

Written evidence submitted by Dr. Keith Dear.

Why I am submitting evidence: As a former Expert Advisor to the Prime Minister on Science, Technology, Defence and National Security in 2020, principally advising on the Government's Integrated Review (published 2021), I have personal experience of Government and Defence AI Policy. As an 18-year regular Royal Air Force Intelligence Officer (now 601 Squadron RAF Reservist leading on Science & Technology) I was one of the earliest advocates of the need for UK Defence and national security to take AI seriously, speaking and writing widely on the topic both within Defence and externally from c.2016 onwards. Indeed, one of my reasons for leaving defence was the belief that I could make a greater contribution to Defence's AI adoption by working on the technology in industry and through reserve service, than in regular service. In my current employment I lead a Centre devoted to the development of cognitive technologies, including AI, for cross-sector applications including Defence.

As a citizen I care deeply about the success of our country in adopting AI in defence to enhance deterrence, making war less likely by convincing our adversaries our capabilities will lead to their defeat, and in our public and private sector to enhance our prosperity and security.

First some context.

1. **AI Urgency.** The MoD's best practice for forecasting the future requires the attribution of probability assessments to uncertain future outcomes ([DCDC. 2023. JDP 2.00 Intelligence. pp.64-65](#)).

The [best way](#) of deriving these forecasts is from crowd judgements and those of '[superforecasters](#)'.

Today, these forecasts estimate the arrival of [weak artificial general intelligence](#) (AGI) in 2027 (at the 75th percentile of human capabilities), [strong AGI](#) - one that matches us in all tasks including those of locomotion and dexterity, in 2032. [Artificial Superintelligence](#) (ASI), one that surpasses us in all cognitive tasks, is forecast to arrive within 2 years of the weak AGI breakthrough, and therefore in 2029.

The forecasts for the arrival of all three are trending closer to the present day, not receding into the distant future.

To understand whether the MOD's response is proportionate to the threat/opportunity, the Committee may wish to understand the probabilities they are assigning to such profound breakthroughs and/or what probability threshold or other criteria would have to be true to change the speed and scale of the response.

2. **Military Urgency.** The Secretary of State [warns](#) that "*In five years' time we could be looking at multiple theatres involving Russia, China, Iran and North Korea*". Presuming this to be too serious an assertion to be political rhetoric, we have to assume there are intelligence assessments delineating this a sufficiently high probability to make this a credible concern.

Similarly, US intelligence suggests war with China is likely from 2027, the Chair of the US House Select Committee [warns](#) that 2027 may be the end, not the beginning of the window for when an attack is most likely, while a leaked [internal memo](#) suggests at least one four-star general in the US Air Force expects a war with China in 2025. In Europe, Estonian Prime Minister Kaja Kallas [believes](#) that Russia may threaten NATO's borders within 3-years.

It is not clear what probabilities the UK or US has assigned to conflict on these timings.

However, if the Secretary of State's timeline of war by 2029 is correct, the median estimates suggest the next war will be fought with AGI (2027) and ASI (2029) available to one or both sides.

Neither the committee nor the public can truly judge the credibility of the UK's response to these two challenges without clarity on the official view of how likely and how urgent they both are.

Whatever the answer, the Committee might also want to understand the extent to which the MOD has analysed and understood the impact if its judgement on the probabilities is wrong, and whether it has a prudent contingency plan in place, ready to respond if so.

- 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?

In its [Defence AI Strategy](#) from 2022 the Ministry sets a series of objectives. While hard to disagree with e.g. *‘Objective: Adopt and exploit AI at pace and scale for Defence Advantage’* they are not the SMART (Specific, Measurable, Agree, Realistic, Time-bounded) objectives that it requires its military staff to set and seek to achieve in their annual reports. They are vague and unclear. It would be hard to judge progress against them, or to say whether the department had succeeded or failed in achieving them. The actions e.g. *‘organise for success’*, are similar.

The MOD’s [Command Paper ‘refresh’](#) from July 2023 is the most recent statement of intent from the department on artificial intelligence. The paper acknowledges that *‘...ever more autonomy and Artificial Intelligence will come into the workplace...’* as well as the need to *‘...make the most of the opportunities offered by automation and Artificial Intelligence.’* Restating that *‘AI is a strategic priority for Defence...’* To the extent that priorities can be derived from the document, these are (1) innovative capabilities for current operations, principally in command and control systems; (2) tools for greater organisational agility [undefined] such as supply chain management; (3) increasing the priority placed on AI in enhancing current capabilities or in current or future major procurement programmes. Again, too vague to judge progress, success or failure against.

The Command Paper makes the contestable, if commonplace, claim that artificial intelligence makes its people ‘ever more critical’, and that the department judges *‘Defence will always need courageous people to do dangerous things; we cannot see a future in which that is not required.’* Contrast this with Air Marshal Brian Burridge’s [description](#) of the use of uncrewed air systems as ‘virtueless war’. There is a legitimate question as to whether the number of people serving might become less important to achieving success in future warfare, a crucial one for the MOD, with reported difficulties recruiting. Similarly, the trends towards the [robotisation of warfare](#), and the increasing use of [remote warfare](#), both reduce the need for the British military to recruit courageous people, and cannot be dismissed out of hand. It is unclear the extent to which the MOD’s assertion has received rigorous analysis.

Turning to the question of what expertise the MOD believe UK defence needs, the [Haythornthwaite Review](#), essentially a review of the MoD’s entire HR and training approach, published in June 2023, makes clear the need to both adopt AI in training, education, recruitment, career management and day-to-day workflows, but is less clear again on how this should be done, by whom, and when – rather it provides a blueprint for the development of new processes that might later address this question.

Similarly, the [Defence and Security Industrial Strategy \(DSIS\)](#) of March 2021 offers ambition and aspiration over clear priorities. It might be usefully contrasted with the US DoD’s 2023 [National Defense Industrial Strategy](#) which offers ‘illustrative outcomes and outputs’ that could be used to assess progress and achievement against actions and objectives.

For industry – whether the primes that have long-dominated MOD procurement, or the start-ups and VCs trying to break into Defence, the absence of clear priorities makes funding the development of competitive capabilities hard. Investment committees, boards and VCs want to know what the MOD wants to achieve, how, and how much funding is available to those that have the most competitive solutions, before backing their teams to develop those solutions and compete. Without this, there is too much risk. What is incentivised is sales and marketing material, pitches that are ‘PowerPoint deep’, while suppliers await clearly funded procurement opportunities

and can see the (usually detailed, dated, proscriptive and restrictive) specifications they need to meet, rather than the development of real capabilities that are competing for MOD funding.

Overall, the MOD and its senior leaders have been consistently clear in communicating the importance of artificial intelligence. It is rare that a speech by a senior leader does not include a reference to it. But without specificity in describing what it wants to achieve and by when, it remains unclear what the priorities are, what success would look like (absence a clear, SMART, vision) and impossible to track progress in the absence of SMART objectives that describe how the vision will be achieved.

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

I don't believe there is any formal benchmarking that compares the relative strengths of the UK's Defence AI Ecosystem with that of allies or adversaries.

There are a growing number of venture capital companies focused on AI in UK national security, for example [Allied](#) and [Gallos](#). And of British AI start-ups such as [Adarga](#), [AdvAI](#), [Skyral](#), [Ripjar](#), and [Mind Foundry](#), either dedicated to, or serving the UK defence and national security market. All of the major defence primes and ICT service and integration companies have AI capabilities to a greater or lesser degree.

True competitive advantage would be evidenced by UK defence AI companies winning significant market share in a given field globally, or a UK prime gaining a particular reputation for leadership in a given AI field, for example in computer vision, electronic warfare, autonomous systems, or decision automation and support, which to date has not happened.

This does not mean the UK defence start-ups, SME, and prime industrial base couldn't be competitive. But it needs UK defence to play a role as first customer, and not just for proof-of-concept or innovation demonstrations – a common complaint in the UK being that there are many funds to showcase what UK industry could do, but few that can showcase companies' capabilities in large scale programmes that might build credibility and capability to compete and expand globally.

That said, the latent potential remains.

The strength of the UK research is evidenced in its citation impact, [ranked first](#) in the G7 every year since 2007. On various rankings of research and scientific output the UK is consistently [2nd](#) or [3rd](#). The top research institutions in the world [are](#) based in the UK.

The UK is home to Deepmind and Babylon Health, two of the leading AI companies globally. The UK is [ranked 3rd](#) in the world for Government AI-readiness, [3rd](#) on the [global AI-Index](#), [3rd](#) in the world for private venture capital investment into AI companies (2019 investment into the UK [reached](#) almost £2.5 billion) and is home to a [third](#) of Europe's total AI companies.

Furthermore, London is [judged](#) to have the best start-up ecosystem after Silicon Valley, and Cambridge the [most](#) innovation-intensive cluster globally, while the UK is 4th in the global rankings for [innovation](#). The UK ranks [third](#) in the world for VC investment, after only China and the US. The UK is home to [more](#) 'Unicorn' tech companies, those valued at >\$1Bn, than anywhere else in Europe. There were 122 UK unicorns at the time of London Tech Week in 2022, with more than 20 cities and towns home to at least one unicorn, and 248 'futurecorns'. More than a third of the fastest-growing next-generation tech companies in Europe are now based in the UK.

- 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?

In 2021 in a short article for the UK Defence Blog the Wavell Room, I wrote that to achieve the Science Superpower agenda, the MOD needed to ‘Close the say do gap’ on innovation, and that:

‘To achieve this the MOD needs to put its money where its strategy is shortening the length of programmes, constantly investing in new capabilities at scale.

The Ministry might adopt two rules to achieve this: no equipment to take longer than five years from contract to delivery; and strategic budget management that mandates a consistent shift of spending from old to new technologies, totalling 30% of the MOD budget over every 5-year cycle.’ These remain sound recommendations – more detail, and justification, in the [article](#).

Additional recommendations would be to ‘contract for outcomes’ not detailed specifications, setting the size of the prize for the winner and the rules of the competition – the focus should be not AI per se, but on what the MOD wants to be able to achieve in future wars – for example ‘preventing missile strikes on the UK’ or ‘devising battle-winning plans faster and more effectively than the existing planning process’, or ‘securing control of the air against a nation deploying 5th generation fighters in combination with the latest ground based air defences’. Companies would then use AI as they seek to outcompete rivals in winning the competition. This is in contrast to the detailed specifications the MOD usually tenders for, which constrain creativity, and lead industry to wait on the arrival of a tender before investing only in capabilities defined in the tender to keep their costs down and ensure they are maximally competitive.

Furthermore, the MoD should take AGI and ASI seriously, building plans for the complete transformation of its industrial base, organisational design, and processes, investing in collective intelligence approaches to understand the likely role of humans in AGI and ASI-enabled systems.

The MOD also tenders for ‘things’ – platforms such as a fighter aircraft to replace a fighter aircraft, a tank for a tank. To succeed, it would be better tendering for the effect it wishes to achieve and scoring bids on \$/effect of each system.

In short, the MOD has the supplier base it incentivises – one where competition in capability development is limited, optimising to be able to bid at the lowest possible price. It incentivises – and gets, more innovation theatre than robust and scaleable capabilities. If it wants one that thinks and operates differently it will need to reimagine and rearchitect its force design, generation and procurement capabilities around a system that incentivises the behaviours it wants.

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

Acting as first customer to help companies get over the valley of death in innovation – the point where they have proved their systems can work, and therefore where they have sunk money into development - but have not yet sold their systems at scale to provide a return.

Separately, to understand UK dependencies and vulnerabilities worldwide: require transparency from all suppliers on the extent to which they understand and can trace their supply chains. Conventional wisdom suggests most primes can (at best) get to a maximum of 2-3 layers into their supply chain, before their knowledge of where components and materials originate becomes unclear. The Government might mandate the standard and depth of supply chain understanding required to supply the UK Public Sector and Defence, perhaps tracking supply chains via digital dashboards and displays – requiring suppliers to provide the data.

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

Setting very clear outcomes, the size of the prize and the rules of the competition. There is little doubt the UK has the talent to build both successful AI companies and a thriving defence industrial base in the technology. What is missing at the moment are clear incentives to mobilise this latent capability.

To do this, it should work closely with UK industry. It must broaden the discussion beyond defence – to deter we will need to develop an industrial base that can rapidly innovate and manufacture new systems fast enough to keep ahead of the adversary, and replace the systems we lose to attrition. Defence industrial policy must take a broad view – to succeed will need energy policy that keeps manufacturing costs down, it will need to mobilise capital to address the late-stage funding gap in UK VC, support reindustrialisation and ensure it has access to sufficient compute. Notes on each of these follow.

Energy. [The Defence Operational Energy Strategy](#) (Dec 2023) shows that in the operational context, Defence sees the need to address its energy needs. In the context of AUKUS, and the possibility that the UK becomes part of (whisper it) something closer to a single-market for defence equipment competing across the UK, US, and Australia, we will need to drop our energy costs or find our defence manufacturing firms uncompetitive. Given the criticality of energy costs in training AI models and providing the compute to run them, this is another important, but not obvious, component of building a competitive AI Ecosystem.

Bridging the Late-Stage Funding Gap. [The State of European Tech Report \(2022\)](#) notes that “*In the UK, domestic investment makes up a large portion of early-stage rounds (under \$10M), and as much as 73% of rounds under \$2M. However, most countries depend on either European-cross border investors or US investors for the later rounds. In fact, both Germany and the UK which are two of the largest countries by capital invested are seeing only 8% and 13% respectively share of investments from domestic investors in large rounds of \$250M+.*” If we want our AI companies to remain ‘sovereign’ we will need to ensure UK investment in late stage VC increases both in real and relative terms.

Essential Re-Industrialisation. The West is undergoing a re-industrialisation, recognising that what has been [lost to globalisation](#) is not just jobs, but also know-how, the process innovation to turn research into products and services. The US Inflation Reduction Act (IRA), the US and EU’s CHIPS Acts and the EU’s green industrial and critical raw materials [plans](#) are seeking to ensure that the anticipated [intensive 15-20 years of CAPEX investment](#) by private companies and Governments take place within their borders.

On 17 April 2023, the Financial Times [reported](#) that such efforts are succeeding. Since President Biden launched the IRA and CHIPS Act there have been 75 large-scale manufacturing projects announced, with companies committing £204Bn to large-scale projects in the US, particularly in semiconductors and clean energy. Much of that money has been crowded-in, pledged by overseas investors. As the FT describes, it represents ‘*...almost double the capital spending commitments made in the same sectors in 2021 and nearly 20 times the amount in 2019.*’ For UK defence in the AUKUS context, reindustrialisation will be about getting match-fit to compete for equally across widened market – as the US and Australian defence industrial ecosystems do the same. This matters for our AI start-ups, which need the business-to-business markets that a defence industrial base provides.

Compute. It seems likely that in the event of war, technological progress, and the application of technology to warfare, would accelerate significantly. When this happens, the demand for vast amounts of computational power to enable battle-management, simulation, planning and analytics tools, for digital engineering, automated manufacture – almost everything, as software eats defence just as it has so much of the world outside it already – will hugely exceed supply. There will be competition for access to, and installation of new, supercomputers between the intelligence agencies, the National Cyber Force, and many agencies across Government. The UK, and defence in particular, will need a contingency plan for how it will access and build the compute it needs, in much the same way we will need a strategy for rearmament. Indeed as part of rearmament. Within the AUKUS framework, the UK might seek to establish plans with allies now, to begin building the compute it will need focused on practical defence and national security applications.

17th January 2024