

Written evidence submitted by RAND Europe.

Summary

This written evidence from RAND Europe was produced by Nicolas Jouan (Senior Analyst), with the support of his colleagues Ondrej Palicka (Research Assistant) and James Black (Assistant Director). With teams in the UK, Belgium and the Netherlands, RAND Europe is the European arm of the RAND Corporation, a non-profit research institute and the world's largest policy research organisation.¹

RAND's mission is to help improve public policy and decision making through objective research, analysis and wargaming for governments, militaries, and non-governmental organisations across the UK, EU, NATO, and other allies (e.g., Australia, Japan, ROK). RAND has worked on Artificial Intelligence (AI) since the 1950s, including extensive studies of the implications for defence and security, and for strategic competition.²

The development of AI capacity and expertise is recognised as a key element of national security by UK Defence. To this end, RAND has collected evidence from our previous work, as well as open-source information, to respond to the questions in this inquiry. This response first considers the priorities set out by the Ministry of Defence (MoD) to advance AI capacity [Question 1]. It then looks at the current strengths of the UK AI sector with defence applications [Question 2]. It follows by exploring means by which the UK Government can propel domestic AI expertise in industry [Question 3] and help embed AI companies into the defence supply chain [Question 4]. Finally, it discusses how to promote the UK AI sector in the context of AUKUS Pillar two [Question 5].

1. How clearly has the Ministry of Defence set out its priorities for the kind of AI capacity and expertise it believes the UK defence sector should have, what priorities has it identified, and are these deliverable?

Over the past years, the Government has set out a series of priorities for the development of AI capacity in the UK. The 2021 National AI Strategy emphasised the need to access to four broad categories of resources essential to AI development: skilled people, data, compute and finance.³ This same strategy presented Defence as a core contributor to the prosperity of the UK AI sector. The UK Ministry of Defence (MoD) was presented as a pillar of AI adoption within government and as a 'natural partner for the UK AI sector' through, inter alia, its procurement and research and development (R&D) programmes.⁴ Finally, the strategy mentioned the MoD's role in climate change mitigation as an example use case for trialling an AI-powered electricity optimisation system to reduce consumption.⁵

In many ways, the 2022 Defence AI Strategy was a continuation of the National AI Strategy, envisioning the transformation of the MoD into an 'AI ready' organisation, driven and orchestrated through the ongoing work of the policy-focused Defence AI & Autonomy Unit (DAU) and the delivery-focused Defence AI Centre (DAIC).⁶ The MoD's strategy echoed the cross-governmental one in its pledges to adopt AI 'at pace and scale for Defence advantage' and to support the UK AI industry, while also recognising the added sensitivity surrounding

¹ For more information on RAND, see: www.rand.org

² For more information on AI at RAND, see: <https://www.rand.org/topics/artificial-intelligence.html>

³ UK Government (2021)

⁴ UK Government (2021)

⁵ UK Government (2021)

⁶ UK Ministry of Defence (2022a)

AI applications in Defence and thus the need for a robust set of ethical principles to guide development and deployment of such systems.⁷

The AI capacities identified as priorities by the MoD can be divided into two main categories. The first is the use of AI systems in the delivery of operational capabilities (e.g., AI procurement) and the second is the wider ability of the defence enterprise to properly leverage such AI capabilities (e.g., AI literacy). These two categories are in practice interlinked with the stated need to 'develop, test and deploy new algorithms' in-house, and conscious of existing frameworks for capability development, such as the Defence Lines of Development (DLODs), which emphasise not only the acquisition of technology but also the integration of other factors such as training, infrastructure, and doctrine.⁸

In turn, this entails a need to bolster not only in-house capacity and expertise within the MoD and Armed Forces, but also those across government, industry, academia, and the skills base. This necessitates both nationally focused efforts, seeking to develop and sustain a sovereign UK skills and technology base for AI, as well as collaborative efforts with international allies and partners to pool and share expertise, learning and resources where appropriate.

Although the Defence AI Strategy mentioned a series of initiatives to recruit and retain AI skills, it did not go into detail on all the structural changes to the MoD's organisation, workforce management and incentivisation, career pathways, or culture that would be needed to make this a reality. One must refer to the MoD's 2021 Digital Strategy for Defence to find further concrete steps towards 'AI readiness', such as the ambition to create a single digital ecosystem for UK Defence through £1.6 billion of investments in workforce upskilling, data access and network services.⁹ However, the National Audit Office (NAO) has already pointed out an initial lack of financial commitment and a persistent shortage of digital skills within MoD as factors that could be detrimental to the plan.¹⁰

Operational requirements also suffer from a relative lack of clarity. The 2021 Defence Industrial and Security Strategy (DSIS) signalled the ambition to 'accelerate adoption of [AI] technology across the full spectrum of [...] capabilities and activities' with for instance the creation of the Defence Artificial Intelligence Centre (DAIC).¹¹ Yet, the MoD did not nominally mention AI a single time in its most recent equipment plan for the period 2022-2032.¹² It however included many acquisition programmes of systems enabled by AI including autonomous platforms, augmented and virtual reality training tools, and advanced logistics capabilities.¹³ One can find echoes of the 2019 Defence Technology Framework which listed possible AI applications such as platforms taking decisions autonomously and automated stock management.¹⁴ While communicating the priority use cases to industry and academia helps the MoD's suppliers better guide their investments, the absence of a formal Defence AI 'wish-list' does have its upsides; giving signs of the MoD moving towards a holistic view of AI featuring in all aspects of military readiness, including operations and maintenance, rather than confined to a silo.¹⁵

⁷ UK Ministry of Defence (2022a)

⁸ UK Ministry of Defence (2022a)

⁹ UK Ministry of Defence (2021a)

¹⁰ NAO (2022)

¹¹ UK Ministry of Defence (2021b)

¹² UK Ministry of Defence (2022b)

¹³ UK Ministry of Defence (2022b)

¹⁴ UK Ministry of Defence (2019)

¹⁵ Chuter (2023)

The priorities defined by MoD for the UK's Defence AI capabilities and capacities are therefore rightly ambitious, but also tend to be open-ended and challenging to assess in terms of deliverability. The Digital Strategy for Defence insists on building bridges with industry and clarifying acquisition requirements for AI firms doing business with the MoD.¹⁶ For instance, the Defence AI Strategy acknowledges the role of Defence in propelling AI innovation through instruments such as the National Security Strategic Investment to explore dual-use technologies with industry.¹⁷ However, the strategy does not really engage with or address the documented technical skills gap within UK industry, particularly for AI literacy and algorithm skills – not least given the fact that many of the policy levers to influence this skills base sit outside of the MoD (e.g., with DSIT, DBT, DfE or other departments), or the overarching challenge that the UK has finite political or financial clout with which to shape global AI markets that are ultimately most focused on commercial applications from AI rather than defence.¹⁸

The belief permeating the MoD strategy seems to be that ensuring higher levels of investments and more streamlined contractual pathways for industry will lead to a stronger AI ecosystem overall. However, more structural issues stand in the way of the MoD's ambitions for national AI capacity. Examples include the persistent lack of sufficient STEM graduates; competitors to the UK Global Talent visa (more expensive than its American and German equivalents); and the ability of foreign companies to either attract UK talent overseas (e.g., to Silicon Valley) or else buy up whole UK firms and their Intellectual Property (IP).¹⁹ Striking a balance between promoting UK sovereignty and realising the benefits of competition and Foreign Direct Investment (FDI) remains a fundamental policy dilemma that Defence – and Government at large – continues to grapple with across many technologies and industries, not just AI.²⁰

2. What strengths and expertise does UK industry currently have in the field of Artificial Intelligence with defence applications?

The UK has many advantages and enablers in its quest to boost national AI capabilities, including the third highest number of AI firms worldwide.²¹ Among 1,607 unique AI specialist UK firms, 37% declare working on software development, 7% on image processing and 6% on autonomy, all fields highly relevant to Defence.²² A number of major AI-related companies originated from the UK, including DeepMind, Graphcore, BenevolentAI and Darktrace, though some are now under foreign ownership (e.g., DeepMind was acquired by Google/Alphabet). In turn, foreign tech companies such as Microsoft, Alphabet, Apple, or Meta, as well as AI firms such as OpenAI or Anthropic, maintain teams in the UK, as well as R&D partnerships with British universities. This brings commercial investments such as Microsoft's £2.5 billion spend over the next three years on UK AI infrastructure.²³

Alongside international investments from global AI companies, the Government provides targeted funding in AI research.²⁴ UK Research and Innovation (UKRI), the national R&D funding agency, has a portfolio of more than £1 billion to invest in people and skills supporting the development of AI.²⁵ The UK also recently established the Advanced

¹⁶ UK Ministry of Defence (2022a)

¹⁷ UK Ministry of Defence (2022a) and Albon (2024)

¹⁸ Dabhi et al. (2021)

¹⁹ Baroness Brown of Cambridge (2023)

²⁰ Retter et al. (2022) and Lucas et al. (2022)

²¹ Kennedy (2023)

²² Department for Science, Innovation and Technology (2023a)

²³ Smith (2023)

²⁴ International Trade Association (2023)

Research and Invention Agency, a funding agency aiming for tech breakthrough in AI and other fields.²⁶

Another UK strength lies in its strong academic sector and existing R&D capabilities, particularly in computing and mathematical sciences. Research in mathematical sciences is key in advancing all areas of science and technology, including AI.²⁷ In the field of mathematics, UK universities rank among the top research institutions in the world with Cambridge, Oxford and Imperial College London among the most distinguished.²⁸ Though behind others such as the U.S. or China, the UK also possesses significant compute capabilities, a prerequisite for AI research. As of 2022, the UK had 15 supercomputers (3% of all supercomputers around the world), ranking sixth in the world.²⁹ To further increase its compute power, the government has announced a £300 million investment to create the country's fastest supercomputer at the University of Bristol and a new supercomputer based in Cambridge that will increase the countries' supercomputing capabilities by a factor of 30 compared with today.³⁰ Such investments are essential to propel the country's research in AI, encourage and 'crowd in' further private investments, and boost the available talent pool both for industry and the military.

The UK can also build on a strong regulatory regime, effective rule of law and support for innovation.³¹ Some of the UK Government's efforts to institutionalise AI reforms domestically include the AI Assurance Roadmap and AI Assurance Guidance, the AI Standards Hub led by the Alan Turing Institute and the AI Council made up of industry representatives to advise the government on AI policy.³² The country is also taking steps internationally; in November 2023, the UK hosted the first global AI Safety Summit at Bletchley Park, which brought together governments, businesses and experts.³³

On top of these efforts, more could be done by the Government to enable UK AI companies to scale up and commercialise promising ideas currently at lower levels of maturity with access to different forms of finance – conscious of the challenges associated with the UK AI sector having a smaller domestic market to address than competing firms in the U.S., China, European Union (EU), or Japan, and the desire of foreign firms to buy up fledgling UK start-ups. Regulations on data sharing and equity sharing between founders and institutions could, for example, be used to incentivise spinout companies from academic researcher wanting to bring their concepts to the market.³⁴ Such dynamism would benefit the UK economy in general and the defence sector in particular with more solutions available on the market and at more affordable prices, with this investment in turn bolstering the pipeline of talent and skills development from schools and universities into industry or government.

²⁵ UKRI (2021)

²⁶ ARIA (n.d.)

²⁷ UKRI (2023)

²⁸ Hemmings (2023)

²⁹ OECD (2023)

³⁰ Department for Science, Innovation and Technology (2023b)

³¹ Department for Digital, Culture, Media and Sport (2022)

³² UK Ministry of Defence (2023c)

³³ TechUK (2023)

³⁴ Avaliani (2023)

3. How can the UK Government best develop capacity and expertise within domestic industry in sectors such as engineering and software to support the development and delivery of Artificial Intelligence applications in defence?

The UK government needs to develop well-designed regulations to promote business confidence and public trust in AI. Such an environment would aim to promote competition, attract new businesses and lead to increased capacity and expertise within the domestic AI industry.³⁵ While this would apply to AI in general, the need for trust is particularly acute to AI technology with military or other security-related applications. The use of AI in weapons raises obvious ethical questions and requires added safeguards to foster trust in the technology. Losing public consent might undermine Defence's ability to operate, feed adversary narratives hostile to the UK, and in turn hamper the development of AI capabilities and expertise.³⁶ The definition of trustworthiness itself should be examined by MoD as it starts to field AI and, relatedly, autonomous systems, in particular to develop an audit process of its AI-enabled systems in partnership with industry.³⁷ Building on the ethical principles for AI in Defence outlined by the MoD, and wider work ongoing across Government, robust regulations designed to ensure transparency and accountability can help develop this trust and, as a result, promote further development and investment in AI with defence applications.³⁸

In addition to robust regulations, the UK will have to ensure better recruitment and retention of talent. AI and machine learning skills are in a high demand, with jobs for data scientists tripling over the past five years.³⁹ Demand continues to outpace supply and many AI businesses face a lack of skills and talent.⁴⁰ The UK must continue to invest in increasing AI skills through plans such as the £118 million boost to skills funding announced in October 2023.⁴¹ To ensure access to talent for the development of AI with defence applications, the MoD should work closely with AI businesses. Despite differences in scale, the experience of the US Department of Defense is comparable to the UK, notably regarding the technological skills gap, and US and other allies' policies could serve as a useful inspiration. These include collaborating and partnering with the commercial software sector, investing in the human capital of existing talent pools, increasing the defence community's integration into the broader technical workforce and cultivating a future civil-service-minded tech workforce.⁴²

Along with data and tech skills, compute is an essential component in building AI systems, as discussed above.⁴³ Computational power is therefore a key enabler for developing capacity and expertise within UK's AI industry. Although the country has the sixth largest number of supercomputers in the world, it ranks tenth when it comes to achieved computing performance (as opposed to theoretical processor-based performance).⁴⁴ There is therefore a need for more effective investment in compute infrastructure with for instance a national AI compute plan to guide its efforts and long-term funding to deliver this. OECD's blueprint for building national compute capacity for AI can serve as a good starting point.⁴⁵ Besides financial investments, the UK should develop AI capabilities by providing businesses with

³⁵ Department for Science, Innovation and Technology (2022)

³⁶ UK Ministry of Defence (2022c)

³⁷ Cohen (2023)

³⁸ Blauth (2023)

³⁹ Beauchene et al. (2023)

⁴⁰ UK Ministry of Defence (2023c)

⁴¹ Department for Science, Innovation and Technology (2023c)

⁴² Gelhaus et al. (2023)

⁴³ Vipra & West (2023)

⁴⁴ OECD (2023)

⁴⁵ OECD (2023)

non-financial investment such as advisory support for establishing a business, creating a business plan and providing market intelligence.⁴⁶ The government, including MoD, should establish and fund initiatives to support small and medium-sized AI businesses at both early and growth stages.

4. What can the Government do to help embed UK AI companies in defence supply chains, both domestically and internationally?

AI firms will embed in the defence supply chain if they can expect a return on their investment – and if this makes sense compared to, say, developing products for potentially more lucrative, more easily accessible, and less ethically contentious markets in the civil/commercial sector. The MoD's procurement process is the most important tool of influence at its disposal to incentivise such investments from AI industry. This perspective was supported by the National AI Strategy where the use of public procurement, including Defence's, to propel AI in the UK was mentioned multiple times.⁴⁷

At the same time, the UK Government and the MoD must be realistic: they are and will remain much less influential customers for AI, with its myriad dual-use applications and global market, than for more traditional defence products. Whereas suppliers such as BAE Systems operate in a monopoly-monopsony relationship with the MoD for some military equipment (e.g., submarines, aircraft carriers, etc.), the MoD has considerably less clout with which to shape AI markets as a customer, entailing a need to maximise the impact of its limited funding.⁴⁸

As such, the MoD must learn to work in close cooperation with domestic and international AI industrial players to define needs, pool resources, and assess risks, again as proposed by the Government's strategy.⁴⁹ Recent initiatives from the MoD seem to go in this direction. The ministry recently created the DAIC to build an AI-specific internal knowledge base able to coordinate the procurement of AI systems.⁵⁰ For instance, the DAIC worked in support of the Defence Science and Technology Laboratory (Dstl) to test AI-enabled air and ground intelligence, surveillance and reconnaissance (ISR) systems over the summer of 2023.⁵¹ These were developed in cooperation with UK-based company Blue Bear (part of Saab Group) on contract with the MoD since 2019.⁵²

The integration of UK AI companies to the defence supply chain is however confronted to other fundamental issues. Technology companies keen to do business with MoD tend to be confronted to the so-called 'valley of death' effect: the period of time when a company needs to rely on its own funds to get its concept ready to commercialise, at the risk of not finding any buyer.⁵³ The MoD has a role to play to support industry in developing concepts and has reassuringly mobilised £6.6 billion for R&D between 2021 and 2025 with AI as one of its top priorities (although it won't unlock £4.4 billion of capability development funds before 2025-2026).⁵⁴ Still, the MoD's procurement authority often tends to establish technical requirements before procurement starts, an approach poorly fitted to new exploratory concepts such as AI-enabled systems. Furthermore, the procurement process is still

⁴⁶ UK Ministry of Defence (2023c)

⁴⁷ UK Government (2021)

⁴⁸ Retter et al. (2022) and Lucas et al. (2022)

⁴⁹ UK Government (2021)

⁵⁰ UK Ministry of Defence (2023a)

⁵¹ UK Ministry of Defence (2023b)

⁵² Husseini (2019)

⁵³ Wilson et al. (2023)

⁵⁴ UK Ministry of Defence (2023d) and UK House of Commons Public Accounts Committee (2023)

hindered by a relative lack of engagement between MoD and industry, and tends to be burdened by complex and changing requirements due to ‘requirement creep’.⁵⁵ Such a risk-averse approach clashes with the rapid pace of development currently seen in the AI industry where risk-taking is seen as the norm (the Silicon Valley mantra of ‘move fast and break things’ standing at odds with the bureaucratic and fiscal imperatives of MoD Commercial, or processes such as legal and safety reviews).⁵⁶

Institutional barriers to the public procurement of advanced disruptive technologies are common features. The MoD acknowledged in its Defence AI Strategy the need to be ‘prepared to tolerate increased risk [and to] learn by doing and rapidly reorient to pursue successes and efficiencies’ in the AI domain.⁵⁷ The need to increase the MoD’s risk-tolerance is even greater for the UK where venture capitalist investors themselves tend to be risk averse.⁵⁸ As mentioned in previous section, the MoD is attempting to build-up its internal AI knowledge base which will facilitate the establishment of a mutual understanding and realistic technical requirements. However, the MoD’s acquisition process is still not optimally set up: AI technical knowledge mostly lies with Dstl and DAIC while decision power on operational requirements resides in Front Line Command’s Senior Responsible Owners (SROs).⁵⁹ SROs, who are used to work with the defence supply chain, must fully embed AI requirements into their programmes with the direct input of the MoD’s growing AI expertise to provide industry with incentives to do the same. There is also an important role to be played by UK Strategic Command, and specifically its new Integration Design Authority (IDA), in driving coherence between AI-related capability development and acquisition programmes across the Services, conscious of the cross-cutting and ‘multi-domain’ relevance of AI and digital technologies.⁶⁰

5. How can the UK Government ensure that it champions the UK AI sector in the context of Pillar 2 of the AUKUS Partnership?

AUKUS Pillar Two is a natural vehicle to advance the UK’s AI ambitions through international collaboration. The UK will be able to leverage its relationship with the US, already well established in terms of academic and military collaboration, to enhance joint capabilities and interoperability with AI research as one of the main enablers.⁶¹ For the UK, this is an opportunity to benefit from the US leadership in AI research where competition with China is at its fiercest.⁶² The UK has much to learn from the American relations between government, academia, and industry (e.g., Stanford University and Silicon Valley) particularly to boost its own capacity to translate research into commercialised solutions.⁶³ Recent moves to exempt the UK and Australia from US defence export control licensing and to consider those two nations’ industrial bases as ‘domestic’ to the US under its Defense Production Act are positive.⁶⁴ However, the UK and Australia should continue to pursue a review of US International Traffic in Arms Regulations (ITAR) and standards that are still hindering technology sharing between the three countries and driving away foreign companies afraid of losing control of their technologies – something which has already been

⁵⁵ UK House of Commons Defence Committee (2023)

⁵⁶ US GAO (2023) and Tarraf et al. (2021)

⁵⁷ UK Ministry of Defence (2022a)

⁵⁸ Department for Science, Innovation and Technology (2023a)

⁵⁹ UK House of Commons Defence Committee (2023)

⁶⁰ Luckenbaugh (2023)

⁶¹ Christianson et al. (2023)

⁶² Koetse (2024)

⁶³ Avaliani (2023)

⁶⁴ Australian Department of Defence (2023)

flagged by some in the context of deepening technology and industrial base cooperation through AUKUS.⁶⁵

Besides the obvious opportunity to tap into the US's wealth of tech skills, research and industrial products to propel its own R&D through AUKUS's Pillar Two, the UK should also exert caution.⁶⁶ The US has the strongest start-up sector in the world with the highest number of unicorns worldwide as of 2022 and could potentially cannibalise the UK's industry.⁶⁷ The acquisition of DeepMind, a British deep learning start-up, by Google/Alphabet in 2014 showcased the US's ability and willingness to tap into other markets, including close allies, to grow its share.⁶⁸ Furthermore, both the UK and the US are both facing a gap of available STEM-educated graduates to fill the ranks of their expanding tech industries, including in the defence sector.⁶⁹ The two governments have every incentive to collaborate on campaigning for STEM career paths jointly with Australia in the framework of AUKUS but the three nations are also de facto competing to attract the best talent. The US tends to have the upper hand in this (friendly) competition given scale, scholarships, and higher graduate salary prospects.⁷⁰ It is therefore important to ensure a compelling UK proposition to AI talent, including factors such as strong public services, a competitive immigration regime and affordable housing.⁷¹

⁶⁵ Cheverton (2023) and Harris (2023)

⁶⁶ Christianson et al. (2023)

⁶⁷ Baltrusaitis (2022)

⁶⁸ Gibbs (2014)

⁶⁹ Shankar (2023) and Erudera News (2023)

⁷⁰ Woolcock (2022)

⁷¹ Guthrie et al. (2017)

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