Armament Industry European Research Group

CRITICAL TECHNOLOGIES AND INDUSTRIAL CAPABILITIES: NATIONAL DEFINITION AND POLICY IMPLICATIONS

The UK case

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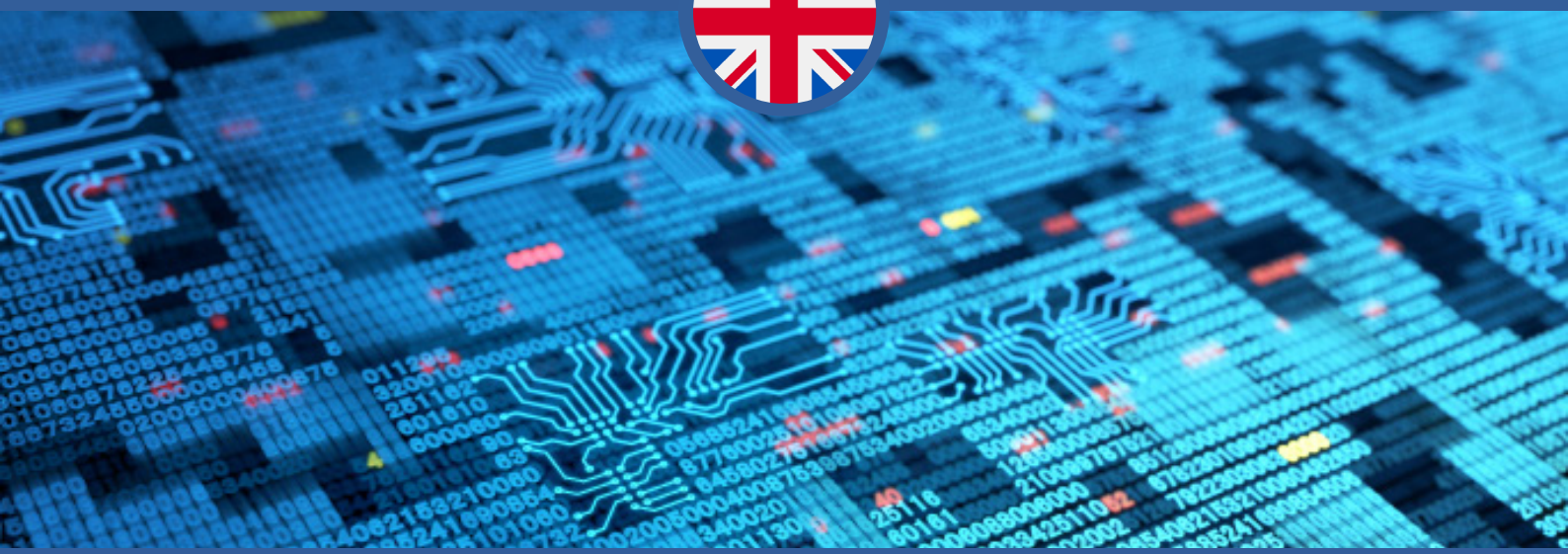

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Armament Industry European Research Group

The Armament Industry European Research Group (Ares Group) was created in 2016 by The French Institute for International and Strategic Affairs (IRIS), who coordinates the Group. The aim of the Ares Group, a high-level network of security and defence specialists across Europe, is to provide a forum to the European armament community, bringing together top defence industrial policy specialists, to encourage fresh strategic thinking in the field, develop innovative policy proposals and conduct studies for public and private actors.

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ABSTRACT

This paper analyses the way the UK addresses dependencies on critical technologies within the defence industry. It shows that the UK has developed a complex and exhaustive policy framework to identify key technologies, application areas and industrial capabilities for the future of British armed forces. It also details the mechanisms the British DoD set up to support the preservation and / or the development of its autonomy in these domains.

Keywords: UK / defence industrial policy / EU / technology / innovation / cooperative programmes / NATO

UK official stances have slightly different purposes and foci of attention, and a reasonable question concerns how they will be carried forward in an integrated manner. This short paper address four somewhat different but related questions:

- Which technologies will be of key importance for defence looking forwards?
- Which defence industrial capabilities does the British Government want to sustain and develop?
- In which areas of technology does the Ministry of Defence feel its needs solid expertise?
- How are priority areas for innovation being pursued?

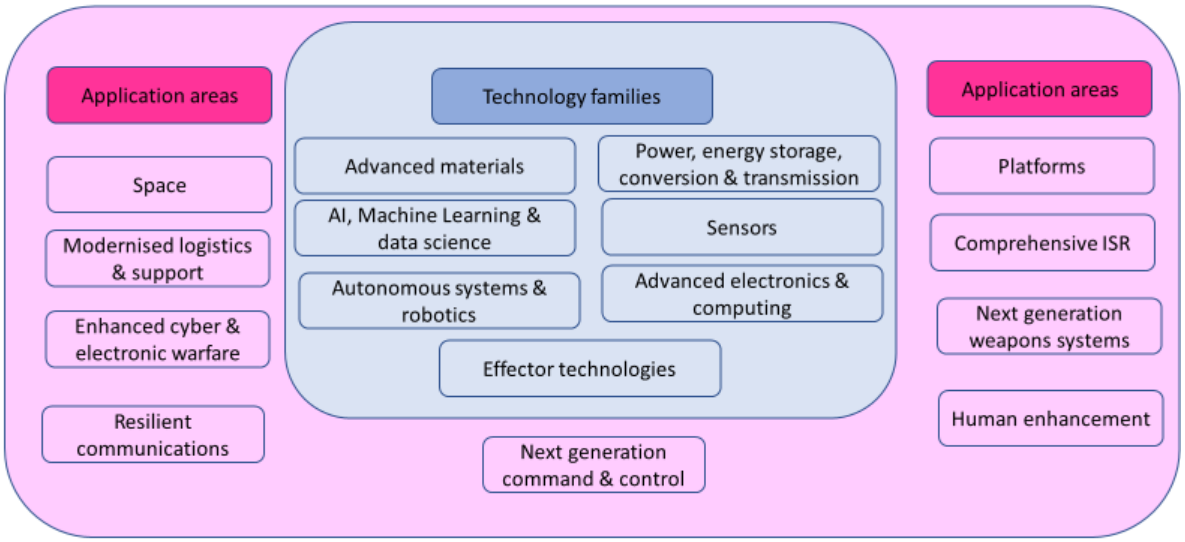
However, in terms of policy context, it is necessary to note that the British Government aspires to enjoy discretion about where, where when and how it uses its armed forces, which is summarised in the 2021 Integrated Review and its subsidiary documents, Defence in a Competitive Age and the Defence & Security Industrial Strategy (DSIS), as 'operational independence'. These policy stances also stressed the UK as having global interests and expecting to play a significant international military in multiple areas of the world. Operational independence implies limited reliance on others for support to military equipment and also the ability to upgrade equipment and modify it as needed for particular operations. This in turn implies access to a capable national defence industrial base which has access to the technologies needed for internationally competitive equipment. Thus, UK defence technology stances would likely have a very different agenda were UK defence policy to prioritise a narrow range of NATO roles.

WHICH TECHNOLOGIES WILL BE OF KEY IMPORTANCE?

The Ministry of Defence has developed a framework of seven key 'technology families' and nine areas of application.[1] While some technologies have clearly apparent areas of application, the MoD has not publicly mapped which technologies relate particularly to which uses. Many of the technologies have been defined as priority areas by other NATO partners and in many ways can be seen as conventional Western wisdom on the topic. Notably, space is classed as an area of application rather than a technology family.

A widely acknowledged feature of the several critical technologies for defence is that they are of greater importance for the civil, commercial world. They should thus be seen in terms of any national technology approaches overall [2] and also in the context of private sector investments in research and development.

The UK Defence Technology Framework



In the key technology families, the Government feels in many cases that the country begins from a strong base, not least in artificial intelligence, advanced materials and electronics, where much of the expertise has emerged from the university sector. The area around Cambridge has emerged as a particular hub.

However, when attention is turned to the perspectives of the individual commands, the MoD's own scientific community, and what is expected of different industrial sectors, somewhat differing and longer lists emerge.

[1] Defence Technology Framework (publishing.service.gov.uk)
[2] Government Technology Innovation Strategy - GOV.UK (www.gov.uk); Innovate UK - GOV.UK (www.gov.uk)

WHICH DEFENCE INDUSTRIAL CAPABILITIES DOES THE UK WISH TO SUSTAIN AND DEVELOP?

The UK has a growing series of established and novel defence industrial strategies focused largely but not exclusively on the capability to develop and build platforms and individual systems while leaving more open what sub-system and component capacity should be retained or developed. It has long felt the need to sustain the ability to design, develop and support nuclear weapons and nuclear submarines. Its explicit intention to maintain the ability to develop and build 'complex weapons' dates back to the 2005 Defence Industrial Strategy and is effected in 2022 through the Complex Weapons Portfolio in which the MoD and an industrial team led by MBDA work in partnership. The practice of the UK designing and building its own warships was formalised in policy through the National Shipbuilding Strategy of 2017[3] This document was 'refreshed' in March 2022[4] with warships being set alongside an ambition to revive the shipbuilding sector as whole. However, the NSS kept its focus on the building of ships rather than diverting much attention to important sub-systems and technologies. There was however considerable attention given to reduce the carbon footprint of the maritime sector and some concern with the UK capacity to produce steel for ships. The document did include a Royal Navy Technology Roadmap (p55) which specified greener technology as industry driven, Defence-driven technologies were specified as involving resilient and improved communications, underwater communications, radar, novel sensors and complex weapons, open architecture combat management systems, laser and directed energy weapons, cyber and electronic warfare, flexible command spaces and replenishment at sea.

The aspiration not to lose the capacity to design, develop and build its own combat aircraft was articulated in the Combat Air Strategy of 2018.[5] The implementation if this latter area was notable in that the industrial team from the beginning included the key engine, avionics and weapons suppliers and has since been widened to bring in other firms. Features of this domain include a stress on government and industry operating in partnership, and an emphasis on working with collaborative partners. [6]

A Land Systems Industrial Strategy (LIS) was released in May 2022 and included a list of key 'game changing technologies': Artificial Intelligence, Advanced materials science, survivability and protection; Electrification, hybrid propulsion and power generation; Novel and directed

[3] National Shipbuilding Strategy - GOV.UK (www.gov.uk)
[4] (CP 605) – National Shipbuilding Strategy Refresh Web Accessible.cdr (publishing.service.gov.uk)
[5] CombatAirStrategy_Lowres.pdf (publishing.service.gov.uk)
[6] tempest_programme_final_web_version_0.pdf (rusi.org)

energy weapons; Networks and sensors; Robotics, automation and human-machine teaming; Sythetic environments, System and systems of systems integration; and Human optimisation, enhancement and augmentation. This one of the areas where the Government is looking to foreign investment in the UK for industrial capability and development. The LIS also recognises that the exploitation of all possible technology potential will involve collaborative work with NATO states and other partners. As in other areas, the LIS promotes partnered working between industry and government.

The rotor craft sector dominated by Leonardo still lacks a formal strategic approach.

The Government also recognises that it needs a high-level sovereign capability in defensive cyber.

Space is an unusual sector for UK defence because for many years the UK was content to rely on the US for surveillance and intelligence-gathering systems and of course GPS. The UK abandoned its own space launch plans in the late 1950s and chose not to participate in the Ariane programme. It did, however, through an Airbus-led consortium, fund the provision of the Skynet communications satellites. Space was not even addressed as an industrial sector in the 2005 Defence Industrial Strategy. However, by 2021 the Government had realised that significant achievements in space had become more affordable and that, largely of its own accord, the space industry in the UK had developed well. In the Defence and Security Industrial Strategy and the National Space Strategy, there was strong confidence in the UK space sector and governmental readiness to provide further support in the defence sector.[7] Obviously the consequences of Brexit for UK participation in the Galileo programme have meant that London has shot in the foot both continental Europeans and itself.

As noted, the Ministry of Defence acknowledge the potential of artificial intelligence and related fields for defence but has not yet finalised its strategy for dealing with it (the document is at least nine months overdue) [8] and the Defence Centre for AI announced in the Defence in a Competitive Age White Paper of March 2021 was set up only in the spring of 2022 with a small initial staff Northeast of England. [9] A National AI strategy, which did not address defence directly, was released in September 2021.[10]

Funding lines are in place for all these platform and system commitments although long-term affordability remains uncertain. As noted, in many cases the UK is using collaborative

[7] Defence and Security Industrial Strategy (publishing.service.gov.uk), p.99.
[8] Information regarding MOD use of artificial intelligence at 23 October 2018 (publishing.service.gov.uk);
[9] Defence in a competitive age (publishing.service.gov.uk)
[10] National AI Strategy (publishing.service.gov.uk)

structures with other friendly governments and is looking for more use of collaboration in future.[11] An integrated view of all these was provided in the Defence & Security industrial Strategy in the spring of 2021.

IN WHICH TECHNOLOGY AREAS IS IT FELT THAT THE GOVERNMENT NEEDS EXPERTISE?

The MoD's research arm, the Defence Science and Technology Laboratory, reports that it needs to maintain its capabilities across 22 defence areas which cover all the technology families noted above but go beyond to address pretty much all defence areas. [12] It spends its funding to address all these areas. There is ambiguity however about the extent that DSTL is funded to generate new technology to pass to the private sector for further enhancement and to what extent it is focused on giving technically- sound advice to Government.

Table: Science & Technology Capabilities for the Defence Science & Technology Laboratories.

1. Above Water Systems	9. Explosives & Energetics	17. Space
2. Advanced Materials	10. Homeland & Counter-Terrorist Systems	18. S&T Futures & Incubator
3. AI & Data Science	11.Human & Social Sciences	19.Strategic Systems
4. Air Systems	12.Land Systems	20.Survivability
5. Chemical, Biological & Radiological	13. Information Systems	21.Underwater Systems
6. Communications & Networks	14. Operational Research	22. Weapons
7. Cyber	15. Robotics & Autonomous Systems	
8.Electromagnetic activities	16. Sensing	

Beyond DSTL and into the single services and the Defence Equipment & Support Organisation, the problems of the Ajax programme alone have exposed that outsourcing and staff cuts have left holes in the MoD's internal technological and management expertise.

[11] Defence Equipment Plan
[12] 20211208-2021_26_Corporate_Plan.pdf (publishing.service.gov.uk)

WHICH ARE THE PRIORITY AREAS FOR DEFENCE INNOVATION IN THE UK AND HOW ARE THEY BEING PURSUED?

UK defence has a strong emphasis on the pursuit of innovation but only some or even little of the effort is directly focused on the key technologies noted at the beginning of the paper.

A number of defence organisations are involved with the innovation agenda: DSTL publishes a list of R&D topics on which potential suppliers are invited to bid for money. [13] and DSTL agency, the Defence and Security Accelerator (DASA) has both open and themed programmes for small awards.[14] In May 2022 it has 70 technologies and defence and security problems where it is running competitions in which companies can bid for small funding amounts. [15]

In addition, the four commands (Army, Navy, Air Force and Strategic) have established their own innovation hubs and, while the Army is particularly interested in robots, they pursue wide and even open-ended agenda. On the innovation front, the Government is looking specifically to small and medium-sized enterprises (SMEs) which it sees as imaginative and more agile than the large defence primes. Especially with regard to SMEs, the services tend to be interested in ideas that could enable them to address specified but even small problems in a cost-effective manner. However, the question remains of how any innovations from small firms can be integrated into platforms and wider defence systems: SMEs partnering with primes must be part of the answer.

CONCLUSION

The British Government and its MoD are pursuing all these technologies with modest spending compared with the amounts devoted to R&D in the Cold War years. In the Ministry of Defence Annual Report and Accounts, of which understanding requires an advanced qualification in accounting, in 2021 the MoD's spending on R&D in the capital expenditure category was £968 m and the resource (i.e. recurrent) spending was £265 million.[16] Official Government figures changed their profile markedly from 2019/20 because, to reflect Frascati definitions, a lot of work previously classified as using development spending was taken out of the category.[17] This likely involved mostly testing activities. Other work was seemingly moved from

[13] Dstl research and funding priorities - GOV.UK (www.gov.uk);
[14] Apply For Funding - GOV.UK (www.gov.uk); see also Apply For Funding - GOV.UK (www.gov.uk).
[15] Defence and Security Accelerator themed competitions - GOV.UK (www.gov.uk)
[16] Ministry of Defence Annual Report and Accounts 2020-21 (publishing.service.gov.uk), pp.177-181.
[17] MOD Departmental resources: 2021 - GOV.UK (www.gov.uk)

development into research. Overall, successive ministers since 2010 have sought to protect research spending.

Despite the lateness and over-budget condition of many defence projects, the current Government has expressed significant confidence in the potential of its established defence industrial sector and also in the wider technology base of small, medium and large companies in the UK. As noted, which technology areas secure a mention depends significantly on the question being asked. Where could useful innovations be generated gives a much longer list than the few technologies first mentioned in the paper.

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