Defence Technology Exploitation Programme

Guidance on Programme Areas of Interest

The Defence Command paper, published in March 2021, detailed how MOD will transform the armed forces and equip it for the changing threat and its new tasks. With the accompanying Defence and Security Industrial Strategy (DSIS) aiming to establish a deeper, more productive and better-directed relationship between Government and Industry, with greater transparency and collaboration on the capability being developed.

The areas of interest listed in this document, which are an annex of the Defence Technology Exploitation Programme (DTEP) competition document, align with publications such as the Defence Science and Technology Strategy 2020 and the Defence Command Paper. Building on these earlier publications, MOD has recently published the Defence Capability Framework, which is an articulation of our longer term Military Capability Priorities and challenges. It provides greater transparency on our future plans and is part of our ongoing push to be more open and transparent with industry and to create a stronger and more predictable demand signal.

As MOD's defence needs develop with time, this list will change and expand.

DTEP will require that a submission from the leading lower-tier supplier into the programme aligns with at least one of the following MOD Enduring Capability Challenge areas:

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

There will be an exception to these areas of interest:

Where the project can evidence a strong and supported end-user demand for the benefit of the new technology, process or material development, or where there is a need for innovation within the defence supply chain to benefit an existing MOD capability or develop a new capability area. This defined need will need to demonstrate a commercialisation route within the supply chain linked to a strategic supplier providing that capability. It will also need to show why industry cannot support this development within the usual internal research and development (IRAD) investment cycles.

1. Pervasive Full Spectrum Multidomain Intelligence, Surveillance and Reconnaissance (ISR)

DTEP Technology Area	Description	High Level Challenge	Application / Exploitation	Topics of Potential Interest
1.1	Subtheme: Processing, Evaluation and Dissemination (PED)	Increasingly sophisticated sensors produce vast amounts of data. This needs improved methods of analysis for detection, identification, and classification to turn data into actionable intelligence faster, more reliably and reducing the burden on the requirement for additional human analysts. PED techniques should be able to detect and alert users to spoofing and false positives / negatives	This is applicable to all implementations of pervasive ISR for sensors and systems in all domains - land, sea (above and underwater), air, stratosphere, space and cyber. It has application in actual conflict and sub- threshold situations.	The challenge may be addressed by leveraging developments in machine learning and algorithms, AI and quantum computing to increase automation and hence reduce the burden on manpower requirements. Other techniques, such as processing at the sensor may also be part of any solutions
1.2	Subtheme: Improved Performance Datalinks	Bandwidth, data rate and reliability are a perennial problem for military communications and datalinks. This situation is set to worsen as increasingly sophisticated communications and sensor systems come into service, with increasing demands on bandwidth and data rate. It is likely that the need will be further focused in order to implement systems such as multi-domain integration (MDI).	Beyond line of sight (BLOS) communications and datalinks rely on satellite communication with its constraints on radio frequency bandwidth and data rates. However, there are also issues in land, sea, and air domains.	The challenge may be addressed by one or more routes, including for example edge processing (i.e., processing more data at the sensor), rather than transmitting raw data, changes in frequency band or moving to optical communications. Whichever route is used, it must be capable of providing reliable links with minimal atmospheric effects or interference from weather (e.g., clouds). Solutions may come from military or civil domains which have a need for secure, high speed, high bandwidth links (e.g., banking).
1.3	Subtheme: Sensors and Detectors	The maintenance of technical superiority and detection of adversaries, including personnel, equipment, facilities, or changes, requires increasingly sophisticated sensors capable of operating day-night all weather. These more sophisticated sensors demand more power, at a time when electrification of the battlespace may result in using energy sources which have lower energy density than diesel or JP-8. Consequently, there is potential for sensors and sensor systems which offer increased functionality and	Reduction of SWAP and increased capability is applicable in all domains, but especially air (manned and unmanned platforms, stratospheric platforms) and space, where the increasing focus is on SmallSats and CubeSats	Sensors and sensor technologies offering equivalent or greater functionality / capability at reduced SWAP, and potentially with additional benefits. For example, software defined sensors, passive alternatives to active sensors, such as passive radar or BLOS capabilities to increase detection range

		capability but at reduced size, weight and power (SWAP).		

Multi-Domain Command, Control, Communications and Computing (C4)

DTEP Technology Area	Description	High Level Challenge	Application / Exploitation	Topics of Potential Interest
2.1	Subtheme: Human Machine Teaming	The cognitive and physical abilities of military personnel can be augmented through advanced forms of human-machine teaming, improving decision-making speed, enhancing survivability, increasing strength, increasing capacity/mass, and even increasing lethality. Whilst many defence projects in the UK and globally have explored the potential utility of advanced human-machine teaming, striking the right balance between human led and machine-led decision making (a trade-off between trust, safety and speed) remains to be fully resolved. The exploitation of human-machine teaming in new and novel ways to enhance the execution of both cognitive and physical tasks, offers significant potential.	Human-machine teaming can be applied to almost any defence task or activity. The areas where there is greatest exploitation potential are related to the creation of mass effect ("force multiplier"), enhancement of command and control (enhancement/automation of elements of the observe, orient, decide and act - "OODA" - decision making loop), the enhancement of training through realistic live-synthetic interactions, and other activities that involve processing large volumes of information.	Areas of potential interest include the use of RAS (robotics and autonomous systems) technologies for human augmentation (for example, the use of autonomously controlled UXVs to gather ISR data to support a soldier, or the use of attritable systems for the creation of mass effect), technologies to enable the effective cooperation between manned and unmanned platforms (for example a mix of autonomous logistic resupply trucks), or demonstration of effective and trustworthy human-augmented decision making (e.g. automatic allocation of the "best" effector in response to a sensor demand signal, drawing on a range of intelligence sources).
2.2	Subtheme: Technology Enablers for future Military Satellite Communications (MilSatCom)	As the amount of data generated and shared across the battlefield increases, the limitations imposed by existing MilSatCom solutions will become starker. Existing MilSatCom solutions, whilst providing an effective means for secure global communications, present limitations around latency, bandwidth, redundancy, and system portability / deployability.	With the development of smaller, more portable antenna technologies, and the arrival of high throughput LEO satellite mega constellations, there is now potential for the use of MilSatCom not only for strategic communications, but also across the tactical battlespace - including, for example, from aboard moving vehicles and dismounted personnel.	Areas of potential interest include the use of platform-mounted and personnel carried compact, flexible (multi-satellite / multi-orbit / multi-frequency) GEO and LEO satellite communications terminals (using, for example, Active Electronically Steerable Arrays) avoiding the need to unpack large antennae, or the development / demonstration of technologies for inter-satellite links between multiple orbits - a key enabler for the creation of layered Multi-Orbit Communications Networks that could provide both high bandwidth regional communications and secure global connectivity (for example, enabling

				integration of HAPS & LEO, or LEO & GEO communications satellites)

3. Secure and Sustain Advantage in the Sub-Threshold

DTEP Technology Area	Description	High Level Challenge	Application / Exploitation	Topics of Potential Interest
3.1	Subtheme: Social Media "Influence" Campaign Optimization & Evaluation	To underpin effective sub-threshold operations, UK Defence requires state-of the-art approaches to the use of social media for the dissemination of targeted information and narratives. These approaches must include the means to measure and assess the success of social media campaigns in line with their intended effect. Finally, the approaches must adhere to relevant legal and ethical laws, rules and principles.	The main applications relate to gaining intelligence through mining the deep web, social media and darknet networking, tapping into open, closed, and hidden online communities and identifying key topics of interest in real time and in context. The optimisation, assessment and evaluation of publicly accessible information, opinions, and viewpoints across differing demographic and national groups.	Topics of potential interest include leveraging state-of-the-art media and marketing approaches to enhance the way UK Defence delivers influence and propaganda campaigns - including media scraping, campaign optimisation using artificial intelligence and/or machine learning, and campaign impact assessment, in line with UK and international legal and ethical frameworks.
3.2	Subtheme: Communications Security & Resilience	As forces become more reliant on access to the electromagnetic (EM) spectrum for communications and data exchange, the potential impact of adversary denial of the EM environment increases. This fact, coupled with the ongoing evolution of jamming and decryption technologies, points to the need for ever-more robust solutions for counter-jamming and communications security. These solutions must be devised to ensure sensitive data can be reliably and securely transferred across the battlespace.	The main applications relate to the protection of sensitive information shared between members of the blue force across the battlespace (or further afield), and to the resilience of systems used to transfer data, in the face of adversary attempts to jam, hack or otherwise deny those systems.	Topics of potential interest include quantum key distribution (QKD), including implementation of QKD over long distances using aerial or terrestrial network nodes, frequency-hopping technologies for communications and sensing systems (random hopping of carriers to make the signals hard to jam), and counter-jamming technology (such as nulling active antennas - "jamming the jammer")

4. Asymmetric and Hard Power

DTEP Technology Area	Description	High Level Challenge	Application / Exploitation	Topics of Potential Interest
4.1	Subtheme: Threat detection	New and novel weapons systems like hypersonic weapons and sUAS being developed by potential adversaries will require advanced technologies and techniques to detect and identify threats faster and with high levels of assurance to reduce the risk of 'false positives'. This will require advanced sensors and sensor systems which may detect the small signature of a fast moving, manoeuvrable object in relatively low altitude compared to a conventional ballistic missile. This challenge is accompanied by the need for advanced analytical techniques to track, process, identify and classify the threat and alert blue force quicker and hence provides maximum time to cue the appropriate defensive measures. This must be accompanied by high-speed data links and techniques to deliver the intelligence.	The main applications relate to exploitation and application of existing sensors coupled with edge processing and optimisation of data transmission to provide a fast, effective and an integrated system to defend against the threat presented by novel weapons systems. The need to interface, fuse and extract data from multiple FIND and TRACK capabilities (EO, Radar) and develop low-cost novel detection/tracking capabilities for wider exploitation. Investigation into leveraging low cost/widely available EO capable assets (cameras/phones) and whether these can be harnessed to provide wide area detection/tracking capabilities whilst maintaining data integrity and minimising false positives.	The challenge has synergy with ISR in Theme 1 and may be addressed by drawing upon similar routes, including for example: - new developments in Sensors for space based, stratosphere, air or ground-based platforms. New methods of analysing data through repurposing existing sensors - data processing techniques such as machine learning, advanced algorithms, or AI - Create a "Red Team" simulation capability to test candidate systems effectively and independently. - Addressing data transmission from a variety of approaches, including edge processing (I.e. processing more data at the sensor), changes in transmission frequency band or moving to optical communications. Whichever route is used, it must be capable of providing reliable links with minimal atmospheric effects or interference from weather (e.g. clouds). Solutions may come from military or civil domains which have a need for secure communications
4.2	Subtheme: Defensive Measures	The defeat of fast moving, manoeuvrable weapons such as sUAS or hypersonic missiles may not be possible using conventional kinetic weapons. Defensive measures could include DEW. Whilst there are programmes addressing integrated systems, ongoing support for development of innovative supporting technologies and leveraging developments in other sectors is lacking. There are challenges including high efficiency power storage for rapid discharge applications, power management and smoothing, thermal management (especially	Innovation and scale-up of innovative technologies would be exploited in the programmes developing integrated systems to address the challenge. - Possible upscale of existing SMEs in low power industrial laser manufacture for increasing UK market share in civil and potential manufacturing applications of laser technology. Create a minimum "cost per kW" scale to validate low power, high volume DEW for UK & Export. - Use of non-military optics SMEs for track and focus of low power laser - to assist in applications such as laser comms, remote	Topics of Potential Interest may include: - Leveraging civil developments in battery / power storage technologies from the Faraday challenge - Power management techniques and technologies to cope with smoothing of pulsed power demands whilst maintaining power to other electrical systems - Thermal management of high-power electrical systems - Optical systems - leveraging developments in similar applications, such as high-power industrial lasers, lasers for wireless charging, etc

		for land-based systems, where dissipation of waste heat is a significant issue) and high efficiency optical systems.	power provision, or low power engagement. (Both civil and military applications)	

5. Freedom of Access and Manoeuvre

DTEP Technology Area	Description	High Level Challenge	Application / Exploitation	Topics of Potential Interest
5.1	Subtheme: UXV Swarming and Intelligent Co-operation	The operational utility and resilience of unmanned systems (UXVs) can be amplified through their employment in cooperating teams (or "swarms"), rather than as individual assets. Whilst algorithms for the dynamic control of UAV swarms have been previously developed and tested within various UK defence trials, there remains a major opportunity to develop swarming technology capable of adapting to a broader a range of roles & scenarios, and across a broader range of platform types (UXVs including UAVs, HAPS, UGVs, USVs and Satellites)	UXV swarms can be used in support of communications networks, medical assistance, logistics resupply and situational awareness.	The challenge may be addressed through - Development and testing of advanced swarming dynamics & control algorithms, leveraging advanced techniques such as AI and ML to emulate intelligent, collaborative decision-making within the swarm - Specific focus on UAVs, another type of UXV, or may even offer applicability to multiple types of UXV. - Adaptative networks of UXVs, self-healing mesh networks for wide area or localised communications. - Swarming UXVs to provide enhanced surveillance capabilities through formation of Distributed Synthetic Aperture Sensors - for example from UAVs, HAPS or satellites. - High volume/low cost UxVs to be used at scale in non-combat roles, how can these perform as part of the battlespace; i.e. establish a proactive supply chain, provide or follow a "proven route" for troops, and feed the ISR picture?
5.2	Subtheme: Solutions for Enhanced Space Domain Awareness (SDA)	As orbits become more congested and adversary anti-satellite technology (ASAT) matures, there is a greater need for effective Space Domain Awareness (SDA) capabilities for tracking space-based objects. Given that even tiny objects can pose a threat to satellites, there is a need to improve the sensitivity, coverage and automation of Space Surveillance & Tracking (SS&T) systems. This may involve improvements to sensor hardware, or the development of advanced algorithms for detecting, characterising, classifying and even formally identifying space-based objects.	Applications include the detection and tracking of space debris, as well as the detection, classification, identification and tracking of third-party satellites and ASATs.	The challenge may be addressed by leveraging developments in machine learning and algorithms, AI and even quantum computing to detect, characterize and classify space objects. These technologies offer the potential to increase the performance of SS&T sensors whilst increasing automation and hence reducing manpower burden and reducing the risk of objects being missed through human error or oversight. Furthermore, the challenge may be addressed through the re-purposing and re-programming of existing operational or defunct satellites for SS&T, or through novel ground-based or orbital SS&T sensors.

5.3	Subtheme: Support Chain Optimisation Technologies	To ensure the UK's forces are reliably and efficiently sustained when operating at reach, there is an opportunity to exploit recent developments in digital and robotic technologies to improve supply chain management, planning, optimisation, automation and actuation technology, capitalising on technologies developed and exploited within the retail sector.	Novel solutions can be exploited to optimise warehouse management, inventory management, engineering through life support (ETLS) processes, and for automating shipping / transportation processes at various stages of the supply chain.	Areas of potential interest include the application of 3D-printing technology to enable on-demand creation of spare parts close to the point-of-need (e.g. deployed operating bases), the use of efficient and autonomous logistic delivery platforms/vehicles (UAVs, UGVs), the use of robotics to autonomously pick, pack and ship inventory upon receiving a demand, optimization of inventory location within a warehouse to expedite the pick & pack process, the use of predictive analytics to optimize stock levels at each point along the supply chain, or to forecast maintenance requirements.