THE NEED FOR SPEED: Technological Advances Require Agile Command Post

因應科技高度發展要求機敏快捷分散式指揮所：戰場指揮速度需高度提升

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Thursday, May 25, 2023

2023 年 5 月 25 日

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The proliferation of drones, long-range artillery and precision missiles is forcing the Army to evolve a key component of the battlefield—the command post. The large, concentrated, tent-based command and control systems that sprawled across the landscape in Iraq and Afghanistan are too easily targeted and attacked using new technologies, rendering them vulnerable in the future operating environment.

由於新科技技術發展快速，使無人機、遠程火砲和精準制導彈藥於戰場上運用激增，迫使陸軍必須發展戰場作戰上關鍵組成部分-指揮所以因應之。遍布於伊拉克和阿富汗各地的大型、集中以帳篷為基礎搭設的各類指揮管制中心或系統很容易被上述新技術瞄準和攻擊，使它們在未來的作戰環境中變得異常脆弱。

Today, commanders are dismantling the tent-based command post and disaggregating it into more mobile—and therefore more survivable—nodes. This

achieves two goals. First, it makes command posts harder to detect, find and target. Second, it disperses command elements so the enemy cannot eliminate them all with a single devastating strike.

如今，各級指揮官正在屏除帳棚式指揮所，並將其轉化為更具機動性且更具存活能力的指揮作業節點。這實現兩個目標。首先，它使得指揮所更難被偵測、發現和被瞄準攻擊。其次，指揮所各作業組分散配置，使敵軍無法透過一次毀滅性的打擊就將指揮所徹底消滅。

This change is supported by leaders in the field. Lt. Gen. Xavier Brunson, I Corps commanding general, noted during an event in October at Joint Base Lewis-McChord, Washington, that “this nodal concept allows us to be in the contact layer, to be present and distributed in the theater, so that we remain agile, resilient, survivable and scalable.”

這樣的分散式指揮管制節點，獲得了戰場上各級指揮官的支持。第 1 軍團指揮官賽維爾布倫森中將於 10 月份在華盛頓路易斯－麥科爾德聯合基地舉行的一次活動中指出〝這個節點概念使各層級指揮所能夠在戰場上有效指揮各部隊，並保持機敏、彈性、存活率和擴展性。〞

The success of an agile and mobile command and control concept in a dispersed environment will rely on a staff’s ability to confer, share data and make decisions. This creates a greater dependence on network connectivity, made more challenging by the Army’s current multiple and ephemeral hub-and-spoke architectures across several networks. Hub-and-spoke architecture is not conducive to a rapid-mobility fight in an island-hopping campaign or across a continental land mass. Being anchored to spools of wire, fiber optics, multiple heavy server stacks and trailer-mounted satellite terminals demands time and personnel, which inhibit mobility of the command and control infrastructure.

在四散的戰場環境中機敏且具高度機動的指揮管制概念能否成功，將取決於參謀群能協商、共享資訊和做出決策能力。這就造成了對網路連接更大的依賴性，而陸軍目前跨（多重網路且因任務組成短暫的中心化)組織架構使這一問題變得更具挑戰性。中心化指揮架構不利於跳島式戰役或橫跨歐亞大陸兵力部署的快速機動作戰。將網路電纜、光纖系統、多個大型網路伺服器架疊並固定安裝於車載衛星終端器上需要花費時間與人力，而這正限制了指揮管制設施的機動性。

Reducing Physical Requirements

Cloud computing and data management can be employed to reduce these physical network requirements and enhance survivability and mobility of distributed command nodes. Hybrid cloud computing, which uses off-premises resources in concert with geographically local computing, allows commanders to balance resiliency in disconnected, intermittent and low-bandwidth environments with the size, weight and power and cooling requirements of on-premises server stacks collocated with the command and control nodes. This hybrid approach can speed emplacement and displacement, decrease power demands and reduce the need for dedicated stacked server platforms.

對物理性實體網路需求予以減量

運用雲端資訊處理技術與數據資料庫管理，可以減少對於實體網路之需求，並提升分散式指揮管制節點的存活率與機動性。混合雲端運算將外在雲端運算資源與現地實體電腦運算作業作協作使用，使指揮官能在指揮管制節點內部所需伺服器架疊排列時所需大小規格、重量、電源功率和系統冷卻要求等，與指揮管制節點位於網路斷開連結(斷線)、資料傳輸斷斷續續不穩定和網路頻寬太低的環境中，去取得平衡，以回復彈性運用資訊網路相關資源。這種混合方法可以加速指揮所開設及移轉，降低電力需求並減少對專用堆架伺服器平台的需求。

Cloud computing also allows redistribution of staff positions in the close area, reducing the command post footprint associated with the need for a workstation, planning space and sustainment requirements for personnel and endpoint systems. As defined in Army Doctrine Publication 3-0: Operations, the close area is the portion of a commander’s area of operations where most subordinate maneuver forces conduct close combat. For example, in a division’s area of operations, it is the area assigned to a brigade combat team.

雲端運算功能還可讓於近接作戰區域(與敵第一線部隊直接作戰區域)的參謀重新分配位置，減少指揮所內部工作電腦、計畫作為空間和人員與終端系統維護需求之場域，降低指揮所暴露風險。如同美陸軍準則 3-0：作戰一書中的定義，近接區域是指揮官連續作戰全程戰場架構區域的一部分，多數下級部隊仍以部隊機動作戰方式運用直接、間接火力與敵於陸地上直接實施近接作戰。例如，在一個師級作戰區域的戰場架構上，近接作戰區域通常會分配給旅級戰鬥群去執行。

A prudent data management system utilizing a hybrid cloud approach can help compensate for reduced staff in the close area and permit command operations to occur at a global scale. This will enable the Army to deliver a mobile and dispersed command post to the division, the Army's unit of action through the foreseeable future.

利用混合雲端資訊處理方法的審慎資料管理系統，可以幫助近接作戰區域內參謀人員不利的影響，並允許在全球資訊網絡範圍內進行指揮作戰。這將使陸軍執行作戰行動的部隊能夠預見，爾後師級部隊能夠提供一個機動力強且是分散式的指揮所機構。

Enacting a dispersed and mobile command post concept will not be a simple matter of adopting new technology. It also will involve changes in how a commander approaches the operations process and integrates novel solutions to improve mobility and survivability in a distributed environment. As always, it is the soldier who will implement the new command post concept and put the Total Army on the path toward mission success.

實施分散式機動指揮所節點的概念，並不是僅僅採用資訊網路新技術就可運作那麼簡單的事情。它還包含了如何因應現代四散的戰場環境下，整合新穎的解決方案去提高部隊機動力與存活能力，而必須對現有作戰程序流程(計畫-準備-執行-評估)與作業步驟作相關調整與改變。一如既往，軍人將貫徹新的分散式指揮所節點概念，引導全軍走向任務成功的道路。

A soldier with the 35th Air Defense Artillery Brigade talks to higher headquarters during an exercise in South Korea. (Credit: U.S. Army/Sgt. Josephus Tudtud)
第 35 防空砲兵旅的士兵在南韓演習中與上級通話。(圖片來源：美國陸軍/約瑟夫斯.塔德圖德中士)

Global Access

The hybrid cloud approach opens new opportunities for configuration and architecture needed at echelon. Units expected to remain in garrison potentially no longer would need physical server stacks, lessening or eliminating the need to configure and maintain them. Cloud computing architecture is still designed as a hub-and-spoke model, but unlike the current server stack capability, the cloud “hub” is accessible globally. Conceptually, only a singular entity is needed for the echelon. The endpoints, or command post nodes, continue to be the spokes, enabling the nodes to disperse farther than can be achieved using current wired solutions. Cloud computing enables access to required data, even in distributed operations.

全球數據資料庫

混合雲端資訊處理方法，為各個指揮層級所需的配置和架構開啟了新的機會。當部隊預計於駐防地留置時間不會很久時，將會對於實體網路伺服器架疊需求，從而縮小化或儘量剔除配置和維護它們的需要。雲端資訊處理運算架構仍然被設計為中心輻射化模式，但與目前的伺服器架疊功能不同，雲端「中心」是可在全球範圍內存取的。從概念上來說，各個指揮層級只需要一個單一實體。電腦終端或指揮所節點仍然持續透過無線幅射與中心連結，使指揮所各節點能夠比現行以有線網路形成指揮所網路通聯的距離分散更遠。因此，即使實施分散式指揮作戰，雲端運算功能依舊可提供數據資料庫的存取。

Units currently supporting rapidly changing operational mission sets are utilizing and demonstrating how software designed for a cloud implementation is benefiting the commander and their staff. In one case, a division tactical command post dispersed, and before the tents, tables and chairs were set up, the staff was able to start collaboration on assigned common operating tools.

目前支援快速變化的作戰任務的各級部隊，正在執行實現雲端作業而設計的軟體實施示範，以使指揮官及所屬參謀在戰場指揮中受益。在一個案例中，一個師的戰術指揮所分散了，在帳篷、桌椅搭好之前，參謀人員就可以開始就分配的共同作業工具分別執行任務。

Consistent View

Cloud resources also allow for a constant, consistent view of the operational environment, from home station to the edge of battle. With the advent of civilian technologies such as commercial satellite connections and 5G, there come improvements in connectivity and shortened latency. Additionally, given the diverse nature of these technologies, it is difficult to block or deny all of them simultaneously.

戰場共同圖像

雲端資源還可以讓指管系統主機站臺的網站首頁資訊，到最偏遠戰鬥部隊終端資訊有持續性之戰場共同圖像可以運用。伴隨著商業衛星提供資訊連結和 5G 系統等民間技術的出現，資訊網路連接不穩定與常延遲等問題亦獲得改善。另外，有鑒於這些民用技術多樣化的性質，欲同時阻止或阻斷這些技術的運用決不是容易的事。

Given that these technologies are becoming more available around the globe, accessing them could enable the military to digitally disperse within the civilian infrastructure. In addition, reducing network infrastructure through cloud implementation results in a smaller physical and electronic signature footprint across the command post.

鑒於這些技術在全球範圍內變得越來越廣泛，獲取這些技術可以使軍方在民用基礎設施內進行數位化分散式指揮。此外，透過實施雲端資訊處理系統減少網絡基礎設施，就可運用較小型的電腦網路實體和電子簽章運作在各級指揮所之間。

Soldiers work together during a command post exercise at Fort Carson, Colorado. (Credit: U.S. Army/Spc. Joshua Zayas)

科羅拉多州卡森堡指揮所演習時，戰士們共同作業。
(圖片來源：美國陸軍/pc. Joshua Zayas)

A segmented hyperscale cloud pilot capability has been demonstrated at the corps and subordinate levels to reduce command post standup time. The design also seamlessly supports multiple geographic locations, providing a global common operating picture. However, hyperscale cloud computing itself is not a stand-alone solution. The Army must be able to run software seamlessly in on- or off-premises environments to maintain local resilience and meet global demand.

曾於各軍團與其下轄所屬各層級間，試驗性的使用一部分超大規模雲端計算功能，來減少各指揮所等待命令與資訊傳輸時間，該試驗還規劃了當支援使用多重不同的地理位置時可一體化的呈現地理圖資，提供全球通用的操作畫面。然而，超大規模雲端運算本身並不是一個獨立的解決方案。陸軍必須能夠在軍事體制內或軍事體制外環境中無縫運行軟體，以維持作戰當地的適應性並滿足全球性軍事需求。

The Army is seeing success with application of cloud computing for training across the Army. At echelon, staffs can train on the same common operating picture system, pulling the system from the cloud, instead of struggling across disparate server hardware. The goal for cloud computing is to reduce the risk associated with a loss of services and continuity of operations. It ensures that when a unit is reestablished on the network, it has immediate access to data to continue operations.

陸軍通過雲端運算處理實施陸軍指揮所訓練看起來是成功的。各指揮層級參謀可以通過共同作戰圖像平台進行培訓，從雲端運算處理系統中拉出作戰資訊系統運行，取代在不同的伺服器硬體間資料傳輸各項問題間處理之掙扎。雲端處理系統運作目標在降低網路中斷傳輸服務和造成戰場資訊傳輸斷斷續續等相關風險，確保當某些部隊需重新建網路時，可立即存取雲端數據資料庫以利後續作戰。

Datacentric[1] Approach

As operational commanders stress the importance of data access at the point of need and sharing data with joint service partners and allies, a datacentric environment is a top priority for Army senior leaders. In a February 2022 message to the force, Secretary of the Army Christine Wormuth outlined six objectives to guide the way forward. Her second objective is to ensure that the Army becomes “more data-centric

[1] Data-centric 的意思是以數據資料為核心，與 Model-centric 程式碼為核心不同，以資料為中心的方法是關注數據資料本身資訊，並希望透過數據資料組織產生更準確的模型。即其程式碼與模型是固定的，以改善數據資料庫為主，收集更多數據資料、做數據資料清理、合成、增強的方法。

and can conduct operations in contested environments, which will enable our ability to prevail on the future battlefield."

指揮所網路模型中心模式改以數據資料中心的模式

由於作戰指揮官承受著在必要時機點上，需立即存取資料以及與聯合後勤合作夥伴和同盟友軍共享資料重要性的壓力，因此，以建置數據資料中心模式的環境，是陸軍高階領導幹部的首要任務。在 2022 年 2 月發給部隊的資訊中，陸軍部長克莉絲汀・沃穆斯略述六個目標的大綱指導，如何將傳統指揮所資訊傳輸方式，改由數據資料中心的發展方向。她的第二個目標是確保陸軍變得"更多的數據資料中心，能夠在有爭議的複雜環境中執行軍事行動，這將使我們有能力在未來戰場上取得勝利"。

Datacentricity and data management also enable the Army of 2030 to exercise global, distributed command and control. A benefit is the opportunity to reduce the physical staff footprint in the close-area fight by reallocating noncritical staff capacities and redistributing them across command and control systems.

以資料中心為本和數據資料管理，還使 2030 年陸軍能夠進行全球分散式指揮管制。好處是有機會減少參謀人員於近接區域內戰鬥時所需空間位置，依照非關鍵性參謀的能力，透過指揮管制系統重新規劃其相關設施節點。

Convergence is essential in the distributed command and control environment. This concept involves the convergence of talent, tools and data in the right place and at the right time to improve the commander's decision-making abilities.

想法趨向於一致的觀點在分散式指揮管制環境中是極其重要的。這個概念包括於正確的地點和時間上，融合了相關專業人員意見、戰具運用和相關戰場即時資訊資料，來提升指揮官下達決策的能力。

A soldier in a Stryker armored vehicle from the 2nd Battalion, 3rd Infantry Regiment, prepares for a live-fire exercise rehearsal during an exercise in Thailand. (Credit: U.S. Army/Spc. Christopher Wilkins)

在泰國的一次演習中，第 3 步兵團第 2 營一名士兵在史崔克裝甲車上，準備實彈射擊演練。

(圖片來源：美國陸軍/克里斯多夫 威爾金斯士官)

For example, data warfare teams, while not necessarily needed in a forward command and control node, are needed to meet a commander's decision-making information requirements. They converge what information is needed, determine how it can best be visualized and deliver the data at the right place and time so it can be used to direct resources, apply effects or provide direction and leadership to the organization.

例如陸軍數據資料作戰團隊雖然不需要出現在戰地前沿指揮管制節點，但必需滿足指揮官的決策資訊需求。他們匯集必要的作戰資訊，確定如何將其作成最好的視訊畫面，在正確的地點和時間提供相關作戰資訊資料，以利指揮官可直接指揮各項作戰資源，達成所要之成效或用來提供其對組織的指導方向與領導統御。

A datacentric approach also can improve protection of the command post. The traditional 24-hour predictive battle rhythm is a risk to the survivability of distributed command and control nodes. Enemies can detect elevated emissions spikes, which alert them to possible action and can help them pinpoint and target the location of a command and control node.

以資料為中心的方法還可以強化指揮所的防護。傳統 24 小時預習推演戰場節奏的方式對分散式指揮管制節點的生存能力構成威脅。敵人可以透過科技偵測到電磁輻射

升高排放熱源或紅外線峰值，這會使其意識到我方正在做資訊指揮所作業而透過這些高峰值位置，採取精準目標攻擊我每一個指揮管制節點。

In the future, managing data through a dashboard[2] to simplify and standardize operations could enable a command node to manage its operational emissions so they blend in with civilian infrastructure. This could lower detection and improve survivability of the command and control node.

未來，通過簡易型和標準化操作模式，利用戰情室大屏幕視覺化儀表板，管理資料庫可以使管制節點能夠管理其操作排放，以便他們與民用基礎設施融為一體。這可以減少遭敵軍偵測並提高指揮和控制節點的生存能力。

Survivable Nodes

The Army cannot return to the command and control processes of the past 20 years. Cloud computing reduces the need for cumbersome large server stacks that are difficult to sustain and protect. Cloud computing also could allow staff processes to integrate artificial intelligence algorithms and machine learning to conduct predictive analysis of imagery, detect patterns in enemy sensing and enable predictive sustainment. Reducing the human in the loop minimizes the physical staff presence needed in the close-area fight, which ultimately leads to more survivable command and control nodes, reduced sustainment needs and lower nodal emissions in the enemy contact layer.

各指揮管制節點存活率提高

陸軍不能再走 20 年前指揮管制作業流程的回頭路。雲端訊息處理運算減少了對難以維持和保護的繁瑣大型伺服器架疊的需求。雲端訊息處理運算可以允許參謀作業程序整合 AI 人工智能演算規則系統與人工智能相關設施，習得如何就大屏幕上之整合資訊進行對戰場即時現況與未來預測性的分析，察覺敵軍對我方實施偵測模式以使我原預測的持續作戰能夠進實施。減低參謀人員於近接戰鬥時必須來回的接近第一線，使指

[2] Dashboard 一種類似互動智慧型電子白板作為戰情室(各指揮管制節點)使用，是一可將各種數位資訊呈現為可視覺化工具，用於呈現、監控和分析敵我雙方各類型與不同層級部隊相關資訊化數據，通常以圖形、流程圖、圖表、組織圖、圖解、表格等方式呈現相關數據資訊於一大屏幕上，讓使用者可快速理解複雜戰場場景和判斷，並從中獲得洞察問題與處理方式核心以為決策之依據。

揮管制節點各指揮所作業組能獲得更強生存力，減少支撐前線作戰需不斷出現於第一線附近次數，以降低敵對我運用各不同層面偵測我指揮所各節點高排放峰值。

Distributed command and control for the Army of 2040 should not be restricted to specific areas of operations but should be viewed as connected and synchronized nodes from home station to the edge of the battlefield. The capacity to achieve global reach is imperative toward the convergence of data at the commander's—or decision-maker's—point of need. This can occur from the mobile command platform, nontactical vehicles, fixed civilian infrastructure and even aboard joint, interagency vessels. The air and space domains also must be considered viable mediums for effecting global command and control processes.

2040 年陸軍分散式指揮不應侷限於特定的作戰區域，而應被視為從駐地到戰場邊緣的連結和各指揮管制節點協同作戰。實現全球覆蓋的能力對於指揮官(或決策者)的決心點進行整合資訊數據至關重要。這可以透過機動式指揮平台、非戰術性車輛、固定民用基礎設施甚至聯合跨機構船隻上進行。空中和太空領域也必須被考慮為全球指揮管制作為程序有效實施的中介手段。

Regardless of the platform, venue or location, the operations process is successful when a staff has the right talent, the right tools and data access to provide a commander with actionable information.

無論是使用共同作業平台、集合於一個集會地點或位置，當參謀人員具備有專業的智識才能、使用合適正確的工具和必要資料存取權限，來為指揮官提供以分析且可運用的資訊時，軍事行動(作戰)程序就能成功實施。

As the Army prepares for the future operating environment, current threats and opportunities make command post transformation critically important. Adapting the Army's technologies and processes to mobile, agile nodes will untie commanders and their staffs from static systems and enhance their ability to fight and win wherever the future demands.

當陸軍為未來的作戰環境準備時，當前的威脅和契機使得指揮所轉型變得至關重要。使陸軍的作戰技術和程序適應具機動性、機敏快捷的指揮管制節點，將使指揮官及其參謀人員從原靜態指揮所作業方式的束縛中解脫，並提高他們在未來需要的任何地方作戰和獲勝的能力。

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