Ministry of Defence

The Defence Capability Framework

July 2022

Foreword

The brutal, illegal invasion of Ukraine serves as the most pressing reminder of the need for Defence and the importance of NATO as the bedrock of the UK's security. Russia's actions reinforce the conclusion of the Integrated Review and Defence Command paper that Russia continues to pose the greatest nuclear, conventional military and sub-threshold threat to European security. Our approach in the Integrated Review was threat led. Accordingly, we continue to learn from the situation in Ukraine and will review our capabilities and readiness levels in the light of events and lessons identified. What seems clear, so far, is that the conflict has not changed our long-term priorities and that the threats and challenges outlined within the Defence Command Paper endure.

The Defence Capability Framework provides a longer term demand signal to industry. It has been developed in line with our current policy and is intended to focus the collective efforts of Government and industry in the areas that matter most; allowing us to adapt to existing and emerging threats.

The Defence Command Paper signalled the biggest transformation of our Armed Forces since the fall of the Berlin Wall, making them more effective, more agile, more adaptable and more persistently engaged. The Defence Command Paper set out the plan to strengthen our alliances with new and existing partners, build on a more permanent overseas footprint and had NATO at its heart. It was supported by the settlement of an additional £24 billion[1] over four years allowing us to invest more in our armed forces' capability. The Defence Capability Framework has been informed by the Integrated Operating Concept (IOpC) and the requirement for our forces to deter and, if necessary, defeat our adversaries in conflict, as well as compete below the threshold of armed conflict. The IOpC also requires our armed forces to deliver a more dynamic posture through persistent engagement and to be integrated across domains and across government, with an increased focus on the domains of space and cyber. These requirements have driven our future capability plans and investment priorities, which are detailed within the Equipment Plan (EP) 21 and are set out in more detail in the Defence Capability Framework.

1. £16.5bn over previous planning assumption of 0.5% real growth.

The spending review settlement has put the department on a sounder financial footing, with the EP 21 setting out how our military capability will evolve to meet the changing threats articulated in the Defence Command Paper within an affordable cost envelope. New funding and a clear vision have given us the opportunity to ensure that ambition and resources are in balance. Much of the equipment programme over the next ten years is well established, but there are still choices to be made on how we deliver the capabilities we need. There is financial headroom within the EP to enable future investment to exploit the outcomes of our Research and Development, exploit emerging technology and to further develop and enhance our capabilities; this will allow us to adapt to emerging threats, challenges and learn from world events like those we have seen in Ukraine.

The Defence and Security Industrial Strategy (DSIS) aims to establish a deeper, more productive, strategic, and sophisticated relationship between Government and the Defence and Security industries, with greater transparency and collaboration on capability development being key enablers of this new approach. We recognise the importance of Defence industry to long-term capability advantage, and we will work in partnership with industry to help deliver our equipment plan, with an increased focus on the social value and the development of the skills base that our partnership provides for the UK. In future, we will continue to work with industry on how our military capability requirements are set as well as how solutions to the threats and capability challenges are generated.

As set out in DSIS, we are determined to be more open and transparent about our future capability requirements, to help provide industry with a clearer demand signal and to focus our collective efforts on the area's most important to the UK. The Defence Capability Framework is part of that journey, it provides our approach to and priorities and plans for military capability development, drawing from our other published strategies, for example the Defence Space Strategy. It articulates our overarching priorities for future capability and provides greater detail on planned investment within the current equipment plan (Annex A). The Defence Capability Framework is not intended to define all our industry segment strategies, which will be developed iteratively over the next few years as described in the DSIS.

The Defence Capability Framework has been developed with input from industry and the UK Defence Solutions Centre (UKDSC). We will continue to develop our plans in partnership with industry; section 6 of this paper outlines some of the ways industry can work with us, but we recognise that the relationship with industry will need to develop over time. Nonetheless, publishing the Defence Capability Framework is one step in establishing a more productive and strategic relationship between government and the defence and security industries. Through being more transparent about our future approach to capability development and focussing the collective efforts of Government and industry we want to maximise the capability we deliver for our armed forces.

Jeremy Quin MP

Minister for Defence Procurement

Ministry of Defence

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1. Introduction

1. In November 2020, the Prime Minister announced an increase in defence spending over four years of an additional £24 billion[2] to meet the threats set out in the Integrated Review. This has allowed us to make significant new investment over the Spending Review period and beyond. These include investments across five domains, with a particular focus on space and cyber, increased investment in research and development, renewal of the deterrent, upgrades to our current equipment and more investment in equipment support that will drive improvements in readiness and availability.

2. The Defence Capability Framework outlines our guiding principles that will inform our approach to investment decisions, how we develop military capability over the next decade and address the enduring capability challenges. The enduring capability challenges[3], outlined later in this paper, are aligned to threats we believe will intensify and provide the basis for our understanding and prioritisation of future capability development to support the IOpC. Whilst most of our current investment will be on delivering and supporting capabilities that are already in our plan, these capability challenge areas signal our focus for future capability, which should guide industry's plans. In this, we recognise that Military Capability is about more than just equipment, it is the combination and integration of equipment alongside our infrastructure, personnel, information, data, concepts, and training; but given the high level of spend on the EP this paper focuses on equipment capability (both physical and digital) and builds on the plans set out in EP21. By doing so we hope to focus Defence and industry resources on these challenges, they offer the opportunity for the UK to develop the technology and capability that will provide a decisive edge in future military conflicts.

2. £16.5 billion over previous planning assumption of 0.5% real growth.

3. Initially outlined in the MOD's Science & Technology Strategy 2020.

3. **Relationship with DSIS and other industrial segment strategies.** The Defence Capability Framework has been developed, in consultation with our industry partners, to be more transparent about our ideas and plans and to support the implementation of the DSIS. It does not represent our priorities for sovereign capabilities. Individual segment strategies[4] will be published in due course covering our sector-by-sector considerations on on-shore capability requirements. The Defence Technology Framework (DTF) sets out our strategic assessment of our most critical technology families, together with their most relevant applications areas and the capability outcomes we are looking to generate to deliver operational and strategic advantage. The Defence Capability Framework sits above the DTF, with the technologies outlined in the DTF supporting the development of the solutions to the enduring capability challenges.

4. This paper **builds upon our current plan, our operating concept and the policy context** set by the Integrated Review, to prioritise our capability development over the coming years. These requirements will continue to be refined alongside industry and elaborated upon within other strategies and publications as our understanding of opportunities available and the threat landscape evolves.

4. Further information can be found in Annex A of the DSIS (page 80).

2. Military Capability Development – shaping the Equipment Plan

5. The Equipment Plan (EP) 21 articulates the changes that were funded through the increased investment in defence spending to reflect the changes to deliver the Integrated Review, whilst balancing cost and budget. It details the ten-year programme where, over these years from 2021/22, we plan to spend £238 billion on equipment procurement and support, which is an increase of £48 billion from the previous EP report[5]. We anticipate spending around £124 billion on support over the next ten years, with around half of this not yet committed, giving us opportunity to consider how best to sustain our capabilities and achieve greater readiness, availability and deployability. The Equipment Procurement Programme over the next ten years, where we are spending £114 billion, is now well defined with many major acquisitions set over that period, largely due to capability planning decisions taken during the Integrated Review. It is not, however, immutable. The rapidly changing global security environment means that **it is vital that our investment plans remain flexible and adaptable**. We must be ready to make changes, either by using the headroom available, money set aside in the plan for exploitation of Research and Development or by adjusting our plans, where circumstances have changed, and we judge it sensible to do so. Any changes and re-prioritisation we make will be guided by the principles and enduring challenges outlined in this paper, emerging technology opportunities, evolving threats and world events.

6. The EP has **£4.3 billion of headroom over ten-years** and, **from 2025/26 onward the department has set aside a further £4.1 billion** to develop and exploit emerging technology. As programmes mature this funding will enable us to continue to develop new and innovative capability, prioritising our investment against relative threats and opportunities to have best effect. **This is, however, dependent on the successful delivery of our core programmes which relies on industry delivering to time and cost**. Failure to deliver these on time and to budget may lead to pressure on our available resources and limit scope for future investment.

5. Equipment Plan 2020.

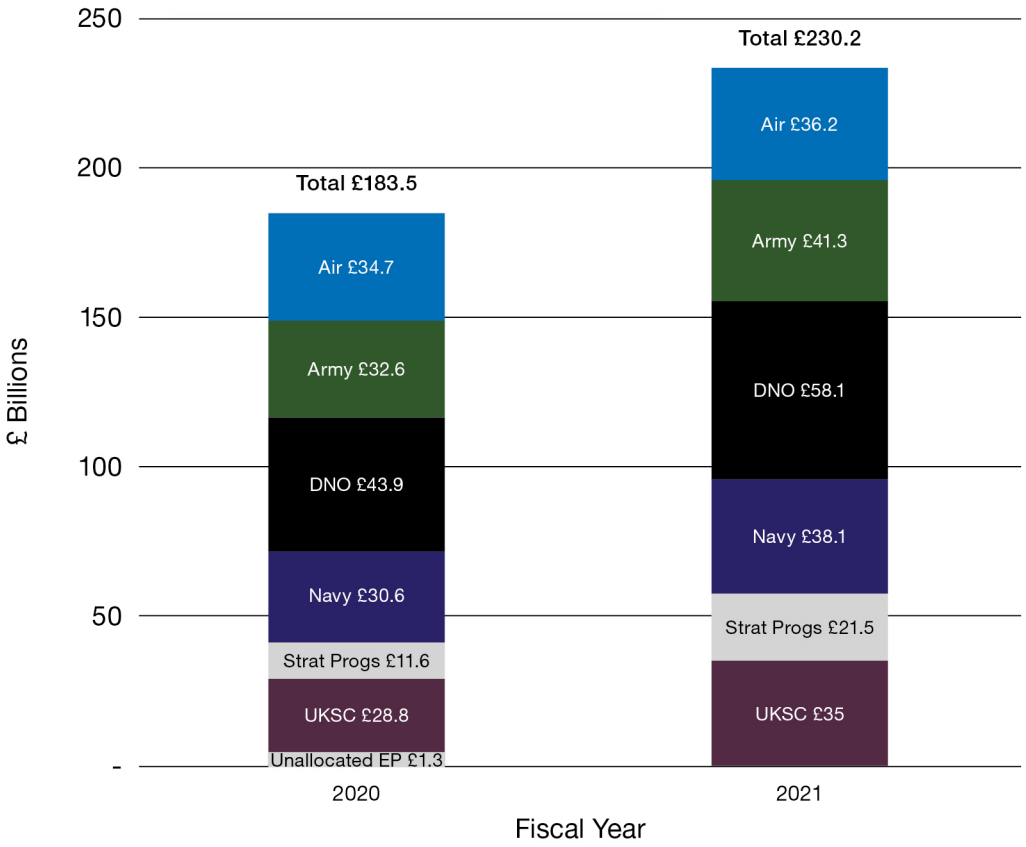


Figure 1: Chart showing change in ten-year total spending by Top Level Budget (TLB) for the total Equipment Plan

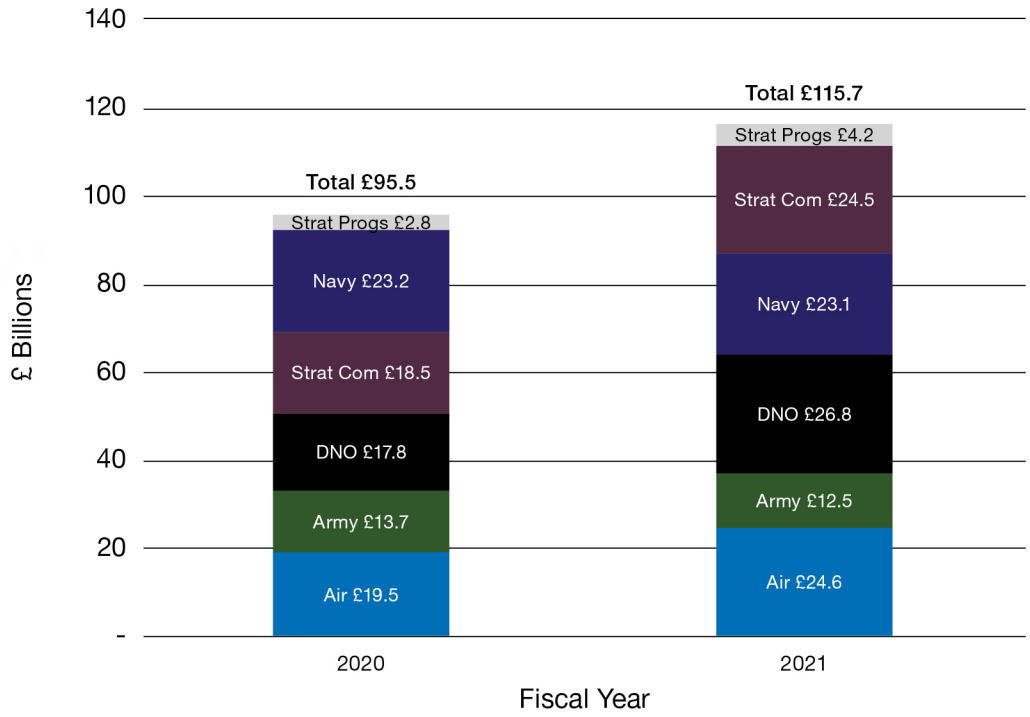


Figure 2: Chart showing change in ten-year total spending on equipment support by TLB

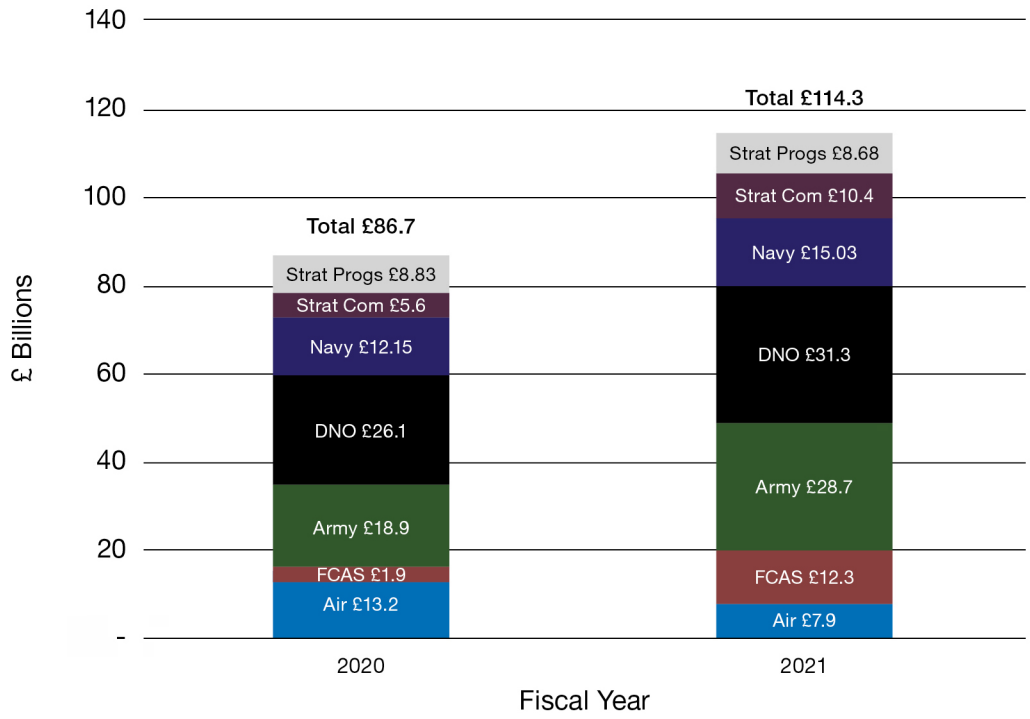


Figure 3: Chart showing change in ten-year total spending on equipment procurement by TLB

3. Guiding Principles for Capability Development

Key Priorities for the Defence Command Paper

- Capability modernisation: reversing hollowing out and retiring older legacy equipment.
- Maximising investment in new equipment which can meet the threat in a competitive age.
- A highly skilled workforce, with fewer personnel, more spent on availability and focussed on forward presence.
- Agile and digitally enabled to support multi-domain operations.
- Investment across five domains – including a new investment in space and cyber.
- Focus on investment in R&D.
- Renewing the deterrent.

7. We have seen a resurgence of 'great power' across the globe, posing a challenge to the UK, our allies, and the international rules-based order. As identified in the Integrated Review and shown by its actions in Ukraine, Russia poses the greatest military, sub-threshold, and geopolitical threat to European Security. Moreover, as the Integrated Review made clear, China is an increasingly assertive competitor, posing a complex systemic challenge. The investment today by Russia and China in a range of new capabilities including hypersonic missiles and glide vehicles, space and counter-Space capabilities, AI, autonomy and cyber, as well as their Maritime, Land and Air capabilities, presents a significant challenge to the UK and our allies. The Defence Command Paper (DCP) outlined Defence's priorities and approach in responding to this changing context. The priority capability areas outlined within this paper are informed by this backdrop.

8. The capabilities that we develop over the next ten-fifteen years need to contribute towards the priorities set out in the DCP and support the IOpC[6]. In this context, to deliver effective military capability, **we will be guided by the following principles for our capability development and investment decisions**:

- **Guiding Capability Principle 1: Deterrence – Credible and Capable.** Deterrence is a cornerstone of UK Defence and the need to deter threats will be a key driver of our capability requirements. The delivery of the Continuous at Sea Deterrent (CASD) will continue to play a vital role, receiving further investment through the IR/SR. In addition to nuclear deterrence, another critical part of deterrence is effective and agile conventional forces across all domains, being able to threaten our adversaries.

6. Integrated Operating Concept 2025, Page 17.

- **Guiding Capability Principle 2: Multi-Domain and Integrated Capabilities.** To maintain operational advantage Defence needs to integrate activity and effects across all five domains, across government and with key allies and partners. **This also needs to be achieved in a contested and degraded operating environment** given the increasing and proliferating threat. The adoption of common data standards, interoperable network systems and open architecture for systems across domains is a critical enabler of multi-domain Integration. The ability of our capabilities to be more deeply integrated will endure as a **key feature of our future capability development**, with the integration of sub-systems and software by our industry partners being a vital factor to achieving the effects we require.
- **Guiding Capability Principle 3: Readiness, Availability and Deployability.** Getting the maximum output from limited resources and ensuring the Armed Forces are able to outpace and outfight our enemies are key to our future success. To achieve this, we must improve platform availability and Force readiness and design-in superior[7], assured, environmentally sustainable and cost-effective logistic and engineering solutions that exploit data and technology.
- **Guiding Capability Principle 4: Innovation and Experimentation – speed of adaptation to the threat and exploitation of technology.** The capability of our adversaries is evolving rapidly, we need to respond with the exploitation of ideas being fundamental to the development of future capabilities and enhancement of in-service capabilities. It enables us to adapt to a changing threat and exploit emerging, disruptive, dual-use, technologies faster and better than our adversaries. Our Test and Evaluation capabilities will play a key role in supporting the development and pull through of innovative technologies. Not everything that receives innovation funding or that we test will succeed and be pulled through into larger programmes, but the process of innovating and experimenting allows us to understand better the opportunities and risks, as well as receiving feedback from operators. This allows us to accelerate the development pathway, to take decisions earlier and pull innovation through quicker. We recognise that even if the exploitation only initially provides a less than 100% solution, that we subsequently spirally develop, this is often better than a 95-100% solution that is brought in late.

7. In accordance with the Support Design Principles within the Support Solutions Envelope (available on Knowledge in Defence).

- **Guiding Capability Principle 5: People at the heart of capability.** People, both military and civilian, are a critical component of Defence capability. They can give us our edge. To operate in the information age and to exploit rapidly emerging technologies we will need to ensure that we have a diverse, inclusive, and skilled workforce with policies aligned to maximise talent and motivation. Human-machine teaming and the increased use of Artificial Intelligence will move people 'up the value chain', requiring a shift in the qualifications and skills required to operate our capabilities. As outlined in the Defence Command paper, our focus on exploiting technology at pace will be matched with a more modern approach to our people.
- **Guiding Capability Principle 6: Allied by Design.** Working alongside and being interoperable with our Allies and Partners , especially NATO, is an essential element of delivering Defence outcomes and of our capability development. NATO is the cornerstone of our Defence and it is essential that our capability planning remains aligned with NATO. But the centrality of NATO does not mean 'NATO only', we must continue to look beyond our traditional partners to further increase our capabilities. The Defence Command Paper provides more detail of our priorities for cooperation, including capability development, with other nations. Future capability development will **explore opportunities to collaborate with other nations from the earliest stages**, enhancing interoperability and the potential for **export opportunities**.
- **Guiding Capability Principle 7: Maintaining a balanced and affordable Defence Programme.** An over-heated equipment plan slows delivery and leaves minimal room for adoption of new capability or innovation. We therefore need to continue to drive value for money into acquisition and maintain headroom to allow the pull through of technology into operational capability. The wider social value of developing new capabilities and the contribution towards the Government's levelling up agenda will also be important considerations when assessing the value of alternative propositions.
- **Guiding Capability Principle 8: Mitigation of and adaptation to the effects of Climate Change.** Climate Change is already having an impact on both the operating environment and effectiveness our capabilities. We will need to build resilience to climate change, including through reducing our dependency on fossil fuels, while preserving and strengthening our operational advantage. We will make choices, assess, and **adapt our in-service capabilities to the impact of climate change**, as well as continuing towards **Net Zero 2050** to mitigate its effects. Therefore, planning for and assuring that future capability decisions are informed by the changing environmental and security context in which they will operate will continue to be a key consideration.

- **Guiding Capability Principle 9: The importance of Defence Industry to Long-Term Capability Advantage.** The DSIS highlighted the importance of capacity and capability of the UK defence and security industry to our long-term capability advantage, with civil industries being a key factor in future. It also sets out which strategic capabilities are an imperative to maintain onshore and where we value onshore industrial capability to maintain operational independence, with industrial segments and their subsequent sub-strategies[8] outlining this in more detail. We recognise that industry, with their collective experience, investment, networks, and the means of production, can be considered as a capability in its own right. Increased transparency and collaboration with industry is also fundamental to addressing the enduring capability challenges. Through this document and ongoing engagement, we will seek to involve industry at the earliest stages of our concept to capability development journey to invest and explore opportunities to better develop the capabilities that the UK's Armed Forces, our allies and partners, need to deter, defend and, if necessary, defeat our adversaries.

Defence's Guiding Principles for Capability Development

1. Deterrence – Credible and Capable.
2. Multi-Domain and Integrated Capabilities.
3. Readiness, Availability and Deployability.
4. Innovation and Experimentation – speed of adaptation to the threat and exploitation of technology.
5. People at the heart of capability.
6. Allied by Design.
7. Maintaining a balanced and affordable Defence Programme.
8. Mitigation of and adaptation to the effects of Climate Change.
9. The importance of Defence Industry to long-term capability advantage.

8. Annex A of the DSIS provides an overview of these areas.

4. Enduring Capability Challenges and Priorities for development

9. The Science and Technology Strategy (2020) introduced the five enduring capability challenges, aligned to threats we know will intensify and evolve in future, where emerging technology presents opportunities to deliver decisive military effect and operational advantage. This section of the Capability Framework outlines the priority areas where we will focus our investment to develop military capability in the future, to address the enduring capability challenges. **These areas will be prioritised at the Defence level but also pursued by individual Front Line Commands.** We are already seeking to address these challenges with much of our, significantly increased, investment in Research and Development (R&D) being focussed in these areas.

10. Future capability development will continue to be informed by the threat landscape and led by our operating concept. The principles outlined in section 3 of this paper will act as a guide for all future investment decisions related to military capability. However, given the rate of technological change, the adoption of new and novel systems by our potential adversaries - we must up our game and harness the best of both industry and Defence to focus our collective efforts to ensure we deliver operational advantage through our capability.

11. **The capability priorities outlined below are not exhaustive but are key areas of focus**. Prioritisation will inevitably change over time as the threat and our concepts evolve. The results of our R&D investment will change our understanding of the opportunities presented by technological developments, guide our future investment, and may establish new areas of focus. In some areas our requirements are still being matured and as such the level of detail provided in this paper varies between capability areas. It is our intention to provide further detail through other publications, engagement with industry and future iterations of this document.

Using the priorities

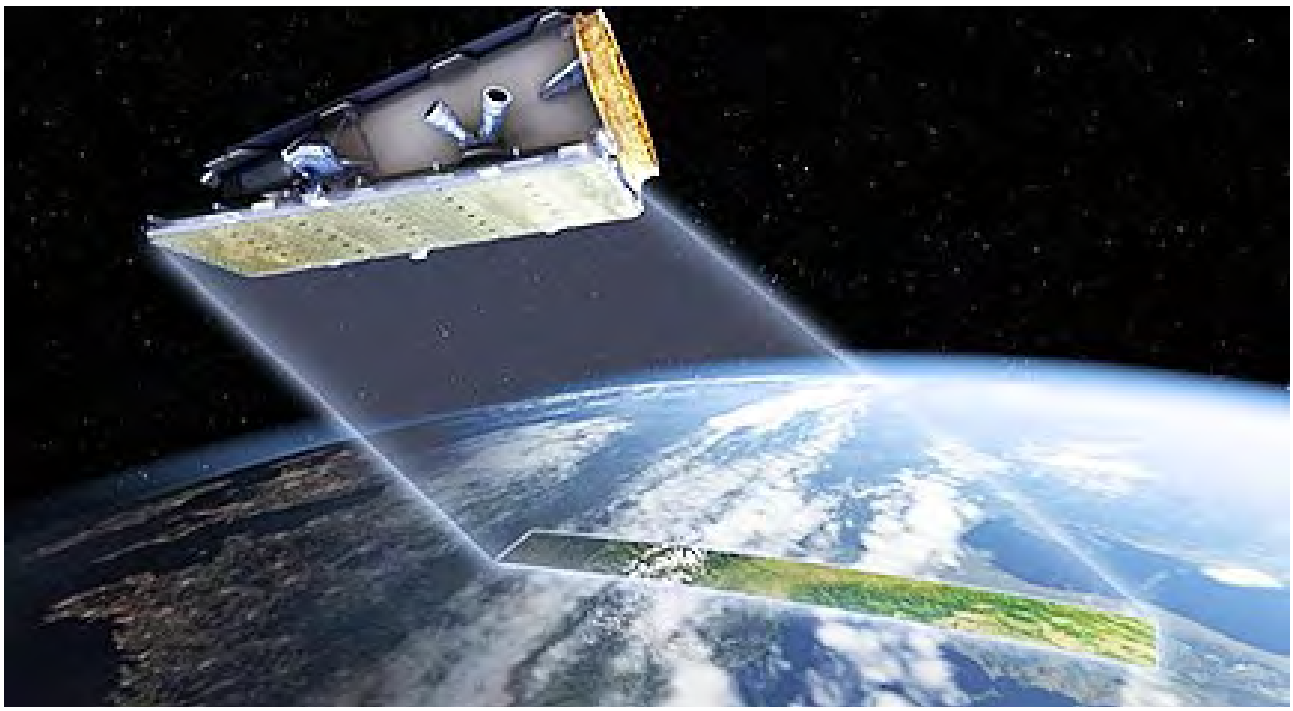
12. This paper outlines our future capability priorities to address our enduring capability challenges. These priorities largely describe the "what", i.e. what Defence is interested in developing, but we need industry to provide solutions to and work with us on "how" these challenges can be addressed. **Within Defence** these capability priorities will be used to inform future policy, strategy and plans at both the Defence level and that of individual front line commands; it will also focus our future investment whether through routes like the Defence Technology Exploitation Programme (DTEP) or elsewhere. **Outside Defence** these priorities should be used by organisations who are able to supply solutions or work with us to address the enduring capability challenges, providing input via the various mechanisms outlined in section 6, and provide ideas that we can test and exploit. We want to focus our collective resources and incentivise industry investment in R&D which will inform future investment decisions by being clear about our enduring challenges and priorities for investment. The below figure shows where the Defence Capability Framework, in articulating the "what", sits in relation to other Defence publications that articulate the "why" (why we are doing things) and the "how".

Figure 4: Publication Landscape

The Enduring Capability Challenges

1. Pervasive, Full Spectrum, Multi-Domain Intelligence, Surveillance and Reconnaissance (ISR).
2. Multi-Domain Command & Control, Communications and Computers (C4).
3. Secure and Sustain Sub-Threshold Advantage.
4. Asymmetric and Hard Power.
5. Freedom of Access and Manoeuvre (FOAM).

Enduring Capability Challenge 1: Pervasive, Full Spectrum, Multi-Domain Intelligence, Surveillance and Reconnaissance (ISR)



13. **Challenge definition:** Information will be central in the conduct of future warfare with our ISR capabilities being fundamental to our understanding. We must respond to the threats and opportunities of current and emerging technologies that affect our ability to conduct ISR in all domains and environments. The UK's ISR capabilities are increasingly becoming overmatched by our adversaries' anti-access and area denial capabilities, denying us the ability to conduct ISR operations. Our ability to understand the future battlespace will be challenged further as adversaries develop advanced networked sensor technologies, passive detection systems, quantum sensing and counter-ISR and counter-PNT capabilities.

14. **How this will be addressed:** By 2030 Defence will have a modern, capable, resilient and adaptive ISR system, with a data-centric approach at its heart. It will be able to collect across all domains and enable Defence to retain the initiative by outcompeting our adversaries in understanding. This will place an increasing emphasis on opportunities in the space domain, we will look to establish the optimum complementary mix of ISR 'Collect' capabilities information processing, exploitation and dissemination capabilities to enable timely decision making.

15. **Priorities for future capability development.** Defence will explore advanced technologies to deliver pervasive, full spectrum, multi-domain ISR, accelerating and integrating those technologies into service. **We will look to industry**, to support us by providing the technologies to enable this, helping to provide options for the integration of those technologies onto our current platforms, the systems to enable exploitation of the data we collect and, in the long term, to work with us to define our future ISR requirements. To help address this challenge we are looking to develop the following capability areas in future:

- **Processing, Exploitation and Dissemination (PED).** Being able to process, exploit and disseminate information is key to ensuring information advantage. Defence will continue to invest in multi-source PED to better analyse data from a variety of sources creating a system sufficiently coherent and ubiquitous to exploit all intelligence disciplines. The massive amount of data will be managed, processed, exploited and disseminated in the most effective and efficient manner possible by exploiting AI, Machine Learning and advanced data analytics. This will focus reconnaissance assets on specific targets of interest and advanced data analytics and visualisation tools will allow humans to produce intelligence in support of operational planning, decision making and targeting.
- **Open-Source Intelligence (OSINT).** Defence will increase its exploitation of publicly and commercially available information. This will augment our Secret and Above Secret, improve dissemination to tactical levels, provide greater automation opportunities and improve our collaboration with diverse partners. An increased OSINT capability is also essential in underpinning Defence's emphasis on audiences and influence activity. Our current OSINT capabilities have given the UK an early lead on many of its partners and we will seek to invest further to outpace our adversaries.
- **Persistent Space Based ISR.** Defence is currently funding investigations and operational demonstrators to deliver space based ISR capability. We will explore and develop our requirements for sovereign, space based systems to understand how these could augment and replace existing ways of providing ISR. Leveraging existing R&D investment and developed in line with the Defence Space Strategy, we are looking at advanced sensors, hyperspectral imaging, Electro-Optical and Infra-Red as well as synthetic aperture radar. Key decisions in this capability area are anticipated from 2025 onwards.

- **Next Generation Autonomous Systems.** The exploitation and inclusion of autonomous systems, from Uncrewed Air Systems (UAS) through to Uncrewed Ground Vehicles (UGV), Uncrewed Surface Vessels (USV) and Uncrewed Underwater Vehicles (UUV), form a key part of our future capability plans and for UK ISR capability. Through our investment in current R&D and anticipated technological development, Defence will continue to upgrade existing, and develop new, uncrewed and autonomous systems. Our Protector UAS and autonomous Mine Hunting Capability will be upgraded through its life, small UAS (such as project Tiquila[9]) and options to replace our Land and Maritime rotary wing aircraft are key areas of development to support our ISR capabilities.
- **Maritime Airborne Surveillance and Command.** The UK requires a sovereign Maritime Task Force Intelligence, Surveillance, Acquisition and Reconnaissance (ISTAR) capability to replace the Navy's Crowsnest Airborne Early Warning system when it goes out of service. The Defence and Security Accelerator (DASA) has run a competition for potential solutions for a capability to replace Crowsnest which will feed decisions on the future of this capability, which are expected in the mid-2020s.
- **Airborne ISTAR.** Given anticipated technological development over the next ten years Defence wants to explore the full range of options to deliver resilient and pervasive ISR. Currently, Rivet Joint provides an electronic surveillance and reconnaissance capability; it is anticipated that it will leave service in the mid-2030s. The E-7 Wedgetail will enter service in 2023/24, providing a step-change and world-leading airborne surveillance and aircraft control capability that we will seek to upgrade through its life to stay ahead of the threat. We will need to examine our future requirements within our overall ISR enterprise to determine what part Airborne ISTAR platforms, including potentially uncrewed or autonomous systems, will play in our future force mix.

9. A project for Mini-uncrewed air systems.

Enduring Capability Challenge 2: Multi-Domain Command & Control, Communications and Computers (C4)

16. **Challenge definition:** The pervasiveness and complexity of information, as well as the pace of technological change, are transforming the future operating environment, potentially degrading the effectiveness of C4 capabilities. Threats to the UK's communications, networks, information systems and platforms are accelerating, risking our ability to provide secure, long range, resilient and interoperable capability required to enable multi-domain integration and coordinate effects globally. C4 is a broad, complex and technically challenging area characterised by rapid advances in technologies, driven by commercial information systems technology and significant investment from state actors. Given this, our capabilities need to be better integrated, operating across domains and working in concert with other instruments of national power.

17. **How this will be addressed:** By developing the capability to enable multi-domain integration and the coordination of effects across government and globally with allies and partners – enhancing our ability to do multi-domain C4. This will require integrated and interoperable systems at all classification levels with built in resilience to enable operations in contested and degraded environments.

18. **Priorities for future capability development.** To get ahead of the continually evolving threat, Defence must develop more resilient, autonomous, and interoperable C4 systems. This will be enabled by underlying technologies, to ensure freedom of action and protection of our most valuable information. **We will look to industry** to support this by, applying open systems architecture to enable easier and lower cost integration of digital solutions and ensure the interoperability of those systems with our allies and partners. This will also involve working with industry to develop the systems to better utilise the data we collect. To help address this challenge we are looking to develop the following capability areas in future:

- **Multi-Domain Command and Control (C2).** As the new domains of Space and Cyber become more active we need to integrate them routinely into our thinking and existing C2 structures. Our people will be at the heart of our C2 capabilities, and we need to be able to exploit vast quantities of data to inform decision-making without overwhelming our operators, it is our intent to further invest in strategic communications infrastructure to protect our C2 information and to employ human machine teaming to increase the speed of our C2. In the space domain we are already investing over £135 million[10] over the next ten years to enhance our space domain C2 and will work with industry partners to best exploit available technologies to achieve this.

- **Defence Digital Backbone.** The Defence Command Paper set out Defence's plans to modernise the Digital Backbone that underpins the modernisation of our armed forces and support the broader transformation of Defence capability and business practices. As highlighted in the Defence Digital Strategy, digital technologies are constantly evolving and over the next ten years we plan to invest an additional £1.6 billion in People, Processes, Data, Technology and Cyber that underpin the Digital Backbone. Moreover, we are currently investing in developing Hyperscale Clouds, in part to better exploit the large volumes of data collected by Defence, to provide the foundation to deliver future capabilities and Next Generation Networks. Whilst there is significant investment over the next ten years in the Digital Backbone, we will constantly seek new opportunities to achieve the aspirations set out in that strategy and keep priorities and plans under review as they further develop.

10. The Defence Space Strategy, page 31.

- **Integrated Synthetic Environments.** To enhance Defence's situational awareness and planning, we require new more sophisticated and integrated synthetic environments and operational planning tools. The use of synthetic environments to enhance training of personnel is common in the maritime and air environments, for example the Defence Operational Training Capability provides a common platform in both of those domains. Moreover, the Army's Collective Training Transformation Programme (CTTP), where we intend to spend over £700 million over ten years, will put data exploitation and digitisation at the heart of training design and delivery. To improve integration across all Defence synthetic environments we will invest further in a common platform for all to operate off, improving both effectiveness and efficiency of delivery.
- **Secure Satellite Communication.** Global, secure satellite communication is essential for our operational independence. We are already investing over £5 billion over the next ten years in our Skynet satellite system and are now investing further in other space-based communications capabilities[11]. It is our intention to enhance our ability to transfer large volumes of data globally, rapidly and securely through future investment.
- **Cryptography.** The ability to securely exchange information at SECRET and above to support MOD's mission and operational needs requires sovereign, high-grade cryptographic capabilities. Defence investments will continue to address obsolescence issues while first improving and then transforming how crypt-key (CK) capabilities are delivered to Defence. By closer collaboration with industry, Defence will ensure the next generation of the UK crypt-key capabilities are designed and developed to ensure that the we evolve to maintain pace with technologies and threats.
- **Data.** The Defence Data Strategy, supports the development of our Defence Digital Backbone which will provide the basic foundations to fully curate and exploit our data assets. The establishment of MOD's data rules and the data strategy set the criteria and standards against which all data delivery and decisions across Defence will be measured. We have also established a Digital Foundry to unleash the power of Defence's data, it will exploit Artificial Intelligence and other game changing technologies to do this, it will pioneer new ways to rapidly exploit Defence's data. It is our intention to further develop this as technology matures, working with industry partners outside the typical defence and security industry, to allow seamless access to data and collaboration with our allies and partners. In particular, the ability to exploit data to support decision making, underpinned by Artificial Intelligence, Machine Learning and Human Machine Teaming.

11. The Defence Space Strategy, page 30.

Artificial Intelligence (AI)

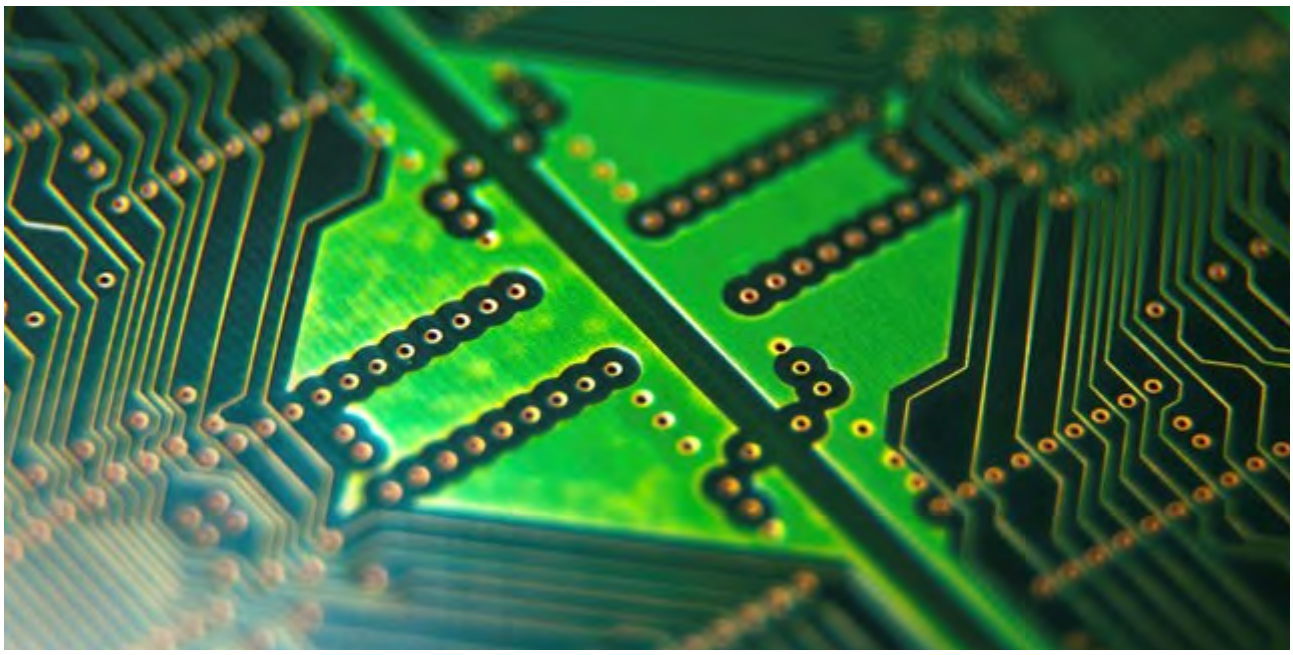
AI-enabled technologies are expected to proliferate further over the next decade, with the much of the expertise contained within the commercial sector. The military adoption of AI-enabled autonomous capabilities, and the exploitation of Human-Machine Teaming, has the potential to deliver a step change in the UK's way of warfare, with consequential and significant changes to our force structure.

Defence understands AI as a family of general-purpose technologies, any of which may enable machines to perform tasks normally requiring human or biological intelligence, especially when the machines learn from data how to do those tasks. As such AI **cuts across all the enduring capability challenges** and is a fundamental component of our future capability development.

The Defence AI strategy outlines our aspiration to exploit AI comprehensively and accelerating 'best in class' AI-enabled capabilities into service, maximising impact by bringing coherence and avoiding inefficiencies as well as unnecessary duplication. It sets out the approach to achieving this and how we will partner with industry to achieve the ambitions of the strategy.

The Defence AI Centre (DAIC) will act as the engine room for AI, Autonomy and Human-Machine Teaming, as it moves to a full operating capability in 2023. The DAIC will drive open architectures; agreed standards; and testing, evaluation, verification and validation processes. It will work with the Future Capability Group in DE&S to cohere and test battlespace AI, Autonomy and HMT solutions, including safe to release and safe to operate processes. It will work with Defence Digital to ensure appropriate data requirements are developed and with Dstl to seize emerging opportunities within S&T. Our adversaries will also be building capabilities in this area and will attempt to exploit our vulnerabilities, which will require innovative solutions to ensure our resilience. A better understanding of potential exploitation timelines will inform major investment decisions at the next Defence-level review – both for new capabilities and for the incorporation of AI within existing capabilities.

Enduring Capability Challenge 3: Secure and Sustain Advantage in the Sub-Threshold



19. **Challenge definition:** The pervasiveness of information and the pace of technological change are changing the character of warfare with malign actions below the threshold of conventional combat increasing. Our adversaries are changing their tactics and looking to win without fighting, to achieve their objectives by using attacks below the threshold that would prompt a warfighting response. There is a need to improve the UK's ability to anticipate, detect, attribute, counter and compete against adversaries below the threshold of conventional conflict and address our vulnerabilities.

20. **How this will be addressed:** As the Defence Command Paper set out, in an era of constant competition we must have an increased forward presence to compete with and challenge our adversaries below the threshold of armed conflict, to help project strategic influence, build partner capacity and prevent conflicts. This will be supported by the adoption and integration of new technologies to develop our capability to identify and disrupt sub-threshold activity and if required, attribute the actions being undertaken by our adversaries.

21. **Priorities for future capability development.** The pace of technological change and increasing prevalence of malign activity below the threshold of conventional conflict requires the UK to further develop its capability to protect its interests, as well as compete and constrain potential adversaries in this space. **We will look to industry** to support this by helping to ensure our capabilities are secure by design, less susceptible to cyber-attack and can contribute towards the identification of sub-threshold activity. To help address this challenge we are working to develop capability in the following areas in future:

- **Protection of Critical National Infrastructure.** It is essential that our data and digital systems are protected from interference. This includes space-based communications and fibre connections both on land and undersea cables, as well as the cloud-based storage within which our essential data is held. Protection can be achieved through a range of capabilities including cryptographic and cyber capabilities and traditional physical measures. We will continue to invest in this essential capability area building upon our existing programmes as solutions become available. We are particularly interested in developing innovative solutions to the threats in both the underwater and cyber space.
- **Special Operations.** Our Special Forces capacity and capability was enhanced through the Integrated Review, improving their ability to operate covertly in the harshest environments worldwide. Moreover, the Integrated Review led to the development of and investment in the Future Commando Force and Land Special Operations forces that are forward deployed and able to support a broader set of special operations whilst operating alongside our allies and partners. The determination of capabilities spend reflecting the accelerated investment remains to be finalised.

- **Cyber and Electromagnetic Environment (EME).** Both Offensive and Defensive Cyber capabilities are fundamental to sustaining our strategic advantage in the future operating environment. As announced in the Integrated Review we are investing in capabilities that enable us to respond in the electromagnetic environment, of which cyber is a part. We are also investing further to enhance our cyber defence, to address the cyber security gaps that exist in people, processes, and technology and expand our offensive cyber capabilities in conjunction with our UK Intelligence Community (UKIC) partners. This will be an enduring and likely increasing area of interest and investment where technological developments will provide both opportunities and threats to the UK. We must have the ability to contest and, if required, deny use of the EME to our adversaries. We will also need to develop techniques and solutions to detect, attribute and counter deceptive and malign activity in the EME. As it is our intention to invest further in capabilities that contribute to our situational awareness and understanding within the EME, as well as providing resilience where this environment is increasingly contested and congested.

- **Anti-Submarine Warfare (ASW).** To respond to an increasing challenge in the underwater battlespace we must exploit emerging technologies and high maturity research for operational advantage. Our existing investment in Type 26 Frigates and P-8 Poseidon highlight the importance we place on Anti-Submarine Warfare and in future we plan to invest further in ASW capabilities. In particular, we are interested in developing autonomous systems, exploiting AI and machine learning to link sensors and generate a greater collective underwater detection and tracking capability.

Enduring Capability Challenge 4: Asymmetric and Hard Power

22. **Challenge definition:** The development by Russia and China in their hard power capabilities, such as hypersonic missiles and glide vehicles, pose a significant challenge to the UK and our allies. If we are to deter aggression, by holding our adversaries at risk and to win if forced to fight we must, working alongside our allies and partners, be able to defend against the full spectrum of threats and develop ways to outmatch our adversaries' hard power capabilities; either through conventional, symmetric capabilities integrated to achieve best effect or through the development of new novel capabilities.

23. **How this will be addressed:** Through investment in advanced hard power capabilities and the exploitation of exploiting novel approaches and capabilities that have been developed through our enhanced R&D investment. To achieve this we will still need to invest in symmetrical hard-power capabilities that are similar to those being fielded by our potential adversaries to ensure they do not have a clear advantage over us. We will continue to modernise and focus future investment on the areas that will deliver advantage and provide a deterrent effect to our potential adversaries in novel and affordable ways.

24. **Priorities for future capability development.** Defence will look at technologies and capabilities that enhance our offensive capabilities, enable more efficient and agile deployment of those capabilities, deliver a step-change in force protection and to counter a broadening range of kinetic and non-kinetic effects. **We will look to industry** to support this by exploring and providing novel technologies and solutions that will enhance our capability through R&D and to consider how these can be developed alongside our allies and partners to achieve best effect. To help address this challenge we are working to develop capability in the following areas in future:

- **Directed Energy Weapons (DEW).** A Directed Energy Weapon (DEW) is a weapon system that disrupts, degrades, or damages a target by emission of highly focused electromagnetic energy, either laser or radiofrequency. Defence is investing significantly in developing DEW capabilities which could have multiple applications from Air Platform Protection to Ground Based Air Defence. Our expansion of and increased investment in the DEW programme will, inform decisions on the scaling up of future investment in DEW.

- **Hypersonic and High Speed Weapons.** The UK currently does not possess a hypersonic[12] weapons capability in the form of Hypersonic Glide Vehicles (HGVs) or Hypersonic Cruise Missiles (HCMs). As outlined in the Integrated Review, the UK is seeking to develop long-range precision strike capability more broadly, and hypersonic weapons need to be considered in this context. Defence is already investing in capabilities to counter the threat from adversary hypersonics and in S&T programmes to develop High Speed Weapon (HSW) technology. As technology matures, we will look to build on this for the spiral development and upgrade of our existing capabilities, for example our Aster missiles, as well as continuing to collaborate with our closest allies to develop hypersonic technology and understanding. Alongside this we will also explore complementary sovereign capability and capacity that builds upon our existing investment and complex weapons pipeline. The size and scale of our investment in hypersonic technology will continue to evolve; the Integrated Review funding enables a concept informed, threat lead and evidence-based approach with further funding decisions around hypersonic development anticipated over this decade.

12. Generally accepted as speeds greater than Mach 5.

- **Future Land Combat System (FLCS).** FLCS, within the Future Soldier Plan, will modernise the British Army, enabling it to adopt new approaches and prepare for the transformative effect of new capabilities, including those integrated from the other domains. It will shift the Army to a more forward deployed posture, operating below the threshold of conflict, anticipating and reacting at speed to developing situations, in order to achieve asymmetric hard power effect. It will address the risk inherent in the physical presence of land forces including in the urban environment. Capability investment to achieve this is described at Annex A, and comprises the 'Integrated 8' system of systems outlined in the Land Industrial Strategy.
- **Multi-Domain Integrated Swarms (MDIS).** Our MDIS "Game Changer" programme is both developing the information architecture and facilitating the experimentation to enable a multi-domain autonomous swarming capability; a potential use case is helping to access and retain freedom of manoeuvre in contested environments. Currently MDIS is attempting to demonstrate the feasibility and viability of using Remote and Autonomous systems in contested environments and as this technology matures it is our intention to invest further in this capability area, should to concept prove viable.
- **Above Water Lethality.** Part of our increased investment through the Integrated Review was focussed on the lethality of the surface fleet. In particular, we are looking to introduce a step change in the Navy's surface to surface guided weapon capability through our Future Cruise / Anti-Ship Weapon (FC/ASW) programme with our French allies. This will shift the Royal Navy from a predominantly defensive force to a more offensive one, through provision of sophisticated strike systems providing both land attack as well as an anti-ship capability.
- **Research and Development (R&D).** We cannot anticipate all technological changes over the next decade with the development of advanced conventional and novel weapons being areas where, in addition to our largely traditional areas of development, we are exploring technologies which could provide game-changing effects. Through our R&D investment we aim to exploit these technologies to give us hard power advantage, deliver effects and protect critical UK interests abroad, and is where we will need to most help from industry in this challenge area.

Future Combat Air

The Defence Command Paper reaffirmed that we will invest more than £2 billion in the Future Combat Air System (FCAS) programme out to 2025 The ultimate amount we invest will depend on key programme choices. Over the next 10 years we have allocated around £10 billion to the FCAS programme. We are exploring how our future capability could be more than a traditional combat air platform; creating the vital connected heart and mind of an integrated combat air system. This would mean the ability to contribute to and utilise wide-ranging capabilities, from intelligence, surveillance and reconnaissance (ISR), to command and control and air defence. The aim is to deliver initial operating capability by the middle of the next decade. We have also committed to grow the F-35 fleet beyond the 48 F-35 aircraft already ordered and continue to invest in Typhoon to meet the operational threat well into the 2030s. More information on our approach can be found in the Combat Air Strategy.

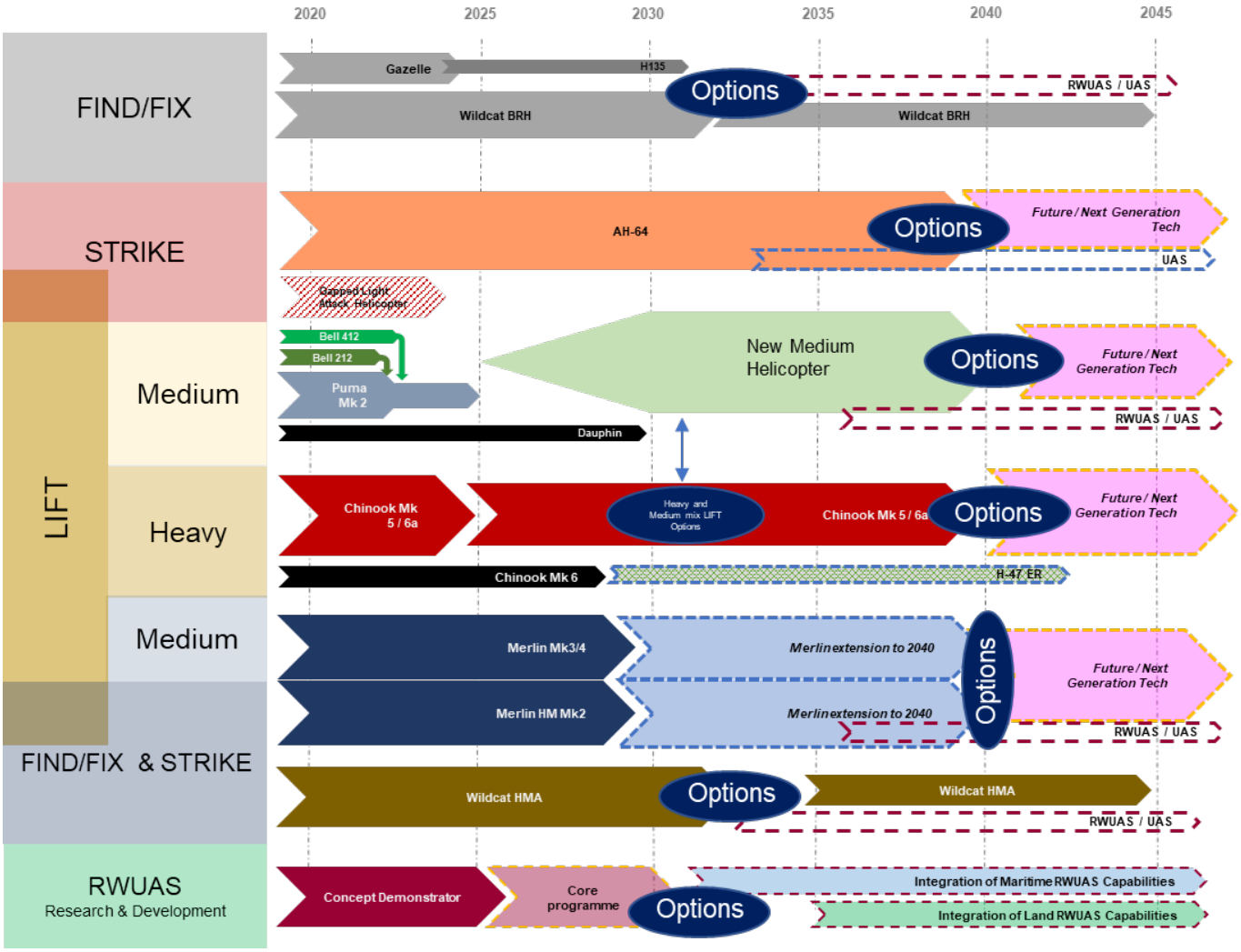
Future Rotary Wing

UK Defence recognises the unique value that Rotary Wing capability provides to the Whole Force in terms of speed of response, flexibility and tactical reach, exploited through the roles of LIFT, FIND and STRIKE. These effects will remain critical to delivering Defence outputs until at least 2040. We are cohering a number of formerly disparate Rotary Wing lines of effort into a single efficient, resilient, sustainable and affordable enterprise, with imminent capability gaps and obsolescence resolved and aircraft types rationalised from ten down to six between now and 2030.

The IR decisions to invest in a New Medium Helicopter and the Chinook Capability Sustainment Programme, and to extend Merlin fleets until 2040, all form key elements of this process. Our strategy also seeks to identify the optimal transition points in the future where the need to modernise ageing and obsolescent in-service capabilities intersect with realistic opportunities to exploit the predicted technological advances that Defence and the aviation industry continue to work hard to realise. Our strategy therefore expects FIND, STRIKE and non-human LIFT effects to be increasingly delivered by uncrewed and autonomous systems over the next decade with the Maritime domain initially leading for Defence.

This could see several roles currently fulfilled by crewed Rotary Wing platforms being delivered by other means in the future. Defence has commissioned several lines of investigation to understand and shape these transition points, including: investment in the Rotary Wing Uncrewed Aerial System Concept Demonstrator (PROTEUS); a related study to understand the potential shape and scale of a Wildcat Mid-Life Upgrade; investigations into the Uncrewed delivery of Maritime Airborne Early Warning and Maritime Intra-Theatre Lift; developing Next Generation Air Survivability capabilities; analysis to inform

future medium and heavy lift requirements and the balance between the two; and, to support the NATO Next Generation Rotor Craft concept work as well as engaging with the US Future Vertical Lift programme. The summary of the likely inflection points where Defence will be afforded choice are captured in the diagram below:



One strategic objective within our future Defence Rotary Wing aspiration is to reinforce relationships with industry, Partners and Allies. The DSIS sets out the importance of being able to maintain our operational independence as we support and upgrade our fleets and respond quickly to changing threats through the integration and adoption of new weapons, defensive systems and digital technologies. As part of this objective, we would value an on-shore industrial Design Organisation and manufacturing base, access to intellectual property and user rights for capability areas which underpin operational advantage, and assured and responsive regulation and certification to support through-life capability management.

Enduring Capability Challenge 5: Freedom of Access and Manoeuvre (FOAM)

25. **Challenge definition:** Our adversaries are adopting new ways of warfare, using an array of capabilities which look to deny our Freedom of Access and Manoeuvre through contesting and degrading operating environments across all domains. Our ability to project and sustain a deployed force is becoming more constrained. An increasingly challenging electromagnetic environment and more lethal, technologically advanced threats require us to change if we want to be able to operate with minimal constraints and achieve freedom of access and manoeuvre in all domains.

26. **How this will be addressed:** As outlined in the Integrated Review we will ensure our freedom of access and manoeuvre through a constant global presence with more forces deployed on an enduring basis, persistently engaged to pre-empt and manage crises before they escalate. This will be supported by our ability to confuse our adversaries ISTAR capabilities to give us operational advantage.

27. **Priorities for future capability development.** Enabling FOAM will ensure that Defence can operate when it needs to fulfil its tasks. We will seek to exploit technologies and capabilities that enable operation in a contested and degraded environment, are more survivable and exploit AI and human machine teaming. **We will work with industry**, to support this through the generation of low-observable and stealth technologies, which are designed to be interoperable with our allies and partners, that Defence can exploit and integrate into our existing and future capabilities. Some of the capability areas that may offer advantage in the future are:

- **Position, Navigation and Timing (PNT).** Defence will continue to support the Department of Business, Energy and Industrial Strategy's office of PNT and the extensive cross-government 'system of systems' approach to develop secure and resilient PNT to meet wider societal requirements in line with the stated IR intent. Given the global nature of PNT it is important that we continue to work with our allies and partners, in particular the U.S., regarding any future capability choices. This will include considerations around the protection and resilience of PNT capabilities in a contested or denied electromagnetic environment.
- **Ballistic Missile Defence (BMD).** The Integrated Review included a significant uplift of R&D funding, enabling further development of promising programmes, such as next generation radar technology, to detect and track ballistic and hypersonic threats. We will continue to invest in cutting edge scientific research and technologies to meet the challenge of rapidly evolving threats and remain committed to NATO's BMD Radar. In particular, we are interested in capabilities to help further protect deployed forces, novel forms of BMD, enhanced sensors and interceptors to counter a ballistic missile threat. Where appropriate we will look to build on our existing international partnerships, such as with NATO, to further develop BMD capability. We will begin to take an Integrated Air and Missile Defence (IAMD) approach, whereby systems are developed and integrated to better counter the full spectrum of threats from small UAS through to BMD and counter-hypersonics capability.
- **Counter Uncrewed Air Systems (C-UAS).** Uncrewed Air Systems (UAS) have become a ubiquitous threat across the spectrum of conflict, varying significantly in size, capability and control method. Their deliberate or unintentional misuse poses a significant threat to Defence both in the UK and overseas and represents an early manifestation of how autonomy can and will alter the future battlespace. This trend is set to continue and the need to counter uncrewed air systems, of all sizes and capability, both bespoke and off the shelf, will increasingly become a prerequisite for protecting deployed forces within a layered approach to defending the airspace. To focus our investment and meet the most immediate operational threat we will prioritise counter small UAS capability development initially but recognise the intrinsic link to the upgrade for our Ground Based Air Defence system.

- **Ground Based Air Defence.** Looking to the future defending against threats, whether small UAS through to larger crewed systems from longer distances is of increasing importance. Our Ground Based Air Defence System, where the Army are spending around £1 billion over the next ten years, is an integral part of enabling Defence against these threats. The introduction into service of our new air defence systems will be part of a layered and full spectrum air defence system that will need to be embedded within the Defence Digital Backbone to enable better exploitation of information to support decision making and enable us to counter the threat.
- **Force Protection.** As the threat posed by our adversaries develops and diversifies, the ability to protect deployed forces and increase their survivability becomes more important to enable FOAM. As well as advanced camouflage, concealment and deception, platform protection systems will be critical for success in future operations with air platform protection systems being of high importance. Novel solutions, for example the incorporation of DEW, to enhance force protection are of particular interest. The Army's MERCURY series presents the technology challenges of tomorrow to industry today, and in its first instance considers systemic, off-board electrically powered protection.
- **Air Platform Protection.** An important subset of Force Protection is platform protection which has traditionally been focussed in air and maritime environments but is of increasing importance to land based platforms as well. EW, decoys, countermeasures and other techniques will need to be employed to increase platform survivability in increasingly contested environments and enable Freedom of Access and Manoeuvre. It is our intention to invest further in Air Platform Protection capabilities to adapt, upgrade and evolve to counter a changing threat as well as securing a valuable sovereign industrial capacity.
- **Counter – Chemical, Biological, Radiological and Nuclear (CBRN).** CBRN weapon use remains an enduring and growing threat to the UK, deployed forces and international stability. Defence's world leading CBRN science and technology capability will continue to play a vital part in maintaining our counter-CBRN operational advantage and we will continue to invest in counter-CBRN capability. In particular we are interested in medical countermeasures, decontamination systems, protective equipment and sense and detection systems to help counter current and emerging CBRN threats.
- **Air-to-Air Refueling.** Air-to-Air Refueling (AAR) allows our aircraft to reach further and fly for longer, it is essential to maintaining our FOAM. Our AAR capability is currently provided by Voyager, which also delivers long-range airlift; the Voyager fleet is delivered as a service by the AirTanker consortium. This arrangement is due to expire in the mid-2030s. Defence see AAR as an enduring requirement and one that might benefit from a higher degree of autonomation and wider utility of the AAR platform.

- **Support.** Through the Defence Support Strategy (DSS) we are investing in our Support capabilities. Contested Logistics anticipates a potential fight against a near-peer adversary that is contested in all domains and against a background of climatic, social and physical threats, spread across an extended theatre. It assumes that all domains are threatened, that the homeland is no longer a sanctuary, and that there will be a direct targeting of logistics. In countering this, we will look to achieve Support Advantage through agile and resilient logistics. We will need to continue our extensive transformation of our Defence Logistics and Engineering Support capabilities to give Defence the ability to deter and, if necessary, outcompete its near-peer enemies by having more of our key capabilities available, more of the time, positioned where and when we need them and sustained through more resilient support chains. This will be delivered through increased platform and equipment availability and the development of superior, assured, environmentally sustainable and cost-effective logistics services which must be an integrated military-industry endeavor. Defence will deliver Support Advantage through a resilient Strategic Base, an efficient Coupling Bridge and robust enablers able to open and enable a contested theatre.
- **Adapting to Climate Change.** To maintain our Freedom of Access and Manoeuvre, our capabilities need to be resilient to the effects of climate change. Defence expects to invest in more sustainable fuel and alternative energy sources to power both our operations in the battlespace and our estate in the business space. These requirements, as well as contributing to Net Zero 2050, will be considered throughout future capability development with investment decisions considered iteratively over the next decade and beyond.
- **Defence Medical Services (DMS).** The DMS is at an inflection point where we must shift from linear care pathways to medical support options that are more networked, adaptable, scalable, and layered with an all-hazards approach. Intelligent use of data and commonality of equipment can unlock greater flexibility in medical support to the force. Investment in simulation is required to enable the medical workforce. DMS will improve whole force deployability through data driven health networks, capitalising on the use of wearable technologies and connected patient records to provide an end-to-end picture of patient health and care. We will continue to seek out modular, scalable equipment sets and will invest in protected deployable infrastructure in the land and maritime (including CBRN) environments and will decrease the requirement for refrigeration for pharmaceuticals and blood products. This, in turn, seeks to minimise the demand for specialist engineering and logistical support. At the human level, our R&D investment focuses on optimising human performance and improving patient outcomes.

Summary of future Military Capability Priorities

Enduring Challenge Area	Priorities for Future Capability Development
Pervasive, full spectrum, multi domain Intelligence, Surveillance and Reconnaissance (ISR)	• Processing, Exploitation and Dissemination 9PED) • Open-Source Intelligence (OSINT) • Persistent Space Based ISR • Next Generation Autonomous Systems • Airborne ISTAR
Multi-domain Command and Control, Communications and Computers (C4)	• Multi-Domain Command and Control (C2) • Defence Digital Backbone • Integrated Synthetic Environments • Secure Satellite Communication • Cryptography • Data
Secure and sustain advantage in the sub-threshold	• Protection of Critical National Infrastructure • Special Operations • Cyber and Electromagnetic Environment • Anti-Submarine Warfare (ASW)
Asymmetric and Hard Power	• Directed Energy Weapons (DEW) • Hypersonic and High Speed Weapons • Future Combat Air • Multi-Domain Integrated Swarms • Above Water Lethality • Future Land Combat System
Freedom of Access and Manoeuvre	• Position, Navigation and Timing (PNT) • Ballistic Missile Defence (BMD) • Counter Uncrewed Air Systems (C-UAS) • Ground Based Air Defence • Force Protection • Air Platform Protection • Counter – Chemical, Biological, Radiological and Nuclear (CBRN) • Air-to-Air Refuelling • Support • Adapting to Climate Change • Defence Medical Services
Cross-Cutting	• Artificial Intelligence • Future Rotary Wing

5. Measuring Success: Transforming Test and Evaluation

28. To measure success against our guiding principles, challenges, and priorities a step-change in our approach to test and evaluation is required. Whilst acknowledging the value of UK live trial capabilities, we need to embrace a more digitally enabled future.

29. Several factors are driving this change (see Figure 5). Challenges such as rising system complexity and satellite overwatch need to be overcome, but there are also opportunities such as continuous evaluation that starts earlier in the capability lifecycle, so that feedback can be introduced when it is most able to be utilised. Modelling and simulation, data exploitation and the adoption of continuous digital evaluation could equip the MOD and our suppliers with the insight to define, design and deliver more adaptive, integrated, threat-optimised military capability.

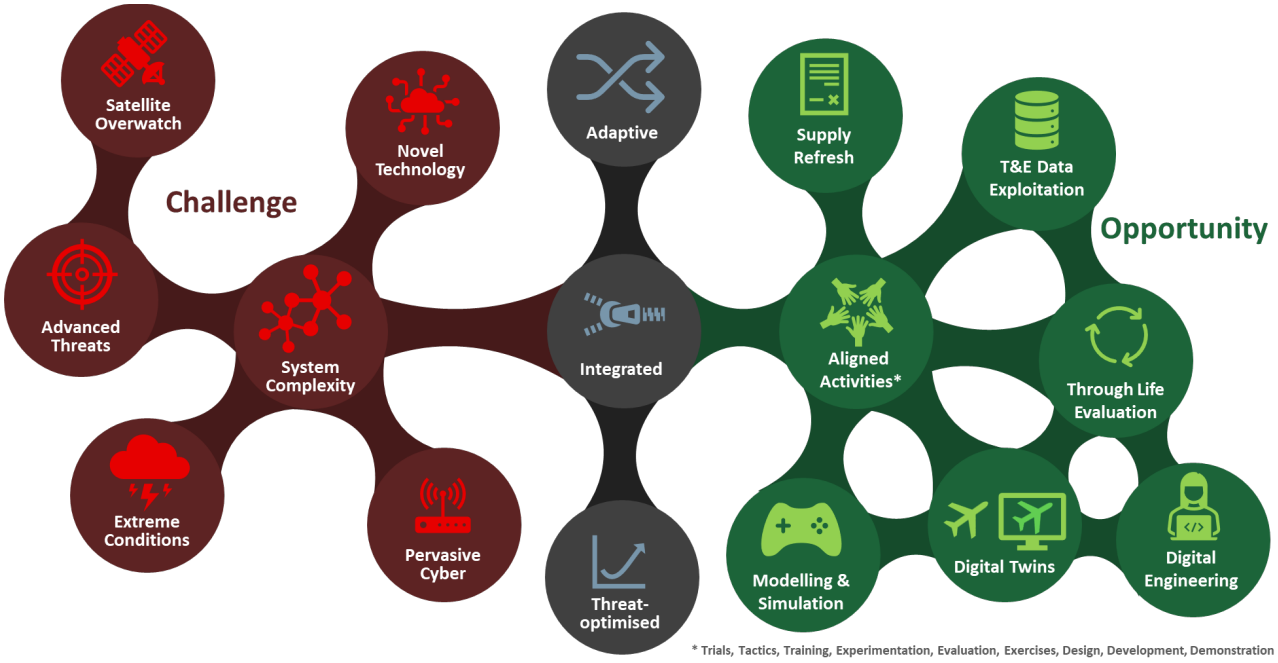


Figure 5: Drivers of change in the Test and Evaluation Enterprise

30. For many companies in the Defence industry and the wider UK economy this approach is already integral to product and service development. The challenge is to integrate this approach across the Defence enterprise, and unlock the advantages of continuous, integrated, threat-orientated evaluation from force design, through capability development to mission rehearsal and beyond. In short, the systemic challenge is to move beyond evaluation for acceptance, to evaluation for advantage.

31. In the Defence Command Paper (2021) we announced £60 million of investment over four year in the first phase of a test and evaluation transformation programme. This programme is now underway, and its initial phase will culminate in 2023 with a de-risked blueprint and implementation plan for a modernised test and evaluation enterprise. It is our intention to invest further in phase 2 to implement these plans and deliver transformation over the course of 10 years. This will include addressing the enabling infrastructure, skills, data, culture, processes, standards, services, and capabilities needed to realise the benefits of transformation.

32. This is an exciting opportunity to build on and develop evaluation capability and competence where the UK is either world leading or adapting as a fast follower at the pace of innovation. Our strategic intent is to leverage industrial capability within the UK and foster international cooperation where appropriate. We are keen to learn from those industries and organisations already enjoying the benefits of 21st century test and evaluation, and exploit capability that exists across the UK economy.

33. This is a wide-ranging, long-term initiative, impacting the evaluation of most future UK military capabilities, particularly those containing novel technologies and complex systems. This is a journey the MOD, our suppliers, regulators, and partners must go on together to achieve maximum benefit. Which is why during Phase 1 of this programme, we will seek to jointly develop a common view of the future test and evaluation enterprise and the roadmap we must jointly travel to get there.

34. The test and evaluation transformation programme will be engaging with Defence and non-Defence industry through various forums, including many of those listed at the end of this document. To sign-up directly for updates about the test and evaluation transformation programme email: fmc-futurete@mod.uk

6. How to engage with the Ministry of Defence

35. **Next Steps.** Our future capability development will be influenced by the developments and ideas of Defence industry, the commercial sector and academia. We will work closer with industry to inform our thinking with the opportunities presented through research and experimentation undertaken by industry forming the basis of this thinking. This paper will be revised following every Defence review with interim updates published when our thinking changes, for example through the outcomes of our R&D investment and experimentation.

36. Defence has hierarchies of requirements from capability (next equipment programme) to innovation (new ideas and evidence). They will have different timeframes and lifecycles from concept to capability and not all R&D/Innovation/ experimentation funding will lead to an equipment capability programme. This paper sets out Defence's capability challenges and the area's most likely to require Defence and Industry to develop equipment capability programmes to meet these challenges, the model for how we take this forward is subject to ongoing attention through the acquisition and approvals transformation programme.

37. The Ministry of Defence is a large and complicated organisation. We recognise that it can be difficult for those in industry to understand where and how to interact with Defence to explore ideas and opportunities for potential investment. The DSIS outlines how the relationship between Defence and industry will change with further developments expected in the coming years. The following section explains the role of different parts of Defence and how engagement may be framed.

Strategic Level Engagement

The Defence Suppliers Forum (DSF)

38. The main forum for MOD-industry relationship is through the Defence Suppliers Forum (DSF), chaired by the Secretary of State for Defence and including representatives from prime contractors, international companies, and small and medium sized enterprises. These fora tend to look at cross-cutting issues that affect both MOD and Industry, providing space for discussion about these issues and Defence's priorities, they do not focus on individual technology or capability areas nor provide funding for their exploitation. The DSF is supported by several sub-groups, co-chaired by MOD and Industry, that focus on particular areas of interest. The DSF Capability Management, Innovation and International (CMI&I) sub-group and the Research, Technology, and Innovation Group (RTIG) are the main fora for discussions around capability, technology, science, and innovation issues. The DSF Capability Enterprise & Acquisition steering group (CEASG) provides an opportunity to engage on MOD's acquisition reform work which is delivering a range of initiatives aimed at driving pace and agility into the acquisition system. More information about the DSF and its sub-groups is available here.

Commercial and Exports focussed engagement

The Defence Growth Partnership (DGP)

39. This partnership between Government and industry that works to grow the UK's defence sector by strengthening its global competitiveness to achieve international success. Sponsored by the Department for Business, Energy, and Industrial Strategy, the DGP membership includes MOD, Department for International Trade, eleven leading defence primes, and ADS, the trade association. It has established the UK Defence Solutions Centre to provide market intelligence, capability and market development, innovation and aligned investment jointly for the UK government and defence industry; designed to enable UK companies to win significant new international business. More information about the DGP and how to engage with it is available here.

Defence Equipment & Support (DE&S)

40. DE&S manage a vast range of complex projects to buy and support all the equipment and services required for the Royal Navy, British Army, Royal Air Force and UK Strategic Command to operate effectively. DE&S works closely with industry and is the primary interface with industry for the procurement and support of Defence equipment, including the exploitation of new and emerging technologies into safe, integrated, and sustainable military equipment systems. The DE&S Future Capability Group provides its corporate link to UK MOD's technology and innovation organisations, to enable DE&S to meet customer requirements, enabled by emerging technologies, with the necessary agility and pace. Further information about DE&S is available here.

Submarine Delivery Agency (SDA)

41. The SDA is an Executive Agency of the MOD that was established in April 2018 to manage the procurement, in-service support and disposal of the UK's nuclear submarines. The SDA delivers assured capabilities to the Royal Navy that are essential to the delivery and maintenance of the nation's Continuous at Sea Deterrent. As a delivery organisation, the SDA's focus is on operations alongside the Royal Navy at Her Majesty's Naval Bases (HMNB) Clyde and Devonport, and with key suppliers BAES, Rolls-Royce, and Babcock across the UK.

Defence Digital

42. Defence Digital is responsible for making sure that effective Digital and Information Technology (D&IT) is put into the hands of the military and business front line. They lead on defensive cyber strategy, capability development and policy, whilst also supplying IT to 200,000 users across more than 2,000 defence sites in the UK and globally.

UK Defence and Security Exports UK Defence and Security Exports (UKDSE)

43. Part of the Department for International Trade, UKDSE provide specialist export advice and practical assistance, working closely with industry and government departments including MOD, the Home Office, and the Export Control Joint Unit (ECJU). They are responsible for:

    - helping UK Defence and security industries export their products
    - maintaining relationships with overseas governments to promote British Defence and security products
    - working with MOD and industry to ensure Defence and security products have export potential
    - providing UK Defence and security companies with specialist support to sell their goods.

44. The UK Defence and Security Exports SME Support Team provides and supports a wide range of events and activities designed to help UK small and medium-sized enterprises win overseas defence and security business. If you are contacting UKDSE for the first time fill in our short contact form. UK SMEs that have already engaged with UK DSE should email ukdse.smeenquiry@trade.gov.uk.

Defence Sourcing Portal (DSP).

45. All new direct tender and contract opportunities valued over £10,000 are advertised on the DSP. Access and registration is free of charge and all suppliers looking for opportunities in Defence procurement are encouraged to register their details on the DSP now.

Military Command and Enabling Organisation Procurement.

46. Each Military Command and Enabling Organisation has their own commercial and procurement mechanisms. Engagement on the challenges and priority capability areas outlined in this paper will happen at Military Command level.

Innovation and Ideas focussed engagement

The Defence and Security Accelerator (DASA)

47. DASA actively seeks out suppliers that have innovative ideas to support UK defence and security. DASA's unique team of regionally based Innovation Partners and Access to Mentoring team are on hand to provide support to industry particularly, small and medium enterprises and academic institutions who have not previously worked with Government. DASA funds suppliers to develop their innovation through two main mechanisms: Themed Competitions and the Open Call for Innovation.

- **Themed Competitions** offer innovators the opportunity to submit proposals around specific government areas of interest, with the aim of driving the development of technologies that address predefined challenges in national security. Through Themed Competitions, we work with the MOD, other government departments and organisations across the wider public sector to maximise access to cutting-edge science and technology, providing a route to strategic advantage.
- **The Open Call for Innovation** is open to innovators with good ideas for defence and security, offering them the opportunity to submit their ideas to defence and security stakeholders. Innovations are welcomed that address any defence or security challenges where there is a relevant security Innovation Focus Area (IFA). The Open Call is open for proposals all year round, with assessment dates scheduled across the year. We will gauge end users' interest, then assess and contract the very best of these ideas.

48. DASA has also launched a new Defence funding competition: **The Defence Innovation Loan**, which currently has £10 million available to fund Innovative Defence solutions. This service provides an opportunity for single small and medium enterprises (SMEs) with Defence solutions to apply for a Defence Innovation Loan of between £250,000 and £1.6 million with an interest rate of 7.4% per annum. More information about DASA is available here.

Defence Science and Technology Laboratory (DSTL)

49. DSTL is the principal channel for Defence to engage with suppliers (in industry and academia) to understand and procure research and development products and services in the technology areas set out in this Framework. DSTL manages a range of competitions and R&D procurement activities, including the Searchlight function which aims to attract non-traditional Defence suppliers and SMEs that are developing ideas or products with potential Defence and Security applications. Further information about DSTL is available here.

The Defence Small and Medium-sized Enterprise (SME) Action Plan

50. The SME action plan sets out our commitments to SMEs and explain how we will meet them. We also highlight practical ways in which smaller and non-traditional defence suppliers can find and compete for opportunities in UK defence, and provide an overview of what a new supplier needs to know to work with us. The plan can be found here.