The Dragon Cave:
A Central Repository for Dynamic CBRN Planning

龍穴：動態化生放核任務規劃的中央資料庫(譯)

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By Sergeant First Class Jesus Ambrocio[1]

著者：美國陸軍一等士官長 Jesus Ambrocio 耶穌·安布羅西奧

譯者簡介

作者郭怡梵少校，畢業於專業軍官班 101 年班、化校正規班 105 年班，歷任排長、連長、化學官。現職為化生放核訓練中心戰鬥支援組教官。

本文

The U.S. Army Chemical Corps must gain an edge in multi-domain operations through a data-centric, decentralized, and doctrinally sound mission planning hub. As the Army and the Department of Defense (DoD) continue to adopt the mission command software known as the Tactical Assault Kit (TAR)--which supports cross-platform tools across various (including mobile) operating systems and devices---the Chemical Corps could lead the chemical, biological, radiological, and nuclear (CBRN) mission-planning fight on Android Tactical Assault Kit (ATAK) devices through a central repository of approved mission templates.[2]

美國陸軍化學兵團必須透過一個以資料為中心、去中心化且符合作戰理論的任務規劃中心，在多域作戰中取得優勢。隨著陸軍和國防部 (DoD) 持續採用名為「戰術突擊套件」(TAR) 的任務指揮軟體 (該軟體支援跨平台工具，適用

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1 Sergeant First Class Ambrocio holds a bachelor's degree in computer networking and cyber security from the University of Maryland–Global Campus, Adelphi, Maryland, and a master's degree in computer science from the University of Illinois, Springfield. 一級士官長 Ambrocio 擁有來自馬里蘭大學全球校區（University of Maryland–Global Campus）位於阿德菲的計算機網絡和網絡安全學士學位，以及來自伊利諾伊州斯普林菲爾德分校的計算機科學碩士學位。

2 Christopher Kiley, "ATAK in the Field: Forging a Tactical Edge," Defense Visual Information Distribution Service (DVIDS), 15 April 2024, <https://www.dvidshub.net/news/367459/atak-field-forging-tactical-edge>, accessed on 20 March 2024.Christopher Kiley, "ATAK 在戰場：鍛造戰術優勢，"國防視覺信息分發服務（DVIDS），2024 年 4 月 15 日，https://www.dvidshub.net/news/367459/atak-field-forging-tactical-edge 2024 年 3 月 20 日訪問。

於各種（包括行動）作業系統和設備），化學兵團可以透過一個已獲批准的任務模板中央儲存庫，在安卓戰術突擊套件 (ATAK) 設備上領導化學、生物、放射核 (CBRN) 任務規劃和核子 (CBRN) 任務規劃。

An ATAK in use in the field
在野戰使用的 ATAK

Mission planning for CBRN missions currently involves pen and paper; dismounted reconnaissance sets, kits, and outfits; laptops; and other government-furnished equipment. The process for achieving continuous improvements in dismounted reconnaissance sets, kits, and outfits and other government-furnished equipment could be more robust. The dynamic nature of real-world multi-domain operations necessitates proactive solutions that enable a flexible and continuous iterative process of systems to support CBRN missions.

目前，化生放核任務規劃方式，仍以紙筆、徒步偵察裝備、筆電與其他軍用裝備為主。儘管這些裝備持續精進，但在支持動態作戰需求上仍不夠完善。當前多領域作戰的動態特性需要主動提供解決方案，使系統能夠靈活、連續地迭代過程來支援化生放核任務。

The Chemical Corps could create a repository of mission templates that the force could field through the ATAK ecosystem. Mission results could be reported back to the Corps, and the Corps could learn from and iterate those results. This would create a continuous, iterative loop process decentralized to the unique mission context of each unit and doctrinally sound mission planning at scale.

因此，化學部隊可以創建一個任務範本資料庫，並透過 ATAK 系統進行部署。任務結果可以報告給各單位，部隊亦可以從中學習並反覆分析這些成果。這將創建一個連續、反覆的循環流程，並根據每個部隊獨特的任務背景進行分

散式管理，從而實現符合作戰理論的大規模任務規劃。

Mission Planning Today 當前任務規劃

The Chemical Corps stands to gain an edge during the transition to multi-domain operations in the large-scale combat operations of tomorrow. As focus shifts and doctrine is updated, current systems and processes must be able to adapt to the rapid changes of the battlefield. Efforts to address any shortfalls must include bridging gaps, enhancing readiness, and providing input for modernization efforts.

隨著陸軍邁向多領域作戰的轉型，化學兵有機會在未來的大規模作戰行動中取得領先。當作戰重點轉移、戰術戰法更新，目前的系統與流程也必須能快速適應戰場變化。對於現有缺口的因應策略，應涵蓋彌補裝備落差、強化戰備能力，以及為現代化改革提供意見。

The U.S. Army Combat Capabilities Development Command Chemical Biological Center, Aberdeen Proving Ground, Maryland, and the Defense Threat Reduction Agency, Fort Belvoir, Virginia, have published ATAK plugins for weather, navigation, and sensor support in CBRN environments. While these efforts support the advancement and distribution of technology and tactics, techniques, and procedures, we can and must complete iterations at a faster pace.

位於馬里蘭州阿伯丁試驗場的美國陸軍作戰能力發展司令部化學生物中心（CCDC CBC）與維吉尼亞州貝爾沃堡的國防威脅降低局（DTRA），已針對化生放核環境推出可用於 ATAK 的天氣、導航與感測器套件。雖然這些努力推動了技術與戰術（TTPs）的發展與應用，但我們仍需加快這些更迭過程的速度。

The feedback loop for redesigning missions for hazard assessment platoons and other CBRN mission-focused entities is time-consuming and costly. Inefficiencies in adapting to change could have detrimental effects on our force. More quickly bridging the feedback loop could potentially result in more qualitative and quantitative data.

目前針對危害評估排（HAP）與其他任務單位的任務設計回饋機制，耗時又成本高。若無法有效適應變化，將對部隊造成不利影響。若能更快取得成效回饋，可取得更多質化與量化數據，進一步提升系統效能。

Failure to rapidly adapt doctrine and tactics, techniques, and procedures can be illustrated by the recent conflict of the second Nagorno-Karabakh War. Zhirayr Amirkhanyan's paper on the conflict highlights the devastating effect

that Azerbaijan's integration of drone warfare technology had in both the air and ground domains of the conflict, as Armenian forces failed to adapt to the new drone tactics, costing them crucial resources.[3]

Zhirayr Amirkhanyan 的研究就凸顯了一個問題，現代戰爭中，若未能快速調整戰術與戰法，將導致嚴重後果。以近期的第二次納卡衝突（納戈爾諾-卡拉巴赫戰爭）為例，Azerbaijan（亞塞拜然）導入無人機作戰技術，在空地領域均取得壓倒性成果，而 Armenian（亞美尼亞）部隊因無法及時應變新戰術，導致損失慘重。

The Dragon Cave Solution 龍穴解方

The concept of a "Dragon Cave" repository for CBRN mission planning is modeled after software package repositories. Units could access doctrinally sound mission templates that they adapted and executed, and then they could send the results back to the repository, where they would be reviewed and data would be adjusted to improve the templates. This repository would ideally be maintained by the U.S. Army Chemical, Biological, Radiological, and Nuclear School (USACBRNS).As the U.S. Army continues to move toward data-centric operations, the Chemical Corps could leverage this emerging technology to gain a tactical edge from the field and deliver it to the wider Army.

「龍穴」這個構想，源自於軟體套件資料庫的概念，旨在建立一個可供化生放核任務規劃使用的中央資料庫。各部隊能夠從資料庫中取得已核定、符合理論的任務樣板，自行調整與執行後，再將任務成果回傳資料庫。這些回傳結果將被審查與分析，進而調整樣板資料，使其更加完善。理想情況下，這套資料庫將由美國陸軍化生放核學校（USACBRNS）負責維護。隨著陸軍日漸轉型為「數據導向」的作戰體系，化學兵部隊能善用這項新興技術，從前線獲取戰術優勢，再回饋整個陸軍系統。

For this concept to be successful, ATAK devices must be distributed to CBRN units. This would result in easy access for adapting doctrinal mission planning templates to their specific mission context. Features envisioned in this approach include the ability to track Soldier vital signs, Internet of

[3]Zhirayr Amirkhanyan, A Failure to Innovate: The Second Nagorno-Karabakh War, 2022, , accessed on 20 March 2024. Zhirayr Amirkhanyan,《創新失敗：第二次納戈爾諾-卡拉巴赫戰爭》，2022 年，https://press.armywarcollege.edu/cgi/viewcontent.cgi?article=3133&context=parameters，於 2024 年 3 月 20 日訪問。

Things-enabled self-contained breathing apparatuses, and CBRN equipment to enable real-time tracking and logging of mission metrics. Soldiers could connect to the broader Internet and send the mission metrics to a central source for review.

為使這一構想成功，必須將 ATAK 裝置全面配發至化學兵部隊。如此，單位將能更容易調整任務樣板，使其符合自身任務情境。此系統設想的功能還包括：追蹤士兵生命徵象、具備聯網功能的獨立呼吸裝置（SCBA）與其他化生放核裝備，使任務指標可即時紀錄與追蹤。士兵可透過網路連線，將任務資料即時上傳至中央平台進行審核與分析。

An artificial intelligence (AI) machine-learning model could be trained to review mission metrics and develop various performance optimizations and predictions. For example, based on a Soldier's fitness score, vital signs, distance walked, equipment carried, and stress indicators, an AI model could predict how long Soldiers of similar builds could function in self-contained breathing apparatuses and determine what equipment they could carry.

在另一層面上，人工智慧（AI）與機器學習模型可用來分析這些任務數據，進行效能最佳化與戰況預判。例如，根據某位士兵的體能測驗成績、生命徵象、行軍距離、裝備重量與壓力指標，AI 模型可預測具相同體格的士兵，在配戴呼吸裝置下能維持多久戰力，並判斷他們能承擔的裝備負載。

For mission planning purposes, this data could help USACBRNS and other key stakeholders determine which devices to employ for what mission sets, how the devices operate, and the success rates of equipment down the line. From a logistical point of view, depending on upcoming missions and projected unit support for decontamination, the amount of fuel, water, and other resource support that a CBRN unit may need could be predicted.

這些數據有助於美國陸軍化生放核學校與其他決策單位，評估哪些裝備適合哪些任務類型、其運作方式與成功率；而從後勤角度來看，AI 亦能根據即將執行的任務與預期支援需求，預測化學兵部隊所需的油料、水與其他資源。

The Dragon Cave could summarily unlock the future of CBRN mission planning and operations through data, which would then be distributed across units, commands, and USACBRNS to inform, support, and enable mission success. Continuous iteration and feedback would result in better products, which would directly impact Dragon Soldiers across all components.

總體而言，龍穴資料庫的建構能為化生放核任務規劃與行動帶來革新，並

透過資料驅動的方式，讓各部隊、各級指揮機構與美國陸軍化生放核學校共享資訊、共同支持任務成功。這樣的持續更迭與回饋機制，將直接提升所有「龍兵」(Dragon Soldiers) 的任務工具品質與作戰效能。

Adaptive Mission Planning 任務規劃的適應性

Not all missions are the same across all contexts. One key Army concept involves empowering junior leaders, allowing them to adapt to changing conditions. While a central repository would provide a sound building block, Dragon leaders must still make command decisions that best suit mission requirements; conditions and situations vary across components and unit types.

任務性質因作戰環境而異，並非在所有情境下皆可套用相同模式。因此，美軍一項核心理念即是「授權基層指揮官」，讓他們能順應戰況，靈活調整戰術。雖然中央資料庫提供了穩固的任務規劃基礎，但化學兵領導幹部仍需依任務需求做出最合適的指揮決策，因為不同單位、不同編制，其面對的情況與需求會有所差異。

Adaptability hinges on the critical thinking of officers, warrant officers, and enlisted Soldiers across the force. These Soldiers can be further enabled through possible suggestions (based on their current mission requirements) and AI learning models (based on historical data, including terrain, mission type, and Soldier information). A key feature of ATAK and its decentralized nature is that units could continue to function if they found themselves in a denied, degraded, or disrupted operational environment.

這種「適應性」的核心，在於整體部隊中各級軍官、準尉與士官兵的批判性思維。這些人員可透過下列方式進一步被賦能：根據當前任務需求，獲得資料庫提供的建議樣板;利用 AI 學習模型，該模型結合歷史數據 (如地形、任務類型、士兵背景資訊等) 進行任務建議生成。ATAK 套件的一大優勢在於其去中心化設計，意味著即使部隊處於通信受限、功能受損或敵干擾的作戰環境中，仍能維持任務執行能力。

As mission data is returned to the Dragon Cave, a team could set up a pipeline to extract and transform data and train an AI model to improve templates and predicted mission success. These new mission templates would then be reviewed and approved by USACBRNS. Following the review stage, a new pipeline could be initiated and the mission templates could be

uploaded, where they would then become available to all units.

隨著任務數據回傳至「龍穴」資料庫，資料團隊可建立一條資料處理流程（pipeline），提取並轉換這些資料，進一步訓練 AI 模型以優化任務樣板與預測任務成功率。這些經過更新的新任務樣板將交由美國陸軍化生放核學校審查與核定。審查完成後，會開啟新的資料上傳流程，使這些樣板重新上架、並開放給所有單位使用。

Challenges and Considerations 挑戰與考量

Potential challenges and limitations abound with emerging technology.Some challenges associated with the concept of a central repository for CBRN mission planning include designating a central organization to maintain software,designating the approval authority for doctrinally sound mission templates,and managing the costs of devices to units.These challenges are not the sole responsibility of any one echelon;together, organizations are beginning to address the challenges across the Army and, more importantly, the DoD.

新興科技雖充滿潛力，但也伴隨著諸多挑戰與限制。關於建立化生放核任務規劃中央資料庫的構想，目前需面對的幾項主要挑戰如下：

1. 需指派中央單位維護軟體系統：

   哪個單位應負責管理整體系統與軟體更新，目前尚無明確共識。

2. 任務樣板需有理論依據與核准機制：

   誰有權決定一份樣板是否符合「理論正統」並可廣泛發佈，是一項重要且敏感的任務。

3. 裝備配發與經費支出問題：

   要讓各單位都能使用 ATAK 裝置，代表需要龐大的裝備預算與維護支援。這些挑戰並非由某一單位單獨承擔，而是需要各級機構協同努力。目前，陸軍與國防部已開始共同針對這些問題進行研議與應對。

TAK implementation across the force is currently limited.The building blocks of the ecosystem continue to evolve and become prepared for wider distribution. Implementation of the Dragon Cave concept would also require that Soldiers be trained on the use of ATAK devices.

Designation of the appropriate organization for creating and maintaining

the software is another challenge. With the help of organizations such as the U.S. Army Futures Command, possible solutions can be prototyped. These prototypes could then be used to help develop a longer-term solution.

The current sensor suite upgrade package for the Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV)' is an excellent example of how the acquisition process can evolve to quickly and efficiently meet new requirements.[4]

目前 TAK 系統在全軍的應用仍有限，該系統的核心套件仍在持續改良中，以因應更廣泛的部署行動。若要實現「龍穴」構想，士兵也需接受 ATAK 裝置的使用訓練。此外，在選定負責開發與維護系統的組織指派上，亦是一大挑戰。借助如美國陸軍未來司令部（AFC）等單位，可協助設計初始化方案，藉由這些方案，再進一步發展更長期的解決方案。舉例而言，史崔克核生化偵檢車（NBCRV）目前的感測器升級套件，就是一個很好例子，說明了裝備獲得流程如何快速回應新需求，提升整體作戰效能。

Another challenge is the central authority approval of doctrinally sound CBRN mission templates. USACBRNS recently opened a professional forum in which leaders and Soldiers across the force can ask subject matter experts questions on various CBRN-focused topics. USACBRNS stands to lead the way in data-centric mission planning, with a continuous feedback loop to improve and iterate doctrine.

Lastly, implementation costs money and time. Deciding how many devices are required and purchasing them for each unit necessitates further study of the most cost-effective means for these purchases. Training on the use and maintenance of the equipment and mission templates requires time.These challenges are not unique to the CBRN community.

另一項挑戰是「由誰來核定符合準則的化生放核任務樣板？」近期，美國陸軍化學兵推出一個專業論壇，允許各級士兵與指揮官直接向主題專家（SMEs）提問，討論各種化生放核議題。該校有望在數據導向的任務規劃領域中，發揮

4.Shawn Nesaw, “NBCRV Sensor Suite Upgrades Draw Praise from CBRN Stakeholders,” U.S. Army Combat Capabilities Development Command Chemical Biological Center, <https://www.cbc.devcom.army.mil/solutions-newsletter /nbcrv-sensor-suite-upgrades-draw-praise-from-cbrn-stakeholders/>, accessed on 20 March 2024. 肖恩·內索，“NBCRV 感測器套件升級獲得 CBRN 利益相關者的讚揚”，美國陸軍作戰能力發展司令部化學生物中心，<https://www.cbc.devcom.army.mil/solutions-newsletter/nbcrv-sensor-suite-upgrades-draw-praise-from-cbrn-stakeholders/>，於 2024 年 3 月 20 日訪問。

領頭羊的角色，推動一個可持續回饋與迭代的理論更新機制。

最後，不可忽視的挑戰就是經費與時間。需要多少裝置？各單位的採購方式為何？這些都需進一步研究最具成本效益的策略。使用者訓練、裝備維護與樣板操作，也同樣需要時間投入。這些困難並不只存在於化生放核領域，而是所有推動現代化部隊都需共同面對的問題。

Conclusion 結語

The possibility of a Dragon Cave repository of mission templates could be an incredible win for the Chemical Corps. Leaning forward with regard to emerging technology in the face of the transition to large-scale combat and multi-domain operations enables the Chemical Corps to lead a data-centric approach that aligns its strategies and unit missions with operational data. With a central authority of doctrinal truth and coordination, future CBRN leaders will be able to more quickly adapt to missions with more understanding and, ultimately, with more lethality. The Chemical Corps must start and complete this innovative initiative to overmatch and win tomorrow's fight.

建立一個化生放核任務樣板的「龍穴」資料庫，有可能成為化學兵的一項重大突破。在面對大規模與多領域作戰轉型的關鍵時刻，若能勇於擁抱新興技術，化學兵將有機會引領整體軍種走向以數據為中心的作戰模式，並使部隊策略與任務執行更加緊密地結合實際作戰數據。透過建立具備權威性的中央組織，負責理論審核與資料整合，未來的化學兵部隊指揮官將能更快速地理解任務本質、調整任務規劃，最終提升作戰殺傷力。因此，化學兵部隊必須立即啟動並完成這項創新計畫，以在未來戰場上取得優勢、贏得勝利。 ,