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China Accelerates Modernization by Applying Lessons From Russia-Ukraine War

EXECUTIVE SUMMARY

Since 2015, the People's Liberation Army (PLA) has prioritized modernization, focusing on incorporating technological advancements into its fighting force as well as expanding its organizations. Historically, the branches of the PLA have lacked interoperability and the ability to integrate across domains. Xi Jinping's 2015 military reforms aimed to address these shortcomings by emphasizing joint doctrine and theater commands. Xi's stated goal of achieving a "world-class" military by 2035, underpinned by "intelligentization," required a fundamental shift in operational concepts and significant organizational and technological improvement to fully integrate joint operations. The ongoing conflict in Ukraine provides a key, real-world case study for the PLA, offering lessons for what to emulate and what to avoid, and helping accelerate the PLA's transformation.

PLA'S KEY TAKEAWAYS FROM RUSSIA-UKRAINE WAR

The Russia-Ukraine War is a critical case study for the PLA, serving as a real-world "laboratory" to observe and analyze modern warfare.[1] Beyond simply monitoring the conflict, the PLA is meticulously examining how forces employ new technologies and integrate warfighting domains, as well as looking at the broader psychological dimensions of contemporary combat.[2]

- **Importance of Integrated Air Defense and Suppression of Enemy Air Defenses.** Ukraine's layered air defense systems, bolstered by Western assistance, have significantly degraded Russian air superiority. This has reinforced the PLA's own investment in joint integrated air defense system (IADS) capabilities and underscored the need for effective suppression of enemy air defenses (SEAD).[3]

- **Vulnerability of Logistics.** Russian logistics failures, stemming from inadequate protection from precision strikes and limited mobility, have highlighted the critical need for resilient, dispersed logistics networks. The PLA, with its own potential logistics challenges in a long-range operation, such as invading Taiwan, is likely analyzing these failures to improve its own sustainment capabilities.[4]

- **Effectiveness of Precision Strike and Reconnaissance-Strike Integration.** Both sides' successful use of precision-guided munitions, coupled with joint forces' effective multidomain reconnaissance-strike complexes, often enabled by unmanned aerial vehicles (UAVs), demonstrates the lethality of modern warfare. The PLA is accelerating its development and deployment of these capabilities.[5]

- **Critical Role of Information Dominance.** The extensive use of electronic warfare (EW) and cyberattacks in Ukraine underscores their importance in disrupting enemy communications, targeting systems, and degrading operational effectiveness. The PLA had already been focusing on increasing its EW capabilities before the war, and evidence from the Ukraine conflict has only served to reinforce this as a priority, as well as the importance of denying the enemy access to critical information.

- **Limitations of Massed Formations and Importance of Maneuver Warfare.** Russian attempts to employ large-scale, conventional attacks have proven costly and ineffective against a well-prepared and highly motivated defender. The successes and failures on both sides demonstrate the importance of coordination in combined-arms operations. This reinforces the PLA's emphasis on maneuver warfare and combined-arms operations.

PLA TRAINING AND EXERCISES APPLY LESSONS LEARNED TO IMPROVE JOINT OPERATIONS

In the past decade, PLA training and exercise events have increased in scale and complexity to advance the effectiveness of joint operations. These events have increasingly focused on multidomain operations, incorporating realistic scenarios from the Ukraine conflict and mirroring a potential Tawain conflict.[6] These combined efforts highlight China's dual focus on modernizing its military and improving joint combat readiness by translating wartime observations into concrete equipment, actions, and behaviors.

China's joint doctrine, formalized in 2020 with the publication of *Guidelines on Joint Operations of the Chinese People's Liberation Army*, emphasizes integrated, information-centric, multidomain warfare. It aims to enhance the PLA's ability to conduct joint operations in various environments and against diverse threats, reflecting a shift towards a more offensive posture.[7]

The PLA has enhanced its IADS and SEAD training, practicing layered air defense against a simulated Western adversary in joint exercises. It is simultaneously investing in and training with low-altitude drone defense technologies to counter the small UAV threat evident in the Russia-Ukraine conflict.[8]

- **Simulated SEAD.** PLA exercises have demonstrated increased emphasis on SEAD tactics, including electronic attack and missile strikes against radar sites, likely informed by Russia's struggles to neutralize Ukrainian air defenses.[9] JOINT SWORD is a large-scale exercise around Taiwan that included extensive drills focused on countering air raids. It featured layered air defense deployments—likely a direct response to Ukraine's success in integrating Western-supplied air defense systems.[10, 11]

- **Focus on Low-Altitude Drone Defense.** The PLA is prioritizing defenses against low-altitude drones, which have played a prominent role in the Russia-Ukraine war.[12] Training exercises reveal a concerted effort to counter this growing threat. Units like the 82nd Group Army's service support brigade are conducting large-scale readiness exercises focused on defending against reconnaissance assets, including UAVs and satellites, while the 75th Group Army's air defense brigade is enhancing air defense skills and empowering younger personnel to lead in this evolving threat landscape.[13]

The PLA has expanded railway transport for troop and equipment movement in response to the demonstrated vulnerabilities of road-based logistics in the Russia-Ukraine war. It is also actively developing and optimizing its tactical sustainment capabilities, recognizing weaknesses identified both internally and through observations of the Russia-Ukraine conflict.

- **Increased Emphasis on Railway Transport.** Joint training exercises center on rapid loading and unloading procedures, as well as securing rail lines.[14] The PLA Southern Theater Command (STC) transport center's systematic approach integrates mission data, research findings, and real-world validation to develop and implement innovative technologies.[15] Further demonstrating this commitment, the Guilin Joint Logistics Support Force (JLSF) utilized large-scale fuel delivery to conduct an emergency rail-delivery exercise, highlighting a holistic approach to securing rail-based supply lines.[16]

- **Developing and Optimizing Tactical Sustainment.** Combined-arms logistics exercises now emphasize integrating logistics support into combat units, ensuring tactical sustainment can move forward in a contested environment.[17] A central component of this effort is the JLSF, which is increasingly integrated with combat units to ensure supplies reach the forward line of troops (FLOT). Joint exercises have demonstrated a commitment to using technology to enhance equipment transfer, improving battlefield logistics.[18,19]

The PLA is conducting more frequent exercises integrating UAV reconnaissance with precision artillery fire and long-range precision strikes using ballistic and cruise missiles, simulating attacks on key enemy infrastructure.[20] This mirrors the use of UAVs seen on both sides of the Russia-Ukraine war to identify targets and direct fires, and it appears to replicate Russia's attacks on Ukrainian infrastructure protected by layered air defense.[21]

- **UAV-Artillery Integration.** The STC recently practiced precision reconnaissance strike during an air assault live fire exercise. The brigade field artillery unit used its UAVs to

acquire targets, pass them directly to the Fire Direction Center, and execute a fire mission, thereby circumventing the normal call for fires process. After the initial strike, the UAVs performed battle damage assessment and quickly relocated to a new position to strike remaining opposing forces.[22]

- **Long-Range Precision Strike Drills.** The PLA Eastern Theater Command (ETC) conducted long-range live-fire drills in the East China Sea during its annual training event. Exercise STRAIT THUNDER 2025-A is a multiservice event that included joint operations practice. It involved precision strikes on simulated targets of key ports and energy facilities to control energy lanes, cut off supply routes, and block escape paths.[23]

The PLA is increasingly prioritizing information dominance by integrating EW units more closely with reconnaissance and strike assets, aiming to disrupt enemy communications and targeting systems.[24]

- **Information Dominance.** Recent exercises demonstrate a concerted effort to operate effectively in complex electromagnetic spectrum (EMS) environments and counter opposing forces' information-gathering capabilities.[25] The 72nd Group Army's 10th Heavy Combined Arms Brigade conducted joint combined-arms training specifically designed for a contested EMS environment, coordinating UAV reconnaissance, armored assaults, and EW tactics against a simulated enemy.[26] Additional exercises collectively highlight the PLA's growing emphasis on EW integration and its ability to operate effectively in a contested information environment.[27]

The PLA is conducting exercises with more emphasis on battalion-level combined-arms exercises, focusing on maneuver warfare and decentralized decisionmaking. This is a shift away from the PLA's traditional emphasis on large-scale, centralized operations.[28]

- **Combined-Arms Battalion-Level Exercises.** In 2024, a PLA ETC 85th Medium Combined-Arms Brigade exercise revealed significant issues in combined-arms coordination. The exercise after-action report revealed ineffective interservice cooperation. Further analysis led to recognizing previous combined-arms training focused on commanders at battalion and above, leaving lower-ranking soldiers to rely on higher echelons, without the capacity for independent combined-arms coordination. To fix these problems, the PLA began to emphasize training at team, squadron, and platoon levels. Units reduced training scale and increased frequency, aiming to improve the coordinated operational capabilities of subordinate units. Initiatives to fix combined-arms training included integrating combined-arms elements into tactical training at all levels, establishing a routine training platform for combined-arms coordination, and using wargaming and evaluations to strengthen cooperation between different arms. Subsequent ETC exercises demonstrated noticeable improvement in the brigade's ability to plan and execute coordinated combined-arms operations.[29]

IMPLICATIONS FOR U.S., ALLIED, AND PARTNER FORCES

The Russia-Ukraine conflict has served as an accelerant for the PLA's ongoing evolution in joint operational capabilities, highlighting the importance for the U.S. Army to continue to strengthen its own joint interoperability and train to fight an adversary skilled in modern combined-arms maneuvers.

- **Development and Deployment of Resilient, Distributed, and AI-Enabled Command-and-Control (C2) Systems.** The PLA's increasing emphasis on reconnaissance-strike complexes, integrating UAVs with artillery and long-range precision strikes, coupled with its prioritization of information dominance and EW, creates a significant threat to traditional C2 structures. The PLA intends not only to destroy hardware, but to paralyze the enemy's ability to function by disrupting information flow. Countering this threat would likely require C2 systems that are resilient and adaptive, including via AI-enabled systems that could support rapid adaptation to help move information more effectively.

- **Importance of Combined-Joint Operations Interoperability.** The PLA's actions demonstrate a strategic understanding—beyond doctrine—that modern warfare requires a holistic, integrated approach vice its traditional service-centric approach. The PLA is actively breaking down silos between its branches through formalized communication mechanisms, shared training grounds, and collaborative research to strengthen joint operations. It is also integrating its political organizations into war preparation, fostering a unified approach at all levels that underscores the importance for the U.S. Joint Force to enhance interoperability with Allies and partners.

APPENDIX A: PLA LESSONS AND IMPLICATIONS

PLA Lesson Learned	PLA Lesson Applied or Innovative Technology Developed	Implications for U.S. and Allies
Importance of Integrated Air Defense	During JOINT SWORD, the PLA practiced coordinating surface-to-air missile systems, defending against saturation attacks, and disrupting enemy radar and communications	PLA presents an unprecedented challenge when attempting to achieve air superiority and penetration of contested airspace in a conflict
	Developing new technology, such as directed energy weapons to counter UAVs	
Vulnerability of Logistics	STC “Smart Positioning Adjustment Device” capable of automatically correcting railway car misalignment to within one centimeter to expedite logistics	PLA is leveraging intelligent equipment to streamline and protect sustainment operations
	Guilin JLSF exercise training included pipeline leak handling, fuel-firefighting, and UAV reconnaissance awareness	
	JLSF and PLA Navy Shenyang joint exercise used “container-as-warehouse” transport model, replacing traditional vehicles and bulk cargo systems	
	PLA Army exercise teamed soldiers with manned and unmanned systems while wearing exoskeleton suits, moving cargo towards the FLOT in simulated combat conditions	
	PLA STC battalion exercise practiced remote maintenance support; the training scenario depicted a notional radar malfunction and prompted rapid repair efforts guided remotely by a senior NCO from another battalion	

PLA Lesson Learned	PLA Lesson Applied or Innovative Technology Developed	Implications for U.S. and Allies
Effectiveness of Precision Strike and Reconnaissance-Strike Integration	PLA Central Theater Command 82nd Special Operations Brigade conducted a UAV reconnaissance exercise to improve ISR; the unit received a no-notice order in the morning, deployed to a designated location and established a UAV ground control station; the UAV operators then successfully collected and relayed targeting information to the command post under simulated EW conditions	Longer-range missiles, paired with UAVs with greater endurance, give the PLA more capable strike capabilities
	PLA Rocket Force unit conducted high-intensity training evaluations; evaluations included battalion and team competitions with assessments of encampment camouflage and railway loading/unloading drills of more than 10 different training scenarios	
Critical Role of Information Dominance	A reconnaissance element of the PLA's 35th Heavy Combined-Arms Brigade conducted ISR coordination training in Fujian Province, utilizing UAVs, electro-optical radar, and infrared observation devices to accurately assess enemy deployments before initiating an armored assault	PLA have heavily invested in multirole EW capability and train to integrate these units into combat operations
	The 81st Ground Army Service Support Brigade conducted a round-the-clock signal support exercise where it successfully employed electromagnetic spectrum protection measures and jammed in response to simulated enemy reconnaissance UAVs	

PLA Lesson Learned	PLA Lesson Applied or Innovative Technology Developed	Implications for U.S. and Allies
Limitations of Massed Formations and Importance of Maneuver Warfare	A PLA 71st Group Army brigade conducted exercises where UAVs provided reconnaissance for soldiers and unmanned ground vehicles guided them into buildings, as well as providing sustainment and obstacle breaching; additionally, the PLA People's Armed Police 1st Mobile Commandos conducted a comprehensive exercise near Beijing, incorporating close-quarters combat, antihijacking drills, and diverse insertion methods, demonstrating novel uses of UAVs; this exercise included a 12-story building assault and siege, integrating assault teams with UAV operators and snipers, employing tactics like UAV-assisted window breaching and multipoint entry to practice building clearing procedures	PLA is significantly increasing urban warfare training to enhance maneuver capabilities in preparation for possible conflict in an urban environment, such as Taipei
	PLA People's Armed Police 1st Mobile Commandos conducted a comprehensive exercise near Beijing, incorporating close-quarters combat, antihijacking drills, and diverse insertion methods, demonstrating novel uses of UAVs; this exercise included a 12-story building assault and siege, integrating assault teams with UAV operators and snipers, employing tactics like UAV-assisted window breaching and multipoint entry to practice building clearing procedures	
	PLA Central Theater Command battalion of the 5th Electric Countermeasure Brigade practiced rapid mobilization and building shelters in frigid weather, while emphasizing camouflage and avoiding aerial detection	

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