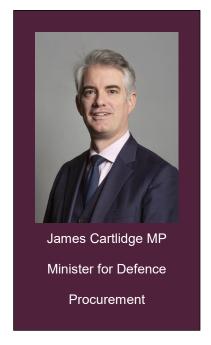Ministry of Defence

Defence Drone Strategy
The UK's Approach to Defence Uncrewed Systems

Introducing Defence's Approach to Uncrewed Systems

The return of war to Europe has demonstrated the essential requirement for a resilient, robust and agile approach to Defence procurement. The Integrated Review Refresh and Defence Command Paper recognise this challenge and underline the importance of overhauling our acquisition system to ensure operational advantage. The conflict in Ukraine has become a very visible representation of a 'new way of war', one characterised by innovation, the proliferation of technology, digitisation of the battlefield and the need to rapidly develop capability fit for the tempo of operations.

James Cartlidge MP

Minister for Defence

Procurement

There is no clearer example than the development and employment of uncrewed systems, where low-cost solutions are increasingly defeating more exquisite capabilities and delivering disproportionate impact on the battlefield. The UK must learn from the Ukrainian experience, amongst other lessons, to position ourselves as a world leader in uncrewed systems. This will require changes in our processes, culture and relationship with industry. We will need to foster a culture of delivery-focused innovation across Defence, able to rapidly pull research & development (R&D) breakthroughs into the frontline. The UK's leading manufacturing, robotics and digital sectors will be vital in supporting Defence.

As this document's case studies from today's armed forces attest, the potential of uncrewed technology is far from confined to one area of capability. We are harnessing this new approach for use in naval mine clearance; one way attack; heavy lift and Intelligence/Surveillance. Meanwhile, concerted focus is underway to ensure we can counter such threats and provide the protection from uncrewed vehicles that our forces require.

Our approach to uncrewed systems will drive a more deliberate and coherent partnership with our industrial base, ensuring vital onshore resilience and component stockpiles. In close partnership with industry, we will spirally and collaboratively develop platforms and components to keep up with relentless cycles of battlefield adaptation, whilst driving sovereign industrial strength - and the export opportunities necessary to reinforce such resilience. We will also work across Government to foster a pro-innovation regulatory environment, delivering the ability for uncrewed military platforms to be tested as effectively as possible on UK sites, and within our sovereign airspace.

Ultimately, to the perennial procurement question of mass, I am clear that looking ahead it is in the uncrewed space that we will increasingly drive the mass of our forces, whilst in parallel strengthening the lethality and survivability of all our platforms and personnel. If we can deliver the technological and industrial base to drive excellence in our performance and production of uncrewed systems, command and control and software, we will deliver a more potent total military effect in a way that truly strengthens our overall deterrence.

James Cartlidge MP
Minister for Defence Procurement

Uncrewed Systems – changing the character of warfare

Video Shows Russia's T-90 Tanks Getting Destroyed by Kamikaze Drones

Ukraine says 'destroyed' Russian ship in underwater drone attack off Crimea

Military intelligence releases nighttime video showing sinking of ship it said was the missile boat Ivanovets.

RAF's Protector flies in the UK for the first time

Royal Navy warship HMS Diamond shoots down Houthi attack drone in the Red Sea

Royal Navy destroyer HMS Diamond was forced to defend itself with Sea Viper missiles on Saturday after the latest attack from Iran-backed Houthi rebels in the Red Sea

British drone releases torpedo at sea for first time

A pilotless plane has flown on and off a Royal Navy aircraft carrier for the first time.

The W Autonomous Systems (WAS) drone flew from the Lizard Peninsula and on to the deck of HMS Prince of Wales off the Cornish coast, delivered supplies, then flew back in a milestone flight which points the way to the future of naval aviation.

Context

The use of uncrewed systems in conflict is not new. During the First World War, both aerial target drones and distance control boats were developed for deploying explosives. However, in contemporary conflicts uncrewed systems are being used for a wider range of tasks than ever before – from finding to lifting and striking. Uncrewed systems increase the efficiency of a force, reducing the risk to people in physically and electronically contested environments and freeing up personnel for essential tasks that only humans can do.

The scale of use of uncrewed systems in increasingly physically and electronically contested environments in recent conflicts is unprecedented. The rapid development of dual-use and relatively inexpensive commercial and military technologies have democratised their employment; used both surgically and to generate mass to hold much more expensive and advanced platforms at risk. Their use in all theatres – Ukraine in the tens of thousands, the Middle East and the southern Red Sea – indicates the use of uncrewed systems are not only here to stay but are likely to increase as technology expands opportunities for their employment.

The UK defence enterprise – Government and industry together – has stepped up to the challenge supporting Ukraine. We have already provided thousands of uncrewed systems, with our recent annual commitment of £2.5 billion of military support to Ukraine continuing, including hundreds of millions to support logistic, surveillance, strike and maritime uncrewed platforms.

We have learnt, and will continue to learn, important lessons relating to uncrewed technology from Russia's illegal war in Ukraine, including developing and delivering long range air and maritime strike uncrewed systems. Uncrewed *systems* are about much more than the platform – they rely on the deliberate integration of components, software and supporting networks. We have also learnt wider lessons for acquisition: the fast-paced nature of technological adaption alongside industry measured at times in weeks, challenging our traditional development and acquisition methods. This demands a shift in our procurement approach to deliver effective, interoperable and safe capabilities at pace.[1]

Uncrewed technologies are forming an increasingly important part of the UK's force mix. We already have significant experience, and ambitious programmes in train. But our adversaries are developing their capabilities at pace too, and we must retain our edge.

Developed with defence and industry stakeholders, this strategy aims to enhance collaboration and innovation relating to uncrewed systems. It focuses on capability development, acquisition, and the achievement of operational advantage across air, land, and maritime surface and sub-surface systems.[2] It is designed to guide defence practitioners and industry on how the Ministry of Defence will link research, development, manufacturing and platform adaptation to make the UK a world leader in uncrewed systems. Its delivery will be driven by a governance mechanism involving all single Services and integrated through UK Strategic Command to maximise the integration of our uncrewed capabilities. As technology advances, we must adapt to seize the shifting opportunities and adapt to the changing character of warfare.

Vision

Our vision is for the UK to be world-leading in uncrewed defence systems, leveraging our considerable research, development and manufacturing capabilities to safeguard national security and foster economic growth; protecting the nation and helping it prosper.

The seamless integration and operation of uncrewed and autonomous systems will significantly enhance our defence capabilities. Through constant adaptation and iterative development, they will deliver a more potent military effect that ensures we are better able to defend and deter.

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[1] Defence Command Paper 23 (DCP23), p.8 outlines 'the requirement for a more agile acquisition process'
[2] The strategy encompasses uncrewed Remote Piloted and Uncrewed Air Systems (RPAS and UAS), Ground (UGV), maritime surface (USV) and underwater (UUV) vehicles. While it acknowledges the role of space, this strategy does not specifically cover space vehicles.

Uncrewed Systems - Pan-Defence Excellence

Air

- The MQ-9 Reaper, in service with the Royal Air Force since 2007, has completed over 140,000 operational flying hours and 1,500 weapons releases. Its replacement, the world-class MQ-9B Protector, will carry a variety of weapons and sensors and can self-deploy anywhere in the world.

- Alongside development of the Global Combat Air Programme (GCAP), the RAF is testing cost-effective expendable Autonomous Collaborative Platforms (ACP) designed to leverage cutting edge technology to support high-risk combat operations.

- The ACP Programme has a range of experimental and development platforms able to deliver strategic effects at range.
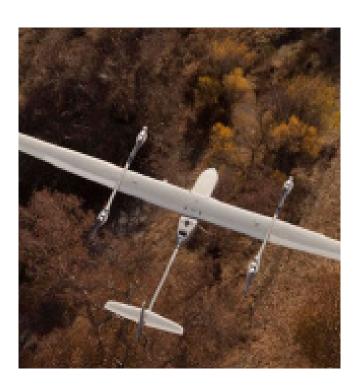

Underwater, Surface and Above Water

- The Royal Navy has developed the use of Remus 100 and 300 Uncrewed Underwater Vehicles (UUVs) for mine detection, and M500 underwater Remote operated Vehicles for seabed operations.

- Learning the lessons from the Black Sea and our leadership of experimentation in the Maritime Coalition, UAS are deployed onto Royal Navy frigates, increasingly integrated into ship Combat Management Systems.

- HMS Prince of Wales has conducted a number of 'firsts', launching and landing a 9 metre long Mojave RPAS and the UK produced Windracer heavy lift logistic drone.

Littoral Strike

- The Commando Force and Royal Navy have built upon lessons from Ukraine to develop the use of UK built heavy lift UAS (Uncrewed Air Systems) to deliver munitions and supplies.

- Uncrewed systems are being fully integrated with networks to minimise the 'sensor to shooter' cycle across the Joint Force.

- The Commando Force is also developing autonomous sub-surface and surface craft to enable manoeuvre from the sea.

Land / Near Surface

- The Army has a long history of uncrewed system development and operation, from the small tactical Desert Hawk to the larger Phoenix, Hermes and Watchkeeper.

- We have developed short and long-range find and strike systems for use in the Ukrainian theatre, with many sourced from UK small and medium companies.

- The lessons learned from Ukraine are informing the Army's spiral system development at pace.

Our Approach

Our approach will be one of **unparalleled collaboration** and **bold innovation**. We already have a foundation of investment of over £4.6 billion over the next 10 years on uncrewed capability, which we only expect to accelerate as these technologies advance. We intend to harness a culture of innovative delivery that swiftly brings research and development breakthroughs to the frontline, maximises our people's ingenuity, avoids unnecessary bureaucracy and captures the potential of our leading manufacturing, robotics and digital sectors.

We will seize the opportunity to bring together Government and industry, empower our collective workforce, and draw upon our significant Research, Development, Test and Evaluation capabilities and regulatory standards to meet our ambition to become world leaders in sectors of autonomous and uncrewed systems.

By approaching the challenge through innovation and collaboration, we believe we can create closer partnerships between Government and industry, build resilient supply chains, and generate employment and export opportunities. Working ever more closely with our allies and partners for mutual benefit, we will also further enhance our collective operational advantage and security.
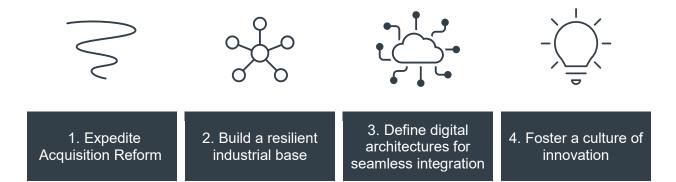
Case Study – learning from Ukraine

The war in Ukraine has demonstrated the ubiquity of uncrewed systems in contemporary conflict – initially focused on UAS and rapidly expanding to all forms of uncrewed systems. The frontline operational environment is the most challenging for operating these types of logistic, find, and strike systems, with previously unseen levels of Electronic Warfare (EW). High equipment attrition rates have demanded new types of capabilities, utilising technologies developed at scale for the commercial sector to enable a different cost model to deliver capability.

This has driven a new type of acquisition and support model for delivering UK procured uncrewed systems to Ukraine - a true partnership with industry to enable capability development at a pace of operational relevance measured in days, sometimes hours. The Ministry of Defence has worked with both established and new Defence companies to operate 24/7 support cycles, with a direct feed of data at the frontline able to run capability sprints against adapting threats and requirements. This has necessitated hundreds of software and hardware modifications with parallel teams of developers and trials engineers alongside native Ukrainian speakers, a willingness to go far beyond traditional MOD-supplier relationships. Crucially, we are learning these lessons in real-time from the Ukrainian theatre and elsewhere, to inform the development of our own sovereign production base and drive uncrewed acquisition for our own armed forces.

Coherent Actions

To deliver our vision we will focus on **four key objectives**:

1. Expedite Acquisition Reform	2. Build a resilient industrial base	3. Define digital architectures for seamless integration	4. Foster a culture of innovation

Objective 1: Expedite the adoption of Acquisition Reform

Guided by the lessons we are learning from Ukraine – including procurement at pace, rapid delivery and iterative capability development – we will expedite the adoption of a more adaptable and agile acquisition process. This will include:

- Understanding the changing threat picture, developing capabilities that can evolve as the threat develops.

- Learning the lessons from Ukraine in operating uncrewed systems in physically and electronically contested environments.

- Enshrining the principle of iterative – or spiral – capability development in our acquisition process. This will allow us to assure and sustain military capability in a rapidly changing threat environment.

- Being transparent with industry – both traditional defence suppliers and new small and medium-sized enterprises[3] – about specific requirements and design standards, while leaving room for the market to provide innovative solutions[4].

- Using our position as a leading developer and supplier of uncrewed systems – and our continued commitment to supporting Ukraine – to create a more predictable demand signal, drive down cost, and procure at scale for both the Ukrainian and UK armed forces.

Objective 2: Build a resilient industrial base

The Defence Command Paper 2023 recognised our industrial base as an essential component of our national security.[5] Together with industry, we will build the resilience of our uncrewed systems' industrial base. This will include:

- Ensuring supply chain resilience for key components and platforms, enabling us to procure at scale in line with UK military needs. This will assure access to an adaptable onshore and international industrial supply chain, able to deliver resilient stockpiles with the capacity to surge during times of conflict.

- Being guided by the Defence and Security Industrial Strategy (DSIS) to balance capability needs and national security requirements, cost, sovereignty and a domestic industrial base, prioritising UK sovereign capability to sustain our competitive advantage.

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[3] DCP23, p.8: 'an even stronger partnership between government and industry, both primes and small- and medium-sized enterprises'.
[4] DCP23, pp.41, 43.
[5] Defence Command Paper Refresh 23, p.37.

- Focusing on onshore design and production, reducing barriers for small- and medium-sized enterprises, and exploring opportunities to scale civil and military platforms or components both to enhance our operational capability and enable exports, working with key departments across Government.

- Engaging with industry through regular events to share knowledge, expertise and capability requirements, and to build a genuine partnership for mutual benefit.

Objective 3: Define digital architectures for seamless operational integration

Uncrewed systems are essential for delivering accurate data and targeting information to decision-makers; they must be resilient to interference. They need to navigate and communicate in the most contested spaces, synchronising effects across smart networks. The single Services need to be able to integrate uncrewed systems across domains, alongside counter-uncrewed systems and our Allies. We will therefore define digital architectures to enable seamless operational integration and interoperability. This will include:

- Setting high standards for digital integration while ensuring our uncrewed systems are 'secure by design' and use 'open architecture' by default.

- Working closely with selected international partners, investing in relationships that support capability development and maintain robust supply chains, including through an active approach to exports.

- Harnessing data from Ukraine and other theatres to continuously refine our capabilities, and adapt and improve our uncrewed systems in response to real-world challenges, to maintain a competitive advantage.

Objective 4: Foster a culture of innovation - exploit technology at the leading edge

We wish to unleash the ingenuity of our personnel – across the defence enterprise – to foster a culture of innovation, harness their expertise and speed up automation. This will include:

- Fully exploiting our estate and infrastructure by adapting them with industry partners.

- Tailoring our Research and Development to meet the challenges of a constantly evolving operational environment, setting up controlled test areas ('sandboxes') in the UK and overseas, and learning from experiences across the world, including through AUKUS, to develop and fine-tune our capabilities.

- Working with civilian and military regulators, including the Civil Aviation Authority and the Military Aviation Authority, to navigate regulatory challenges and support our industries to test and evaluate their products in the UK across all domains.

Next Steps

Our initial priority is the successful delivery of the Ukraine-UK uncrewed systems initiative, a critical milestone in our strategic bilateral relationship. Alongside other strategic partnerships and coalition opportunities, we will continue to learn lessons from the frontline, to catalyse spiral development and reduce unintended duplication. We will drive procurement at scale to meet the demands, both of our armed forces and those of Ukraine.

We will continue our close engagement with industry to refine our requirements and address queries. We will hold direct engagement with regulatory bodies to align our ambition with regulatory standards, and we will collaborate with existing partners – across the defence enterprise and internationally – to deliver on all aspects of our strategy.

While maintaining the necessary operational sensitivity, we also recognise the importance of public engagement. We are committed to balancing transparency with security, keeping the public informed of our progress and developments in a responsible manner.

Finally, we are establishing a Defence-level governance mechanism to support the pan-domain delivery plans of the Royal Navy, Army and Royal Air Force. We will focus across six Defence level areas to accelerate frontline capability and offer industry a clearer interface into the appropriate parts of Defence:

Research & Development

Test & Evaluation coordination and exploitation

Operational, Equipment and Market Analysis

Policy, Regulation and Risk

Digital, integration and security standards

Industrial Principles and Commercial Agility

Annex A: Selected Glossary / References

Term	Definition
Artificial Intelligence	Machines that perform tasks normally requiring human intelligence, especially when the machines learn from data how to do those tasks. (Defence AI Strategy)
Autonomy	A system's ability to function, within parameters established by programming and without outside intervention, in accordance with desired goals, based on acquired knowledge and evolving situational awareness.(NATO Term)
Autonomous Collaborative Platforms (Air ACP Strategy)	A group of uncrewed Assets capable of operating in a collaborative manner with other crewed or uncrewed Assets. (RAF - ACP Strategy) Tier 1: *Disposable*. ACP with a life cycle of one or very few missions. Tier 2: *Attritable*. ACP that are expected to survive the mission, but losses are acceptable. Tier 3: *Survivable*. ACP of strategic value; their loss would significantly affect how we fight.
DDIL Environment	Environments where activity is Denied, Degraded, Intermittent or Limited due to adversary, environmental, equipment or network challenges.
Experiment	A scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known fact. (COED)
Innovate	Change something established by introducing new methods, ideas or products. (COED) Innovation without change is still experimentation. (DIU)
Machine Learning (ML)	Computer algorithms that can 'learn' by finding patterns in sample data and then apply this to new data to produce useful outputs, often using neural networks. (*Alan Turing Institute*)
Open Architecture	A type of platform, sub-system or software architecture intended to enable adding or upgrading components. (Concise Encyclopaedia of System Safety)
Remotely Piloted Air System (RPAS)[1].	A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other com ponents as specified in the type design. (NATO Term)
Research and development (R&D)	Work directed towards innovation in and improvement of products and processes. (COED)
Robotic Autonomous System (RAS)	A system comprising the platform, control and sensor equipment, the supporting network, information-processing system and associated personnel where the platform may be operated remotely and/or have automated functionality. (JDP 0-01.1 DCDC 2019)
System of Systems (SoS)	An organised collection of interacting systems. (Knowledge in Defence)
System of Systems Approach (SoSA)	An approach to systems of systems analysis, systems design and systems and equipment acquisition. (Knowledge in Defence)
Test and evaluation (T&E)	Test – a procedure intended to establish the quality, performance or reliability of a capability. Evaluate – form an idea of the amount, number or value of and assess. (COED)
Uncrewed Aircraft System (UAS)[1].	A system whose components include the uncrewed aircraft, the supporting network and all equipment and personnel necessary to control the uncrewed aircraft. (JDP 0-01.1)
Uncrewed Ground Vehicle (UGV)	An uncrewed ground vehicle. (Adapted from JDP 0-01.1)
Uncrewed Surface Vehicle (USV)	An uncrewed surface vehicle. (Adapted from JDP 0-01.1)
Uncrewed System (UxS)	A system including the platform, the supporting network and all equipment and personnel necessary to control it. (Adapted from JDP 0-01.1)
Uncrewed Underwater Vehicle (UUV)	An uncrewed underwater vehicle. (Adapted from JDP 0-01.1)