individual vehicle types more expensive to support.
The Army’s overall plan to generate two Strike brigades plus two Armoured Infantry brigades addresses two essential but complementary needs. Strike brigades can deploy easily and quickly but are less resilient. Armoured Infantry brigades are more difficult and take longer to deploy but are more resilient. The two formation types are designed to work together, but Strike units also have utility across medium and low intensity scenarios. Assuming that two Strike and two Armoured Infantry brigades are generated by 2025, the Army would certainly be able to counter peer adversaries.

Ultimately, brigades are like orchestras - they depend on multiple elements to deliver effect. The challenge is to balance the need for critical mass with the need for specialist equipment. If the concept of a single deployable division with four brigades (plus a fifth air assault brigade) is considered to be unaffordable, it should be remembered that during the Cold War and until 1990, the British Army had three entire armoured divisions, a fourth infantry division, and an entire artillery division. With 160,000 personnel, the Army was also double the size it is today. Therefore, the four brigades proposed by the Army 2025 plan should not be considered as extravagant. It is a bare minimum to take our place in a coalition of equals.

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

(See response to Question 2 above.)

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

Contractor performance has been a factor with both Warrior and Ajax. The failure to deliver a working turret according to the agreed timeline has hamstrung both programmes. This is what has most delayed delivery of new vehicles since 2011. In defence of General Dynamics and Lockheed Martin, these were extremely ambitious and complex programmes. The original Challenger MBT, for example, was developed in 1977. It entered service in 1983, but wasn’t optimised until the revised Challenger 2 specification was agreed and implemented in 1998. If Ajax and Warrior were entering service today, they would have followed a routine development profile. The question is: have all outstanding technical issues now been resolved and will this allow almost 1,000 armoured vehicles to be delivered?

It should be added that the Army bears some responsibility for the delays as it changed vehicle specifications once the contract had been agreed. As noted above, this is what allowed contractors to wriggle-out of their delivery obligations once they ran into development problems. The key lesson from these programmes is not to change anything once the production contract has been agreed. Since these programmes were initiated, DE&S has become much sharper at devising enabling contracts with tighter provisions.

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

A United Kingdom land vehicles industrial strategy would support industrial regeneration and growth by providing commitment at a government level to purchasing vehicles manufactured in the UK over vehicles manufactured abroad. It would incorporate clear acquisition guidelines to support major programmes. This would lead to increased efficiency, reduced risk and greater transparency. Contractor certainty about the need for domestic supply chains would simplify
planning and bidding for projects, making it faster and more efficient. This would encourage investment by domestic contractors and international firms.

If the Ministry of Defence were required to compete all programmes and follow an agreed selection process, this would help manage supplier expectations. At the same time, **HMT’s Red Book guidelines** (which define a set of criteria and rules for evaluating programmes) must incorporate any Land Vehicles Industrial Strategy so that acquisition prioritises domestically produced options rather than only value-for-money, which inevitably selects equipment from the lowest bidder.

In essence, an industrial strategy is a charter that helps to build strong mutually beneficial relationships between industry and government. When it incentivises businesses to expand and grow in this marketplace, it serves a national prosperity agenda. This requires a long-term armoured vehicles strategy with a clear industrial roadmap to enable industry to align itself with the Army’s needs. It applies to the manufacture of vehicles, but also to how they are supported through-life.

If a land vehicles industrial strategy can help suppliers to develop best-in-class vehicles, these will attract export orders, especially as the British Army’s status as a Tier 1 army is seen as a strong endorsement for such products. Export orders to overseas customers will sustain domestic prime contractors as well as their supply chains. At the moment, Supacat is the only domestic armoured vehicle manufacturer exporting vehicles to benefit the UK economy. Meanwhile the UK Aerospace industry’s export revenues for aircraft technologies generate £34 billion\(^{25}\) of income for the UK. This brings obvious benefits to the UK economy and helps to reduce the cost of buying aircraft for the RAF. A robust UK armoured vehicle industry exporting internationally would similarly make armoured vehicles less expensive for the Army.

Without a land vehicles industrial strategy, it will not be possible to re-establish the UK as a centre of excellence for armoured vehicle manufacturing. We will rely on “pop-up” facilities that are set-up only to assemble and integrate vehicles imported from abroad and that are then closed as soon as delivery is complete.

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

Five firms presently have or are developing sovereign capabilities to design and produce armoured vehicles. These are:
- Rheinmetall BAE Systems Land Ltd. (RBSL), Telford
- William Fairey Engineering Ltd. (WFEL), Stockport
- General Dynamics Land Systems (UK) GDLS, Merythyr Tydfil
- Supacat, Dunkeswell
- Thales, Scotland

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

The author’s subjective view is that the Challenger 2 LEP does not offer sufficient value-for-money. With the UK as the sole operator for this MBT type, upgrade and support costs are likely to be much greater than acquiring an alternative new-build platform in service with multiple users.

The USA’s M1 Abrams and Germany’s Leopard 2 MBTs both started life in the late 1970s, around the same time as Challenger. The difference between these tanks and Challenger today is that

\(^{25}\) Source: UK Ministry of Defence
both have been continually upgraded since being introduced, whereas Challenger 2 has received no substantive improvements since 1998.

Acquiring the Abrams MBT would give the Army improved interoperability with the US Army. It is a proven design that has performed exceptionally well in combat. The latest US Army standard, the M1A2C, incorporates a revised fire control system, upgraded armour, improved ammunition and other incremental changes to ensure it remains competitive. In particular, the Trophy active protection system has been integrated. If the UK were to acquire this MBT, it would be a refurbished second-hand model from a stock of 3,500 surplus Abrams currently held in storage. Modernisation of older vehicles would likely be completed in the USA with vehicles shipped to the UK for final integration of C4I equipment.

Buying the US Army’s M1 Abrams tank would have three disadvantages. One is the cost and complexity of bringing a major new vehicle platform into UK service with all of the related Defence Line of Development (DLOD) requirements. The second issue is US International Trade in Arms Regulations (ITAR). This would likely restrict changes that could be made to the platform. Third, Abrams has a gas turbine engine which is extremely thirsty. US Army M1A2Cs are now fitted with an auxiliary power unit which reduces consumption when the tank is stationary, but UK adoption might require an uplift in fuel re-supply vehicles to support it. As an alternative, General Dynamics has looked at integrating the MTU EuroPowerPack with a 1,700 bhp diesel engine. However, changing the basic configuration would stop it from being an off-the-shelf purchase. It would become a development programme with unknown costs and risks. Despite these drawbacks, Abrams is a formidable machine and is something we should reconsider.

A second option could be to purchase new-build Leopard 2A7s. Like the M1A2 Abrams, this is also a proven design with prodigious capabilities. Leopard 2 would give us commonality with Germany as well as with 18 other user nations. Spare parts are plentiful and cheap. It has an L/55 calibre 120mm smoothbore gun and a state-of-the-art Fire Control System. The Trophy active protection system has also been fully integrated. Leopard would be a viable off-the-shelf system that could acquired without making substantial changes. It would provide a pathway to the next generation of tank, the Main Ground Combat System (MGCS) being jointly developed by France and Germany. It could be manufactured and supported in the UK. Like Abrams, buying Leopard 2 has certain disadvantages. One is the complexity and effort required to bring a major new vehicle platform into UK service. Second is price, but since support costs are so much lower than Challenger 2, total lifetime cost could potentially be less. Few people regret buying a German car. The same is true for German armoured vehicles.

A third option would be the Korean K2 Black Panther. This has a three-person crew and uses an autoloader instead of a fourth crew member. Its hydro-pneumatic suspension allows the hull to be lowered reducing the overall profile. Poland is currently evaluating a revised version of this tank.

The Japanese Type 10 MBT, which has the same three-person configuration as the K2 Black Panther, is a fourth option. This is a smaller lighter MBT with a 40-tonne basic weight and mission configurable appliqué armour that incrementally increases weight to 44 and 48 tonnes. It may not offer the high levels of protection that British tankers are used to, but it is likely to be good in expeditionary roles. Neither the K2 or Type 10 has been combat tested and the only real reason to consider them is if they offer a significant price advantage.

The Israeli Merkava Mk IV is a fifth option. After the M1 Abrams and Russian T-72, it is the most combat tested MBT in service today. It mounts an L/44 calibre 120mm smoothbore gun and offers high levels of survivability. Uniquely among modern MBTs, the Merkava’s engine is mounted at the front of the vehicle, offering increased protection and allowing the crew to escape through the rear of the vehicle if necessary. The rear crew compartment also allows the tank to be converted into a heavy Infantry Fighting Vehicle, the Namer. This offers the same level of protection as a MBT. Since Israel is the only user, Merkava support costs are likely to be as high as Challenger 2, while depending on an overseas supply chain.
The final option is MGCS, which has been discussed above, but this is unlikely to be available before 2040 and possibly not until 2045, as Britain will need to join the queue behind the nations who have already signed-up MGCS. Waiting for MGCS could potentially force us to gap an MBT capability for 20-25 years.

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

(See need for additional Boxer variants above, including a turreted cannon variant)

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

The recommendations of the 2011 NAO report, “The cost-effective delivery of an armoured vehicle capability,” led to an organisational redesign of DE&S that improved the systems and processes it now uses to deliver capabilities. The NAO report was followed-up by the Levene report. This was a fundamental review of how the Ministry of Defence was structured and managed with the goal of creating a blueprint for simpler and more financially efficient government departments. A secondary aim was to improve capability management by moving from a delegated approach to a direct approach for equipment acquisition. This gave each of the three services control and over their budgets and the procurement process. It meant that Army HQ could allocate spend across its most essential equipment needs.

Improved acquisition processes are evident in the Boxer and MRVP programmes. The author’s experience working with the Boxer teams at Army HQ and DE&S reflects very high standards of technical expertise. For example, the officer responsible for ensuring protection requirements are met survived a serious IED attack while serving in Afghanistan. While industry may be critical of the fact that Boxer and MRVP requirements were not competed, both programmes have been ruthlessly focussed on performance and value. A deep understanding of the existing supply chain for both vehicles was developed so that the cost of every component was known. This allowed bids to be intensely scrutinised to ensure that both purchase and through-life costs were measurable and predictable. Both programmes are likely to deliver outstanding vehicles with a long service life.

The Royal United Services Institute, a defence think tank, recently released research that considered the “Management of Defence After the Levene Reforms. One observation is that entrusting financial management to each service has not helped the Ministry of Defence to manage over-commitment. Moreover, increased competition for finite defence resources encourages each service to understate costs. While a Joint Forces Command has been established, often individual services will prioritise their own needs without taking a holistic view of how different naval, land and air capabilities work in concert. Related to these issues is the fact that service chiefs are only accountable for the decisions they make during the three years they are in post, and not after they have left office. If someone is not accountable for setting an unrealistic budget and the true cost to deliver a capability is only realised after they have retired, then the process is still broken. If this correct then the Ministry of Defence Main Building may have delegated too much control.

Problems with the Ajax and Warrior programmes are partly attributable to the fact they were started prior to 2010. Few if any of the officers responsible for envisioning these programmes are still serving. If the Ajax requirements had been less ambitious, delivery could have been faster.

26 National Audit Office Report, May 2011, The cost-effective delivery of an armoured vehicle capability

the true costs of Warrior had been fully understood a decade ago, an alternative solution might already have been purchased. There is no point closing the door after the horse has bolted, but we should avoid this happening again.

The turnaround achieved with Warrior since LMUK was asked to conduct reliability growth trials under close supervision by the DE&S project team undoubtedly reflect an improved process. If it is decided that a production contract for Warrior is worthwhile, it will be due to the combined efforts of the Vehicle Manufacture & Demonstration team at Abbey Wood, the Army’s Armoured Trials & Development Unit, Bovington, and Lockheed Martin’s commitment to the project.

As already noted, the level of ambition for the Challenger 2 LEP may exceed the available budget and the requirement to deliver it by 2025. The programme’s slow progress is partly attributable to the decision to extend its scope. But the Army has been planning to upgrade Challenger 2 since 2006, when it first considered fitting a 120 mm smoothbore gun. If it knew this was necessary in 2006, why did it wait until 2016 to make it part of the LEP? This is the opposite of bloated requirements.

If MRVP Package 2 has been deferred because of a budget shortfall, this shows that resource allocation and management still has room for improvement.

With the Boxer Mechanised Infantry Vehicle Programme, there has been a collective recognition that future armoured vehicle procurement must be accomplished through international collaborations. Joint programmes ensure development costs are shared and bounded by requirements that are set in stone once they have been agreed. They result in a larger user base which reduces acquisition and through-life costs. They ensure the availability of inexpensive spare parts from multiple sources. They provide interoperability benefits. Ultimately, joint programmes have the potential to make NATO more effective across all deployment scenarios. Conversely, when we develop bespoke platforms independently, we introduce high levels of cost and risk. However good such a vehicle may be, the cost is likely to be too high to achieve export sales that would lead to a critical mass of numbers. In 2002, Britain made a huge mistake by leaving the MRAV programme and OCCAR, which led to the Boxer vehicle. If we had persevered, Boxer would have entered service in 2009. This would have undoubtedly saved British lives in Afghanistan.

One issue that has not been addressed by the NAO, or any other organisation with procurement oversight, is relationship building between the Army and industry. This can be a critical issue, but very little has been done to understand how trust and respect can breakdown on both sides during a programme, especially when it runs over a long period of time. One example of this was the unofficial policy of "Anyone But BAE" (ABB), which seems to have been informally instituted from 2009. The Army might have selected BAE Systems’ MTIP turret for Warrior and Ajax, which incorporated a working ammunition handling system a decade ago. It is incomprehensible that it was excluded from both programmes. Secondly, if the BAE Systems/ Hagglunds CV90 had been selected instead of Ajax or as an alternative to Warrior, it would already be in service.

When selecting the 40 mm CTAS cannon, a fatal error was made when the full, proven system developed jointly by BAE Systems and Nexter was not mandated. Instead, Lockheed Martin only bought cannon barrels and reverse-engineered the ammunition handling system. This was a complex task that added unnecessary cost and risk to the Ajax and Warrior programmes. To make matters worse, the contract was awarded to Lockheed Martin when it had no experience developing armoured vehicle turrets. Conversely, Nexter now has two qualified 40 mm cannon turrets: Jaguar and T-40. Both use the CTAS ammunition handling system qualified more than 10 years ago. While Lockheed Martin’s turrets may be close to maturity, the development process has added significantly to the Ajax and Warrior timelines.

BAE Systems’ exclusion by the Ministry of Defence may have had something to do with the 2009 Haddon-Cave report that investigated the loss of an RAF Nimrod MR2 aircraft in Afghanistan.28
Although this was critical of BAE Systems, the MoD and QinetiQ were also judged to have been at fault. It may be that BAE Systems had simply become a monopoly supplier with too much power, but punishing its Land Systems division through a loss of business over a decade-long period weakened its position in its home market, caused its exports to stagnate, and killed-off domestic AFV expertise built-up over many decades. This was a spectacular own goal.

To conclude, cuts imposed by the 2010 SDSR, followed by the NAO and Levene reports of 2011, forced a radical re-boot of the Army’s key vehicle programmes and its entire acquisition approach. Over the last decade, Army HQ and DE&S have implemented root and branch reforms, not only for purchasing new vehicles, but for all equipment types. Major programmes initiated since 2012 have all benefitted from streamlined processes. While Warrior and Ajax can be compared to the RAF’s Nimrod MRA4 aircraft (which was cancelled after 15 years of development, with only three airframes built, and after £4 billion had been spent), both programmes have the potential to deliver the required capability by 2025. With a looming financial crisis, the Army may need to sacrifice one or two key programmes to make sure its overall Equipment Plan is affordable. If this happens, the capabilities should be gapped, not deleted. The silver lining is this would allow more capable vehicles with longer service lives and better value-for-money to be bought later. It might also give DE&S breathing space to ensure it can deliver the remaining programmes for which it is responsible in-line with expectations.

Section 3 - Summary of Key points

- The Ministry of Defence’s vehicle delivery arm, Defence Equipment & Support (DE&S), has instituted a much leaner and more efficient approach to vehicle procurement since the 2011 NAO and Levene reports by leveraging experience gained through the delivery of Urgent Operational Requirements (UORs).

- Modernisation post Iraq and Afghanistan has been delayed by consecutive governments to the point where the Army’s vehicle fleet is approaching a state of block obsolescence. The need to replace so many vehicles at the same time has required DE&S to run multiple vehicle programmes concurrently, putting the organisation under additional strain.

- The Army’s six flagship armoured vehicle programmes remain central to its modernisation efforts, but there is a need to question whether individual programmes (some of which were started a decade ago) are still relevant to the most likely deployment scenarios.

- Despite improvements to the Army’s acquisition approach, the NAO Equipment Plan Report 2019-2029 identified a potential £13.0 billion funding shortfall. While this applies more to Carrier Strike and submarine programmes, there is no escaping the fact that Warrior, Ajax and Challenger programmes have exceeded budget estimates and are late. This suggests that resource planning and process management remain sub-optimal.

- Delays to the delivery of Ajax and Warrior are attributable to a single factor: unresolved technical issues with the two 40 mm CTAS turrets being developed by Lockheed Martin. While Warrior may now be potentially viable, the increased cost to manufacture the upgraded fleet has undermined the value-for-money case.

- Given experiences with Ajax and Warrior, DE&S may have under-estimated the development challenge and amount of time that will be needed to deliver Challenger 2 LEP - it may not arrive before 2030. If Challenger 2 enters service in 2030, but is obsolete by 2035, then, like Warrior, the value-for-money case will be difficult to substantiate.

- While Warrior and Challenger 2 may be problematic programmes, IFV and MBT capabilities remain essential if the UK wishes to field armoured infantry brigades capable of operating in partnership with our key allies. Without heavy armour, the Army risks being overmatched should the need to counter peer adversaries arise.

- While Ajax will provide the Strike Brigades with the firepower needed, mixing wheels and tracks is not ideal when operating at distance.

- In evaluating whether to proceed with or cancel Ajax and Warrior, it should be remembered that bringing any turreted fighting vehicle into service remains a fundamentally complex and difficult proposition - typically it takes 10 years to achieve.

- Boxer is a highly modular vehicle that offers unprecedented deployability and flexibility. Its combination of on-road speed and off-road mobility has the potential to reduce the Army’s dependency on tracked vehicles.

- MRVP is a lighter wheeled vehicle family that will complement Boxer to ensure that a larger number of troops benefit from protected mobility. This will reduce operational risks. No delivery issues are foreseen with either Boxer or MRVP.

- While wheeled armoured vehicles are required to give the Army more expeditionary reach, tracked platforms are still essential to negotiate the most extreme terrains, especially in winter.
• The overall mix of vehicles that the Army plans to acquire reflect a well-considered strategy that will do much to enhance its operational capabilities - in particular it will achieve a core Army 2025 requirement: to make the Army expeditionary by design.

• When the Equipment plan was reconfigured after the 2010 SDSR, it was anticipated that, even without development glitches, the desired range of vehicles the Army planned to procure would not be fully deliverable before 2022-2023. While this date may no longer be achievable, 2025 is a realistic target.

• Despite overall improvements to procurement processes, there are still areas of concern:
  - DE&S may not have sufficient resources to run so many vehicles programmes simultaneously
  - The practise of serving Army officers gaining acquisition experience over two-year appointments is necessary to build acquisition skills within the organisation, but constantly rotating positions of responsibility within key programmes can compromise delivery
  - DE&S may not be as good at drafting contracts as its suppliers - there is a need for enforceable penalty clauses and greater latitude to rescind contracts for non-performance
  - Changing vehicle specifications after a contract has been agreed has been a key factor that has delayed delivery and incurred extra costs
  - Army HQ continues to under-estimate the cost to develop and bring a new vehicle into service - sometimes deliberately, to ensure a programme is approved
  - Army HQ needs to become better at buying vehicles off-the-shelf without customising them
  - Delayed or piecemeal allocation of the budget by HMT can make the above problems worse, especially when it causes projects to be stopped and re-started.

• Future vehicle procurement should focus on international collaborations because development risk and costs are shared; a larger number of vehicles in service with different nations reduces acquisition and support costs; and widespread use ensures interoperability. If MBTs remain an important land warfare capability, then the UK should join the Franco-German Main Ground Combat System (MGCS) programme with immediate effect. Above all, we can no longer afford to develop highly sophisticated vehicles alone.

• While most of the Army’s current vehicle programmes should be deliverable by 2025, concerns that the overall equipment plan is unaffordable are valid, because there is insufficient budget to fund other priorities. In particular, there is a pressing need for new artillery systems; unmanned ground vehicles; cyber, EW and hybrid warfare capabilities.

• The Integrated Review seeks to align Defence commitments with foreign policy; in doing so, the challenge is to balance affordability with credibility. Armoured vehicle acquisition should be threat-based with programmes based on reduced number of platform types.

• A land vehicles industrial strategy would do much to support UK industry, to attract overseas investment and to manage the expectations of the MoD customer and suppliers who support it. Above all, it is needed to ensure the UK once again becomes a centre of excellence for armoured vehicle manufacturing and to avoid the boom and bust cycle of “pop-up” industries that disappear as soon as programme is delivered.

• On balance, the Army’s four vehicle acquisition entities: Army HQ, DE&S, MoD Main Building and HM Treasury, have learned from past failures, although there is still room for improvement. The way in which individual services control their budgets may need fine-tuning, possibly by ensuring that there is increased accountability.