指揮所變成墳場：喬爾諾巴伊夫卡戰事啟發大規模作戰行動的指管之道*

The Graveyard of Command Posts: What Chornobaivka Should Teach Us about Command and Control in Large-Scale Combat Operations

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Progress of the Chornobaivka

In Ukraine, the village of Chornobaivka is legendary.[1] Songs are written about it.[2] Throughout 2022, the small town and its airfield on the outskirts of Kherson were a meatgrinder for Russian forces. From its original occupation in February to its liberation in November, Ukrainian strikes rained down with a precision and lethality rarely seen in war and allowed a scrappy defender to take down a regional leviathan.[3] Patriotic enthusiasm aside, closer inspection of this hard-won victory reveals that lurking beneath the wreckage of Russian ambitions in the Kherson Oblast is a warning about the vulnerability of legacy command posts that the United States and its allies would do well to heed. The story of Chornobaivka is one of relentless assault on command and control characterized by a systematic attack on Russian command posts at scale and across all tactical echelons.[4] Over the span of eight months, the Ukrainian fires strike complex successfully attacked the headquarters of Russia’s 8th Combined Arms Army, the 49th Combined Arms Army, the 22nd Army Corps, the 76th Guards Air Assault Division, the 247th Guards Air Assault Regiment, and their subordinate elements over twenty-two separate times.[5] These attacks significantly degraded the Russians’ ability to plan and conduct coordinated operations on the western side of the Dnieper River. The loss of effective command and control sapped Russian momentum and prevented Russians from consolidating gains, which ultimately led to their expulsion. In the process, Ukraine struck down high-level Russian leadership, killing Lt. Gen. Yakov Resantsev, commander of the 49th Combined Arms

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Army, and nearly killing Lt. Gen. Andrey Mordichev, commander of the 8th Combined Arms Army.[6] Beyond Kherson, this pattern has been similar if less concentrated. Ukrainian attacks on command posts across the country have led to stunning attrition among senior Russian military leaders.[7] This reflects a programmatic approach to striking at the capability and will of the Russian forces by removing their source of purpose, motivation, and. direction. By any measure, the Ukrainians' success is impressive. More than 1,500 officers have been killed in Russia's war on Ukraine, including ten general officers and 152 colonels and lieutenant colonels.[8]

戰事經過

位於烏克蘭東部赫爾松州的喬爾諾巴伊夫卡是一個傳奇小鎮，[1]人們為它寫歌詠唱，[2]但在 2022 年時，這座小鎮和在郊區的赫爾松機場，成為俄羅斯軍隊的刀下亡魂。從俄軍最初於 2 月佔領，直至 11 月烏軍歸復，烏軍在這場戰事中不斷展現精準與致命打擊，凸顯一個小國防守者也能擊退一個區域大國。[3]姑且不論愛國情操的力量，吾人在仔細檢視這場得來不易的勝利會發現，在赫爾松州戰後的斷垣殘壁下潛藏著一個警訊：傳統指揮所的脆弱性。鑑此，美國及其盟友應審慎面對此一問題。喬爾諾巴伊夫卡戰事為一個對敵指管進行無情攻擊的案例，也就是向俄軍所有戰術梯隊指揮所進行系統性攻擊。[4]在 8 個月內，烏軍的火力打擊系統成功攻擊第 8 合成軍團、第 49 合成軍團、第 22 軍團、第 76 近衛空中突擊師、第 247 近衛空中突擊團等所屬單位部隊，共計超過 22 次，[5]這些

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[1] "Зеленський: Чорнобаївка увійде в історію. Інформаційне агентство" [Zelenskyy: Chornobayivka will go down in history], Ukrainian Independent Information Agency, 20 March 2022, https://www.unian.ua/war/zelenskiy-chornobajivka-uviyde-v-istoriyu-novini-vtorgnennya-rosiji-v-ukrajinu-11751448.html.

[2] *Фольклорний гурт "Святовид" (ЗСУ) – Чорнобаївка/Chornobaivka (with English subs)*, YouTube video, posted by "ListenPlay&Enjoy," 3 May 2022, https://www. youtube.com/watch?v=cVg8iKwc25I; *ЧОРНОБАЇВКА (Chornobaivka)*, YouTube video, posted by "Анімаційні історії," 12 April 2022, https://www.youtube.com/watch?v=X6Itg1km3cg; *Alcohol Ukulele – Чорнобаївка* [Alcohol ukulele – Chornobaivka], YouTube video, posted by "Alcohol Ukulele," 31 March 2022, https://www.youtube.com/watch?v=SK2mIKNcWNY.

[3] Zhanna Bezpiatchuk, "Ukraine War: Chornobaivka Airbase, Symbol of Russian Defeat," BBC News, 29 November 2022, https://www.bbc.com/news/ world-europe-63754797.

[4] David Axe, "In Southern Ukraine, Kyiv's Artillery Drops Bridges and Isolates a Whole Russian Army," *Forbes* (website), 29 July 2022, https://www.forbes.com/sites/davidaxe/2022/07/29/in-southern-ukraine-kyivs-artillery-drops-bridges-and-isolates-a-whole-russian-army/?sh=4e11426d1e1a.

[5] "Чорнобаївка, де ЗСУ 6 разів знищили окупантів, увійде в історію воєн, - зеленський" [Chornobayivka, where the armed forces of Ukraine destroyed the occupiers 6 times, will go down in the history of wars, - Zelenskyy], РУДАНА, 20 March 2022, https://rudana.com.ua/news/chornobayivka-de-zsu-6-raziv-znyshchyly-okupantiv-uviyde-v-istoriyu-voyen-zelenskyy; Julie Coleman, "Ukraine Says It's Killed one of Russia's Top Generals in Ukraine," Business Insider, 25 March 2022, https://www.businessinsider. com/ukraine-claims-its-killed-one-of-russias-top-generals-in-ukraine-2022-3; Jay Beecher, "Update: Ukrainian Rocket Strike Killed Twelve Russian Officers near Kherson," *Kyiv Post* (website), 13 July 2022, https://www.kyivpost.com/post/2295; "Пекло для рашистів на півдні України: вражаюча кількість знищених об'єктів та техніки армії РФ за одну добу" [Hell for Russian soldiers in the south of Ukraine: An impressive number of destroyed objects and

攻擊大幅削弱俄軍在聶伯河西岸的作戰規劃與協同作戰能力。指管效能喪失削弱了俄軍作戰動力，使之無法鞏固戰果，最終落得遭驅逐的下場。在這場戰事中，烏軍擊殺了俄軍高階將領如第 49 合成軍團指揮官雅科夫・列桑采夫中將，以及第 8 合成軍團指揮官安德烈・莫爾迪切夫中將。[6]擊殺將領的事蹟除了在赫爾松州，其餘地區也傳出類似捷報，烏軍對全國各地的俄軍指揮所進行攻擊，讓不少高階軍事領導人在攻擊中喪命。[7]這種軍事謀略是要阻斷俄軍之目的、動機及指令，從而打擊其能力與意志，從任何角度來看，烏軍的成功令人印象深刻，因為在烏俄戰爭中，已有超過 1,500 名軍官遭擊斃，其中包含 10 名將官與 152 名中、上校。[8]

Experience and Lesson of Chornobaivka

Some suggest the Russian experience at Chornobaivka and elsewhere can be explained by the Russians' inability to overcome challenges in professionalism, training, and communications, and a fundamentally different philosophical approach to command and control.9 Pinning Russian woes solely on ineptitude, while true to some extent, downplays the effect Ukrainians are having in systematically dismantling their enemy's command-and-control system through multidomain targeting. Furthermore, the Ukrainians are achieving these effects without the benefit of a substantial air force or extensive long-range fires.[10] Limiting this problem to failures in Russian military

equipment of the Russian army in one day], Defense Express, 6 August 2022, https://defence-ua.com/news/peklo_dlja_rashistiv_na_pivdni_ukrajini_vrazhajucha_kilkist_znischenih_objektiv_ta_tehniki_armiji_rf_za_odnu_dobu-8452.html; "Ворожий склад з боєприпасами та командний пункт 247 десантно-штурмового полку знищено в Чорнобаївці, - ОК 'Південь'" [The enemy warehouse with ammunition and the command post of the 247th Airborne Assault Regiment were destroyed in Chornobayivka, - OK "Pivden"], Censor.net, 23 August 2022, https://censor.net/ua/news/3362604/vorojyyi_sklad_z_boyeprypasamy_ta_komandnyyi_punkt_247_desantnoshturmovogo_ polku_znyscheno_v_chornobayivtsi.

[6] Olena Roshchina, "Another General: Commander of Russia's 49th Army Killed by Ukrainian Armed Forces, Says Arestovych," Ukrayinska Pravda, 25 March 2022, https://www.pravda.com.ua/eng/news/2022/03/25/7334482/; Ben Tobias, "Russian General Yakov Rezantsev Killed in Ukraine," BBC News, 26 March 2022, https://www.bbc.com/news/world-europe-60807538.

[7] Phelan Chatterjee and Sam Hancock, "Ukraine War: Exiled Governor Reports Strike on 'Wagner HQ,'" BBC News, 12 December 2022, https://www.bbc.com/news/world-europe-63933132; David Axe, "The Ukrainians Keep Blowing Up Russian Command Posts and Killing Generals," *Forbes* (website), 23 April 2022, https://www.forbes.com/sites/davidaxe/2022/04/23/the-ukrainians-keep-blowing-up-russian-command-posts-and-killing-generals/?sh=5f78a6f9a350; John Varga, Tom Watling, and Katherine McPhillips, "Zelensky Launches Christmas Revenge Attack on Russian HQ before Jet Explodes," Express, 27 December 2022, https://www.express.co.uk/news/world/1713889/ukraine-live-war-zelensky-russian-hq-hit-kherson-region-putin-belarus-mig-31-fire.

[8] William Booth, Robyn Dixon, and David L. Stern, "Russian Generals Are Getting Killed at an Extraordinary Rate," *Washington Post* (website), 26 March 2022, https://www.washingtonpost.com/world/2022/03/26/ukraine-russan-generals-dead/; Will Stewart and David Averre, "Putin 'Has Lost 160 Generals and Colonels among 1,500 Officers', Ukrainian Military Official Claims," Daily Mail Online, 28 November 2022, https://www.dailymail.co.uk/news/article-11477163/Putin-lost-160-generals-colonels-1-500-officers-Ukrainian-military-official-claims.html.

leadership ignores the fact that technologies and capabilities exist today that can enable and deliver devasting effects on command and control. U.S. adversaries, including the Chinese, have made attacking our command-and-control systems a stated objective.[11] Specifically, command posts are targeted because they have become easily targetable. Contemporary tented command posts—with their radio frequency emitting antennas, dozens of generators and vehicles, and extensive support requirements—are easily targetable to even the untrained eye. During large-scale combat operations, these command posts can be easily seen by an ever-expanding array of sensors and just as easily struck by complementary effects throughout the depth and breadth of the battlefield. For anything as ostentatious as a modern command post, no true sanctuary exists.[12] While we may be quick to point fingers at the Russians, Western command posts have significant challenges with survivability. Even where efforts have been made to improve the mobility of command posts, our inability to hide the multispectral signatures of these massive structures coupled with persistent battlefield surveillance and precision weapons negates any benefit achieved and likely renders a second strike unnecessary.[13] At higher echelons, this survivability problem is exacerbated.[14]

戰事經驗教訓

一些人士認為，俄軍在喬爾諾巴伊夫卡及其他地區的戰事失利，可以解釋成其軍事專業能力不足、訓練不扎實、通信不良，以及在指管上採取有別於西方的思維理則。[9]雖然將俄軍失利歸咎於無能，在某種程度上屬實，但卻低估烏軍有能力運用多領域標定火力來瓦解俄軍指管體系，因為烏軍是在沒有大量空軍或大規模長程火力支援下，仍能獲致戰果。[10]此外，戰事失利若也只認為是俄軍領導層級的問題，就會忽略當前既有的軍事科技與能力，已經可以對指管產生毀滅性影響。美軍的潛在敵人如中共在內，已經明確將攻擊指管體系定為目標。[11]具

[9] Tom Nagorski and Joshua Keating, "Ukraine Mystery: Why Have So Many Russian Generals Been Killed?," Grid News, 7 April 2022, https://www.grid.news/story/global/2022/04/08/ukraine-mystery-why-have-so-many-russian-generals-been-killed/; Austin Wright, "Why Russia Keeps Losing Generals," *Foreign Policy* (website), 20 July 2022, https://foreignpolicy.com/2022/07/20/why-russia-keeps-losing-generals-ukraine/.

[10] Sébastian Seibt, "Devastating Strike on Russian Military Base in Ukraine Exposes 'Gross Criminal Incompetence,'" France 24, 4 January 2023, https://www.france24.com/en/europe/20230104-devastating-strike-on-russian-military-base-in-ukraine-exposes-gross-criminal-incompetence.

[11] Jeffrey Engstrom, *Systems Confrontation and System Destruction Warfare: How the Chinese People's Liberation Army Seeks to Wage Modern Warfare* (Santa Monica, CA: RAND Corporation, 2018), https://www.rand.org/pubs/research_reports/RR1708.html.

體而言，指揮所之所以成為攻擊目標，是因為其變得容易為人鎖定。當前的帳篷式指揮所，由於無線電射頻天線、數十台發電機與車輛，以及龐大的軍品補給運輸等不斷暴露行蹤，這讓即使是訓練不精之敵也可以輕易發現指揮所所在位置。在大規模作戰行動中，日益增多的感測器部署可以輕易發現指揮所位置，而且在各式武器互補效應下，打擊火力將遍及於戰場的任何角落。現代指揮所在戰場中已難以有效隱蔽與掩蔽，也就是指揮所的安全已經不可能高枕無憂。[12]雖然我們很快就直指俄軍存在此一問題，但西方指揮所同樣也面臨指揮所生存的重大挑戰。雖然我們致力於提升指揮所的機動性，但仍然無法隱藏這些龐大結構物的多種光譜信跡特徵，況且在戰場持續監視與精準武器之下，相關偽裝作為都會被抵消殆盡，指揮所在敵第一波攻擊下有可能會癱瘓無法運作，[13]這種戰場存活問題對於較高層戰術梯隊指揮所是更嚴峻的挑戰。[14]

The battle for Chornobaivka brings into focus a theory of warfare, introduced during the Nagorno- Karabakh War of 2020, that lays bare the lethality and transparency of the modern battlefield through the concerted employment of multidomain effects on the command-and-control warfighting function.[15] It reveals an imperative to rethink command posts for this new era of warfare. In the face of this immediate threat, the U.S. Army must transform command and control to incorporate the tenets of multidomain operations (MDO) as it transitions to this new operating concept across all warfighting functions. To fight and win on the modern battlefield in large-scale combat operations, Army command posts can and must become more flexible, agile, and resilient while not sacrificing effectiveness. Otherwise, our command posts will be a place our leaders go to die.

喬爾諾巴伊夫卡戰事凸顯一個在 2020 年納卡衝突中引進的戰爭理論，其說明在指管作戰職能上運用多領域的協同部署，可提升部隊致命性與戰場透明性，[15]這意味著吾人有必要重新思考指揮所在這個新戰爭時代的角色。在面對這個迫

[12] Mykhaylo Zabrodskyi et al., "Preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine: February– July 2022," Royal United Services Institute, 30 November 2022, https://rusi.org/explore-our-research/publications/special-resources/preliminary-lessons-conventional-warfighting-russias-invasion-ukraine-february-july-2022.

[13] Samuel Northrup, "New Army Vehicles Being Developed to Counter Modern Threats," Army.mil, 3 April 2019, https://www.army.mil/article/219567/new_army_vehicles_being_developed_to_counter_modern_threats.

[14] Michael Greenberg, "It's Time to Fix the Command Post: Optimizing Headquarters' Mobility, Survivability, and Interoperability for the Future Fight," Modern War Institute at West Point, 19 August 2020, https://mwi.usma.edu/its-time-to-fix-the-command-post-optimizing-headquarters-mobility-survivability-and-interoperability-for-the-future-fight/.

[15] John F. Antal, *7 Seconds to Die: A Military Analysis of the Second Nagorno-Karabakh War and the Future of*

在眉睫的威脅，美陸軍必須在指管上做轉型，並將多領域作戰的要則納入其中，不僅是指管這個作戰職能要如此，其餘作戰職能也應要朝向這種轉型。要在現代戰場的大規模作戰行動下克敵制勝，美陸軍指揮所要能夠也必須在不犧牲作戰效能的情況下，變得更為彈性、敏捷及具備韌性。否則，指揮所將成為我們軍事領導人的墳場。

Function and Form of Command Post

An understanding of how our command posts need to evolve must begin with an appreciation for the role command posts play in our Army. Having defined their function and current form, it will then be possible to illustrate how that form is unfit for its purpose and at odds with the tenets of MDO. This will enable a discussion on a better approach to facilitating multidomain command and control, with near-term goals and an objective end state optimized for large-scale combat operations. Army Techniques Publication 6-0.5, *Command Post Organization and Operations,* broadly defines a command post as "a unit headquarters where the commander and staff perform their activities" and states that "the commander alone exercises command within a CP [command post] or elsewhere."[16] This statement reinforces the purpose of a command post: to "assist commanders in the exercise of mission command."[17] For those unfamiliar with the term, "mission command" is a philosophical concept in the U.S. Army that represents an approach to command and control that "empowers subordinate decision making and decentralized execution appropriate to the situation."[18] While not every nation or service views command and control the same, most view the purpose of the command post similarly, as a tool for enabling the commander's process for understanding, visualizing, describing, directing, leading, and assessing operations. Any suitable and acceptable form of command post must achieve these criteria.

指揮所型態

要理解指揮所如何演變，必須先知道指揮所在美陸軍中的角色，並界定其功能與型態，才能指出其當前型態不僅與開設目的相悖，而且也不符合多領域作戰的要則。這種思維理則能讓我們討論出一個更佳作法，用以精進多領域的指管，還能確立適合大規模作戰行動的近期與最終目標。美陸軍技術出版品 6-0.5 號

Warfighting (Philadelphia: Casemate, 2022).

《指揮所組織與運作》對指揮所做出的廣義解釋是，「指揮官與參謀執行其行動的單位總部，而且指揮官會在指揮所或類似地方下達指令。」[16]該出版品也指出指揮所之目的為「協助各個指揮官行使任務式指揮。」[17]或許有人對任務式指揮這個名詞不熟悉，其是美陸軍的一種軍事學概念，代表一種行使指管的方法，「其授權下級指揮幹部有決策權，為一種基於當下情況的分權式指揮方式。」[18]雖然並非每個國家或每個軍種都對指管有相同見解，但大多數人都認為指揮所之目的，為一種用來協助指揮官理解戰況、具體化敵位置、敵情描述、下達命令、領導部隊及評估作戰的工具。由此可見，一個合格的指揮所型態必須達到這些標準。

The current configuration of the Army tactical command posts poses a major battlefield vulnerability due to size and electronic signature. (Photo courtesy of the U.S. Army)

目前美陸軍戰術指揮所型態，顯而易見的規模與電子信跡，將是其在戰場上的致命弱點。

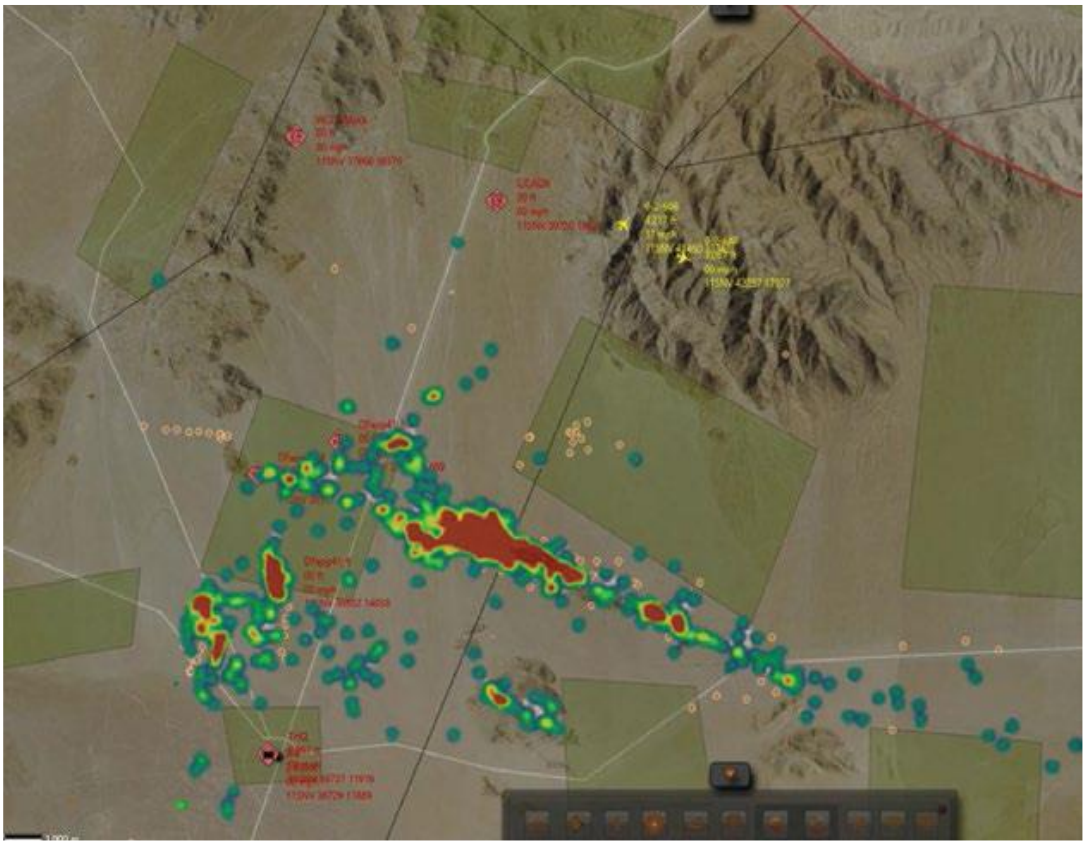
Members of 2nd Infantry Brigade Combat Team, 4th Infantry Division, work inside their mobile tactical operations center. (Photo courtesy of the U.S. Army)

第 4 步兵師第 2 旅級戰鬥隊官兵在機動戰術作戰中心的作業情形。

[16] Army Techniques Publication 6-0.5, *Command Post Organization and Operations Army* (Washington, DC: U.S. Government Publishing Office [GPO], 1 March 2017), 1-1, https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ATP%206-0_5%20(final).pdf.

[17] Ibid.

[18] Field Manual (FM) 6-0, *Commander and Staff Organization and Operations* (Washington, DC: U.S. GPO, 16 May 2022), 1-3, https://armypubs.army.mil/epubs/ DR_pubs/DR_a/ARN35404-FM_6-0-000-WEB-1.pdf.



A satellite image shows the electronic emissions signature of a brigade combat team (BCT) training at the National Training Center (NTC), Fort Irwin, California. The BCT is attacking southeast to northwest to seize several mountain passes (key terrain), while the opposing force (OPFOR) is conducting a reverse slope defense. The dispersed colored areas at the leading edge of the BCT and the greater intensity area to the lower left are the BCT reconnaissance units and lead maneuver battalions. The bright magenta-colored areas edged with yellow are various command posts and sustainment locations emitting highly conspicuous electromagnetic signatures.

This image highlights the challenge of concealing modern-day command posts from detection and attack. The OPFOR at the NTC uses its electronic warfare systems to both generate images like this as training tools to show visiting units what their digital signatures look like from overhead sensors and also to target those units during the exercise using such imagery to simulate the actual threat posed by enemy detection and observation technologies on the modern-day battlefield. (Photo courtesy of Col. Scott Woodward, U.S. Army)

衛星圖顯示某支旅級戰鬥隊在加州歐文堡國家訓練中心從事訓練時的電子信跡，其正從東南向西北進攻，目標是奪取山口(關鍵地形)，假想敵則是採取反斜面防禦戰術。旅級戰鬥隊前沿分布的色塊，以及左下角較密集色塊，分別代表偵察單位與主力戰鬥營的位置。洋紅色及其邊緣帶螢黃色的色塊是各類指揮所與後勤支援區，這些地方發出極為明顯的電磁信跡。

該衛星圖凸顯指揮所在現代戰場上必須做好隱匿，以避免遭受敵偵測與攻擊。國家訓練中心的假想敵運用電子戰系統來生成這種影像，並用來作為訓練工具，以向來訪單位展示數位信號在空中感測器下的模樣，這些影像還用於演習中模擬遭敵偵測與觀察的威脅，呈現出部隊遭標定的現代戰場實況。

A close examination of this screen shot of the destroyed Russian army position 13 March 2022 reveals that the Russian command post configuration of vehicles and structures in the early stages of the invasion closely resemble most current U.S. command post configurations. (Photo courtesy of the Ukrainian Armed Forces)

仔細檢視這張於 2022 年 3 月 13 日遭摧毀的俄軍陣地，可以發現俄軍在入侵烏克蘭初期時指揮所的車輛與設施配置，與當前美軍大多數指揮所的配置極為相似。

A recent overhead image of a command post taken by a UAV at the National Training Center, Fort Irwin, California, during a training exercise. Vehicles and tentage concentrated in a single location to maintain command and control over maneuvering units is a predictable pattern among many militaries today that is increasingly becoming a battlefield vulnerability due to modern detection and observation technologies that enable rapid targeting of such concentrations. (Photo courtesy of Col. Scott Woodward, U.S. Army)

近期在加州歐文堡國家訓練中心的訓練演習中，由無人機空拍的指揮所照片顯示，車輛與帳蓬式設施集中在單一地點來維持戰鬥部隊的指管運作，這種配置在當前許多部隊中很常見，但由於現代偵測與觀察技術之進步，讓這類集結易遭敵快速標定，逐漸變成在戰場上的一個弱點。

Wrong Tool for the Job of Commanders Today

At its core, the current command-and-control dilemma reflects an imbalance in the functional requirements for command posts to be both effective and survivable. Throughout history, as the complexity and scale of war has expanded, so too has the organization, composition, and proliferation of command posts. Commanders and their staffs have tailored these structures to provide the best means to control formations in the chaos of war, deliver good decisions faster than the enemy, and increase effectiveness by leveraging the experience and leadership of the commander. In the nineteenth century, industrial-level warfare bred industrial models for command posts as well as the accompanying bureaucracy to manage them.[19] In many ways, this approach persists even two hundred years later, as represented by the Napoleonic Staff Model, which remains the predominant organizational design.[20] In the early twentieth century, the rise of airpower greatly improved the effectiveness of armies but complicated control and created a need to synchronize a third domain that would be subsequently joined by two others in the twenty-first century. A commander's need for control and knowledge across all these areas created a demand for human and technical decision-support tools. While this initially manifested in the form of an ever-expanding functionally dedicated staff, today it also appears in the form of computer servers and the digital applications required for processing and discerning meaning from the sea of data in which our operations are now awash.21 This insatiable demand for decision-quality information to enable understanding and commander visualization has only increased over time. In the current form, these tools and staff weigh on the agility of the command-and-control system and increase its vulnerability by orders of magnitude. At its core, the current command-and-control dilemma reflects an imbalance in the functional requirements for command posts to be both effective and survivable. Throughout history, as the complexity and scale of war has expanded, so too has the organization, composition, and proliferation of command posts. Commanders and their staffs have tailored these structures to provide the best means to control formations in the chaos of war, deliver good decisions faster

than the enemy, and increase effectiveness by leveraging the experience and leadership of the commander. In the nineteenth century, industrial-level warfare bred industrial models for command posts as well as the accompanying bureaucracy to manage them.19 In many ways, this approach persists even two hundred years later, as represented by the Napoleonic Staff Model, which remains the predominant organizational design.[20] In the early twentieth century, the rise of airpower greatly improved the effectiveness of armies but complicated control and created a need to synchronize a third domain that would be subsequently joined by two others in the twenty-first century. A commander's need for control and knowledge across all these areas created a demand for human and technical decision-support tools. While this initially manifested in the form of an ever-expanding functionally dedicated staff, today it also appears in the form of computer servers and the digital applications required for processing and discerning meaning from the sea of data in which our operations are now awash.[21] This insatiable demand for decision-quality information to enable understanding and commander visualization has only increased over time. In the current form, these tools and staff weigh on the agility of the command-and-control system and increase its vulnerability by orders of magnitude.

當前指揮官用錯了工具

就根本而言，當前指管困境反映出指揮所在效能與存活率兩項功能需求之間的不平衡。在時代演進下，戰爭規模與複雜性已然擴大，指揮所的架構、組成及數量也隨之變化。指揮官與參謀應採取最合適的指揮所架構，以利在戰爭混亂中提出最佳用兵之道，達到制敵機先，還要善用指揮官的領導經驗與領導力來強化指揮所效能。在 19 世紀中，工業特徵的戰爭催生出工業型態的指揮所，以及伴隨而來的科層組織管理模式。[19]即使過了兩百年且在各方面演進下，這種型態的指揮模式依然盛行，並以「拿破崙參謀模式」為代表，迄今仍是主要的指揮組織設計方式。[20]等進入 20 世紀初，空權崛起大幅提升軍隊的作戰效能，但也讓指管更為複雜，從而產生要協調第三方作戰領域(海上)同步的需求，接著到了 21

[19] Frederick Winslow Taylor, *The Principles of Scientific Management* (New York: Harper & Brothers, 1911).

[20] John F. Price Jr., "Napoleon's Shadow: Facing Organizational Design Challenges in the U.S. Military," *Joint Force Quarterly* 68 (1st Quarter, 2013): 48-52, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-68/JFQ-68_48-52_Price.pdf. 譯者註：拿破崙參謀模式的主要特點為集中計畫與分權執行、編制軍的作戰單位、高效通信、高機動性、設置參謀長角色、運用情報分析。

世紀又陸續增加其他兩個作戰領域(太空、網路)。指揮官對各個作戰領域的指管與知識需求，也帶動對人工與技術決策支援工具的需求，也就是一開始為參謀專業職能需求不斷擴大，如今已變成需要電腦伺服器與數位應用程式，以用來處理並辨別在我們作業過程中所接收的大量資料數據。[21]在時代演進下，決策的資訊品質要求將永無止境，因為這樣才能洞察戰況並提升戰場具象化。不過，就當前的指揮所型態而言，資訊工具與專業參謀的加入，反而阻礙指管體系的敏捷，讓其脆弱性倍增。

To increase survivability, commanders sought to protect their command posts by reducing their size, hardening them, splitting them up, camouflaging them, increasing their mobility, and actively defending them against all manner of threats including air, cyber, and electronic attack.22 Advancing technology has been on both sides of this dilemma. It has provided communications, automation, and information technology to compress the structure of command posts and make them more productive. However, technology also created a gateway into further functionality and capability that added size and structure counterproductive to survivability. Generally, this ebb and flow of effectiveness and survivability has been incremental, with actions and reactions reflected in doctrine, material, and design more evolutionary than revolutionary.

為了提升指揮所的存活率與防護力，指揮官運用縮小規模、強化防護力、分散部署、偽裝、增強機動性等手段，並以主動防禦方式因應如空中、網路及電子攻擊等各種不同威脅。22先進科技在這種兩難處境下發揮雙重作用，一方面提供通信、自動化和資訊技術，讓指揮所架構精簡化、更具效能；另一方面先進科技雖然進一步強化指揮所效能，但卻是不利於戰場存活率。由此可見，效能與存活率之間的彼長我消現象會越來越明顯，而造成這種現象的原因是我們在攸關指揮所的準則、軍品及設計等作為，多半都是在逐步演進架構下，而不是革命性變革。

Sometimes, evolution includes mutations that, if left unchecked, can metastasize into a vulnerability that requires a revolution to correct. Such is the case with U.S. command posts over the last twenty years, which have been

[21] Jaspreet Gill, "At Project Convergence, Data Management Is Army's Biggest Challenge," Breaking Defense, 15 November 2022, https://breakingdefense.com/2022/11/at-project-convergence-data-management-is-armys-biggest-challenge/.

[22] Stew Magnuson, "Army Scrambles to Make Command Posts Survivable," *National Defense* (website), 1 December 2017, https://www.nationaldefensemagazine.org/articles/2017/12/1/army-scrambles-to-make-command-posts-survivable.

rendered unfit for their purpose given the speed, complexity, and lethality of large-scale combat operations. Since 2001, the absence of an observable and aggressive threat allowed our command posts to gradually mutate during the Global War on Terrorism. Over the succeeding thirteen years following the invasion of Afghanistan, command posts progressively diverged further and further from a suitable model for large-scale combat operations. At the same time, their organization and systems allowed commanders to have unprecedented levels of control and situational awareness.[23] At times, this threatened the Army's very leadership philosophy of mission command by enabling micromanagement by command posts that were overpeopled, overprocessed, overnetworked, and understressed.[24] Within the U.S. Army, one of the main reasons this gap expanded is because our entire doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) enterprise was oriented on lower tactical echelons to provide the forces and capabilities required for counterinsurgency operations. As an example, within the U.S. Army Training and Doctrine Command, the combat training centers evaluated the command posts of brigade combat teams for nearly two decades using a rubric that promoted a comprehensive and process-driven approach to targeting that previously existed only at the division level or above. This incentivized commanders to develop ponderous infrastructure to support capabilities for integrating complex operations without adequately punishing them for the resulting loss of flexibility, agility, and survivability.[25] Those combat training center "lessons," appropriate though they were for that time and mission, inculcated an entire generation of leaders with a sense of invulnerability inconsistent with highly dynamic, mobile, and lethal warfare against a capable enemy. The United States was not the only nation to adopt this approach; our NATO allies who dutifully participated in counterterrorism and counterinsurgency operations around the world followed suit.[26] Even our adversaries, hoping to replicate successes in Operation Iraqi Freedom and concerned with their own expeditionary regional entanglements, expanded the sizes of their headquarters at tactical echelons.[27] Ironically, commander's experience, knowledge, and intuition today are backstopped by

an unprecedented system of functional experts and technical tools that significantly reduces their decision risk but exponentially increases risk to mission and their personal safety. While there is not space here to fully examine all the implications of this period for command and control, each component of DOTMLPF must be evaluated independently to assess our experience since 2001 and its effect on the command-and-control system and our command posts. Today, our command posts have mutated away from the lean, mean, killing machines we need and are instead fat and ponderous.

有時候，若未能管控在演進過程中的變異問題，可能會演變成一種脆弱性，最後就需要以革命性變革來導正。這種情況正發生在過去二十年來的美軍指揮所，其在面對大規模作戰的速度、複雜性及致命性等因素下，已無法發揮其應有效用。自 2001 年以來，由於缺少明顯可見的攻擊威脅，美軍指揮所在全球反恐戰爭中逐漸發生變異，接著在阿富汗戰爭爆發後的十三年間，指揮所型態逐漸偏離不適合用於大規模作戰的戰場環境，雖然這時候的指揮所組織與系統能達到前所未有的指管與狀況覺知功能，[23]但有時候卻會影響到部隊的任務式指揮領導哲學，因為指揮所型態在變成人員眾多、流程繁瑣、網絡過多及面臨各種壓力的情況下，會促成微觀管理模式。[24]在美陸軍中，這個落差會擴大主要原因是「準則、組織、訓練、軍品、領導統御、人員與設施」(DOTMLPE)這套制度都是套用在基層戰術編隊，演變成兵力與能力之培養是用來應付反叛亂作戰行動。以美陸軍訓練暨準則司令部為例，其戰鬥訓練中心在近二十年來用以評估旅級戰鬥隊指揮所的標準，正促成一種全面以程序取向為主的方法，但這方法先前僅存在於師或師以上單位。這種現象等於是鼓勵指揮官認為唯有建立繁重的基礎設施，才能將作戰能力整合至複雜的作戰行動中，反而不是讓他們理解這麼做會犧牲彈性、敏捷及存活率。[25]戰鬥訓練中心的「作戰教則」雖然是適用於過去當下的任務，但卻也讓整個世代的領導幹部養成一種錯覺，認為在面對高動態、機動性強及致命性的敵人時，依然能克敵致勝。美國不是唯一採取這套作戰教則的國家，北約盟國也採取這套作法，因為各國也忠實參與美國在全球的反恐與反叛亂作戰行動。[26]不僅如此，連美軍對手也在複製「伊拉克自由作戰行動」的成功經驗，

[23] Jeremy Horton and Ted Thomas, "Adapt or Die: Command Posts – Surviving the Future Fight," Army.mil, 27 May 2020, https://www.army.mil/article/235968/adapt_or_die_command_posts_surviving_the_future_fight.

[24] Justin T. DeLeon and Paolo G. Tripodi, "Eliminating Micromanagement and Embracing Mission Command," *Military Review* 102, no. 5 (September-October 2022): 88–98, https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/September-October-2022/DeLeon-Tripodi/.

[25] U.S. Army Center for Army Lessons Learned (CALL), *National Training Center Operations Group Fire Support Handbook* (Fort Leavenworth, KS: CALL, November 2020), https://usacac.army.mil/sites/default/files/publications/21558.pdf.

[26] Federico Clemente Clemente, Jan Willem Streefkerk, and Marcel Scherrenburg, *The Future of the Command Post*,

因為敵人也認為在遠征區域從事作戰行動時，必須要擴大戰術編隊的指揮所規模，才不會處處制肘。[27]諷刺的是，指揮官的經驗、知識及直覺之養成都是靠強大的各系統專家與科技工具，雖然這樣做大幅降低他們的決策風險，但在對任務與人員安全而言，其風險卻是以指數等級攀升。本文在此並不探討那段時期對指管的各種影響，但只要對 DOTMLPE 的各個組成進行獨立評估，就可以理解自 2001 年以來美軍所形塑的經驗如何對指管體系和指揮所產生影響。如今，美軍指揮所已偏離吾人所需既精簡又高效的殺戮機器，反而變異成臃腫笨重的存在。

Putting the Right Tool in the Hands of Commanders

Change is coming. The release of the U.S. Army's capstone doctrine, Field Manual 3-0, Operations, in October 2022 codifies a significant departure for all warfighting functions from legacy foundations and seeks to drive the Army to sustained dominance of the land domain while operating in multiple domains in the twenty-first century.[28] Recognizing the challenges of the current environment, MDO emphasize that command posts, as an element of the command-and-control system, must adhere to the tenets of agility, convergence, endurance, and depth. To optimize our command posts, we must reduce our reliance on the physical dimension (the material), increase our utilization of the information dimension (the data), and maximize our relationship with the human dimension (our leaders). These three mandates provide the framework for a new rubric to assess and evaluate command posts across the Army's training programs.

將正確工具交到指揮官手上

改變即將來臨。美陸軍最高作戰指導準則，2022 年 10 月修訂版第 3-0 號野戰教範：《作戰》(FM3-0)標誌著所有作戰職能從傳統基礎上的重大轉變，旨在讓陸軍維持地面作戰的主宰力，並融入 21 世紀的多領域作戰環境。[28]由於認知到當前環境的挑戰，多領域作戰強調指揮所作為指管體系的要素之一，同樣也要依循敏捷、聚合、持續力及縱深等要則。此外，指揮所的優化還必須減少對實體面(軍品)的依賴，增加對資訊面(數據)的運用，強化人文面(領導幹部)的人員管理與運用，此三層面亦可作為陸軍訓練計畫在評估指揮所時的新標準。

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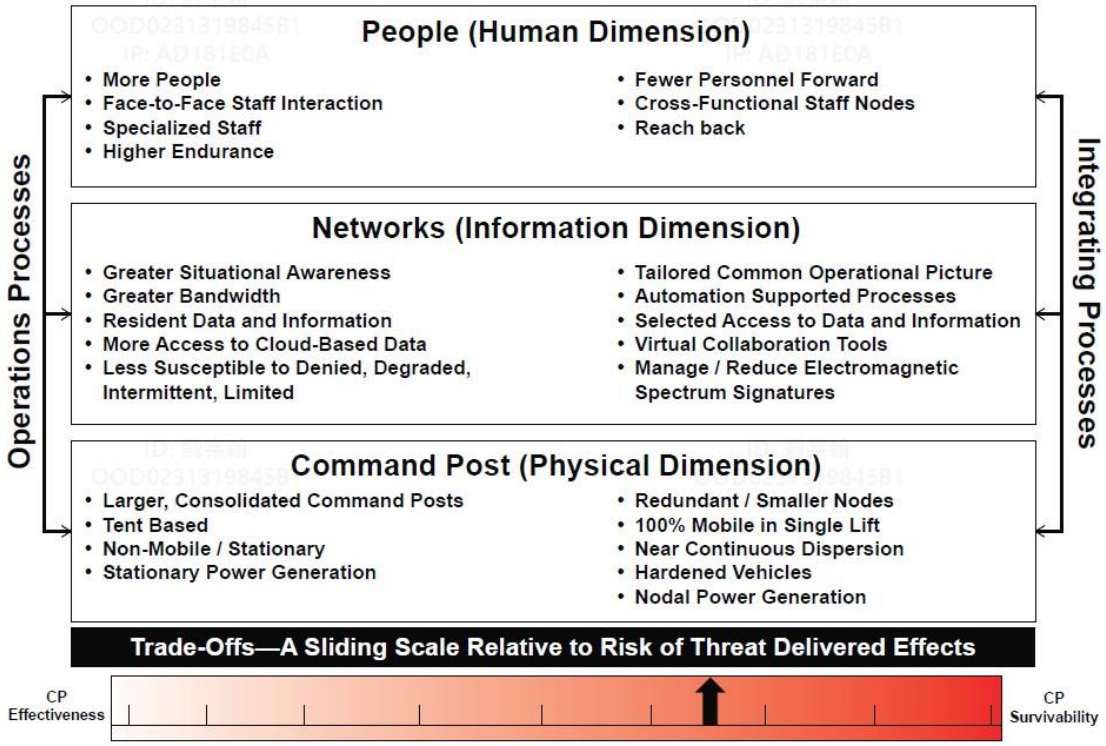
part 1 (Utrecht, NL: NATOC2COE, January 2019), https://c2coe.org/download/the-future-of-the-command-post-part-1/.

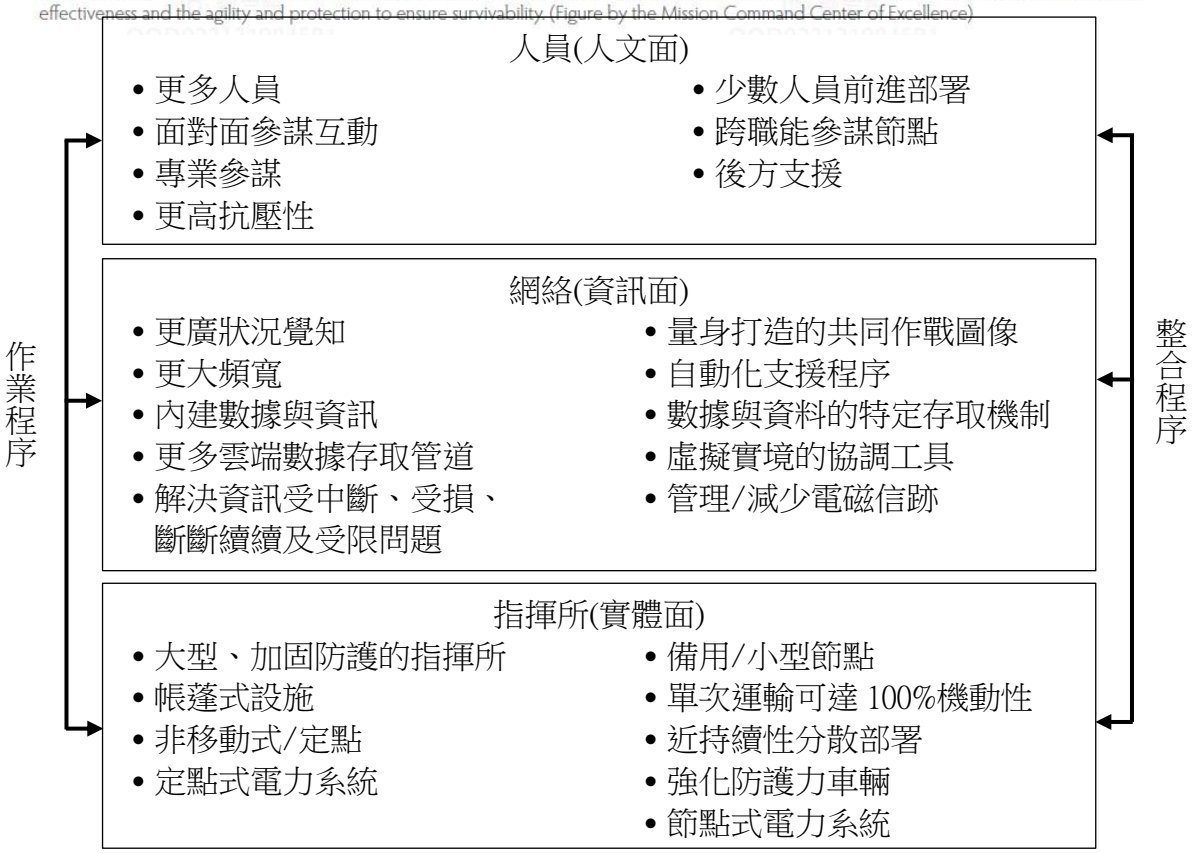
[27] Nick, Mordowanec, "Intelligence Report Reveals 3 Intrinsic Russian Tactical Unit 'Weaknesses,'" *Newsweek* (website), 29 November 2022, https://www.newsweek.com/intelligence-report-reveals-3-intrinsic-russian-tactical-unit-weaknesses-1763215.

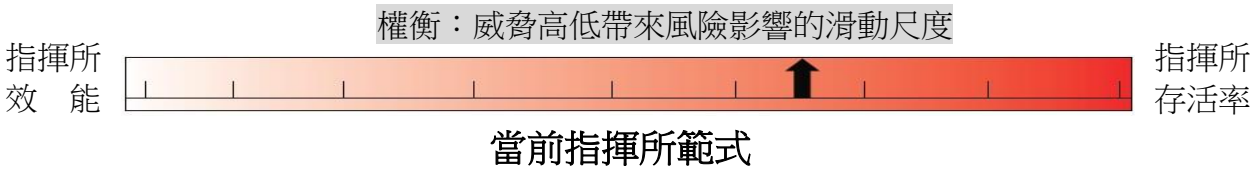
[28] FM 3-0, *Operations* (Washington, DC: U.S. GPO, 1 October 2022), 1-3, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN36290-FM_3-0-000-WEB-2.pdf.



Current Command Post Paradigm

This graphic represents the current necessary trade-off between CP effectiveness and CP survivability, dependent on the threat level. Our current paradigm and the associated command-and-control systems and infrastructure necessitate a trade-off in a "fight tonight" scenario. However, implementation of the recommendations in this article will decrease the trade-off, resulting in redundant command post capability that retains both effectiveness and the agility and protection to ensure survivability. (Figure by the Mission Command Center of Excellence)





當前指揮所範式

該圖顯示指揮所在效能與存活率之間的取捨，係以威脅等級而定。美軍當前指揮所範式、指管系統及基礎設施不得不在「今夜開戰」想定下做出一定取捨。然而，若能實行本文所提建議，將可減少這種取捨情況，並讓指揮所具備多餘能力，同時保有效能、敏捷及防護力，以確保在戰場上的存活

To develop a new foundation for command and control, examining each of the tenets of MDO will help distinguish what truly constitutes an acceptable, suitable, and complete command post design; one that is both effective and survivable in large-scale combat operations against a capable enemy.

為了奠定完善的指管新基礎，接下來將檢視多領域作戰所強調的四個要則，以利找出真正一個完整合適的指揮所設計方案，如此才能在大規模敵作戰行動中發揮指揮所效能並增加存活率。

Agility

By the Army's definition of agility, "the ability to move forces and adjust their dispositions and activities more rapidly than the enemy," our current command posts are not providing us with any demonstrable advantage.[29] Agility denotes speed and the nimbleness to change quickly. At present, our command posts are locked in an endless cycle of the work required to establish, disestablish, displace, and emplace to remain survivable and keep pace with operations. This alone disrupts operational tempo and degrades decision advantage even without enemy interference. Increasing mobility by divesting tentage and transitioning to vehicle mounted systems will help but not eliminate this problem. Increasing mobility will not change the fact that when our command posts arrive at their new location, they will not be more than what they were before. For example, a brigade command post cannot rapidly become a division command post, even though a brigade command post may have to assume those roles and functions with less capability if the division command post is destroyed.

敏捷

美陸軍對敏捷的定義是，「比敵人更快速調動部隊並完成部隊部署與行動的能力」，且觀美軍當前指揮所並沒有任何明顯優勢。29敏捷就是速度與得以迅速

[29] Ibid., Glossary-3.

變換的靈活性,美軍當前指揮所陷入開設、撤離、轉移及重新部署的無止盡循環,因為只有這樣做才能維持存活率並跟上作戰步調,但只要這點做不好就會擾亂作戰節奏,並削弱決策優勢,根本用不著敵人出手就自亂陣腳。雖然藉由減少帳篷式設施並運用車裝系統可以提升機動性,但仍無法解決敏捷問題,其癥結點在於不管美軍指揮所轉移到哪個新地點,其功能並不會就此提升,也不會超越之前水準。例如,在師指揮所被摧毀,旅指揮所不得不取而代之承擔其角色與功能情況下,旅指揮所的量能並不足以支撐並迅速轉變為師指揮所。

If we organize our command posts around what is truly important, the commander's processes, then we can be indifferent about what provides those processes. If we envision our command posts as less of a place or a thing and more as a service, it may be possible to vastly increase our agility. What happens if a corps, division, or brigade commander arrives, takes control of any command post, and receives the capability of the appropriate echelon with a push of a button? What if command posts at higher tactical echelons were truly fungible based on connectivity and accessibility of data? What if, instead of tents and dozens of vehicles and generators, the command post capability could be delivered in a footprint the size of a personal security detachment (three to four vehicles)?[30] This approach to achieving the tenant of agility could be a game changer and enhance the commander's ability to achieve decision advantage in a hyperactive environment. In MDO, decision advantage is leveraged to enable convergence of joint and Army capabilities.

若我們將指揮所聚焦於真正重要的指揮官程序,就不必受制於哪個層級指揮所就要用哪種程序,若我們將指揮所視為只是提供服務,而不一定是要開設成一個具體場所或物件,改變思維才有可能大幅提升敏捷。不妨想像一下敏捷提升後未來的各種場景,如軍長、師長及旅長到達任何一個指揮所後,只需要啟動程序就可以運用該層級的戰術梯隊能力;如較高層戰術梯隊指揮所在完善的數據連通與存取下,可以由其他指揮所取而代之;如指揮所效能將以個人安全分遣隊(三至四輛軍車)的型態來開設,而不是以帳篷、發電機及數十輛車的型態開設。30這種提升敏捷的途徑將會成功扭轉戰局,並增強指揮官在高動態環境中的能力,而且在多領域作戰中,敏捷所帶來的決策優勢,將促成陸軍兵力與聯合部隊的聚合。

[30] John Antal, "Sooner Than We Think: Command Post Survivability and Future Threats," 4 August 2022, in *The Convergence: An Army Mad Scientist Podcast*, episode 62, 44:13, https://theconvergence.castos.com/episodes/62-sooner-than-we-think-command-post-survivability-and-future-threats-with-col-ret-john-antal.

Convergence

Newly introduced in Field Manual 3-0, the tenet of convergence is "an outcome created by the concerted employment of capabilities from multiple domains and echelons against combinations of decisive points in any domain to create effects against a system, formation, decision maker or in a specific geographic area."[31] In part, convergence is achieved through combined joint all-domain command and control and therefore must be a driving factor in the composition of future command posts. Convergence reminds us that, far from giving up capability at echelon to simplify our activities, any acceptable command post design must be able to achieve even greater effectiveness through more robust integration and interoperability. Command posts that connect sensors, shooters, and decision-makers enabled by machine learning and artificial intelligence will transform the legacy kill chain into a kill web to create exploitable opportunities that enable freedom of action and mission accomplishment.[32] This mandate for data integration positions decision-quality data that enables commander's processes (e.g., understanding, visualization) at the heart of the modern command post. To retain agility and enable the constant flow of the right data to the right leaders, command posts can no longer rely on legacy stove-piped systems, on-site servers, and the accompanying support mechanisms as the primary means to support decision-making. Instead, we must migrate to the cloud and leverage data mesh and data fabric concepts to ensure data is secure, organized, and available in a manner that is usable for commanders and their staffs. For those unfamiliar, data mesh and data fabrics are complementary approaches to data management that enable connectivity and accessibility. A data mesh is a decentralized data architecture that federates data production, management, and sharing within and among domains.[33] A data fabric is a domain within the data mesh that automates data integration and enables connectivity and access to find, create, and widely share data products across the breadth and depth of the battlespace, including with joint, allied, and partner forces. These data management concepts within the civil sector enable endurance and agility of our command posts, reducing reliance on single platforms or repositories that have the potential to be trapped and isolated as a result displacing command posts or the effects of enemy actions. Here we begin to see the shift away from

the physical dimension and toward the informational, which requires significantly different approaches and skill sets to facilitate operations.

聚合

FM3-0 野戰教範將新引進的聚合乙詞定義為，「藉由協同一致運用多領域與各編隊的能力在各個作戰領域中，針對各個決策點產生影響系統、編隊、決策者或特定地理區域的一種結果。」[31]在某種程度上，聚合是藉由盟軍聯合全域指管來實現，所以其會成為未來在開設指揮所時考量的要則。此外，我們也要理解，不能在簡化各項業務過程中而犧牲部隊能力，一個合宜的指揮所設計必須藉由健全的整合與互通性來提升作戰效能。指揮所也可藉由機器學習與人工智慧科技來統合偵打與決策系統，將傳統單一領域的擊殺鏈轉變為範圍更大的擊殺網，以達成奪取先機、實現行動自由及完成任務。[32]由於現代指揮所的核心是決策數據品質，各項數據的整合必須能支援指揮官指揮程序(如戰況理解與戰場具象化)，而且為維持敏捷並讓對的人(領導幹部)獲得對的數據，指揮所不能再依賴傳統的封閉式系統、當地伺服器及附屬的支援機制，以作為支持決策的主要手段。換言之，我們必須轉往雲端系統，並運用數據網格與數據經緯的概念模式，以確保數據安全、分類儲放，並易於指揮官與參謀作業使用。數據網格與數據經緯雖然是個令人陌生的概念，但其是互補的數據管理方法，旨在實現資料的連結與存取。數據網格是一個去中心化的數據架構，其會整合多個資料來源並將數據下放至各個領域中管理，[33]至於數據經緯是數據網格中的一個領域，負責自動化數據整合及執行數據的連結與存取，有助於美軍聯合部隊與友軍在戰場空間的深度與廣度中找出、建立及廣泛共享數據資料。這種源自於民用領域的數據管理概念，有助於強化指揮所的敏捷與持續力，減少對單一平台或數據庫的依賴，從而避免指揮所在轉移或遭敵行動影響所產生的限制與孤立情事。此處，我們發現從實體面轉往資訊面的轉變，將需要不同方法與技能才能推動這項運作。

In data-centric command posts, commanders may rely on data development, security, and operations engineers who could expedite the secure development and integration of new applications on operational timelines and forward at the point of need.[34] These data professionals will replace the legacy employment of the operations sergeants responsible for configuring and organizing the network-centric command posts we have today. This would essentially provide commanders with the flexibility to fine tune their

[31] FM 3-0, *Operations*, Glossary-5.
[32] Christian Brose, *The Kill Chain: Defending America in the Future of High-Tech Warfare* (New York: Hachette Books, 21 April 2020); FM 3-0, *Operations*, 3-3.
[33] "What Is a Data Mesh?," IBM, https://www.ibm.com/topics/data-mesh.

command-and-control system based on unique mission requirements and leader preferences. To remain survivable, we must also divest command posts of the physical collocation of anything delivered “as a service” (aaS). This includes communications (CaaS), radios (Raas), and especially, knowledge (KaaS). For those unfamiliar with the as-a-service model, aaS is a disruptive business approach that outsources the burden of ownership-based sustainment that requires the functional expertise and infrastructure to operate and maintain. Those past practices reinforce dependencies on legacy systems and skill sets, which stagnates innovation.[35] The aaS approach enables rapid adoption of emerging technology and mobility, and it opens the door to competition among providers, which ensures our soldiers have the very best capability available. Consider, for example, the unique and creative ways that the Ukrainians are using Starlink’s capabilities without owning the satellites and the associated skill sets and support infrastructure. However, decreasing commanders’ reliance on the physical dimension in favor of the information dimension will increase survivability by reducing the overall command post signature and the need to aggregate staffs in a single location. To achieve the full potential of convergence, command posts will need to adapt to such an extent that they will be unrecognizable to the generation of leaders that fought in Iraq and Afghanistan.

在數據中心化的指揮所，指揮官可以仰賴負責數據開發、安全暨營運工程師的專業能力，因為該專業人員可以提升安全防護、配合作戰時間表來整合新應用程式，以及前進部署至前線需求點。[34]他們可以取代當前負責在籌組網路中心指揮所的傳統作戰士功能，基本上，可以讓指揮官有能力依任務需求與個人偏好來彈性調整指管體系。此外，為了維持存活率，指揮所必須從實體面配置轉型為即服務(aaS)的型態，其中包含通信即服務(CaaS)、無線電即服務(RaaS)、知識即服務(KaaS)。軍方可能不熟悉 aaS 的方法，其是一種創新的外包商業模式，將主要的營運負擔委外處理，以減輕維持營運所需的基礎設施與專業技能，至於阻礙創新的可能性是源自於以往作法過分依賴傳統系統與技能，[35]aaS 方法則可以促進新興科技的接納並讓數據快速流動，帶動供應商之間競爭，軍方可從中受益並選出最適合的指管方案。舉例而言，aaS 的方法是讓烏克蘭能使用星鏈衛星

[34] “What is DevSecOps?,” IBM, https://www.ibm.com/topics/devsecops.

[35] Daniel Newman, “Why the ‘As-A-Service’ Model Works so Well for Digital Transformation,” *Forbes* (website), 27 June 2017, https://www.forbes.com/sites/danielnewman/2017/06/27/why-the-as-a-service-model-works-so-well-for-digital-transformation/?sh=7ed867b86490.

網絡，一來無須負擔衛星及其相關基礎設施，二來也不必具備相關專業技能，這何嘗不是一項獨特的創新作法嗎？因此，指揮官在減少實體面依賴並轉向資訊面的過程中，需要減少指揮所的整體信跡，避免將參謀人員集中於單一地點，如此才能提升指揮所的存活率。最後，在聚合發揮作用的過程中，指揮所在適應這些轉變時，勢必要取得那一代在伊拉克與阿富汗戰場指揮官的認同。

Endurance

Endurance, defined as “the ability to persevere over time throughout the depth of an operational environment,” is the next critical tenet of MDO.[36] While more capable and agile command posts provide apparent benefits toward endurance, preserving that command-and-control capability over time will occur in the harshest and most-lethal conditions imaginable. Command posts must demonstrate resilience and persistence in temporary isolation and under austere conditions. This also implies that even highly mobile command posts must be protected in a way that our current expandable vans and tentage are not. They must be armored, and we must develop solutions that deliver scalable capability to units where hardening command posts will be difficult, including our airborne and light expeditionary forces. To this end, we should pursue command post capabilities that are multimodal, with vehicle-mounted capability that can be quickly and easily dismounted to occupy hardened structures and blend into dense urban terrain. Command posts must also be capable of masking their signature to complicate an adversary’s targeting by concealing their visual, thermal, electronic, acoustic, and soon, their quantum signatures[37].

持續力

持續力是多領域作戰的第三個要則，其定義是「在整個作戰環境的縱深中，隨著時間推移的堅持能力。」[36]指揮所具備較多能力與敏捷，將有助於作戰的持續力，但無可避免的是，指管能力在戰事推移中也會面臨嚴苛環境與致命性攻擊。指揮所必須在暫時中斷與惡劣條件下展現韌性與持久性，這意味著高機動性指揮所不能再依賴以往那種擴充式廂型軍卡與帳篷式的防護作為，也就是軍卡必須具備裝甲防護力，還要為那些不易加固防護的指揮所，如空降部隊與輕型遠征部隊，開發出一套彈性應變的解決方案。為此，我們應建立多模組化的指揮所能力，也就是車裝式廂型裝備要能快速輕易拆卸，以利移入加固建築物並融入城市密集地貌中。指揮所也必須有能力掩蔽自身信跡，並藉由隱藏目視物、熱源、電

[36] FM 3-0, *Operations*, Glossary-6.

子、聲音，以及不久將來會使用的量子訊號等，以增加敵人在標定時的困難度[37]。

Ultimately, if we can reduce the size and structure of command posts at all echelons to a few tactical armored vehicles, the extraordinary signature of our high-tactical and operational command posts will fade into the normalized electromagnetic spectrum and background clutter of a battlefield where armored vehicles are ubiquitous. In this way, we may deny the enemy the ability to discern priority and high-value targets, a valuable skill in an environment that may be characterized at times by a shortage of precision munitions. This approach reinforces the Sun Tzu dictum that “all warfare is based on deception” and applies it to our command posts, thereby setting the tone we hope is reflected in the operations they direct.[38] We must also not forget that survivability, whether physical, informational, or human, is just one aspect of endurance. Endurance also has a sustainment aspect, which implies that whatever command-and-control system is fielded, it must be capable of operations for an indefinite period. In the past, this may have implied a mountain of logistics and personnel to support work–rest–maintenance cycles. In the future, this problem may be overcome by simply transferring mission command to any one of many distributed command-and-control nodes within a constellation of distributed nodes in much the same way industry manages global workflows.

最後，我們若能將所有作戰編隊的指揮所規模與架構，縮減到僅由一些戰術裝甲車組成，那麼高層戰術中心與作戰指揮所的遠征信跡，將融入戰場上裝甲車所形成的正常電磁頻譜與背景雜訊中。若用這種部署方式，敵人在無法分辨優先與高價值目標下，斷然不會貿然採用數量有限的精確彈藥攻擊，這會是一項有用的戰術作為。這種指揮所的部署方式，與孫子所言，「兵者，詭道也」，不謀而合，而且也會為作戰指管奠定成功根基。[38]值得一提的是，關於指揮所實體面、資訊面及人文面的戰場存活問題，都可以看成持續力的面向之一；再者，持續力也包含延續面向，這意味著不管是何種指管體系的部署，都必須具備能長久運作的能力。在過去，我們在做這件事時，往往以大量後勤支援與人力的集中化方式，以維持保修這種上下工時間循環。在未來，我們應改以任務式指揮方式來管理眾多的指管節點，而這種管理指管節點群的方式，就是民間企業用於管理全球工作流

[37] Michiel van Amerongen, “Quantum Technologies in Defence & Security,” NATO Review, 3 June 2021, https://www.nato.int/docu/review/articles/2021/06/03/quantum-technologies-in-defence-security/index.html.

[38] Sun Tzu, *The Art of War*, with introduction by B. H. Liddell Hart, trans. Samuel B. Griffith (Oxford: Oxford University Press, 1971), 66.

程的技術。

Depth

Finally, in assessing future command posts against the remaining operational tenet, depth, we can measure the ability of command posts to "extend our operations in time, space or (cognitive) purpose."[39] In the expanded multidomain operational framework, this suggests a command-and-control node that optimizes its effectiveness to exploit or create opportunities in a way that offsets the hyperactive nature of large-scale combat operations to give the commander a comparative advantage. This advantage is also achieved through the integration of combined joint all-domain partners, offensively and defensively. It enables the delivery of effects across all three dimensions, human, physical, and informational, and throughout the entirety of the operational framework while simultaneously protecting its own combat power. These complementary efforts allow friendly forces to apply combat power against enemy capabilities to achieve advantages in time and space. The results can also disrupt the cognitive depth of an enemy, by interrupting or extending their decision cycle, further generating advantageous conditions for a friendly commander. The combined effects across the temporal, spatial and cognitive aspects of depth extend the operational reach of friendly forces.

縱深

指揮所最後一個衡量要則是縱深，我們未來在評估指揮所時，要看它是否能「在時間、空間或(認知)目的上具備延伸作戰行動的能力。」[39]在多領域作戰的廣大架構下，優化指管節點將能提升作戰效能、奪取先機，並有效因應大規模作戰行動的高動態本質，從而讓指揮官獲得相對優勢。另盟軍聯合全域的攻守整合，不僅能提供作戰優勢，而且也能在指揮所的實體面、人文面、資訊面及整體作戰架構上發揮效果，進而強化自身的作戰防護力。上述作為除了能有效匯聚友軍戰力來對抗敵方攻勢外，還在作戰時間與空間上獲致優勢，另外的附帶效應是藉由擾亂或延長敵決策循環，誤導敵認知的戰場縱深，進一步為友軍指揮官創造有利條件。由此可見，時間、空間及縱深認知的統合效應將可擴展友軍的作戰範圍。

[39] FM 3-0, *Operations*, Glossary-6.

An M1087 Expandable Van Shelter houses the Command Post Integrated Infrastructure System under operational test (Photo by Sgt. 1st Class Frederick E. Estep, U.S. Army Operational Test Command)

搭載指揮所綜合基礎設施系統的 M1087 擴充式廂型卡車，其正在進行作戰測試。

The 4th Infantry Division completes set up of a new division tactical operations center in December 2021 at a Fort Carson, Colorado, training area during the Command Post Infrastructure Integration (CPI2) test. The design of CPI2 enables a division headquarters to be scalable, modular, and agile while reducing the physical area required of tactical operations. (Photo by Maj. Monty Blamires, U.S. Army)

2021 年 12 月於科羅拉多州卡森堡的訓練區，第 4 步兵師在指揮所設施整合(CPI2)測試期間設置一個新式師戰術作戰中心。CPI2 之設計不僅讓師部具有擴充性、模組化及敏捷能力，而且也減少戰術行動所需的實體空間

The Department of Defense has selected a mobile power program from Army Futures Command to increase the speed at which on-the-move power capabilities are delivered to the battlefield. (Photo by Dan Lafontaine, U.S. Army Combat Capabilities Development Command, C5ISR Center Public Affairs)

美國防部已同意陸軍未來司令部提出的行動電力計畫，以利盡速將移動式電力部署至戰場。

The Human Dimension

War, now and in the future, is and will remain a human endeavor. The fact that command posts exist at all speaks to the limits of the commander's unaided human capacity for understanding and decision-making as well as the need to amplify the effectiveness of their leadership beyond their physical reach. Thus, the importance of the human dimension and psychology in command and control during large-scale combat operations cannot be overstated. In examining the value of any current or future command post model, the proximity of leaders matters—more so when employing the U.S. Army's command-and-control philosophy, mission command, which places such a great emphasis on trust, shared understanding, intent, and subordinates' initiative.40 During large-scale combat operations, commanders must have the ability to be physically present to provide leadership but also to quickly move to where they are needed to gain understanding. From a morale and motivational standpoint, leaders, especially in the land domain, must be seen to share the hardships and danger of those they lead. The trust and cohesion necessary for mission command is derived from a commander's personal stake and involvement in the conduct of operations. Currently, this occurs in a physical sense through "battlefield circulation" and presence at unit

locations, which is both time consuming and potentially high risk. Alternatively, a commander can virtually bridge the proximity challenge through voice communications, but this approach provides limited context and may not always meet the psychological needs of subordinates under stress. At Chornobaivka, insufficient communications were one of the reasons Russian senior leaders were deployed so far forward, even for the simplest operations. Considering this, a command post should have assured and redundant communications that enable a sense of proximity between commanders and staff and the leaders and the led. Given these challenges and desirable characteristics, imagining a future command post is difficult, but not impossible.

人文面

不管是現在或是未來的戰爭，始終脫離不了人文因素。指揮所的存在就是說明指揮官若沒有參謀人員的協助，其戰況理解與下決策將有所受限，這意味著領導統御的強化，將比指揮所實體設施更為重要。在大規模作戰行動中，指管的人文面與心理面至關重要，不容小覷，所以在評估當前或未來指揮所模式時，圍繞在領導幹部周邊的人文因素很重要，尤其是美陸軍在運用任務式指揮的指管哲學時，該指揮哲學強調的是信任、共同理解、意圖及部屬的主動作為。40指揮官在大規模作戰行動期間必須展現臨危不亂的領導統御，同時也要隨時迅速前往各據點來獲致最新戰況。從激勵士氣的角度而言，地面戰的領導幹部特別需要在部屬面前展現共苦共患難的形象。任務式指揮所需的信任與凝聚力，源自於指揮官在作戰行動中的親力親為，這體現於指揮官的戰場巡視與親臨前線，這種事必躬親的模式當然會耗費時間，也會伴隨著高風險。鑑此，指揮官的替代方案可以藉由語音通信來克服距離與移動問題，這種方式或多或少也能緩解前線官兵的一些心理壓力，舉例而言，俄軍在喬爾諾巴伊夫卡戰事的通信能力不足，導致俄軍高階指揮官即使在執行最簡單的作戰行動也必須至前線指揮。這個事實說明指揮所應具備可靠的備援通信能力，以保持指揮官與參謀人員以及領導者與部屬之間的緊密關係。指揮所未來一定會面臨這種戰場特徵與困難棘手問題，但並非無法加以克服。

Organizational Design and Employment of an Objective Command Post

To avoid our own Chornobaivka and provide command and control that possesses the characteristics of agility, convergence, endurance, and depth, an effective and survivable command post must exist in a nonphysical

[40] Scott Schroeder (command sergeant major, retired, U.S. Army Forces Command), in discussion on command and control with author Matthew Arrol, 6 December 2022.

construct. We must aggregate and integrate functions, processes, and capabilities but not the people, equipment, and things that have historically been associated with delivering them. While this may seem to violate the feasibility criteria of course of action development, deeper analysis reveals the technology currently exists, and the world of online gaming is showing us the way. To meet the tenets of MDO, we must rely heavily on both augmented and virtual reality. The Army is already experimenting with both technologies but has yet to fully pursue their utility in the command-and-control space.[41] In a virtual world, commanders could replicate, expand, traverse, and interact as needed with their entire physical command post and never have to leave the room or vehicle they are in. They could move between command posts seamlessly and be present wherever and whenever needed.

指揮所的架構設計與運用目標

為避免重蹈俄軍在喬爾諾巴伊夫卡戰事的覆轍，並實現敏捷、聚合、持續力、縱深四個要則，一個具作戰效能與又能存活於戰場的指揮所，必須能以非實體架構方式存在，也就是我們應重視指揮所的各個功能、決策程序及各種能力的整合，而不是以往那種人員、設備及物品的指揮所轉移工作。這個看法似乎違背行動方案發展的可行性原則，但深入分析後發現，實現該看法的相關技術已經存在，即線上遊戲的世界正在為我們指引方向，而且要符合多領域作戰的四個要則，我們必須仰賴擴增實境與虛擬實境，美陸軍已在試驗這兩項技術，只是尚未全面探索它們在指管領域的實用性。[41]在虛擬世界中，指揮官可以根據需求去進行複製、擴展、穿越並與整個實體指揮所互動，無須離開所在的位置或車輛，不僅如此，指揮官也可以指揮所之間無縫接軌，隨時隨地出現在需要的地方。

One vision of future Army command posts could be a proliferation of small three-to-four-armored-vehicle command-and-control nodes that represent what was formerly a “functional staff tent” in the legacy structure. These nodes would be broadly distributed and mobile on the battlefield. Supported by software and hardware engineers, commanders and staffs would be able to organize these nodes around a variety of tasks, time horizons, or crossfunctional areas. These distributed command-and-control nodes would be connected and able to conduct operations in the physical environment. Enabled by augmented reality, commanders and staffs could also access an

[41] Lisa Daigle, “Army Goes Deep into VR/AR for Training and Combat,” Military Embedded Systems, 17 October 2022, https://militaryembedded.com/radar-ew/sensors/ army-goes-deep-into-vrar-for-training-and-combat.

immersive virtual space and whichever command-and-control echelon they needed. This would allow commanders to initialize, configure, and connect to a constellation of command posts and maintain access all data, knowledge, and decision support tools within the data mesh. By flooding the area of operations with a constellation of command-and-control nodes dispersed over wide areas and employing masking techniques to reduce their battlefield signatures, the effectiveness of the most capable enemy's targeting processes would be minimized. If command-and-control nodes operated alongside tactical maneuver elements of similar design, it would further exacerbate the enemy's targeting dilemma. Unfortunately, assured communications would be even more critical in this approach and would require significant bandwidth. However, recent developments in space-based capability and the science of quantum communications indicate that bandwidth may not be a limiting factor in the foreseeable future.[42] Quantum solutions might also allow us to discard our reliance on legacy antennas and the risks associated with electromagnetic signatures on the modern battlefield.

未來美陸軍指揮所的願景之一，或許是將傳統結構中的「功能性幕僚帳」，轉變成由三至四輛裝甲車組成的小型指管節點，其會廣泛分散部署並遊走於戰場中，而且在軟硬體工程師的協助下，指揮官與幕僚能根據任務屬性、時間範疇或跨功能領域等來組織這些節點。這些分散式指管節點將能相互連結，並在實體環境下執行作戰任務。此外，在擴增實境的協助下，指揮官與幕僚可以進入沉浸式虛擬空間，以連結到任何一個編隊的指管體系，這意味著指揮官能啟動、配置並連結至散布在各地的指揮所，同時在數據網格中持續獲取所有資料、知識及決策支援工具。藉由在作戰區域內各地點廣泛部署指管節點，並運用掩蔽技術來減少在戰場上的信跡，就可以削弱實力強大敵人鎖定我方目標的效能。這類指管節點若進一步與具類似設計功能的戰術作戰部隊相互搭配，將加劇敵人在進行目標定位時的困難度。不過，這種作戰方式的關鍵在於要有穩定可靠的通信系統，大量寬頻支援不可或缺，所幸近期太空技術與量子通信的發展，將使寬頻不再是未來的限制因素。[42]量子技術的解決方案或許還能讓我們擺脫對傳統天線的依賴，並降低電磁信跡在戰場上暴露的風險。

Aside from communications, this approach will require significant work

[42] "NIST-Led Research Shows Advantages of Quantum-Enabled Communications for Internet," National Institute of Standards and Technology, 28 October 2022, https://www.nist.gov/news-events/news/2022/08/nist-led-research-shows-advantages-quantum-enabled-communications-internet.

from developers and the synthetic training community to achieve an "Avatar" level of virtual reality where commanders and staff forget that they are interacting in a virtual world.[43] The advantage of a commander who is able to project their presence anywhere on the battlefield without having to be physically present would be revolutionary. The path to the objective end state described here is resource intensive and will take focused and directed guidance from senior Army leadership, partnership with industry, and political buy-in. But it can and must be done.

除了通信方面，開發者與官兵在進行合成訓練時還要付出大量心力，才能達成像電影《阿凡達》一樣的虛擬實境，真實到讓指揮官與參謀都忘記自己在與虛擬世界互動。[43]指揮官在不需要親臨現場的情況下，就可以將其存在感投射到戰場的任何地方，這種優勢將是革命性。此處所描述的終極目標將需要投入大量資源、陸軍領導高層專門指導、與產業界共同合作及政治支持，這是一個可以達成目標，也必須要做的事。

A Practical Demonstration: Think Big, Start Small, Go Fast, and Institutionalize

The magnitude of the change suggested above will inevitably draw criticism and opposition and require early "wins" to gain support and momentum. A successful effort to introduce this idea into our command-and-control system will need to start small and demonstrate utility through experimentation. A good test case for a multidomain-operations-capable command post relying on virtual and augmented reality would be to experiment with an organization constantly challenged to maintain physical and functional integration in an operationally dynamic environment, the division joint air-ground integration center (JAGIC). This small, thirty-person command-and-control node is comprised of both Army and Air Force personnel and liaison elements executing a variety of functions. Currently, they must come together to manage the employment of joint effects effectively and efficiently in the close fight. Despite their value, the problem these organizations inherently have is that, in garrison, they do not exist. When needed for training and operations, JAGICs are formed from the division and air support operations squadron staffs. As such, they are very difficult to form, train, and maintain to a high degree of proficiency, much less expertise, given the demands of manning cycles and

[43] *Avatar*, directed by James Cameron (Los Angeles: 20th Century Studios, 2009).

garrison activities aligned against them. In this case, a virtual JAGIC could serve as a microcosm for a full command post. Thus, the experiment would simultaneously address an existing real-world and persistent readiness challenge and chart a path toward improved command post capabilities for the entire Army.

施行作法：大膽思考、小步起步、盡速推動、走向制度化

上述所提變革必然會招致批評與引起反對聲浪，所以在早期推動時就要獲得支持才能成功推動下去，要將該理念成功引進指揮所的指管體系，必須從小規模開始，接著藉由實驗來驗證其實用性。要找一個具多領域作戰能力且又依賴虛擬與擴增實境的最佳試驗對象，可以是一個在作戰動態環境下經常面臨實體與功能整合的組織，也就是師聯合空地整體中心(JAGIC)。它是由三十人組成的小型指管節點，其中包含陸軍與空軍人員，以及負責執行各項功能運作的聯絡組。目前，這些人必須要協同合作，才能在近接作戰時以快又有效方式管理聯合火力部署。儘管 JAGIC 有其價值，但只有在戰時才會編成，平常在駐地時並不存在，也就是當在做訓練與作戰任務需要時，才會由師與空中支援作戰中隊的幕僚共同編組而成。因此，人員的籌組、訓練及維持高熟練度並非易事，況且又在人員輪替與駐地任務的壓力下，更難以達到專業技術的標準。在這種情況下，虛擬化 JAGIC 之運作可以作為一個完整指揮所的縮影，也就是該試驗不僅能解決現實中持續存在的戰備挑戰，還能為精進整個美陸軍指揮所鋪路。

Conclusion: Whistling Past Chornobaivka

> *Oft in the lone church-yard at night I've seen, By glimpse of moonshine chequering through the trees, The school-boy, with his satchel in his hand, Whistling aloud to bear his courage up …*
>
> —Scottish Poet Robert Blair, 1745[44]

Any casual visitor to the Army's National Training Center these days, with a watchful eye on the Ukrainian war through their Twitter feed, can attest that U.S. Army command posts are going to struggle in that environment. While the Army may not be able implement a revolutionary new command post structure optimized for large-scale combat operations overnight, neither is it helpless if faced with the imminent prospect of war, even against an adversary as capable as the Chinese. Every day, commanders can start preparing for that environment, assessing their command posts from the standpoint of conducting MDO during large-scale combat operations and with a realistic appreciation for the threat. Leaders at division level and above can help by

doing more of the heavy lifting of joint integration, targeting, and other enabling processes for those at the tactical edge. At the same time, the Army must stay focused on the future. The technology is either here, or on the near horizon, to make everything discussed in this article possible. Given the state of the security situation in the world, it is unlikely that we have time to address the challenges of our command posts through incremental changes. The U.S. Army and the West must respond to the lessons of Chornobaivka with a sense of urgency, leadership, and unity of purpose on the modernization of our command post systems.

結論：吹著口哨經過喬爾諾巴伊夫卡

夜裡，在那寂靜的教堂墓地裡，我常透過樹叢間的微微月光灑落，看見那手提書包的學童，吹著口哨壯膽經過。

——蘇格蘭詩人羅伯特・布萊爾

如今，任何造訪美陸軍國家訓練中心的人，只要透過推特(現名為 X)關注俄烏戰爭，就能理解美陸軍指揮所在那種環境中面臨的困境。雖然美陸軍可能無法在短時間內實施適用於大規模作戰行動的全新革命性指揮所架構，但在面臨戰爭迫在眉睫時，也並非是毫無對策來對付像中共這樣有實力的潛在敵手。身為指揮官，必須以在大規模作戰行動中執行多領域作戰的角度來評估指揮所，每天也應為那種實際的威脅情境備妥所有計畫作為。師級以上層級的指揮官，可以幫忙去承擔更多的聯合作戰整合、目標打擊，以及對下支援戰術單位的繁重任務。於此同時，美陸軍必須專注於未來，或許在不久將來，相關科技得以實現本文討論的諸般可能性。鑑於當前世界安全形勢變遷快速，我們不能以慢慢來改變方式來因應指揮所的各種挑戰。美陸軍與西方國家要以迫切感、拿出領導魄力及一致性目標方式，將指管體系改造成現代化模式，這樣才算是有汲取喬爾諾巴伊夫卡戰事的經驗教訓。

譯後語

俄軍在喬爾諾巴伊夫卡戰事的失利，凸顯當前俄軍指揮所有戰場存活率不佳問題，且觀美軍及其盟友亦復如此，科技雖然為指揮所帶來效能增加的運作，卻也導致存活率下降的事實。鑑此，本文借用多領域作戰的四個要則(敏捷、聚合、持續力、縱深)為論述基礎，逐一探討指揮所當前問題並提出精進建議，作者們也指出這種改變將是顛覆式創新，並非以往逐步改變的革新方式，其施行作法就是大膽思考、小步起步、盡速推動、走向制度化，至於最佳試驗對象為師聯合空地整體中心，因為其堪稱是一個完整指揮所的縮影，適合試行虛擬化的運作方式。本文提出的改變對策，或許在不久將來同樣可以靠科技來部分實現，但會

不會又帶來另一個問題，這是我們要密切注意的，正所謂「停止進步，便是退步的起點」，吾人當引以為鑑。

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