

Project Hyper Real Immersion (HRI) - A Partnership Approach to the Development of a Mixed Reality (MR) Capability

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ABSTRACT

Technology used to provide military forces with their asymmetric advantage; however, the increasing pace of technological advances - particularly in adjacent markets in response to huge investments – is creating new challenges for global military forces. Procurement processes that have matured over decades are well suited to large complex equipment programmes, but are less well suited to exploiting technology, where the pace of change outpaces defence's ability to set requirements, go to competition, down-select, contract award, take delivery and finally get technology into service – by which time the technology is already outdated. In addition, training is a vital ingredient in converting equipment into relevant, credible capability. However, defence is not the market leader in simulation technology, and its procurement processes tend to drive industry to the cheapest compliant solution, rather than incentivising industry to capitalise on adjacent market advances to create a vibrant and evolving training eco-system.

The UK MOD is pioneering a fresh approach. Through the Defence and Security Accelerator initiative, it has down-selected Close Air Solutions (Project Hyper Real Immersion) and its Mixed Reality capability to be a vanguard project in a co-investment partnership approach to capability development. MOD believes that Project Hyper Real Immersion has the potential to transform the operational training landscape and provide our armed forces the ability to fight as we train– quite the opposite of what our peacetime training model provides today. Rather than waiting for a mature product to be available and then start a lengthy procurement process, leading to early obsolescence, MOD is exploring the benefits of a partnership approach, through rapid iterative development activity, to inform MOD's future requirements.

Project Hyper Real Immersion is thus exploring not only the potential technological benefits that MR might offer defence in the near future, but also whether a very different relationship with industry is required to capitalise on the technological revolution. This exciting Team UK approach to addressing future Modelling and Simulation requirements could have profound implications for the way modern military forces procure and develop capability; the UK MOD is very keen to collaborate with other nations facing the same challenge.

1.0 INTRODUCTION

The UK MOD – like many other military organisations – sees technology as its asymmetric advantage. However, the rapidly increasing pace of technological innovation, coupled with a procurement process better-suited to large complex programmes, has demanded a fresh approach. In addition, the large Original Equipment Manufacturers (OEMs) that dominate the defence market have extremely impressive latent capability; however, agility, dynamism and flexibility are more often the characteristics of the Small and Medium sized enterprises (SMEs) rather than large OEMs. The MOD is not the market leader in many of the technological areas that it wishes to exploit; adjacent markets – such as gaming, banking and wider commerce – are investing £Bns to address wider market requirements, and thus defence risks being left in a technological “backwater”. As a result, MOD is looking at ways to engage with the technological revolution, leverage adjacent market investment, and re-define its relationship with national industry.

1.1 Equipment into Capability

Equipment endures as the essential foundation of military capability – the “Industrial Age” of warfare. Whilst equipment and kinetic effects will endure as core capabilities within a credible military arsenal, increasingly strategic success will be achieved by those best able to achieve decision agility and dominance – the “Information Age”. This new information environment has fundamental implications for Defence – for defining military capability, what it means to project military power, and how to ensure relevance in a fast-moving society in which the Military serves. Furthermore, as the late Sir Michael Quinlan, Permanent Secretary at the United Kingdom Ministry of Defence, observed:

‘In matters of military contingency, the expected, precisely because it is expected, is not to be expected. Rationale: what we expect, we plan and provide for; what we plan and provide for, we thereby deter; what we deter does not happen. What does happen is what we did not deter, because we did not plan and provide for it, because we did not expect it.’

Therefore, Defence need flexibility, adaptability and the ability to develop innovative ways to use existing equipment inventories in the most effective way possible. This demands a similarly agile, responsive and adaptable training system that can be swiftly reconfigured to address emerging threats. How does defence realise the full potential of its Equipment acquisitions and develop agile, responsive and credible military Capability?

The current paradigm is neither sustainable, nor affordable – a fresh approach is required. However, as Henry Ford famously observed, if you ask those closest to the problem to solve it, they will be limited by their own experience and imagination.

“If I had asked people what they wanted, they would have asked for faster horses” Henry Ford

This paper will review the way defence has traditionally engaged with synthetic training solutions, and with the tech industry, which form the foundation of defence’s legacy training solutions. The paper will then highlight the UK MOD’s fresh approach to the technology and training challenge, before providing an insight into its partnership approach to exploring the potential of Mixed Reality (MR) training solutions. Finally, the paper will look at some of the benefits of this pioneering approach, and the potential for international partners to collaborate to mutual benefit.

2.0 SYNTHETIC TRAINING

Despite the enduring aspiration to develop credible agile military capability, most simulators remain bespoke, with limited if any ability to network, leaving training focused primarily on single-platform

essential skills. Furthermore, simulators are still viewed by some sections of the military as being a cheaper and less effective method of training – an option for those that cannot afford the “real thing”. Stove-piped simulation capability, which perpetuates the interoperability challenge, makes it very difficult and extremely expensive for the Armed Forces to train as they are going to fight. In addition, another challenge for simulation is isolation; modern warfighting is a team endeavour, so training in isolation creates major challenges for developing a successful teamwork approach, often addressed during live operations.

Defence has long recognised the benefits associated with training in the synthetic environment, which include enabling cost-effective, agile and responsive training with a risk and safety profile usually only associated with live, high risk operational missions. However, legacy simulator training fails to replicate real-world conditions and dynamics – the participants are warm and dry in a geographically detached environment, and most simulators offer very stove-piped platform-centric training options. By contrast, modern military forces expect to be employed in dynamic and unpredictable scenarios, and in a Joint or Coalition environment; accordingly, operational training needs to be tailored accordingly. The MOD has recognised that MR offers significant potential to provide a highly challenging and dynamic training environment.

A prime example of where the training environment has failed to keep pace with the demands of the modern battlefield is Joint Terminal Attack Controller (JTAC) training. JTACs conduct some of the most dangerous and challenging tasks on the modern battlefield – co-ordinating joint fires in close proximity to friendly forces is a high-risk undertaking and requires comprehensive and effective training. The consequences of failure are not only unnecessary fatalities, but also potentially grave political impact that could have strategic consequences for the conflict. Peacetime safety constraints and risk appetite limit our ability to train effectively for such a scenario. As a result, we do the "best we can" with the resources available and expect our personnel to "learn on the job" when deployed on operational duties.

Indeed, the US has recognised formally this shortcoming between what technology (and simulators in particular) can provide and what is required, as follows:

“...the JTAC Simulator Accreditation Standard quickly became the build-to-standard, which was never intended. This resulted in a short-term increase in capability as programs had joint justification for funding to make improvements, however as time passed little effort was given to go beyond the JFS ESC standard. This has resulted in the stagnation of JTAC simulation capability.”

Section B.3.2 - JTAC MOA

Technology has traditionally been the West’s military asymmetric advantage; however, despite significant advances in adjacent market technology, defence has failed to capitalise fully. The military fields an impressive array of warfighting equipment, but training is the vital ingredient that converts Equipment into Capability. However, peacetime safety constraints coupled with omnipresent pressure on resources, limited training areas and a variety of other pressures, have left the military unable to train as it expects to fight. As a result, the military Trains Easy, and Fights Hard – which carries growing strategic reputational risks (of failure) and fails to exploit its huge investment in warfighting Equipment.

3.0 DEFENCE RELATIONSHIP WITH TECHNOLOGY

Globally, armed forces are struggling to adapt to the challenges and opportunities of the technological revolution. With traditional procurement processes matured to manage large complex equipment programmes, which are not well suited to exploit the rapidly changing world of technology. The challenge is to leverage the huge investments in adjacent markets (gaming, banking etc) and create a different relationship with industry to exploit the agility, innovation and exploitation that are core attributes of the technology industry.

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If this is a challenge for individual nations, it is even more challenging for NATO where the strategic nature of the enterprise limits its ability to exploit innovation, pace and agility. The challenge therefore is how does the military embrace/exploit the wider technological revolution, to the mutual benefit of industry and defence.

By way of example, the UK MOD has invested significant resources in support of the UK Growth and Prosperity Agenda and the Defence and Security Accelerator (DASA) initiative. This aims to identify potentially “game-changing” technologies and co-invest with industry with the dual aim of Exploitation and Commercialisation. Having enjoyed significant success with the Capability Proving initiative – the latest phase of the Innovation Challenge – MOD is now looking at ways to bridge the gap between the current Technology Readiness Level (TRL) – defined capability objectives and the final objective of benefits realisation, to secure value for money for both the UK government and Industry. However, as part of this process MOD has realised that in the fast-moving world of technology, the MOD’s procurement process fixes the level of technology early in the process, and thus risks fielded capability usually being dated at best, and at worst, obsolete.

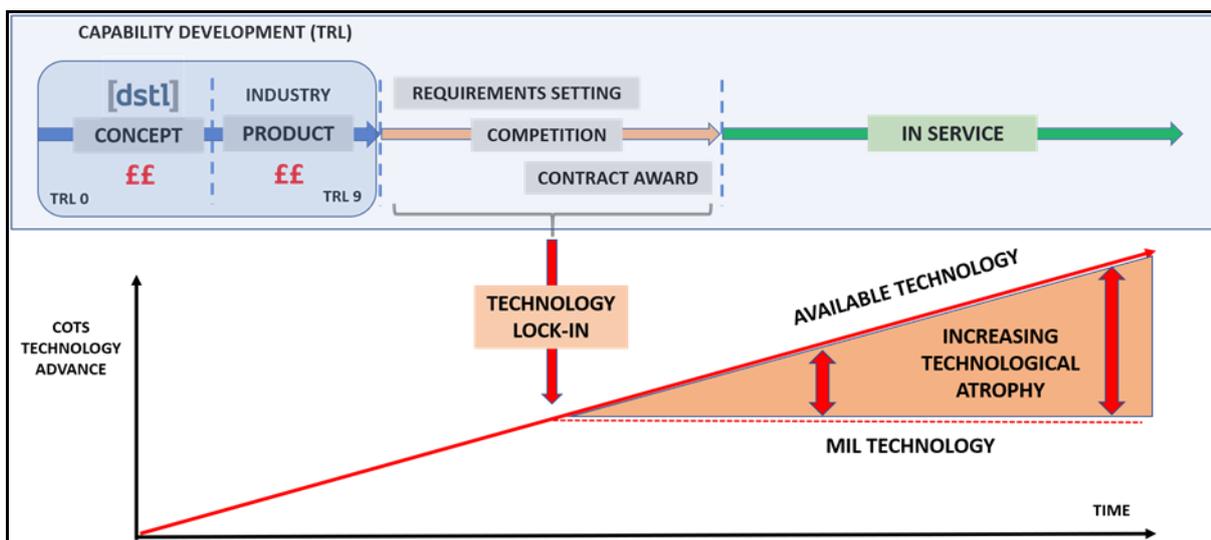


Figure 1 - Capability Development

The 2 primary challenges facing defence are thus:

- How to bridge the gap between the TRL7-defined outcome of the Capability Proving initiative and the point of Benefits realisation
- How to develop a different relationship with industry to exploit the technological revolution, to mutual benefit.

4.0 LEGACY DEFENCE TRAINING MODEL

Global defence forces have recognised the increasingly vital requirement to be able to operate high-technology equipment in a Joint and Coalition environment - the most likely scenario. However, security, agility, affordability, availability, peacetime safety appetite and air space restrictions all limit the ability to Train as you are going to Fight. Interoperability remains a challenge for defence, with equipment enduring as the essential foundation of military capability – the “Industrial Age” of warfare. In contrast, society has been swift to embrace the Information Age. Whilst equipment and kinetic effects will endure as core capabilities within a credible military arsenal, increasingly strategic success will be achieved by those best

able to achieve decision agility and dominance. Society already embraces this philosophy, creating an increasing gulf between society's expectation and the military's capability.

Military Capability is a complex amalgam of several key components – Defence Lines of Development (DLODs¹) - only one of which is Equipment. Training has traditionally been focused on the live experience, using the equipment available in representative scenarios to breed confidence and competence in the equipment available. For many, this training is the most effective way to prepare for conflict, as it breeds familiarity with operational equipment and there remains a view that there is no substitute for “the real thing”. It remains challenging to replicate the fear, adrenalin and sense of jeopardy that the live experience provides, and although simulators have provided cost-effective ways to familiarise users with procedural standard operating procedures, and emergency procedures, simulators lack the immersive experience that is the bedrock of providing quality experiential-based training. Despite advances in simulation capability, defence has been slow to embrace the full potential of adjacent market advances in simulation technology. One reason that military leadership have been sceptical about exploiting technology is because a primary driver often appears to be financial – simulation training costs a fraction of live. Since the military leadership are ultimately accountable for operational capability, any compromise in the training DLOD would risk compromising operational capability, and thus lives. This has contributed to an eco-system where advances in technology are viewed with a degree of scepticism by senior leadership, and where many believe that simulation is only an option “for those that cannot afford the real thing”.

Warfare in the Information Age (WiA) will make fresh demands on our warfighters and will require very different skills and expertise. Next generation equipment will provide personnel with unparalleled levels of information but sifting out the nugget from the tsunami of information available will be challenging. In addition, this will create new challenges associated with tempo and ambiguity. The live training environment will always provide an end-to-end test of functional equipment capability; however, as its limitations grow, so it risks becoming an Achilles heel of modern military forces. Technology has been exploited in the military; however, rather than embracing technology through a partnership approach with industry, defence has tried to adapt its legacy procurement processes to this new technology revolution, which has led to a “rush to the bottom”, with the cheapest compliant solution being procured, rather than creating an eco-system where defence and industry work together to leverage adjacent market investments and advances to improve operational capability.

The legacy relationship between Defence and industry (Customer, Supplier) works well for established complex programmes, but is not well suited to capitalise on Technology. Technology is advancing apace, with new simulation technology including VR & AR demonstrating potential, but defence needs to establish a way to capitalise on the huge adjacent market investments by the gaming industry and others to create a dynamic new training eco-system for our military personnel and close the widening training gap between what can be achieved in peacetime and what is required at war.

Technology has traditionally been the West's asymmetric advantage; however, is it fast becoming our liability?

5.0 A NEW APPROACH

The UK MOD has recognised that its legacy procurement model has been matured to focus on large, complex equipment programmes, and as a result is not ideally suited to the highly agile and dynamic world of technology. If defence is to create an eco-system that encourages innovation and proactively seeks more cost-effective ways to deliver operational capability, a fresh approach is required. Devised as a conduit for collaboration between industry, government defence and security departments, academia, and allies, the

¹ Training, Equipment, Personnel, Information, Concepts and Doctrine, Organisation, Infrastructure, Logistics with an overarching requirement for Interoperability

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Defence and Security Accelerator (DASA) will allow the rapid development of innovative solutions to the most pressing security challenges.

5.1 Partnership

This UK initiative is looking at fresh ways in which to exploit agility, innovation and dynamism of the SME sector to address the technological challenges facing defence. As highlighted in the last UK Strategic Defence Review, the DASA initiative is not just looking at technology, but also the relationship between industry and the MOD. Instead of the traditional transactional relationship between customer and supplier, DASA is exploring the merits of a partnership approach to capability development, to see how adjacent markets investments in technology can be exploited to mutual benefit.

Close Air Solutions Ltd (CAS) is an example of a UK SME that has been supported by DASA to explore the potential of Mixed Reality via the Project Hyper Real Immersion (HRI) to transform the defence operational training landscape. CAS was selected from over 400 other SMEs in a competition to identify potential partners to develop new, innovative and transformative technological solutions to enduring defence challenges. This was not a science project – this was a co-investment partnership model designed to draw-through technology with a primary focus on Exploitation and Commercialisation. Both the MOD and CAS believed that the legacy simulation-based training model had failed to adequately exploit adjacent technological advances, and that Mixed Reality offered a pioneering way to improve dramatically the complexity, realism and value of training, and thus deliver more cost-effective and agile capability to the front-line.

The partnership with CAS has 3 main objectives:

- Save Lives
- Save Money
- Improve Operational Capability

These are ambitious aims; however, the partnership approach to capability development has already enabled focused investment, with both the user community and industry working closely together to develop a credible, relevant and agile solution.

6.0 HYPER REAL IMMERSION

The JTAC Use Case is a challenge for defence. Delivering dynamic effects in close proximity to friendly forces carries immense tactical and political risk due to the inherent dangers involved. However, the legacy training environment is becoming increasingly limited, and the gap between the training experience and that to be expected in conflict is broadening – at an alarming rate. Most challenging has been the steady divergence between the peacetime safety environment in which the military has to train, with society's attendant limited risk appetite, and the hostile, dangerous and high-risk demands of the operational environment. As a result, our warfighters rarely fight the way they have trained, and end up “learning on the job” when deployed on operations. This creates a real Duty of Care conundrum for politicians and senior leadership alike, and also explains why generations of military forces have commenced live military operations with extremely limited experience, suffered initial losses and only then started to develop credible warfighting experience and expertise.

6.1 Mixed Reality (MR)

Technology advances – particularly in the gaming industry – have created new opportunities for exploiting

simulation as a training medium. However, the gaming industry objectives are very different to the military; the most effective operational training seeks to provide an immersive environment where the risks, fear, adrenaline and jeopardy of the anticipated operational environment can be replicated, to enable realistic and credible training to be conducted. Simulators have proven invaluable at training and testing JTAC procedures but are benign, isolated, unable to replicate conditions and complexity in a suitably realistic manner. As a result, there is an enduring requirement to conduct expensive – and ultimately extremely limited value – live training to meet prescribed training standards. These standards have become Input based – what proportion must be conducted Live and what can be done in a Simulator – rather than output-driven based on the skills that must be demonstrated to meet the standard required. Both MOD and CAS believe that MR offers the potential to create a significantly more compelling training environment that will enable more effective, immersive and realistic training than legacy systems, enabling a more effective Day 1 capability (thus saving lives) and fulfilling our Duty of Care to our warfighters in a more cost-effective manner.

MR allows a user to concurrently exist in real and simulated worlds, with synthetic objects appearing alongside and interacting with real objects. For example, a virtual tank could appear on the real terrain, motion could produce virtual dust clouds, and the tank could be destroyed by either real or virtual detonations and drive behind and be occluded by a real building. This is considered an extension of augmented reality, where a level of immersion comparable to virtual reality is achieved in a live environment.

Exploitation of MR, or specifically, networked MR, is arguably the “innovation” in Modelling & Simulation that will support the greatest leap in preparedness throughout the next decade, however, this will not be without first overcoming some considerable technical challenges. The long term ‘dream’ of MR is perceived to be a small form factor wearable display (think Ballistic protection glasses). An exercise ‘player’ should be able to have MR artefacts / entities presented within their FOV and operate unencumbered by PC processing or network requirements. The enablers will not be developed at the National level as that would not offer value for money. Instead UK MOD intends to leverage adjacent technology from within the gaming / social media markets.

It's no secret Mark Zuckerberg is pinning Facebook's prospects on Augmented Reality (AR). For this vision to become reality, investment will run into \$B, Facebook will once again put itself into direct competition with Google, Microsoft & Apple. These and other consumer focused corporations will be reliant on low cost wearable AR displays - the same technology can and will be integrated into MR training solutions for military use. A clear indicator that no military will wish to develop bespoke solutions comes from the US - in November 18, Microsoft announced they had won a \$479 million contract to supply the US Army with a version of its HoloLens augmented reality headset – NATO should take note.

6.2 HRI Project

The goal of the HRI project is to provide a useful, User-centred, accredited, MR joint fires training capability demonstrator that has the potential, to provide more cost-effective training in the near future, and that informs the MOD's future requirements. During this phase the partnership will exploit rapid iterative development cycles to exploit technology through agility and innovation. The aim is to quickly develop an Operational Concept Demonstrator (OCD) that immediately offers value for defence. Through rapid iterative development and a partnership approach, the mixed reality capability can then be continuously evolved, to the maximum benefit of those invested.

The main limitation experienced during Project HRI early phases was the head tracking system. Position / pose tracking indoors with close-in synthetic scenes is starting to become well understood, however, the accuracy required to produce synthetic scenes of distances such as .5 to 5km are much higher due to the rules of sub-tension. The effect was that, over time, a misalignment of the synthetic scene with the physical

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environment occurred, which caused virtual objects to appear in the wrong places. The frequent recalibration required to correct this misalignment then proved to be intrusive to training. Given the points made previously about leveraging the gaming / social media sector, it would be inefficient to pursue mobile ‘on-the-man’ at this stage. Consequently, a different approach is now being adopted, one that lends itself to fixed Observation Points as a steppingstone to the desired end state of full ‘on-the-man’ capability. By focussing on the development of scientifically repeatable and efficient MR techniques and processes, as well as addressing other components of DLOD, such as a robust safety case and human factors, UK MOD intends to be in a position to exploit enabling technology when it becomes available. This approach will ultimately reduce time to exploitation across the wide variety of potentially applicable use cases, as well as de-risking investment into MR technology.

By the end of the current project phase, HRI will have:

- Shown the MOD customer the way that MR technology can be incorporated as a military training capability to reduce the cost and increase the richness of joint fires training.
- Provided a US & NATO accredited OCD platform (based on existing simulation accreditation criteria), to deliver joint fires training in the live environment mixed with virtual content.
- A clear evidence-based Safety Case that covers the use of MR technology as a military training capability for joint fires
 - Vital if we are to understand the full implications of this new form of training
- A robust evidence based human centred design for the capability elements that identifies where this capability can add value to training.
 - Prepare the foundations to answer - is MR a more effective medium to conduct credible training than legacy simulation?
- A greater understanding of the technological pathways to optimising the facilitation of mixed reality training.
- The 3 primary technical areas of focus are as follows:
- Terrain: Aiming to rapidly gather and process extremely high-accuracy terrain data and ensure high-performance ingestion by simulation software.
 - This includes considering airborne and terrestrial data capture; integration with wide-area satellite terrain data; point classification (e.g. roads, vegetation, water, etc.); processing to simulation-compatible formats; and automation of the data processing pipeline.
- Software: Adapting and extending simulation software with optimisations for mixed reality,
 - To include highly accurate render masking, improved physics, and the ingestion of highly accurate terrain data.
- Advanced: Enablers for significant capability enhancements, particularly around the inclusion of physical objects in the synthetic environment,
 - Such as fast 3D scanning, real-time near-field tracking and object occlusion.

7.0 BENEFITS REALISATION

The UK MOD has been clear from the start that this is not a science project – the ambition for the project is exploitation, and to prevail the project must deliver tangible benefits, both near-term and into the future. The initial success of the initiative has resulted in several senior UK stakeholders identifying potential benefits from their investment in HRI, and an urgent need to exploit these benefits at the earliest opportunity.

DASA had identified that Capability Pilots have the potential to be an effective mechanism to review the potential capability being developed to assess its viability, suitability and cost-effectiveness in a timely manner and enable an objective assessment of the potential benefits, both near and longer-term. They were also an opportunity to review an alternative to the TRL-based legacy procurement model, to one where there was immediate benefit to be gained from an early solution, and a clear roadmap for capability realisation through iterative development, exploiting commercial off-the-shelf technology and coherent adjacent Innovation Challenges.

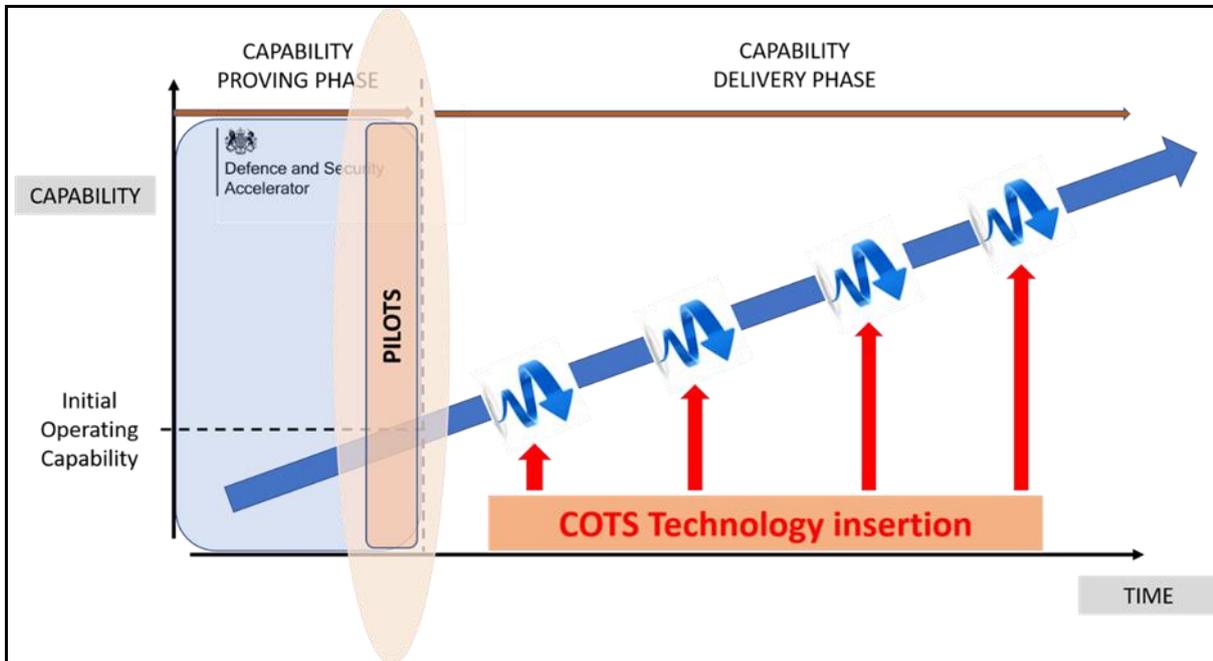


Figure 2 - Capability Pilot

The Capability Pilot activity would thus be the opportunity to review the potential benefits of the DASA investment to decide **if** and **when** to transition to a partnership delivery and exploitation approach.

7.1 Capability Pilots

The UK sees Capability Pilots as the optimum way to bridge from early capability demonstration into Benefits realisation. Unlike previous procurement models, where technology lock-in occurs early in the procurement process resulting in early obsolescence issues, the aim of the Capability Pilots is to decide whether a minimum viable capability is available which can provide immediate benefits, but which also has potential for iterative development to meet future needs. This assessment activity would explore the potential of a partnership approach to capability exploitation, to see whether there was a wider Commercial appetite/demand for the capability, thus creating the potential for MOD to exploit down-stream economies of scale. A Team UK approach to exploring wider export markets was enabled through the UK's Defence Growth Partnership initiative, working closely with the Defence Solutions Centre to establish whether any international partners were facing similar challenges as UK defence. This Team UK approach helped ensure that any MOD solution was also International by Design, to enable the core ambitions of Exploitation and Commercialisation to be achieved.

7.2 HRI Exploitation - JTAC Use Case

The UK MOD is looking to fund a JTAC HRI Capability Pilot to establish whether MR technology can

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achieve the following:

- Save Lives
- Save Money
- Improve Operational Effectiveness.

However, instead of waiting for technology to mature into a defined product, then start a procurement process, then run a competition, select a solution, contract and then build, test and accept, before entering service use - when the technology risks being obsolete having been overtaken by the next innovation in the market - MOD is seeking a fresh approach. The unique industry/MOD partnership expects the initial operating capability to lack the maturity required to deliver a full suite of benefits at Day 1; however, the Pilot will seek to establish whether the MR technology is sufficiently mature to provide a Minimum Viable Capability at Day 1, with significant immediate benefits for defence, and with the potential to liberate further benefits and features as adjacent market technological advances are made.

This pioneering approach has 2 main aims:

- Explore the potential of MR to transform the Operational Training landscape
- Better understand the benefits of a partnered approach to capability development

The MOD believes that HRI has the potential to provide a more effective training model for JTAC training, which will enable more realistic training, thus saving lives, improving operational capability, and delivered in a more cost-effective manner.

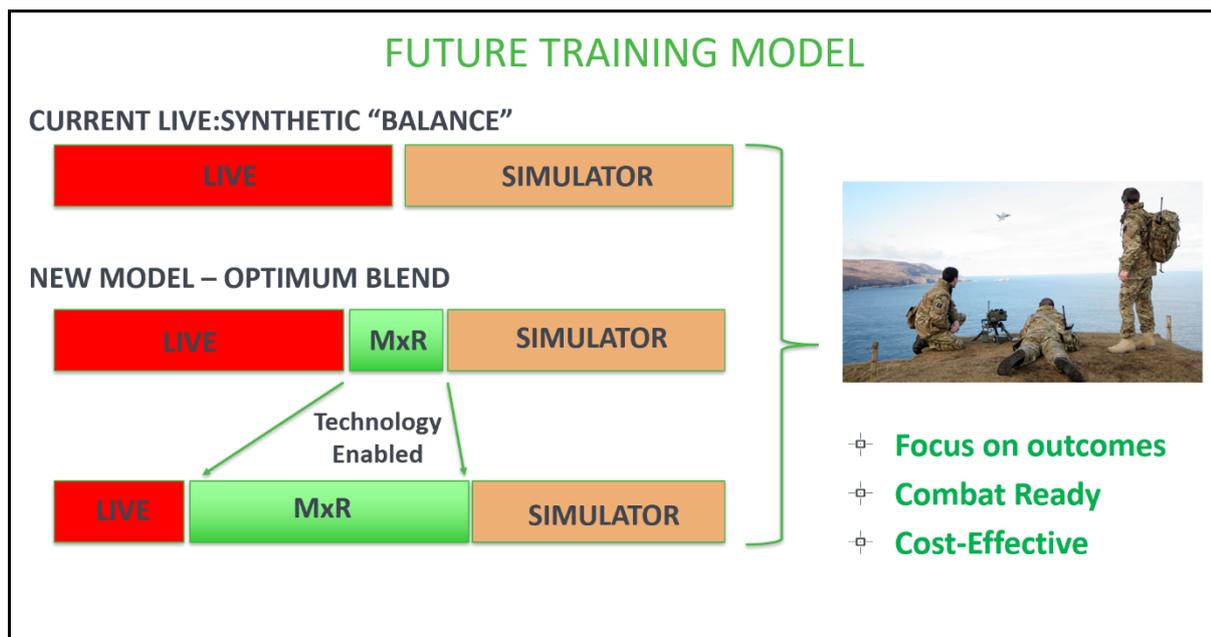


Figure 3 - Future Training Model

HRI is likely to offer more effective immersive training, closer to the real-world experience, and thus enable more credible, complex and high-risk missions to be used – Train HARD Fight EASY. MR is an exciting opportunity for defence, and it holds immense potential for the future. The key enablers for an “on the man” MR capability are already being developed by adjacent markets, where £Bns of investment are being made. However, MR can deliver benefits today – the MOD’s partnership with industry to develop HRI has already

demonstrated where immediate benefits can be realised.

7.3 Partnerships

The challenge associated with exploiting the significant investment in, and capability of, the defence equipment programme is not unique to the UK. Credible defence capability is not simply about equipment, yet in a society where the peacetime risk appetite is limited, and reducing, preparing our warfighters for conflict presents a significant challenge. The UK is exploring a fresh approach and is interested in developing this new model with international partners. HRI is a pathfinder project, which the UK MOD believes holds tremendous potential to deliver enduring benefit to the military. In addition, the MOD's partnership approach to capability development aims to change – perhaps fundamentally – defence's relationship with technology and associated industries, and to exploit adjacent market investment and technology to the benefit of defence.

8.0 CONCLUSION

Although Equipment is an important foundation of defence capability, WIA requires a cost-effective training eco-system to enable exploitation of next-generation equipment potential. Traditional defence industries are not market leaders in some of the adjacent markets where huge investments in related technological areas have fundamental implications for future defence capability. If defence is to achieve and maintain technological superiority over its potential adversaries, it needs to embrace the agility, innovation and pace of related technological advances. This requires a fresh approach to MOD's approach to capability:

- Defence Departments need a fresh approach to their relationships with industry to exploit the opportunities and agility that adjacent market investment will enable.
- Instead of waiting for technology to mature before starting the acquisition process, a partnership approach with tech industry could offer a significantly more cost-effective, agile and mutually beneficial outcome.

In the UK, Project HRI is a partnership approach to capability development between the UK MOD and Industry, with support from the UK Department for Trade and the Defence Growth Partnership, in a Team UK approach. The aim of the initiative is to explore the potential of MR to transform the operational training landscape with 3 main objectives:

- Save Lives
- Save Money
- Improve Operational Effectiveness.

HRI is a co-funded initiative which is enabling close collaboration between industry and the military, focused on a rapid iteration approach to capability development, and looking at fresh ways in which technology can be exploited - and swiftly – to provide more cost-effective and relevant capability. Ultimately, MOD expects HRI to migrate to an “on-the-man” capability; however, the technology to enable that is still some years away despite huge adjacent market investment. However, MOD also believes that there are other ways in which MR can offer near-term benefits through the HRI initiative and is working in close partnership with industry (and export partners) to capitalise fully on the potential that such technology might offer.