致命無人機：從萊特兄弟飛機迄今飛行器發展的漫漫長路

(LETHAL DRONES: A LONG WAY FROM THE WRIGHT BROTHERS)

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In 1903, the Wright brothers invented the first successful airplane. By 1914, just over a decade after its successful test, aircraft would be used in combat in World War I, with capabilities including reconnaissance, bombing and aerial combat. This has been categorized by most historians as a revolution in military affairs. The battlefield, which previously included land and sea, now included the sky, permanently altering the way wars are fought. With the new technology came new strategy, policy, tactics, procedures and formations.

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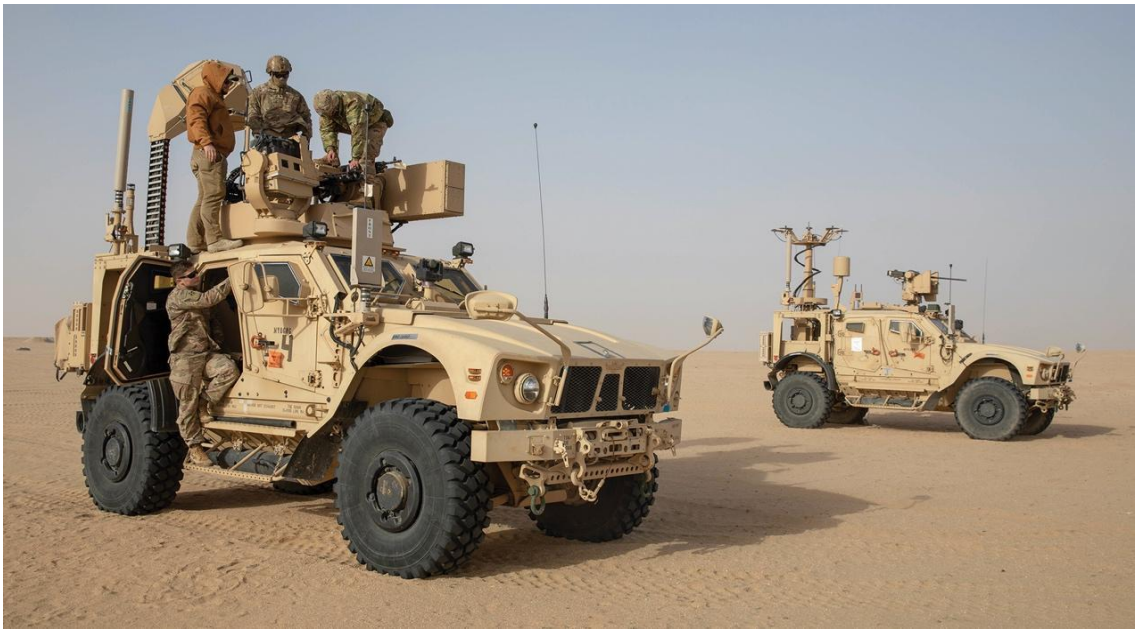
1903 年萊特兄弟成功發明第一架飛機。1914 年，試驗成功十多年後，飛機參與了第一次世界大戰的戰鬥，其功能包括偵察、轟炸及空中纏鬥。之前只在陸地和海洋作戰的戰場現在加上了天空，此舉被大多數歷史學家歸類為軍事革命，永久地改變了戰爭的方式。新技術帶來了新的戰略、政策、戰術、程序及作戰編組隊形。

Twenty years ago, unmanned aircraft systems (UASs) were much less prevalent and capable. Today, their threat potential and risk profile have increased significantly. UASs are becoming increasingly more affordable and capable, with improved optics, greater speed, longer range and increased lethality.

二十年前，無人駕駛飛機系統 (UAS，後續簡稱無人機系統)功能低且並未普及。如今，它們加諸敵人的潛在威脅及風險已顯著增加，無人機系統正變得越來越廉價及性能強大，具有改良的光學器具、速度更快、航程更遠及更大的殺傷力。

The U.S. has long been a proponent of utilizing unmanned aircraft systems, with the MQ-9 Reaper and MQ-1 Predator excelling in combat operations, and smaller squad-based UASs being fielded, such as the RQ-11 Raven and the Switchblade. While the optimization of friendly UAS capability can yield great results on the battlefield, adversarial use of unmanned aircraft systems can be devastating.

美國長期以來都是無人機系統的支持與使用者，MQ-9 收割者與 MQ-1 掠食者都曾在作戰行動有出色表現。此外，美軍配署了機型較小的 RQ-11 渡鴉及彈簧刀等兩型無人機，到班層級的單位。當我(友)軍無人機系統功能被發揮到極致，將在戰場上產生巨大的成果，惟對我具有敵意的一方使用無人機系統時，亦可能對我方造成極具毀滅性的傷害。



Soldiers with the 1st Stryker Brigade Combat Team, 4th Infantry Division, conduct counter- small drone training at Camp Buehring, Kuwait. (Credit: U.S. Army/Spc. Damian Mioduszewski)
第 4 步兵師第 1 史崔克旅戰鬥隊的士兵在科威特 Buehring 營地進行反小型無人機訓練。（來源：美國陸軍/Spc. Damian Mioduszewski）

This began to raise serious concerns due to use by nonstate actors such as Houthi rebels in Yemen and the Islamic State group in the Middle East.

無人機開始引起世人的嚴正關切，係起因於葉門的胡塞叛軍及中東的伊斯蘭國等非正式國家組織，將之運用於戰爭及衝突上。

Now, in addition to nonstate actors, there are multiple examples of peer-to-peer conflict in which UASs have been fielded to great effect. Azerbaijan’ s use of Israeli Harops and Turkish Bayraktar TB2 unmanned aircraft systems in the 2020 Nagorno-Karabakh conflict led to what many have

described as a decisive victory in terms of territory gained and damage inflicted. The UASs used in this conflict have set the stage, with many countries working with Israel and Turkey to acquire these game-changing capabilities. In the conflict in Ukraine, the Bayraktar TB2 has shown great promise, dealing devastating damage against the Russian incursion.

現在，除了非正式國家組織之外，還有多個實力相當的對手的衝突實例中無人機系統已經發揮了巨大的功效。亞塞拜然在 2020 年納戈爾諾-卡拉巴赫衝突中運用以色列製豎琴及土耳其旗手 TB2 無人機系統，使其在擴張佔領區及對目標致損方面獲得決定性勝利。這場衝突為無人機系統的實戰地位奠定基礎，許多國家與以色列及土耳其合作，以獲得這些改變遊戲規則的能力。在俄烏戰爭中，烏克蘭運用旗手 TB2 發揮巨大效用，抵抗俄羅斯入侵並造成極具毀滅性的破壞。

Today, "everyone has access to unmanned aerial systems. They are very easy to make lethal," Army Chief of Staff Gen. James McConville said in March. As manned aircraft gained prominence on the battlefield, so too did anti-aircraft weaponry. Similarly, UAS proliferation across the battlefield has led to the requirement for counter-unmanned aircraft systems.

陸軍參謀長詹姆斯·麥康維爾將軍於 3 月份時表示：今日，「每個人都可以使用無人機系統，它們能輕易地給予敵人致命打擊」。隨著飛行員駕駛戰機在戰場上表現突出的同時，也促使反制性防空武器的研發進程。同樣地，無人機系統在戰場上的運用方式激增，亦導致反制無人機系統的需求增加。

The Solution

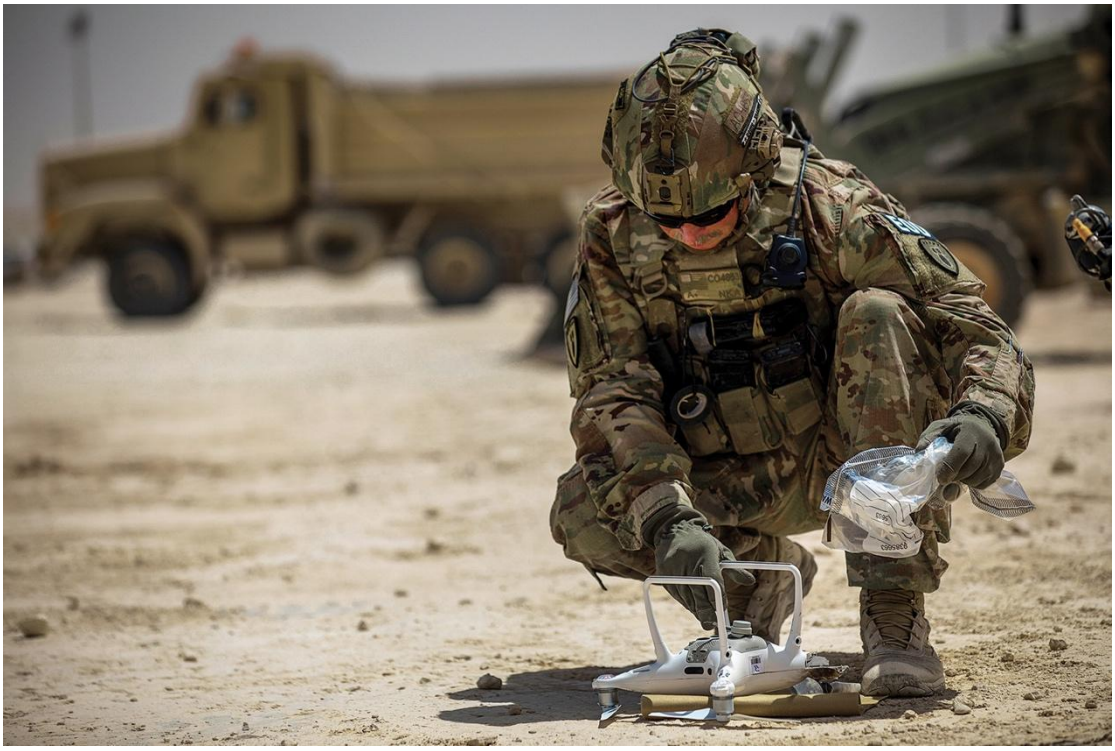
解決方案

To combat this threat, DoD established a grouping system for UASs with five tiers, each tier relating to an increase in size, speed and maximum altitude. Conventional air defense artillery capabilities and tactics can engage the larger group 4 and 5 UASs; however, engaging groups 1 through 3, now defined as small UASs, required a new approach.

為了對抗這種威脅，國防部為無人機系統建立了一個分為五層級的分類系統，每一層級都以尺寸、速度及最大巡航高度的增加做分級，傳統的防空火砲能力與戰術可以接戰大型的第 4 組及第 5 組等層級的無人機系統；然而，反制第 1 到第 3 組等較小型的無人機系統，則需要規劃新的解決方案。

Each of the services independently initiated efforts to acquire service-unique counter-small unmanned aircraft system materiel solutions, and began the development of associated employment tactics and strategies. Each service reacted to the threat individually based on its understanding of the problem from applicable intelligence reports and observed employment of small UASs on the battlefield.

各軍種自行著手開發，以獲取其獨特的反小型無人機系統解決方案，並開始發展整合性的部署戰術與運用策略。此外，亦根據現行情報報告來確認問題所在及觀察戰場上小型無人機系統的使用情況後，針對不同威脅，分別提出反制對策。



Sgt. 1st Class Adrian Coghill, an explosive ordnance disposal technician, sets up a remote-controlled ordnance disposal drone at the Ain al-Asad air base, Iraq. (Credit: U.S. Army/Spc. Derek Mustard)
爆裂物處理員柯希爾(Adrian Coghill)上士在伊拉克安阿撤德(Ain al-Asad)空軍基地架設遙控彈藥處理無人機。（來源：美國陸軍/Spc. Derek Mustard）

Services began to research, oftentimes with unintended overlap, which led to redundant and higher development costs across DoD, and less effective and efficient training and employment in support of joint force operations.

當各軍種開始研究時，卻經常出現非經意的重疊投資，導致整個國防部的重複開發成本過高，無法有效支援聯合部隊的作戰訓練及部署運用。

In November 2019, to counter this constantly evolving threat and decrease duplication and redundancy, the secretary of defense assigned the secretary of the Army as the DoD executive agent for counter-small UASs. To accomplish this mission, the secretary of the Army established the Joint Counter-Small Unmanned Aircraft Systems Office. This office leads the development of flexible, agile and safely integrated emerging joint counter-small UAS capabilities by emphasizing rapid innovation, synchronizing materiel and nonmateriel solutions, and fostering partnerships, which enable the protection of DoD personnel, facilities and assets within the homeland, host nations and contingency locations.

2019 年 11 月，為了應對這種不斷演變的威脅並減少重複投資與冗餘，國防部長指派陸軍部長負責國防部反小型無人機系統的研發。為了達成這項任務，陸軍部長成立聯

合反小型無人機系統辦公室，藉由強調快速創新、整合物資與非物資性的解決方案，培訓共同合作關係，主導靈活、敏捷、順利地整合的新設立聯合反小型無人機系統功能的開發，使其能在美國本土、地主國及動亂地區，保護國防部所屬人員、設施及資產。

Comprehensive Strategy

綜合戰略

Just over a year after its inception, the Joint Counter-Small Unmanned Aircraft Systems Office published the first DoD counter-small UAS strategy. This unclassified document serves to bring DoD counter-small UAS stakeholders into alignment through a jointly developed strategic framework and three strategic objectives. These objectives are to:

成立一年多後，聯合反小型無人機系統辦公室發布了第一個國防部反小型無人機系統的策略。這份非機密文件藉由共同製定的策略架構及三個策略目標，整合國防部與小型無人機系統的利益相關者。這些目標是：

•Enhance the joint force through innovation and collaboration to protect DoD personnel, assets and facilities in the homeland, host nations and contingency locations.

•透過創新思維與協同合作強化聯合作戰部隊反小型無人機能力，以保護美國本土、地主國與在緊急地區保護國防部所屬人員、設施及資產。

•Develop materiel and nonmateriel solutions that facilitate the safe and secure execution of DoD missions and deny adversaries the ability to impede the joint force’ s objectives.

•發展物資及非物資解決方案，有利於國防部能安全而有效地執行任務，並剝奪敵對者阻礙聯合作戰部隊達成目標之能力。

•Build and broaden DoD’ s relationships with allies and partners to protect American interests at home and abroad.

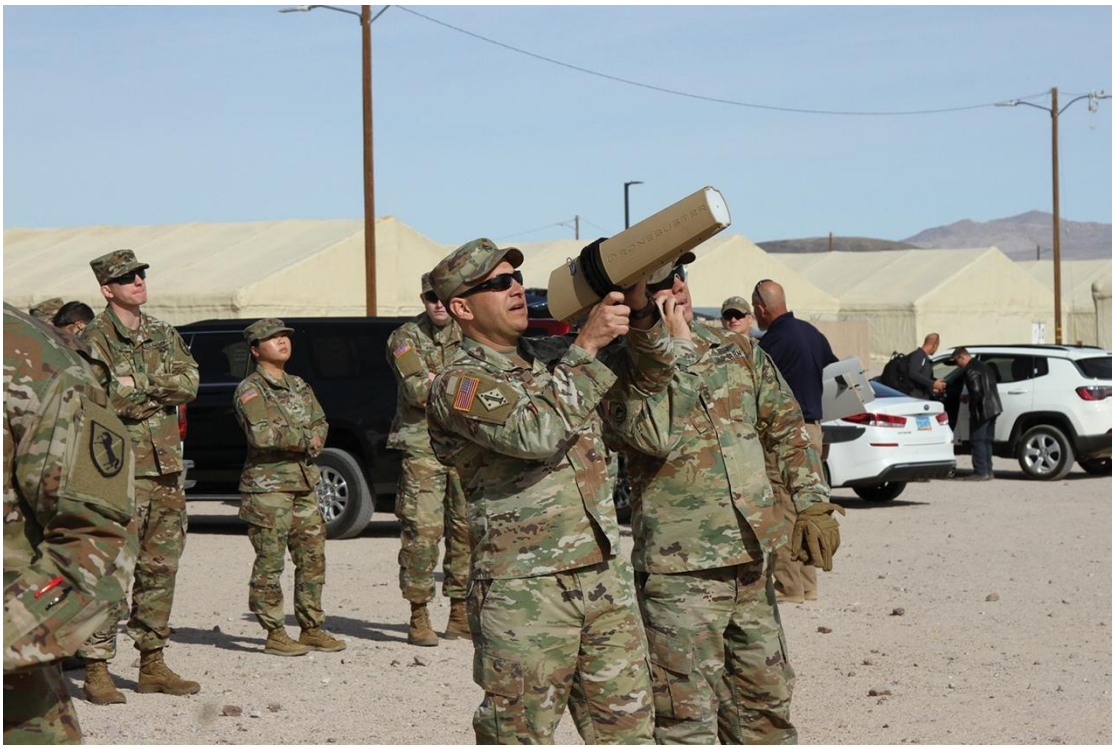
•建立與擴大國防部與盟國及合作夥伴的關係，以保護美國在國、內外的利益。

These objectives are to be achieved through three key lines of effort: Ready the force, defend the force, and build the team. These lines of effort are outlined in great depth in the implementation plan, a supporting document to the DoD counter-small UAS strategy.

上述三個目標將藉由三個戰力指數的建立而達成，即戰備整備、部隊防護及建立團隊等，且都在呈送給國防部的反制小型無人機系統的執行計畫及補充資料中，皆有深入的論述。

These two documents, approved by the secretary of defense, ensure joint counter-small UAS efforts are synchronized and provide required guidance and direction to stakeholders for counter-small UAS efforts.

此兩份文件已由國防部長批准，確保聯合反制小型無人機的努力得以整合，並提供參與反制無人機系統研發之各相關單位，必要之指導與發展方向。



A soldier demonstrates a Dronebuster counter-unmanned aircraft system at Fort Irwin, California. (Credit: U.S. Army/Pfc. Gower Liu)
一名士兵在加州歐文堡示範無人機剋星(Dronebuster)反無人機系統。（圖片來源：美國陸軍/Pfc. Gower Liu）

System-of-Systems Approach

抽絲剝繭手段

In the business of warfare, there are no silver bullets. With this in mind, through research, development, testing and evaluation, the Joint Counter-Small Unmanned Aircraft Systems Office and the services are identifying systems that are interoperable and work within the defined system of systems that will address the threat of UAS use by adversaries across a broad range of conditions and environments.

在繁複的戰爭事務中，沒有靈丹妙藥可輕易解決。有鑒於此，聯合反小型無人機系統辦公室與各軍種有關部門透過研、發、測、評，正在各式體系中找出一種可互相操作與合作的系統，用以辯識出對手廣泛使用無人機的條件與環境中的威脅所在。

Utilizing a shared command and control architecture that is interoperable across the joint force, the systems being developed utilize a broad range of detect, track, identify and defeat capabilities that, when coupled with classic air defense techniques and principles, create a layered defense, capable of mitigating a wide range of threats.

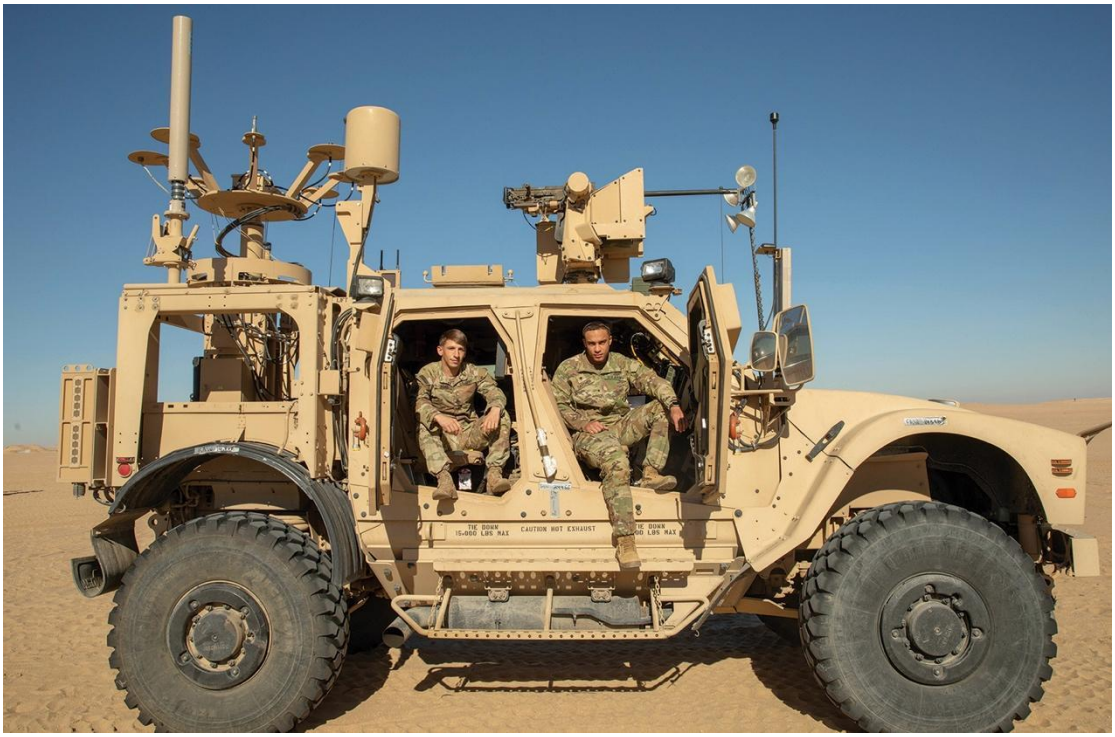
利用聯合作戰部隊中相互操作的共享指揮管制系統架構，當與傳統的防空技術及原則相結合時，這套已開發系統結合廣範圍的偵測、跟踪、識別及打擊合一等能力，可以建構分層防空防禦體系，減輕範圍廣泛的無人機威脅。

To expedite progress toward this system-of-systems approach, the Joint Counter-Small Unmanned Aircraft Systems Office works to reduce redundancy and streamline funding for the development of materiel solutions. In its initial phase, the office conducted a baseline assessment of the current efforts and used that assessment to focus DoD funding on the development of 10 identified systems, which made up the initial joint counter-small UAS capability.

為了加快這種系統方法的進展，聯合反小型無人機系統辦公室致力於減少冗餘流程並簡化研發系統解決方案所需資金的籌獲程序。在初始階段，該辦公室對當前的工作成效進行基準評估，並利用該評估將國防部的資金集中開發 10 個確定的系統上，這些系統構成了初始的聯合反小型無人機系統的功能。

To fully address the counter-small UAS mission, these 10 initial systems contained a variety of capabilities, to include detection, engagement, and command and control. In the realm of engagement, the systems chosen include directed energy, electronic warfare and kinetic capabilities. To ensure warfighters can defend themselves from the small UAS threat at any point during a conflict, the initial 10 systems cover hand-held, mounted and fixed-site options.

為完全應付反小型無人機系統任務，這 10 個初始系統包含偵測、交戰、指揮與管制等多種能力。接戰時，系統選項包括導能、電子戰與動力性能等功能，另為確保參戰者能夠在衝突期間隨何時自我防護，免受敵方小型無人機系統威脅，初始的 10 個系統包括手持、車裝及地裝式等選項。



At Camp Buehring, Kuwait, soldiers with the 1st Stryker Brigade Combat Team, 4th Infantry Division, participate in counter-small drone training. (Credit: U.S. Army/Damian Mioduszewski)
圖為美軍第 4 步兵師第 1 史崔克旅戰鬥隊的士兵，在位於科威特的裴林(Buehring)營區參加反制小型無人機的訓練。（圖片來源：美國陸軍/Damian Mioduszewski）

Technical Demonstrations

技術示範

In an effort to ensure there is constant advancement across the select counter-small UAS capabilities and that DoD stays ahead of threats, the Joint Counter-Small Unmanned Aircraft Systems Office conducts a technical demonstration twice a year. This event, jointly hosted by the office and the Army’ s Rapid Capabilities and Critical Technologies Office and attended by the services, allows industry to show off developmental capabilities on a fully instrumented test range with a predefined technical focus area. Past focus areas have included hand-held solutions, low-collateral effects interceptors, high-power microwave (a component of the directed energy engagement concept) and Counter-Small Unmanned Aircraft Systems as a Service.

為了確保獲選的反小型無人機系統功能得以持續進步，並讓國防部較敵方保持領先優勢，聯合反小型無人機系統辦公室每年進行兩次技術示範。此事由該辦公室與陸軍緊急能力及關鍵技術辦公室聯合主辦，各軍種皆要參加，使業界能夠在高度儀器化的測試場域，以預定的重點領域技術，展示研發功能。過去的重點領域係發展手持式反制手段、低附帶效應攔截器、高功率微波（導向能量交戰概念的一個組件，如干擾無線電頻率）及反小型無人機系統，由各軍種專屬運用。

These events provide a platform for both traditional and nontraditional companies to help with the rapid advancement of DoD’ s counter-small UAS portfolio that closes gaps, informs requirements and promotes innovation.

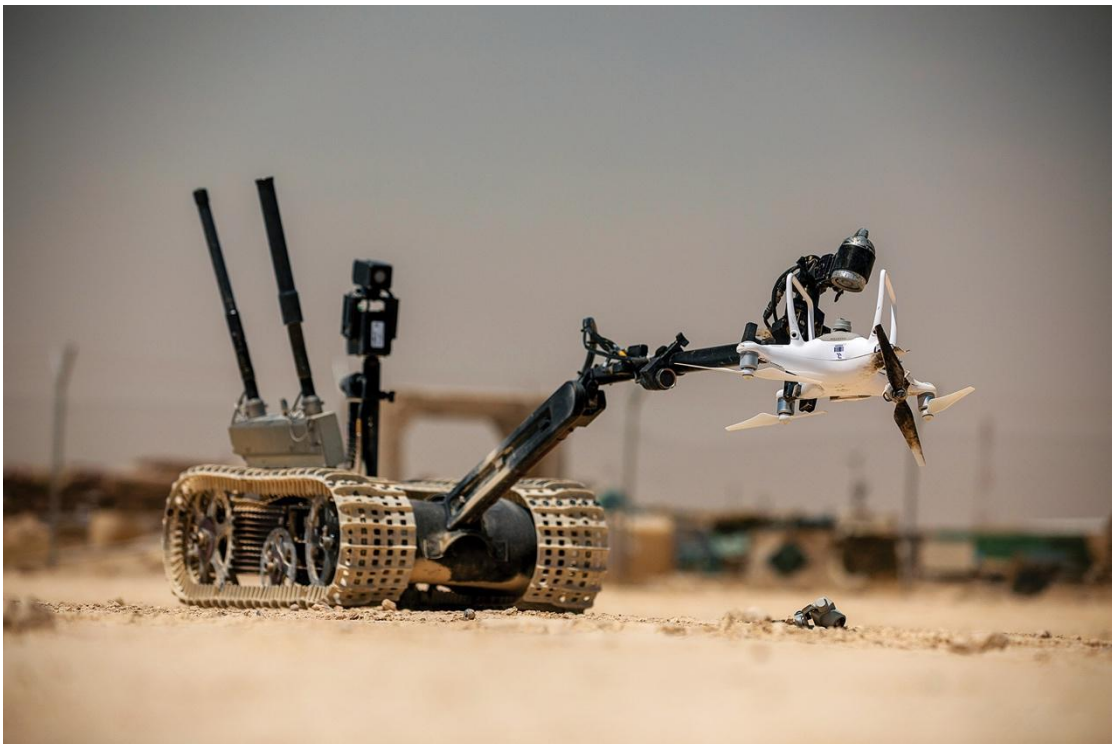
這些措施為傳統與非傳統公司，提供一個可以幫助國防部快速推展反小型無人機系統組合的平台，從而縮小彼此差距、需求條件及促進創新。

The most recent demonstration took place April 4 – 22 at Yuma Proving Ground, Arizona. It focused on ground-based, high-power microwave systems and a concept known as Counter-Small Unmanned Aircraft Systems as a Service. The ground-based high-power microwave systems at the demonstration were capabilities that produced electromagnetic pulses from a fixed ground location with enough energy to destroy or defeat airborne small UAS threats.

最近的示範於 4 月 4 日至 22 日在亞利桑那州尤馬試驗場舉行，該示範聚焦於陸基型高功率微波系統與各軍種研發的反小型無人機系統概念(即以無線電干擾)。示範中展示的陸基型高功率微波系統功能，能夠從地面固定位置產生足以摧毀或擊敗空中小型無人機系統威脅的電磁脈衝。

The Counter-Small Unmanned Aircraft Systems as a Service concept involves contractor-owned, government-operated counter-small UAS capabilities used to defend fixed locations by detecting, tracking, identifying and defeating small unmanned aircraft system threats. Future demonstrations will be conducted as the Joint Counter-Small Unmanned Aircraft Systems Office and the service identify the focus areas that provide the best potential for transitioning emerging solutions into production capabilities.

軍種研發的反小型無人機系統概念涉及承包商擁有及政府操作的反小型無人機功能，可藉由偵測、跟踪、識別及挫敗小型無人機系統威脅，保護地裝設施。未來展示重點，將是以聯合反小型無人機系統辦公室及軍種共同確認重點領域的方式，為新解決方案轉化為生產能力，提供最佳潛能。



A Talon robot picks up a downed drone at the Ain al-Asad air base, Iraq. (Credit: U.S. Army/Spc. Derek Mustard)
一個 Talon 一架鷹爪機器載具在伊拉克 安阿薩德(Ain al-Asad)空軍基地撿起一架被擊落的無人機。（來源：美國陸軍/Spc. Derek Mustard）

Rapid Response Team

問題迅速處理團隊

Another important initiative within the Joint Counter-Small Unmanned Aircraft Systems Office is the Rapid Response Team. This team is a collaborative effort between the office and the Defense Digital Service, and serves to triage gaps in counter-small UASs identified by the services and combatant commands. These gaps are filled through a mix of software, additional training, hardware upgrades, etc.

聯合反小型無人機系統辦公室的另一項重要作為，係成立能快速回應問題的團隊。該團隊係該辦公室與國防數位發展局共同努力的成果，旨在檢視及解決各軍種及作戰指揮部所產生的反小型無人機系統的功能差距。

The team has traveled to Europe, the Middle East, Africa and the Indo-Pacific at the request of theater leaders to assist with deep analysis of the operational and threat environment, technical and materiel recommendations, and assessment and modifications of tactics, techniques, procedures and training that inform leaders within combatant commands about current counter-small UAS best practices and developments.

該團隊應各戰區指揮官的要求前往歐洲、中東、非洲及印太地區，協助渠等深入分析作戰及威脅環境、技術與實體設備的設置建議，並讓作戰區內各階層指揮官了解戰術

戰法、技術、程序與培訓等評估與修正意見，以及當前反小型無人機系統的最佳作法與後續發展。

Army Efforts

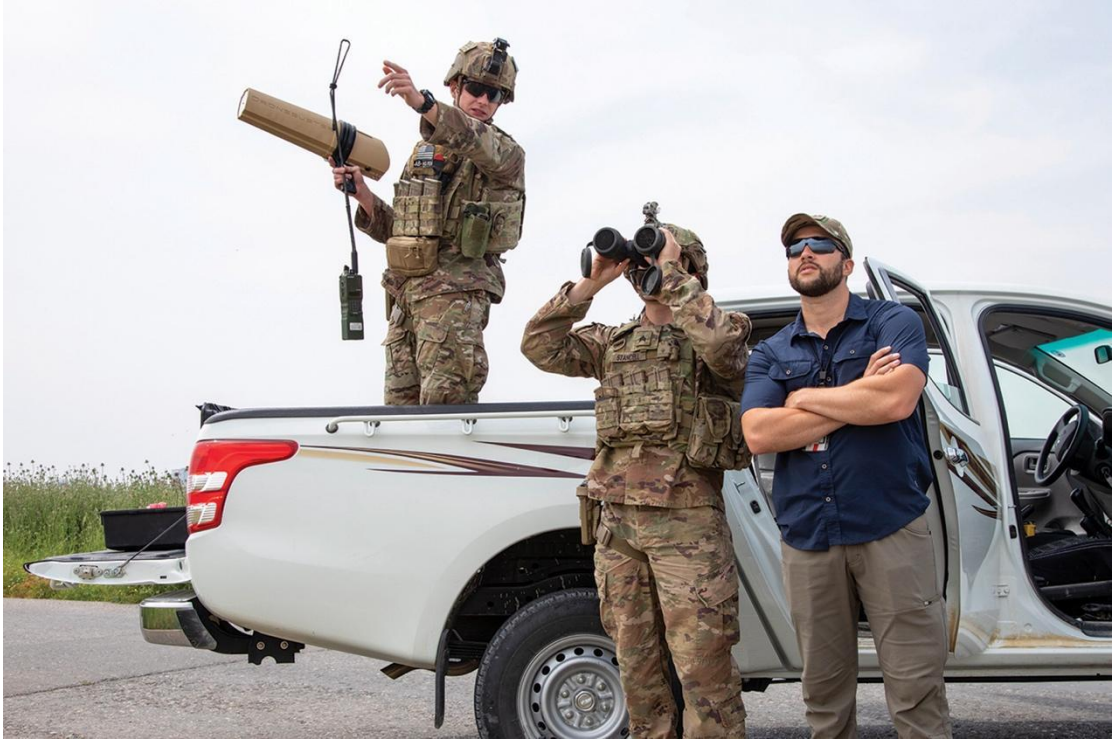
陸軍的努力

The secretary of the Army, while being the executive agent for the DoD, is also aware of the Army’s service-specific need for counter-small UAS efforts. “The Army needs to be very attentive to challenges like counter-UAS, for example. … Those are absolutely areas that we need to be working on in terms of developing our capabilities,” Army Secretary Christine Wormuth said in May 2021 during a Senate Armed Services Committee hearing. There are Army-specific counter-small UAS initiatives and efforts that also must be highlighted, in addition to the work the Army is doing as the executive agent.

陸軍部長雖然是國防部的執行單位首長，但也意識到陸軍對反小型無人機系統功能的軍種特定需求。“例如，陸軍就特別專注於反無人機系統的各項挑戰，這些絕對是我們在開發我們的能力時，需要努力的領域”，以上係 2021 年 5 月陸軍部長克里斯汀·沃爾穆斯在參議院軍事委員會聽證會上的說詞。除了陸軍作為執行機構的任務之外，還必須強調陸軍特定的反小型無人機系統相關作為與成效。

In the context of the proliferation of the small UAS threat across the battlefield, the Army approaches counter-small UASs from both a force protection and an air defense perspective. With that said, some select duties related to counter-small UASs ideally would be MOS agnostic, with capabilities integrated into all echelons and formations from squad to theater. Every soldier has some level of responsibility in keeping their units, missions and facilities safe from small UAS threats.

小型無人機系統威脅在整個戰場擴散的背景下，陸軍係從部隊防護與防空的角度來處理反小型無人機系統。話雖如此，將各式功能整合在從班到作戰區的所有階層中，有些理想上與反小型無人機系統相關的指定職責，並無足夠事證說明其與軍事專業技能有關。每個士兵都有一定程度的責任，保護他們的單位、任務及設施，免受小型無人機系統威脅。



Sgt. Gentry Squier, left, points out a drone to Sgt. during training at Erbil Air Base, Iraq. (Credit: U.S./Spc. Angel Ruszkiewicz)
在伊拉克埃比爾空軍基地的訓練中，史基爾(Gentry Squier)中士(左立者)，向蓋奇·斯坦塞爾(Gage Stancell)中士指出一架無人機。（圖片來源：US/Spc. Angel Ruszkiewicz）

In order to leverage existing experience within the Army, the Fires Center of Excellence, in conjunction with the Joint Counter-Small Unmanned Aircraft Systems Office, will assist the joint force with nonmateriel counter-small UAS efforts while materiel solution requirements, funding and procurement efforts process through appropriate service-specific channels. These nonmateriel efforts include establishing joint training and doctrine.

為了利用陸軍現有的經驗，在裝備需求、資金及採購作業，正透過軍種建案程序進行時，陸軍優勢火力中心與聯合反小型無人機系統辦公室，將共同協助聯合部隊開展反小型無人機系統的整合訓練及準則編修任務。

As one of the directed initiatives from the DoD counter-small UAS strategy and implementation plan, the Fires Center of Excellence, with support from the Joint Counter-Small Unmanned Aircraft Systems Office, will relocate counter-small UAS training from Yuma Proving Ground to Fort Sill, Oklahoma. The establishment of the Joint Counter-Small Unmanned Aircraft Systems Academy at Fort Sill not only will improve soldiers' ability to defend themselves, but also will provide comprehensive counter-small UAS training for joint warfighters across all services and potentially expand in the future to include allies and partners.

由國防部反小型無人機系統策略與實施計劃的直接指導下，陸軍優勢火力中心獲得聯合反小型無人機系統辦公室的支持，將把反小型無人機系統的訓練工作從尤馬試驗場轉移至俄克拉荷馬州的西爾堡(陸軍優勢火力中心所在基地)。在西爾堡建立聯合反小

型無人機系統訓練學校，不僅能提升士兵的自衛能力，還能為所有軍種的聯合作戰人員提供全面性反小型無人機系統培訓，未來並可擴大到包括盟邦及合作夥伴。

Critical Work

關鍵性作為

As the global environment becomes increasingly complex and dangerous, the work the Joint Counter-Small Unmanned Aircraft Systems Office is doing in the counter-small UAS mission area is critical to ensuring that joint warfighters stay ahead of their adversaries. "We cannot expect to be ready for the next fight relying on equipment, training, tactics and operations geared toward the last fight," Gen. Michael Garrett, commanding general of the U.S. Army Forces Command, wrote in an April 2021ARMYmagazine Commentary.

隨著全球環境變得越來越複雜與危險，聯合反小型無人機系統辦公室在反小型無人機系統的任務領域，對於確保聯合作戰人員領先於對手至關重要。美國陸軍司令部司令邁克爾·蓋瑞特將軍在 2021 年 4 月的《陸軍雜誌評論》中寫道：“我們不能指望依靠為上一場戰爭編配的裝備、訓練、戰術戰法及作戰作為，為下一場戰鬥做好準備”。

As seen in the conflicts in Eastern Europe over the past few years, leveraging small UASs can decisively turn the tide of battle in short order. Ongoing and planned counter-small UAS initiatives will ensure the success of U.S. forces in current and future conflicts. These initiatives are bringing an enterprise approach that enables the protection of personnel, materiel and missions from the growing threats and hazards associated with the rapid increase in small UAS technology.

從過去幾年東歐的衝突中可以看出，利用小型無人機可以瞬間扭轉決定性戰局。正進行中及已規劃的反小型無人機系統計畫，將確保美軍在當前與未來衝突中，戰無不勝。無人機的威脅與危害，隨著科技進步與日俱增的狀況下，這些作為明確地有利於人員與裝備的防護及任務的達成。

DoD is making progress in creating a force trained and equipped to counter the undeniable threat adversary small unmanned aircraft systems represent. But this threat is rapidly and ever advancing, and will require a dynamic approach that continues to leverage efforts from across DoD, allies and partners, industry and academia. This is a fight we can and must win.

美國國防部正在建立一支訓練有素且裝備精良的部隊，以應付無可避免的敵方小型無人機系統威脅。但這種威脅正在迅速且不斷發展，需要一種與時俱進的作法，並持續善用國防部、盟邦與合作夥伴及產、學界的努力成果，便能戰無不勝、攻無不克。

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Maj. Gen. Sean Gaineyis director of the Joint Counter-Small Unmanned Aircraft Systems Office and director of fires for the deputy chief of staff for operations, plans and training, Headquarters, Department of the Army, the Pentagon.Previously, he served as deputy director for force protection, the Joint Staff.He has held air and missile defense assignments throughout the Middle East, the Indo-Pacific and Europe. He graduated from Georgia Southern University as an air defense artillery officer. He holds two master’ s degrees, one in human resources administration and one in national resource strategy.

肖恩·蓋尼少將 擔任聯合反小型無人機系統辦公室主任，也是五角大廈陸軍部副參謀長，掌管作戰、計畫及訓練業務。渠曾任職聯參部隊防護處的副處長，並在中東、印度-太平洋及歐洲等地區擔任過防空及飛彈防禦等職務。蓋尼少將畢業於喬治亞州南方大學，擔任防空炮兵軍官，擁有人力資源管理及國家戰略資源等領域的雙碩士學位。

Capt. Chris Pitfieldserves as a strategic operations officer in the Joint Counter-Small Unmanned Aircraft Systems Office. Previously, he served as executive officer to the director of the Air and Missile Defense Cross-Functional Team, U.S. Army Futures Command.He has served as a platoon leader and battery-level executive officer.He graduated from Syracuse University, New York, as an air defense artillery officer, and has an MBA from the University of Maryland Global Campus.

克里斯·皮特菲爾德上尉 擔任聯合反小型無人機系統辦公室的策略作業官，曾擔任美國陸軍未來司令部防空及飛彈防禦跨職能辦公室執行官。渠畢業於紐約雪城大學，防空炮兵專長，歷任排長及炮兵連副連長等職務，擁有馬里蘭大學全球校區的 MBA 學位。